NUYTSIA · Volume 6(1): 1-127 · 1987

NUYTSIA

Volume 6 · Number 1
1987

WESTERN AUSTRALIAN HERBARIUM
DEPARTMENT OF AGRICULTURE

CONTENTS

ISSN 0085-4417

NUYTSIA

VOLUME 6 NUMBER 1
1987

WESTERN AUSTRALIAN HERBARIUM,
DEPARTMENT OF AGRICULTURE,
SOUTH PERTH, WESTERN AUSTRALIA

CONTENTS

Western Australian Herbarium, George Street, South Perth,
Western Australia 6151

Quinqueremulus linearis, a new genus and species in the Australian Asteraceae (tribe Inuleae)

Paul G. Wilson

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Abstract

Wilson, Paul G. *Quinqueremulus linearis*, a new genus and species in the Australian Asteraceae (tribe Inuleae). Nuytsia 6(1):1-5 (1987) A new genus and species of Asteraceae tribe Inuleae is described from Western Australia. Its closest relatives appear to be species of the genus *Polycalymma* F.Muell. et Sonder.

In 1931 W.E. Blackall and C.A. Gardner independently collected between Wiluna and Leonora in Western Australia an undescribed member of the tribe Inuleae (Asteraceae). These collections, and those subsequently made by other botanists, were at various times determined as members of the genera *Gnephosis, Calocephalus,* or *Myriocephalus.* The species is now well represented by flowering and fruiting material in the Western Australian Herbarium (PERTH), the herbarium of the Kings Park Botanic Garden, and the National Herbarium of Victoria (MEL); it is here recognised as constituting a new genus within the subtribe Gnaphaliinae of the Inuleae as circumscribed by Merxmüller et al. (1977).

Quinqueremulus Paul G. Wilson, genus novum.

Herba, foliis integris, caulinis. Capitula breviter pedunculata in glomerulo laxe fasciculata bracteo herbaceo subtento. Bracteae capituli hyalinae. Receptaculum nudum. Flosculi numeroso bracteae capituli aequales, hermaphroditi, tubulares; corolla 5-lobata; styli rami truncata; antherae caudatae. Achenia cylindracea, glanduloso puberula. Pappo squamae 5, applanatae, durae, nudae.

Typus: Quinqueremulus linearis Paul G. Wilson.

Herb with slender branches. *Leaves* entire, cauline. *Capitula* loosely clustered into compound heads (pseudocephalae) with cymose branching; capitulum subtended by a herbaceous bract and surrounded by hyaline involucral bracts. *Receptacle* naked. *Florets* equal in number to involucral bracts, hermaphrodite; corolla discoid, 5-lobed; style surrounded at base by a nectary in the form of a short fleshy cup (stylar cup), branches truncate, terminally papillose; stamens 5 with caudate anthers. *Achenes* cylindrical, glandular puberulous. *Pappus* of 5 hard flattened organs that alternate with the corolla lobes.

A monotypic genus of inland Western Australia.

Quinqueremulus linearis Paul G. Wilson, species nova. (Figures 1 and 2)

Folia caulina alterna linearia 20-30 mm longa, modice glanduloso-puberula. Pseudocephalae hemisphaericae, 1-3 cm diam. Bractea capitulum subtendentem solitaria foliacea ad apicem hyalina. Capitulum anguste turbinatum; bracteae capituli 5, obovatae, c. 3 mm longae, 1.5 mm latae, glabrae. Flosculi 5; corolla c. 2.5 mm longa, parte inferiore abrupte angustata,

modice glandulosa, flava. Achenium anguste cylindraceum, c. 4 mm longum, 0.7 mm latum, modice glanduloso puberulum, atro-rubrum. Pappo squamae demum increscentes, oblongae vel anguste obovatae, c. 2 mm longae, rotundatae, atro-rubrae, divaricatae.

Typus: Western Australia, Youangarra Station, 28° 55' S, 119° E, growing near bore in red sandy loam, 26 August 1970, *P.G. Wilson* 8873 (holo: PERTH; iso: AD, CANB, K, MEL, NSW).

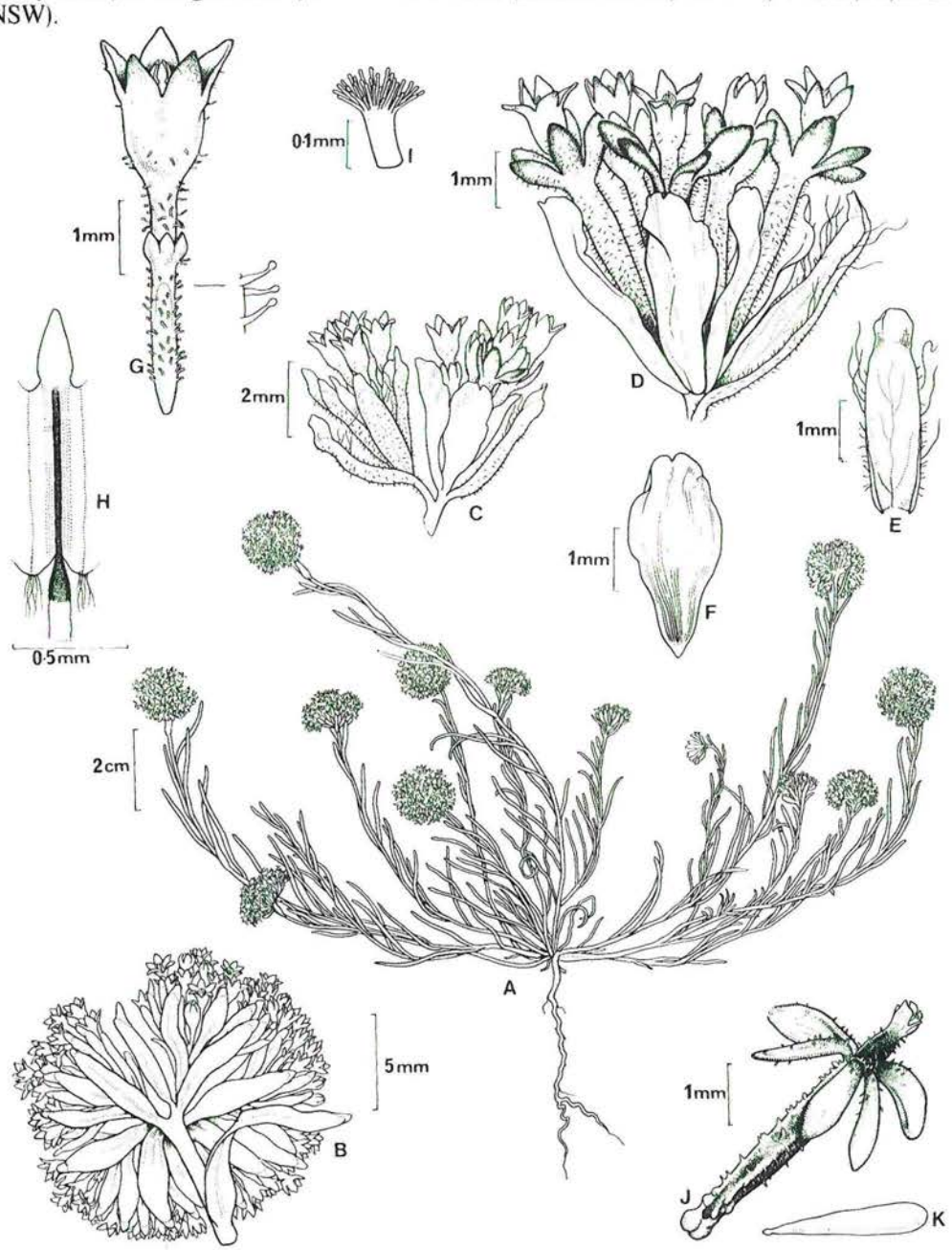


Figure 1. *Quinqueremulus linearis.* A — habit. B — compound head from below. C — two capitula. D — a single capitulum with subtending bract. E — bract subtending a capitulum. F — an involucral bract. G — floret. H — anther. I — style tip. J — achene with corolla attached. K — seed. From *P.G. Wilson* 8873.

Annual herb 10-30 cm high. *Major axes* several arising from base, ascending to erect, slender, puberulous with short gland-tipped hairs and thinly arachnoid towards apex with simple slender matted hairs. *Leaves* cauline, alternate, sessile, linear, obtuse, 20-30 mm long, 0.5-1 mm wide, somewhat fleshy, moderately puberulous with short gland-tipped hairs. *Compound head* irregularly hemispherical, c. 1 cm diameter in flower, up to 3 cm diameter in fruit; short branches of head each subtended by a foliaceous bract the inner of which have short hyaline tips. *Capitula* numerous, each subtended by a foliaceous bract tipped by a hyaline appendage and equal in length to the capitulum. Capitula narrow-turbinate, c. 3 mm high; capitular bracts 5, hyaline, without a midrib, obovate, c. 3 mm long, 1.5 mm wide, slightly concave, undulate or shortly lobed at apex, glabrous. *Receptacle* c. 0.3 mm diameter, glabrous. *Florets* 5; corolla tubular, c. 2.6 mm high, narrow-campanulate in upper half, abruptly narrowed in lower half, moderately glandular puberulous outside, glabrous within, yellow, tardily deciduous; lobes 5, c. 1 mm long. *Style base* narrow at anthesis, eventually hard and swollen. *Stylar cup* fleshy with 5 short rounded lobes opposite the corolla lobes, in all c. 0.2 mm high, at first adnate to the style base but eventually free, firmly attached to achene and forming a shallow cup-shaped appendage. *Achene* narrow-cylindrical, c. 4 mm long, 0.7 mm diameter, moderately glandular puberulous, dark red when mature; basal 0.7 mm sterile, glabrous, with four tumid gland-like ribs. *Pappus* at anthesis of 5 small erect fleshy scales c. 0.2 mm long alternate to corolla lobes; pappus scales in fruit greatly enlarged, woody, flat, oblong to narrow-obovate, c. 2 mm long, rounded at apex, sparsely glandular puberulous, dark red, eventually divaricate and slightly twisted, persistent.

Selection of collections examined (total 13) all herb. PERTH. WESTERN AUSTRALIA: 61 miles (98 km) S of Wiluna, *W.E. Blackall* 317; Leonora, *W.E. Blackall* 353; Glenorn Stn, Aug. 1938, *N.T. Burbidge;* 41 km S of Youanmi, *H. Demarz* 8264; 45 km W of Great Northern Highway along road to Fields Find, *P.S. Short* 2172.

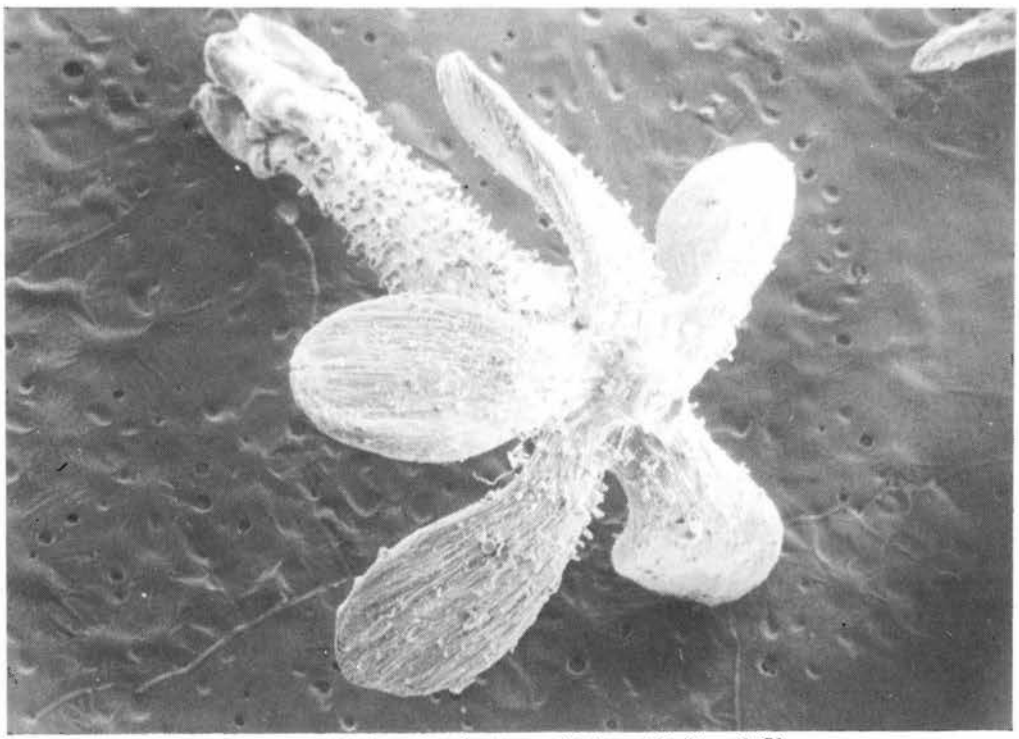


Figure 2. *Quinqueremulus linearis.* SEM photo of achene, x25 from *P.S. Short* 2172.

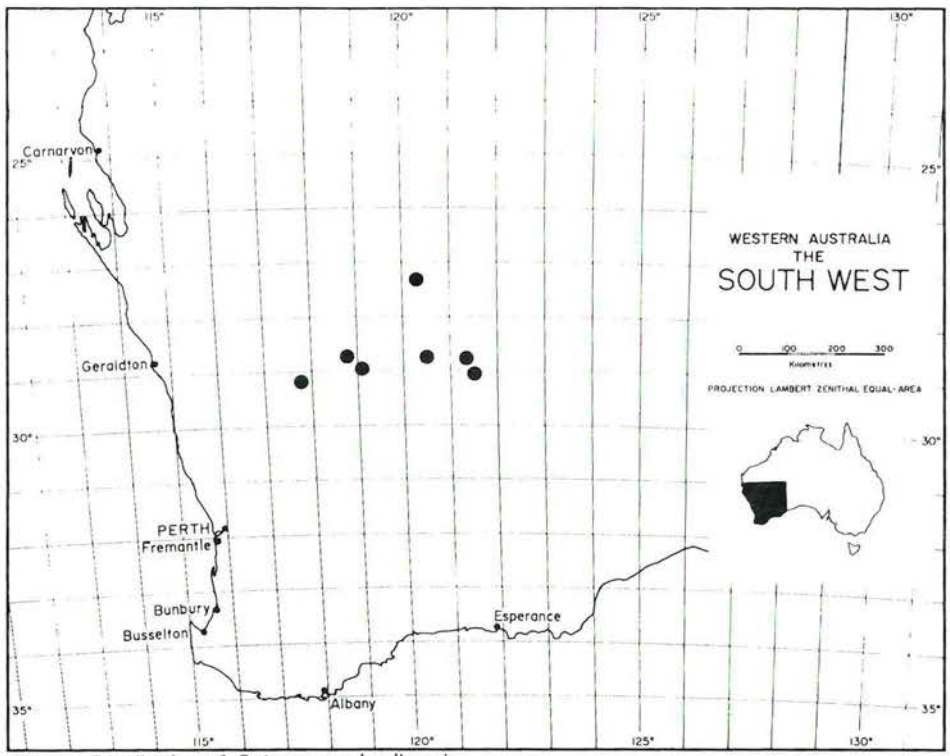
Distribution and habitat. Found in the Meekatharra to Leonora area of Western Australia, a region which falls within the Austin District of the Eremaean Botanical Province (Beard 1980). It is usually found growing in red sandy loam. (Map 1).

Flowering and fruiting period. This plant has been collected in flower from late July to late August and in fruit from late August to late September.

Etymology of name. The generic name is derived from the Latin *quinque* five, and *remulus,* a little oar, with reference to the five paddle-like pappus scales. The epithet *linearis* refers to the leaf shape.

As has been pointed out by Short (1983), the gnaphalioid genera with compound heads, sometimes referred to the subtribe Angianthinae (Bentham 1867), do not form a natural group since many of the constituent species are independently most closely related to different species within the heterogeneous genera *Helipterum* DC. (nom. illeg.) and *Helichrysum* Miller.

Quinqueremulus linearis, while obviously a member of the Angianthinae-Helichrysum group, has a type of pappus that is unique in the Australian Inuleae; it is also one by which this species may be readily recognised. The inflorescence structure is similar to that found in a group of species currently conceived as belonging to the genus *Myriocephalus* Benth. (1837) but which should probably be segregated as a distinct genus *Polycalymma* F.Muell. et Sonder (1853). These species are *Myriocephalus stuartii* (F. Muell. et Sonder) Benth. (*Polycalymma stuartii* F. Muell. et Sonder), *Myriocephalus morrisonianus* Diels (1905), and *Myriocephalus guerinae* F. Muell. *Helipterum craspedioides* W. Fitzg. (1904) is conspecific with *Myriocephalus morrisonianus.* In addition to their inflorescence structure these species have in common with *Quinqueremulus* a general similarity in habit, foliage, indumentum and capitular bracts. They differ most obviously in having plano-convex achenes, a long dense silky achenial indumentum, and in having plumose pappus setae.



Map 1. Distribution of *Quinqueremulus linearis.*

Acknowledgements

The illustration of *Quinqueremulus* (Figure 1) was drawn by Margaret A. Menadue, to whom I wish to express my thanks.

I am grateful to Phillip Short for making critical comments on the manuscript and for providing the SEM photo of the achene (Figure 2).

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Short, P.S. (1983). A revision of *Angianthus* Wendl., sensu lato (Compositae: Inuleae; Gnaphaliinae), 1. Muelleria 5: 143-183.

The names *Asterolasia* F. Muell. and *Urocarpus* Harvey (Rutaceae)

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Abstract

Wilson, Paul G. The names *Asterolasia* F. Muell. and *Urocarpus* Harvey (Rutaceae). Nuytsia 6(1):7-8 (1987). Recent bibliographic research has shown that the name *Asterolasia* was published before *Urocarpus* and thus has priority if considered congeneric. The correct names with synonymy are given for the five species of *Asterolasia* recorded for Western Australia. One new species name and one new combination are published.

Introduction

In an earlier paper (Wilson 1971) I indicated that the names *Urocarpus* J. Drumm. ex Harvey, *Asterolasia* F. Muell., and *Pleurandropsis* Baillon were congeneric and that, since *Urocarpus* was published several months before *Asterolasia* and about 17 years before *Pleurandropsis,* it had priority. I therefore made a number of new combinations for Western Australian species previously placed in *Asterolasia* as well as for the single species then recorded for South Australia. This decision was stimulated by a manuscript prepared by N.T. Burbidge in which were detailed the results of an investigation into the publication dates of volume 1 of the Transactions of the Philosophical Society of Victoria and of the various parts of volume 7 of Hooker's Journal of Botany and Kew Garden Miscellany. Both periodicals were apparently published in 1855, *Asterolasia* appearing in the first and *Urocarpus* in the second. Burbidge considered that the whole of the Transactions were published between September and November 1855 while the relevant pages of volume 7 of Hooker's J. Bot. Kew Gard. Misc. (pp. 54-55) were published in February of that year. My own bibliographic investigations supported the conclusions arrived at by Burbidge.

Recently, H.I. Aston (1984) has demonstrated that pages 1-33 of the Transactions were published twice, the first time as a separate number (Number 1) between 18 September and 22 November 1854 and the second time with the rest of the volume in September 1855. Since it is on page 10 of the Transactions that *Asterolasia* was published, this name appeared 3-6 months before its synonym *Urocarpus.*

Consequent on the recognition of the priority of the name *Asterolasia* two nomenclatural changes are required for the Western Australian species. A generic synonymy, and a species synonymy for those taxa found in Western Australia, are provided.

Asterolasia F Muell., Trans. Philos. Soc. Victoria 1: 10 (Sept.-Nov. 1854). *Asterolasia* sect. *Euasterolasia* Benth., Fl. Austral. 1: 350 (1863) nom. illeg. *Lectotype: A. trymalioides* F. Muell. (see Wilson 1971).

Phebalium a. *Correoides* Endl., Gen. Pl. 1136 (1840). *Phebalium* sect. *Correoides* (Endl.) Pfeiffer, Nom. Bot. 2: 669 (1874). *Lectotype: Phebalium correaefolium* Adr. Juss. [= *Asterolasia correifolia* (Adr. Juss.) Benth.] lecto. nov.

Urocarpus J. Drumm. ex Harvey, J. Bot. Kew Gard. Misc. 7:54 (Feb. 1855). *Asterolasia* sect. *Urocarpus* (Harvey) Benth., Fl. Austral. 1: 352 (1863). *Type: U. phebalioides* Drumm. ex Harvey.

Actinostigma Turcz., Bull. Soc. Imp. Naturalistes Moscou 32(1): 259 (1859). *Type: Actinostigma lanceolata* Turcz. (holo: KW, photo seen) [= *Asterolasia correifolia* (Adr. Juss.) Benth.]

Pleurandropsis Baillon, Adansonia 10:305 (1872). *Type: P. phebalioides* (F. Muell.) Baillon [= *Asterolasia phebalioides* F. Muell.].

1. **Asterolasia drummondii** Paul G. Wilson, nom. nov. Basic name: *Urocarpus phebalioides* J. Drumm. ex Harvey, Hooker's J. Bot. Kew Gard. Misc. 7:55 (Feb. 1855) non *Asterolasia phebalioides* F. Muell. (1854). *Eriostemon drummondii* F. Muell. Fragm. 1: 105 (1859) nom. illeg. *Asterolasia phebalioides* (Harvey) Benth., Fl. Austral. 1: 352 (1863) nom. illeg. non F. Muell., (1854). *Pleurandropsis phebalioides* (Drumm.) Baill., fide C. Gardner, Enum. Pl. Austral. Occ. 70 (1931) nom. illeg. non (F. Muell.) Baill. (1872). *Asterolasia drummondii* Blackall, How to know W. Austral. Wildfl. pt 1: 256 (1954) nom. invalid.

2. **Asterolasia grandiflora** (Hook.) Benth., Fl. Austral. 1: 352 (1863). *Phebalium grandiflorum* Hook., Icon. Pl. 8: t. 724 (1848). *Eriostemon grandiflorus* (Hook.) F. Muell., Fragm. 1: 105 (1859). *Urocarpus grandiflorus* (Hook.) Paul G. Wilson, Nuytsia 1: 207 (1971).

3. **Asterolasia nivea** (Paul G. Wilson) Paul G. Wilson, comb. nov. *Urocarpus niveus* Paul G. Wilson, Nuytsia 3: 211 (1980).

4. **Asterolasia pallida** Benth., Fl. Austral. 1: 352 (1863). *Eriostemon pallidus* (Benth.) F. Muell., Fragm. 7: 22 (1869).
   Asterolasia dielsii C. Gardner, J. & Proc. Roy. Soc. Western Australia 19:84 (1933).

5. **Asterolasia squamuligera** (Hook.) Benth., Fl. Austral. 1:352(1863). *Phebalium squamuligerum* Hook., Icon. Pl. 8: t. 727 (1848). *Eriostemon hookeri* F. Muell., Fragm. 1: 104 (1859) nom. illeg. *Urocarpus squamuligerus* (Hook.) Paul G. Wilson, Nuytsia 1: 207 (1971).

Acknowledgement

I wish to thank Dr N.G. Marchant for making available to me a photograph of the type of *Actinostigma lanceolata* Turcz.

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Aston, H.I. (1984). Publication dates of early scientific journals in Victoria. Muelleria 5: 281-288.
Wilson, Paul G. (1971). Taxonomic notes on the family Rutaceae, principally of Western Australia. Nuytsia 1: 197-207.

Ochrosperma, a new genus of Myrtaceae (Leptospermeae, Baeckeinae) from New South Wales and Queensland

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Abstract

Trudgen, Malcolm E. *Ochrosperma,* a new genus of Myrtaceae (Leptospermeae, Baeckeinae) from New South Wales and Queensland. Nuytsia 6(1):9-17 (1987). *Ochrosperma* is described with three species. *O. lineare* (C. T. White) Trudgen and *O. citriodorum* (Penfold & Willis) Trudgen are new combinations and *O. monticola* Trudgen is a new species. A key, descriptions and distribution map are provided and the relationships of the genus are discussed. Within the Baeckeinae *Ochrosperma* is considered to belong to the same natural group as *Rinzia* Schauer, *Hypocalymma* Endl. and section *Euryomyrtus* of *Baeckea* L.; within this group its closest relatives are considered to be *Baeckea camphorata* R. Br. and some allied undescribed species.

Introduction

In an earlier paper reinstating *Rinzia* Schauer (Trudgen 1986), the heterogeneity of the Baeckeinae and the existence within it of three major natural groups were briefly discussed. The three species dealt with in this paper are considered to represent a new genus which falls into one of these groups, i.e. the group containing *Rinzia, Baeckea camphorata* (and related undescribed species), section *Euryomyrtus* of *Baeckea* L., *Hypocalymma* Endl. and other species (some undescribed). The species of this natural group have the following characters in common: reniform seeds (with or without an aril); anthers opening in parallel slits; external filament glands; and aborted ovules which do not develop into ovulodes but are thin, compressed and often translucent.

Although Bentham (1867) had apparently not seen material of any of the three species included in *Ochrosperma,* they would fit readily into his broad conception of *Baeckea L.*

Distinction of *Ochrosperma*

Ochrosperma can be distinguished from related taxa by its possession of the following combination of characters:

(1) Seeds arillate, 1-1.3 mm long.

(2) Testa pale straw-coloured, shiny, with a papillose surface, the papillae arranged in linear patterns and tending to merge.

(3) Stamens regularly five, one opposite each sepal lobe.

(4) Ovary adnate to the hypanthium for almost all its length.

(5) Ovules consistently two per locule.

(6) Fruit opening very widely.

(7) Flowers in metaxymonads, or less commonly in pairs on a common peduncle, peduncle, internodes and anthopodia quite short so that the flowers appear to be almost sessile.

(8) Filaments terete, or at most slightly flattened near base.

Related taxa may have one or two of these characters but none has the combination. For example, while the species in *Rinzia* have fruit which open widely and arillate seeds (most species), the ovary is only adnate to the hypanthium for at most half of its length, there are 10 stamens, one opposite each sepal and petal (except in one species which variably loses some or all of those opposite the sepals), the stamens have broad filaments and the testa is dark brown.

Baeckea camphorata and two closely related undescribed species are thought to comprise the taxon most closely allied to *Ochrosperma* because they also have the ovary adnate to the hypanthium except at the top, no stamens opposite the petals and pale seeds, all characters shared with *Ochrosperma.* This taxon also occurs in the same geographical region as *Ochrosperma* (northern New South Wales and southern Queensland). On the other hand all except two of the other species in the natural group to which *Ochrosperma* belongs are Western Australian (with one extending into the Northern Territory) or South Australian and the two exceptions are more closely related to these species.

The fact that the taxon containing *Baeckea camphorata* has no stamens opposite the petals is considered to be very important as these are the only other species in the natural group to which *Ochrosperma* belongs which have the stamens predominantly opposite the sepals rather than the petals when the stamen number is reduced. This means that there is a significant difference in the direction of the reduction of the stamens between the species found in the western part of the continent and those found in the eastern part of the continent.

The "B. *camphorata*" taxon differs significantly from *Ochrosperma* as the following points indicate:

(1) The seeds lack the aril found on the seeds of all three species of *Ochrosperma.*

(2) The testas of the seeds are a pale reddish rather than a pale straw colour, dull rather than shiny and, although they are papillose, the individual markings are more distinct than on the seeds of *Ochrosperma.*

(3) There is a stamen opposite each sepal and between each sepal and petal rather than just one opposite each sepal.

(4) The flowers have longer anthopodia than those of *Ochrosperma* and the inflorescence on many specimens is a superconflorescence built of conflorescences which are brachyblasts (short shoots) with monads in the axils of bracts. Such brachyblasts are not known for *Ochrosperma.*

(5) The fruit do not open very widely.

(6) There are nine to twelve ovules per loculus rather than two.

In conclusion *Ochrosperma* is a small, distinct genus, easily recognised by the almost sessile flowers with five stamens (one opposite each sepal) and the three-locular ovary with two ovules per loculus.

Inflorescence

The uniflorescences in *Ochrosperma* are either metaxymonads or pairs of flowers on a common peduncle but separated from it by secondary axes and with the peduncle not terminating in a flower or vegetative shoot. The latter situation could be called a metaxydiad. The uniflorescences are then part of a conflorescence.

Terminology

Aril, hypanthium and *flower size* are used as defined in Trudgen (1986).

Terminology used in the descriptions of testa surfaces follows Murley (1951) as given in Stearn (1973).

Metaxymonad, uniflorescence, conflorescence, superconflorescence and *anthopodium,* are used as defined by Briggs and Johnson (1979) and *metaxydiad* is defined above.

Materials and Methods

This paper was based on the study of the gross morphology of herbarium material borrowed from Australian herbaria. A selection of this material has been cited, based on the number of collections available, their location and the quality of label information.

The measurements given for the parts of flowers were made on material that had been boiled in water with a small amount of detergent in it. The measurements of leaves refer to dry material.

Ochrosperma Trudgen, gen. nov.

Frutex glaber. Folia parva opposita breviter petiolata. Flores parvi, axillares, solitarii vel in dichasiis bifloris. Pedunculus et axes secondarii brevissimi, bracteis bracteolisque terminati. Hypanthium obonicum ovarium paulovel usque ad ⅓ superans; lobi calycis 5 erecti, carinati. Petala parva, suborbicularia, ungue parvi vel absenti. Ovarium omnino inferum, 3-loculare, ad apicem latissimum; parietes ovarii tenui. Placentatio axillare; areae placentae ovales vel circularis; ovula 2 in quoque loculo, collateria, reniformia vel semi-circularia. Stamina 5, sepalina; filamenta ad apicem angustata; antherae dorsifixae, loculis parallelis in rimas dehiscentibus; glans connectivi globularis vel cylindracea. Stylis breviter vel profunde immersus, teres; stigma capitatum. Fructus firmus sed nec lignosus; valvae orificiis late apertae ubi dehiscentes, hypanthio demum leviter convexo vel fere applanato (nec intorso). Semina crasso-reniformia, 1-1.3 mm longa, carunculata; hilum parvum; testa crustacea, straminea, in ordinatione lineari papillosa. Ovulodia complanata, translucetia brunea, seminibus nec simulantia.

Typus: **Ochrosperma monticola** Trudgen

Shrubs to 2 m tall, glabrous. *Leaves* opposite, entire, appressed to spreading, shortly petiolate; lamina narrow-linear to broad-elliptic, flat or variously thickened (plano-convex, concavo-convex), straight or recurved, 0.8-11 mm long, 0.5-2.2 mm wide, glandular-dotted. *Flowers* 5-merous, small axillary, either solitary (in metaxymonads) or in pairs on a common peduncle (metaxydiads); peduncle and subsequent internode(s) very short, terminated by caducous or persistent bracteoles; anthopodium short in one species, extremely short in the others; bracts slightly longer than the bracteoles, both subulate to elliptic or cymbiform. *Hypanthium* obconical, slightly or up to ⅓ exceeding the ovary; base acute, rounded or truncate. *Calyx lobes* ¼-⅓ length of hypanthium, erect (incurved in dry material), strongly keeled. *Corolla* white or flushed faintly with pink, 2.5-5.0 mm in diameter; petals suborbicular, small, claw short and broad or absent. *Stamens* 5, antesepalous, slightly exceeding calyx lobes; filaments terete (slightly flattened at the base), tapering towards the apex. *Anthers* dorsifixed, loculi parallel, opening in parallel slits. *Connective gland* globular or cylindrical. Style terete, inserted shortly to deeply into the ovary; stigma capitate. *Ovary* 3-locular, thin walled, fused to hypanthium for most of its length. *Placentation* axile; placentas elliptic or circular areas on

the floral axis, longitudinally furrowed. *Ovules* reniform or semicircular, 2 per loculus, collateral, one on either side of the placental furrow. *Fruit* a capsule enclosed by the hypanthium except at the top, campanulate or infundibular before dehiscence, firm but not woody. *Dehisced fruit* with valves opening very widely on dehiscence, the hypanthium becoming shallowly convex or almost flat. *Seeds* stoutly reniform, 1-1.3 mm long, arillate; aril white, clasping hilar region; hilum small, in centre of the concave side; testa crustaceous, stramineous, shiny, papillose with the papillosities in a linear pattern and tending to run into each other. *Embryo* filling seed; cotyledons small on a long slender neck, flattened parallel to the plane between them, cotyledons and neck appressed to the massive radicle. *Aborted ovules* flattened, translucent, brown, not developing as "chaff".

Distribution. East coast of Australia (Queensland and New South Wales) between latitudes 25° S and 35° S. *Ochrosperma lineare* and *O. citriodorum* are coastal and near-coastal while *O. monticola* grows in the Great Dividing Range.

Etymology. The name *Ochrosperma* is derived from the greek *ochros* (pale, wan) and *sperma* (seed) and refers to the pale, straw-coloured seeds of the three species in the genus.

Key to the species

1. Leaves linear, semi-terete, straight.....1. *O. lineare*
1. Leaves elliptic to obovate, not thick, usually recurved.
   2. Flowers c. 2.5 mm diameter, leaves 1.2-3.0 mm long.....2. *O. citriodorum*
   2. Flowers 3.5-5.0 mm diameter, leaves 2.5-5.5 mm long.....3. *O. monticola*

1. **Ochrosperma lineare** (C. T. White) Trudgen, comb. nov. — *Baeckea linearis* C. T. White, Proc. Roy. Soc. Queensland. 55: 65-66(1944). *Lectoype* (here designated): Tugun, S. E. Queensland, Sept. 1940, *G. H. Barker* s.n. (lecto: BRI 011121; isolecto: BRI 011122).

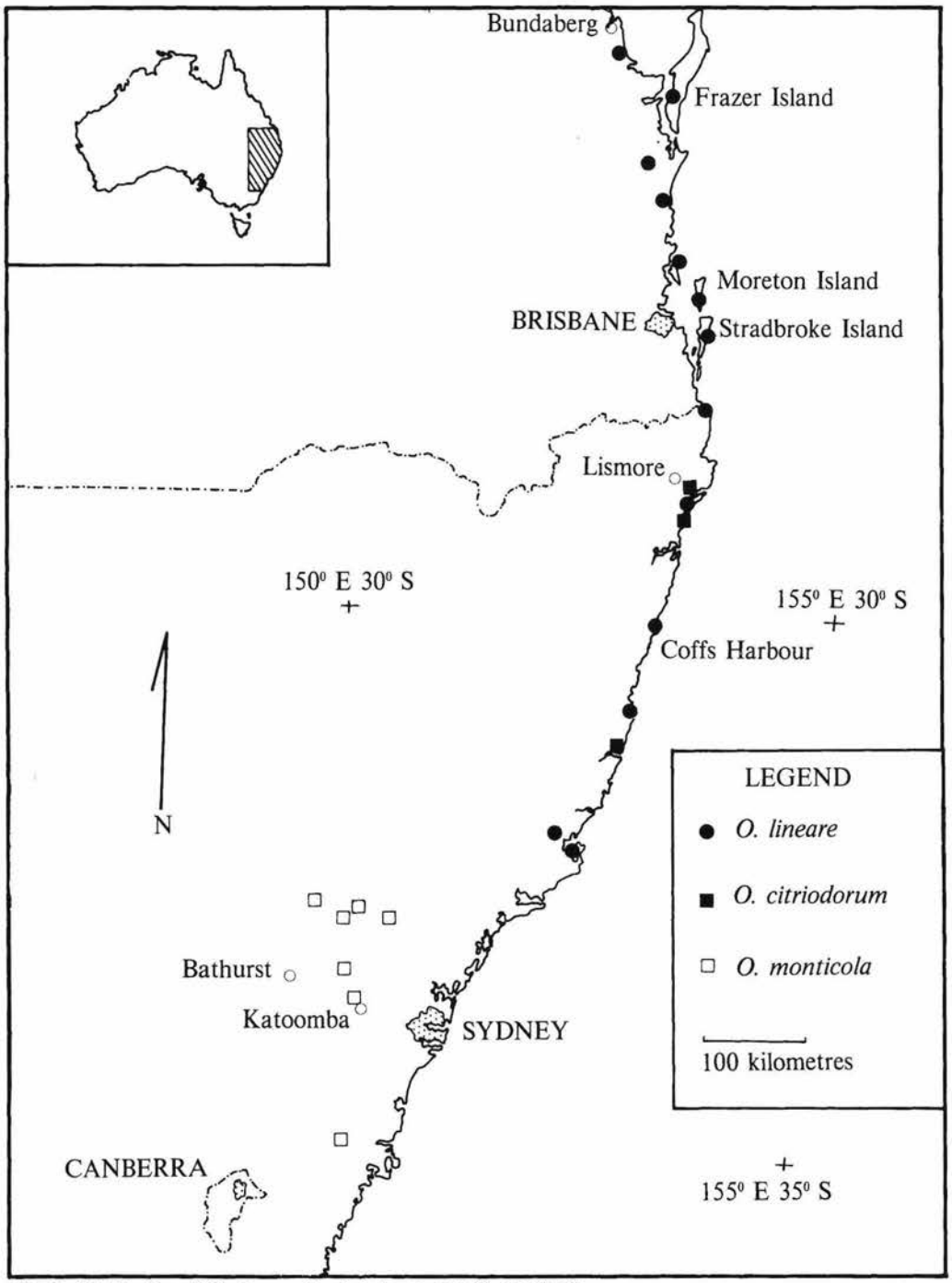
Shrub to 2 m tall, erect or spreading. *Leaves* slightly to ⅔ of length overlapping; lamina linear to linear-lanceolate, 3.5-11 mm long, 0.5-1.0 mm wide, straight, plano-convex, thickened towards apex. *Flowers* in pairs on a common peduncle or solitary in leaf axils (one side of diad aborted), with up to 8 cm of the upper branchlets in flower. *Peduncles* and subsequent internode 0.1-0.2 mm long; anthopodium 0.3-0.4 mm long; bracteoles subulate-elliptic, concave, persistent, equal to the anthopodium. *Hypanthium* obconical, 1-1.5 mm long, 1.5-2 mm diameter, fused for ⅔ length to the ovary; calyx lobes deltoid, acute to obtuse. *Corolla* white or flushed faintly with pink, c. 2.5 mm diameter; petals suborbicular, 0.8-1 mm in diameter; claw short or absent. *Stamens* with filaments terete, 0.4-0.6 mm long; connective gland cylindrical. *Style* inserted for ⅓ the length of the ovary, terete and not tapering at the base, shortly exceeding the calyx lobes; stigma capitate. *Ovary* 3-locular; placentas oval; ovules with one end somewhat pointed. *Fruit* with hypanthium campanulate before dehiscence, becoming shallowly convex on dehiscence, the valves opening widely. *Seeds* 1.3 mm long.

Selected specimens. QUEENSLAND: Burrum Heads Road, *C. H. Gittins* 1121 (NSW); Fraser Island, between the forestry station and Lake Birrabeen, *S. T. Blake* 14353 (BRI); Bribie Island, 9 km N of forestry campsite, *P. Sharp* 00115 (BRI); upper Noosa River at junction with Teewah Creek, 39 km ENE of Gympie, *I. R. Telford* 3780 (CGB, K); about 1½ miles [2.5 km] E of Noosaville, May 1968, *B. Lebler* and *P. Baxter* s.n. (BRI); Moreton Island, Blue Lagoon on the high sand dunes along the SW shore, *L. Durrington* 00431(BRI); Traverston, mouth of Burrum River, *C. T. White* 6333 (BRI, NSW).

NEW SOUTH WALES: Evans Head, near recreation area, *R. Coveny* 4676 (AD, BRI, CANB, HO, K, L, NSW, RSA); 5 miles [8.0 km] NE of Woodburn, *R. Coveny* 3503 (BRI,

NSW); Diamond Head, *P. Burgess* 70 (NSW); South West Rocks, *R. Coveny,* NSW123018 (NSW); Wallis Island, Tuncurry, *E. Cheel* NSW123012 (NSW, PERTH).

Distribution: Between latitudes 25° 20' S and 32° 30' S on the Queensland and New South Wales coasts. Map 1.



Map 1. Distribution of *O. lineare, O. citriodorum* and *O. monticola.*

Habitat. Recorded from a number of habitats including "wallum" (*Banksia aemula*) scrub or flats where it is apparently common (Lebler 1972), dry sclerophyll forest, high sand dunes, swamp edges and heath. Batianoff and McDonald (1980) recorded *O. lineare* from three of their major vegetation types; foredune heath and scrub, rocky shore and headland vegetation and parabolic dune vegetation. It seems to prefer acidic sandy soils, with or without humus.

Flowering time. August through to May, but the best flowering is in September and October.

Notes. In the original description of *Baeckea linearis,* White (1944) states that there are about ten ovules in each ovary loculus. In all the specimens, including the Type, dissected by the author there have been consistently two ovules per loculus. Possibly White inadvertently dissected material of *Baeckea stenophylla* F. Muell.

Lebler (1972) states that "During the Autumn months, most of the leaves change colour through a reddish green to a brilliant red." that "In the young stages, the filaments are green and the anthers red." and that "...the leaves are arranged in four distinct rows..." (i.e. quadrifarious).

2. **Ochrosperma citriodorum** (Penfold & Willis) Trudgen, comb. nov. — *Baeckea citriodora* Penfold & Willis, J. & Proc. Roy. Soc. New South Wales 89: 186 (1956). *Type:* Five miles [8 km] NW of Port Macquarie, *D. K. Hammond,* 15 May 1955 (holo: NSW ex Museum of Applied Arts and Sciences, Sydney (n.v.); iso: BRI).

Shrub to 40 cm tall, spreading, branchlets divaricate. *Leaves* spreading; lamina narrow- to broad-elliptic, occasionally oblong, with a narrow hyaline margin, 1.2-3.0 mm long by 0.8-1.4 mm wide, recurved, plano-convex, concavo-convex or bi-convex and grooved along the midrib, thin at the edges, slightly thickened towards apex. *Flowers* axillary, solitary, or rarely in pairs on a common peduncle, in small groups towards ends of branchlets. *Peduncles* 0.3-0.4 mm long; anthopodia 0.4-0.5 mm long; bracteoles persistent, elliptic, concave, acute, c. 0.6 mm long. *Hypanthium* irregularly hemispherical to broadly obconical, c. 2.3 mm diameter, c. 1.2 mm long, slightly bulged around the ovary loculi, only extending shortly above the ovary; calyx lobes deltoid, acute to obtuse, ½ length of hypanthium. *Corolla* white, c. 2.5 mm diameter; petals suborbicular, c. 1 mm diameter; claw short, broad. *Stamens* with filaments 0.3-0.5 mm long (apparently lengthening as flowers mature), slightly flattened; connective gland cylindrical. *Style* terete, not tapering, inserted for ½ the length of the ovary; stigma capitate, equalling anthers. *Ovary* 3-locular. *Fruit* with hypanthium shortly campanulate and bulging slightly around the ovary loculi before dehiscence, the valves opening widely on dehiscence and the hypanthium becoming quite flat. *Seeds* c. 1 mm long.

Selected specimens. NEW SOUTH WALES: Wardell, Richmond River, January 1944, *J. Weller* (BRI, NSW, PERTH); Wardell, Richmond River, Nov. 1943, *J. Weller* (NSW); Woodburn, May 1924, *A. R. Penfold* (NSW); Woodburn to Evans Head, Sept. 1926, *E. Cheel* s.n. (NSW); Evans Head, *R. Coveny* 4667 (BRI, NSW); Evans Head, Sept. 1927, *E. Cheel* s.n. (NSW); 1 mile [1.6 km] from seashore and 8.5 miles [13.7 km] SSW of Evans Head, *D.J. McGillivray* 2051 (NSW); Shelly Beach, about 3 miles [4.8 km] S of Yamba, March 1968, *K. Grieves* s.n. (NSW); Yuraygir National Park, 2 km SW of Diggers Camp, *K. Wagner, M. Searles & S Griffith* s.n., June 1984 (CANB, MEL, NSW, PERTH).

Distribution. A coastal and near coastal species found only in New South Wales between latitudes 28° 50' S and 31° 30' S. Map 1.

Habitat. O. citriodorum apparently does not grow in the same diversity of habitats as *O. lineare.* From information on herbarium sheets it appears that this species is found in heathland

(on sand) with a variety of other plants, particularly *Banksia serratifolia, B. aspleniifolia* and species of *Leptospermum.* Penfold and Willis (1956) recorded it growing in scattered patches in a band 2-3 miles long and 50 yards wide along the margins of a large swamp 18 miles from the coast and 3 miles from the Coraki-Grafton road, in heath at Evans Head and in heath at Port Macquarie. On each occasion the soil was recorded as grey sand. Subsequently this species has also been recorded growing with *O. lineare.* More detailed information is available for the habitat of *O. citriodorum* in the Cape Byron — Suffolk Park area where it grows in two plant associations on transgressive dunes (Gilmore and Associates 1984). These are *Leucopogon ericoides/Homoranthus virgatus* Dry Heathland and a *Banksia aemula* association which occurs on higher parts of the dunes.

Flowering time. From September through to June. However, from the condition of the available material it seems likely that flowering time is variable rather than continuous for that period.

Notes. Penfold and Willis (1956) considered incorrectly that this species "falls naturally into Bentham's section Harmogia" although they recognised its closest relative to be *O. lineare.*

According to Penfold and Willis (1956) fresh material of *O. citriodorum* gives off a strong citronella odour when crushed and the species was first discovered because it gave a citronella taint to milk from two farms from Woodburn in northern New South Wales, where the plant is apparently now locally extinct (Penfold and Willis 1956).

Two collections seen that include *O. citriodorum* are mixed with *O. lineare.* In *R. Coveny* 4674, Evans Head near recreation area, 14 Nov. 1972, the sheet at NSW is *O. citriodorum,* the sheet at CANB is *O. lineare.* This collection has also been sent to A, B, G, K, L, LE, LISE, MO, RSA and W but these sheets have not been seen. In *R. Coveny* 3501, 5 miles [8.0 km] NE of Woodburn, Feb. 1971, the sheets at BRI and NSW are both mixtures of *O. citriodorum* and *O. lineare.*

Conservation status. O. citriodorum is neither as widespread nor as commonly collected as *O. lineare* and consequently this species may not be adequately protected. However it has been recorded from Yuraygir National Park (where it grows along an ecotone between a *Banksia aemula, Melaleuca nodosa* Dry Heath and a *Banksia oblongifolia, Epacris microphylla, Xanthorrhoea* sp., *Sprengelia sprengelioides, Lepyrodia interrupta* Wet Heath). It is apparently widespread in Bundjalong National Park south of Evans Head (Gilmore and Associates 1984).

3. **Ochrosperma monticola** Trudgen, sp. nov.

Frutex densus ad 0.5 m altus, 2 m latus. Folia effusa, elliptica vel late elliptica, 2.5-5.5 x 1.6-2.2 mm, recurva, pagina superiore applanata vel aliquondo leviter carinata (apicem versus concava), inferiore leviter convexa; margo angustatus, hyalinus. Flores parvi (3.5-5.0 mm diameter), axillares, in dichasiis bifloris vel solitarii (uno lato dichasii abortivo), usque ad 3 cm ramulorum superiorum in statu florescentii. Pedunculi c. 0.1 mm longi, axillus secondariis 0.1-0.2 mm longis, pedicellis c. 0.4 mm longis; bracteae bracteolaeque cymbiformae, caducae, 0.5-0.8 mm longae. Hypanthium obconicum (1.0-1.1 mm diameter, c. 2.2 mm longum), basi rotundata, limbo parvissimo; lobi calyce deltoidei, obtusi, hypanthio dimidia parte breviores. Petala alba, suborbicularia, 1.8-2.2 mm diameter, ungue brevi vel absenti. Placentae circulares leviter sulcatae. Filamenta staminum 0.8-1.0 mm longa; glans connectivii globularis, magna. Stylis breviter immersus, teres, tenuis, stigmate lobis calyce parum superans. Fructus maturus ignotus, in statu immaturo late infundibularis.

Typus: Currant Mountain Gap, 24 km by road E of Rylstone, N.S.W., dense shrub 0.5 m high and 2 m across with white flowers, *R. Coveny* 6619 and *P. Hind*, 10 August 1975, (holo: PERTH; iso: BRI, KEW, MEL, NSW).

Dense, spreading *shrub* to 0.5 m tall and 2 m across. *Leaves* spreading; lamina elliptic to broad-elliptic with a narrow hyaline margin; 2.5-5.5 mm long, 1.6-2.2 mm wide, recurved; upper surface flat or occasionally concave or concave only towards apex, abaxial surface very shallowly convex (i.e. lamina very little thickened), discolorous, paler on abaxial surface. *Flowers* axillary, in pairs on a common peduncle or solitary (one side of diad aborted), up to 3 cm of upper branchlets in flower; peduncle c. 0.1 mm long, subsequent internode 0.1-0.2 mm long; anthopodium c. 0.4 mm long; bracteoles cymbiform, caducous, 0.5-0.8 mm long. *Hypanthium* broadly obconical, c. 2.2 mm diameter and c. 1.1 mm long, rounded at the base, only extending shortly past the ovary; calyx lobes deltoid, obtuse, ½ length of hypanthium. *Corolla* white, 3.5-5.0 mm in diameter; petals suborbicular, 1.8-2.2 mm diameter; claw short and broad or absent. *Stamens* with filaments 0.8-1.0 mm long; anthers c. 0.4 mm long; connective gland globular, large. *Style* only shortly inserted into the ovary, terete, slender, just exceeding calyx lobes; stigma capitate. *Ovary* 3-locular, fused to hypanthium except at the top; placentas circular, indistinctly furrowed. *Ovules* 2 per loculus, collateral. Mature *fruit* not known; the most advanced seen had become broadly infundibular due to the outward growth of the ovary.

Selected specimens. NEW SOUTH WALES: Medlow Bath, Nov. 1914, *A.A. Hamilton* (NSW); Kekeelbon Mountains, 2 miles [3.8 km] SE of "Three Ways" along Putty Fire Trail, *T and J. Whaite* 32777 (NSW); Currant Mountain Gap via Rylstone, Sept. 1960, *C. K. Ingram* (NSW); Talwong, Jan. 1900, ? *W. Forsythe* (NSW); near Wolgan Pinnacle, *I. Olsen* 2905 (NSW); Blackheath, Jan. 1900, *A. A. Hamilton* NSW139563 (NSW, PERTH); Jones Hob, 1.5 miles [2.4 km] NNE of Mt Coricudgy, *D. McGillivray* and *A. Rodd* 121 (NSW, PERTH); 1.5 km S of Kandos Weir, c. 22 km E of Rylstone, *M. D. Crisp* 1278 (CBG, L, MO, PERTH).

Distribution. On the Great Dividing Range in New South Wales between latitudes 32° 50' S and 33° 40' S. Map 1.

Habitat. O. monticola grows on rocky ridges or rock outcrops (sandstone where rock type has been noted by the collector). With one specimen collected from a dry swamp on a sandstone ridge. The type of *O. monticola* comes from a sandstone ridge where it was growing with *Leptospermum parvifolium, L. arachnoides, Leucopogon muticus, Acacia hamiltoniana* and *A. obtusifolia.*

Flowering time. From early September to November with the best flowering in October and November.

Etymology. The specific name reflects the distribution of the species in the mountains and draws attention to the contrast between this and the coastal distributions of *O. lineare* and *O. citriodora.*

Acknowledgements

The preparation of this paper was made possible by financial support from the Australian Biological Resources Study. The author is indebted to Mr P.G. Wilson for translating the necessary descriptions into Latin. Loans of specimens were kindly made by the curators of BRI, CBG, MEL and NSW. Thanks are also given to the curator of the Western Australian

Herbarium for allowing access to that institution and obtaining the loans. Miss C. D. M. Keating proof-read the manuscript and drew the distribution map. The National Parks and Wildlife Service of New South Wales kindly provided a specimen and information on the distribution and habitat of *O. citriodorum*.

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The taxonomy of some South Australian *Acacia* section *Phyllodineae* species (Leguminosae: Mimosoideae)

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Abstract

Maslin, B.R. and Whibley, D.J.E. The taxonomy of some South Australian *Acacia* section *Phyllodineae* species (Leguminosae: Mimosoideae). Nuytsia 6(1):19-32 (1987). Two new *Acacia* section *Phyllodineae* DC. species, *A. alcockii* and *A. cretacea*, are described and illustrated. Both have restricted distributions on the Eyre Peninsula, South Australia. *Acacia cretacea* is considered endangered. *Acacia alcockii* may be of hybrid origin involving *A. anceps* DC. and *A. leiophylla* Benth. as parents. Descriptions are provided for *A. anceps*, *A. nematophylla* (hitherto considered conspecific with *A. calamifolia* Sweet ex Lindley) and *A. notabilis* F. Muell. Putative hybrids between *A. anceps* and *A. nematophylla* and *A. anceps* and *A. notabilis* are noted. A *lectotype* is selected for *A. notabilis*.

Introduction

The main purpose of this paper is to validate new names for use in the forthcoming Flora of Australia account of *Acacia* section *Phyllodineae* DC. Two new South Australian species endemic to the Eyre Peninsula are described and illustrated, viz. *A. alcockii* and *A. cretacea*. Both species belong to an Australia-wide group whose members are characterized by 1-nerved phyllodes, globular flower-heads which are usually arranged in racemes and by long, often red-brown funicles which encircle the seeds. Other members of this group which are described and discussed here include *A. anceps* DC., *A. nematophylla* F.Muell. (until now considered conspecific with *A. calamifolia* Sweet ex Lindley) and *A. notabilis* F. Muell. Putative hybrids between *A. anceps* and *A. leiophylla* Benth., *A. nematophylla* and *A. notabilis* are discussed.

1. **Acacia alcockii** Maslin and Whibley, sp. nov. Figure 1.

Frutex dumosus c. 3 m altus, saepe surculosus. Ramuli sursum subangulati, glabri. Phyllodia plerumque anguste elliptica vel oblanceolata, apice obtusa vel attenuata, basin versus attenuata, 6-9(10) cm x 8-16(21) mm, longitudo: latitudo = (3)5-8(11), tenuiter coriacea, recta vel leviter recurva, glabra, atroviridia, uninervia, nervis lateralibus sat indistinctis; pulvinus 2-6 mm longus. Racemi plerumque 2-4 cm longi, capitulis floriferis (2)5-11, pedunculis glabris (3)4-5 mm longis, pedunculis nonnullis simplicibus axillaribus 8-10 mm longis interspersis. Capitula florifera globularia, pallide flava, 25-40-flora. Flores 5-meri. Calyx gamosepalus. Legumen oblongum ad anguste oblongum, ad c. 9 cm longum sed saepe brevius, 10-17 mm latum, tenuiter coriaceo-crustaceum, glabrum. Semina transversalia, obloideo-ellipsoidea, 5-6 x c. 2.5 mm, nigra, funiculo filiformi pallide rubrobrunneo cincta.

Typus: Eyre Peninsula district, Lincoln National Park, 2.6 km N of Port Lincoln-Cape Donnington road towards Stamford Beach, Stamford Hill, South Australia, 18 Sept. 1983, *J.D. Briggs* 1211 (holo: PERTH; iso: AD, BRI, CBG, MEL, PERTH).

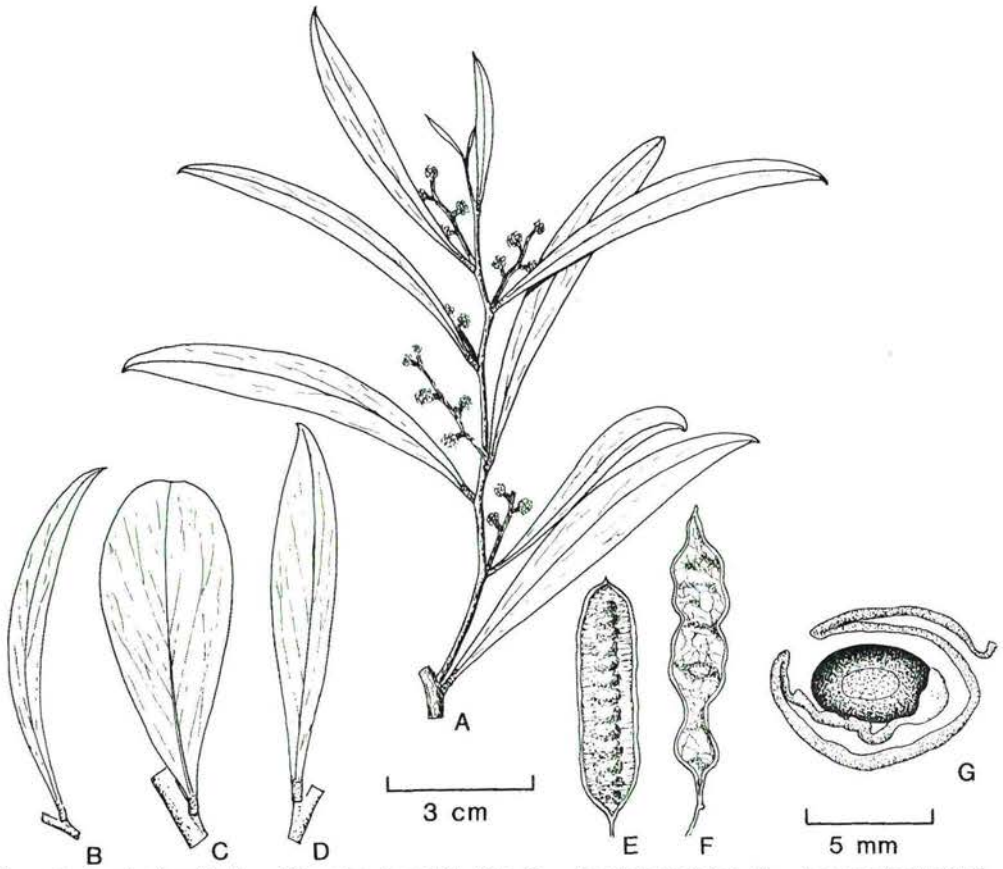

Figure 1. *Acacia alcockii*. A — Flowering branchlet. B to D — Phyllode variation. E — Legume (mature). F — Legume (immature). G — Seed showing light red-brown funicle encircling seed in a double fold. A from *C.R. Alcock* 1682; B from *C.R. Alcock* 1256; C from *J.W. Wrigley* WA/68 7645; D from *C.R. Alcock* 1656; E from *C.R. Alcock* 1682; F from *K. Holliday* s.n. (AD 984227395); G from *E.M. Canning* 5390 and *S. Corbett*.

Bushy *shrub* to c. 3 m tall, often suckering (especially if roots are disturbed). *Bark* mostly smooth, grey or brown at base of trunks, reddish on young branches. *Branchlets* terete but slightly angled at extremities, very finely nerved, straight to very slightly flexuose, rather slender, glabrous, sometimes marked with prominent, distant, raised leaf bases where phyllodes have fallen. *Stipules* persistent, triangular to deltate, minute, c. 0.5 mm long. *Phyllodes* usually narrowly elliptic to oblanceolate, slightly asymmetric, gradually narrowed towards the base, attenuate or abruptly narrowed to acute or obtuse apices, mucro usually present and uncinate, mostly 6-9(10) cm long and 8-21(30) mm wide but frequently interspersed with a few smaller phyllodes (4-5 cm x 5-8 mm), l:w = (2)3-10, straight to shallowly recurved, very thinly coriaceous, flexible, glabrous, dark green; *midrib* not overly prominent but slightly raised when dry, usually yellowish to light brown, central to slightly excentric; *lateral nerves* rather obscure, diverging from midrib at an acute angle, sparsely and openly longitudinally anastomosing; *marginal nerves* narrow, yellowish to light brown; pulvinus 2-6 mm long, drying finely wrinkled and dark brown or reddish brown. *Gland* situated on upper margin of the phyllode (3)8-12(20) mm above the pulvinus, circular or oblong, 0.3-0.6 mm long, sometimes very slightly raised above the margin which is sometimes very slightly indented at the gland, orifice shallow but distinct. *Inflorescences* 1(2) per node, racemose, very rarely interspersed with some simple axillary peduncles, racemes sometimes paniculately arranged. *Racemes* (1.5)2-4(5) cm long with (2)5-11 heads, the lowermost head inserted 8-18 mm above the base; raceme axes straight to very slightly flexuose, glabrous, very finely wrinkled when dry, base ebracteate. *Peduncles*

(3)4-5 mm long (on racemes) or 8-10 mm long (on simple, axillary inflorescences), glabrous, slender (0.5 mm diam. when dry) and finely longitudinally wrinkled when in flower but thicker (to 1.3 mm diam. when dry) and coarsely longitudinally wrinkled when in fruit; basal peduncular bracts 2, c. 0.5 mm long, thickened towards base, scarious and brown towards apices. *Flower-heads* globular, pale yellow, at anthesis c. 10 mm diam. when fresh but drying c. 5 mm diam., with 25-40 rather densely arranged flowers whose petals (in mature buds) are not contiguous (being separated by, but overtopping, the bracteoles). *Bracteoles* peltate, more or less equal in length to the calyx; *claws* linear, glabrous; *laminae* not prominently thickened, more or less circular, 0.3-0.5 mm diam., brown, readily observable in immature buds but at bud maturity overtopped by the flowers (and therefore less obvious), white-fimbriolate otherwise glabrous. *Flowers* 5-merous. *Calyx* c. ⅔ length of corolla, gamosepalous, divided for c. ⅛ its length into broadly triangular, moderately puberulous, slightly thickened, slightly inflexed lobes; calyx tube often light brown when dry, obscurely 5-nerved. *Petals* c. 1.5 mm long, united for c. ½ their length but readily splitting to base upon dissection, narrowly oblanceolate, obscurely 1-nerved, glabrous to sub-glabrous (hairs white and antrorsely appressed), acute and slightly thickened at apices. *Ovary* glabrous or densely white-villous, minutely stipitate. *Legumes* oblong to narrowly oblong, not prominently raised over seeds, straight-edged or slightly to moderately constricted between seeds but random deep constrictions do occur, to 9 cm long but often shorter, 8-17 mm wide, with up to 14 seeds per legume, finely and openly transversely reticulate, coriaceous to slightly crustaceous, occasionally more or less sub-woody, abruptly constricted at base into a thick stipe 2-3(5) mm long; margins somewhat thick. *Seeds* transverse in the legume, close together and not separated by pronounced partitions, oblongoid-ellipsoid but slightly narrowed at the hilar end, 5-6 mm long, c. 2.5 mm wide, somewhat compressed (c. 1.7 mm thick), dull but slightly shiny bordering the pleurogram, black; *pleurogram* fine, continuous; *areole* 3-4 mm long, c. 0.8 mm wide; *funicle* light red-brown, 40 mm long (expanded length), brittle when dry, usually with 2-3 short folds before encircling the seed in a "u"-shaped double fold, terminating in a yellowish, clavate *aril* which often extends c. ½-way down one side of the seed.

Specimens examined. SOUTH AUSTRALIA: Memory Cove, Lincoln Flora and Fauna Reserve, *C.R. Alcock* 1226 (AD); "Pillie Lakes" (which is c. 15 km S of Port Lincoln, between Flinders Cairn and Stamford Hill), *C.R. Alcock* 1256 (AD, PERTH); West Point, Lincoln National Park, c. 30 km SSW of Port Lincoln, *C.R. Alcock* 1656 (AD, MEL); West Point, about 30 km [due] SSE of Port Lincoln, *C.R. Alcock* 1682 (AD); Salt Creek, c. 4 km SSE of Port Lincoln [near Northside Hill], *C.R. Alcock* 2564 (AD); West Point area, Lincoln National Park, *C.R. Alcock* 3278 (AD); Stamford Hill area, Lincoln National Park, *C.R. Alcock* 3279 (AD); Lincoln National Park, Stamford Hill, 34° 46' 30" S, 135° 56' 30" E; Memory Cove, *R. Brown* (Iter Austral. no. 4350) (K); Lincoln National Park, c. 42 km from Port Lincoln along Memory Cove track, *E.M. Canning* and *S. Corbett*, E.M.C. 5387 and 5390 (CBG 8210087 and 8210090); Stamford Hill, 1983, *K. Holliday* s.n. (AD 984227395); Near Billy Light Point, Port Lincoln, *D.E. Symon* 6693 (AD); Cape Donington Peninsula, Lincoln National Park, 34° 46' S, 136° 00' 31" E, *F.J. Vickery* s.n. (CANB 349307-349318) and *F.J. Vickery* and *C. Chapman* s.n. (CANB 346499 to 346502, dups. at PERTH); 30 mi [48 km] from Port Lincoln toward Memory Cove, *J.W. Wrigley* WA/68 7645 (AD — phyllodes abnormally broad).

Distribution. Extreme south-east Eyre Peninsula, South Australia where the species has been collected from two areas about 20 km apart. The northern populations occur at Stamford Hill, Cape Donnington Peninsula and Pillie Lake within the Lincoln National Park and at Billy Light Point near Port Lincoln. From the southern extremity of the Park it has been collected from West Point and Memory Cove and near Jussieu Bay.

Habitat. Usually found in sand over limestone but sometimes in skeletal soil with quartz or deep sandy loam over granite. At Stamford Hill the species forms pure stands in open areas in tall *Eucalyptus gracilis* mallee (*Briggs* 1211). Near Cape Donington it occurs in mallee/tea-tree scrub dominated by *Eucalyptus foecunda*, *Melaleuca lanceolata* and *M. uncinata (Vickery* s.n. and *Vickery* and *Chapman* s.n.).

Flowering and fruiting period. The northern populations have two main flowering periods, late February-April and November (J. Briggs and C.R. Alcock, pers. comm.); herbarium specimens in flower have also been collected in June and September. The only flowering southern population specimen seen was collected in December. Legumes take 6-8 months to mature and specimens with mature seeds have been gathered in November and December.

Affinities. Acacia alcockii is placed in section *Phyllodineae* DC. on account of its globular flower-heads and 1-nerved phyllodes. Taxonomically the new species is placed between *A. anceps* DC. and *A. leiophylla* Benth. from which it can be distinguished by a combination of its racemose inflorescences and transverse seeds (see key under *A. anceps*). All three species occur within the Lincoln National Park. From data derived from comparative morphology it is possible that *A. alcockii* is of hybrid origin. However, it seems that the northern and southern populations of the species may have had different origins.

These two sets of populations can generally be recognized by the following characters.

Northern populations: *phyllodes* 8-11(14) mm wide, l:w = 6-10, usually shallowly recurved (sometimes straight); *legumes* to 7-9 cm long, 8-12 mm wide, thinly to moderately coriaceous, straight-edged or slightly to moderately constricted between the seeds although random deep constrictions do occur.

Southern populations: *phyllodes* 12-21(30) mm wide, l:w = (2)3-7, usually straight (rarely shallowly recurved); *legumes* to 3.5-5 cm long, 12-17 mm wide, moderately coriaceous to slightly crustaceous, occasionally more or less sub-woody, straight edged (occasionally few or many deep constrictions on some legumes).

Detailed field studies of three of the northern populations were recently conducted by J. Briggs and F. Vickery. These populations are located at Port Lincoln, Stamford Hill (which comprises several hundred plants) and Cape Donnington Peninsula. Briggs (pers. comm.) reported that plants from these populations, do not show the range of morphological variation that one would expect from hybrid swarms. Furthermore, neither *A. anceps* nor *A. leiophylla* occur within several kilometres (? at least 15 km) of these populations. Nine seedlings raised by Briggs from seed collected from these populations showed no apparent morphological segregation. Seedlings of *A. anceps* and *A. leiophylla* were not examined. Pollen from the following 15 specimens was examined, *Alcock* 1256 (Pillie Lake), *Briggs* 1211 (Stamford Hill), *Vickery* s.n. CANB 349307 to 349318 (Cape Donnington Peninsula) and *Symon* 6693 (Billy Light Point). The only abnormalities were seen in the polyads of *Symon* 6693 where most were either asymmetric in shape or possessed grains with irregular, vestigial or no cytoplasm.

Comparable field studies have not been conducted on the southern populations. However, Briggs has visited Memory Cove where he observed *A. anceps* and *A. leiophylla* but not *A. alcockii.* Vickery, who knows the southern Lincoln National Park well, reported (via Briggs) that he has never seen anything resembling *A. alcockii* in the area. These observations suggest that the plants which are here attributed to *A. alcockii* from Memory Cove and West Point are not common and may indeed simply be spontaneous hybrids (probably between *A. anceps* and *A. leiophylla).* The pollen of *Canning* 5390 and *Corbett*, however, showed no irregularities. The other specimens from these southern areas were either in fruit or very young bud.

If *A. alcockii* is of hybrid origin then the above data suggest that the northern populations may be a stabilized hybrid derivative probably involving *A. anceps* and *A. leiophylla.* The southern populations, however, may represent spontaneous hybrids between these putative parents. Clearly, further detailed population studies are needed, especially for the southern populations. Such studies may show that it is preferable to restrict the name *A. alcockii* to the northern populations. However, on the basis of present evidence it is considered practical to broadly circumscribe the species to include both populations.

Conservation status. 2RC (Leigh et al. 1981) — rare but not considered endangered or vulnerable and represented within a national park.

Etymology. Named in honour of Mr R. Alcock who collected extensively on Eyre Peninsula between 1951 and 1970 while employed as a Weed Officer with Local Government.

2. **Acacia anceps** DC., Prodr. 2: 451 (1825), non Hook. (1837). Figure 2A-E.

Type citation. "in Novae-Holland. ora orientali. (v.s. ex Mus. Par.)" *Type :* Nouvelle Hollande, cote orientali, anonymous [presumably collected by *J. Leschenault* from near Ceduna in 1803, see note below] (holo: G-DC; iso: BM, P).

A. pterigoidea Seemann, Verh. K.K. Gartenbauges. Wein. 1846: 11 (1846). *Type* : Cultivated, P. Schmidt (n.v.).

A. muelleri Benth., Linnaea 26: 603 (1855); G. Bentham, Fl. Austral. 2: 355 (1864). *Type citation:* "Inter montes Dalton et Greenly". *Type:* Between mounts Dutton (sphalm. "Dalton") and Greenly, S.A. [probably collected by *C. Wilhelmi,* see note below] (holo: K; iso: MEL 615146).

A. megaphylla F. Muell. ex Benth., Linnaea 26: 604 (1855), nom. nud., pro syn. sub *A. muelleri;* F. Mueller, J. Proc. Linn. Soc. Bot. 3: 117 (1859).

A. anceps var. *angustifolia* Benth., Fl. Austral. 2: 355 (1864), *syn. nov. Type citation:* "S. coast, R. Brown; towards Spencer's Gulf, Warburton." *Type:* South coast, *R. Brown,* Iter Australiense, 1802-5, no. 4352 [presumably collected by *R. Brown* from Fowlers Bay, S.A., see note below] (syn: K).

A. glaucescens F. Cels, Ann. Fl. Pomone 1839-40: 30, pl. (1839), non Willd. (1806); *A. celsiana* Ser., Fl. Jard. 1: 483 (1849), *syn. nov. Type:* Cultivated, originating from Australia (n.v.).

[*A. retinodes* auct. non Schldl.: E.C. Nelson, J. Roy. Soc. W. Austral. 57: 110 (1974)].

Bushy spreading *shrub* to c. 3 m tall. *Branchlets* acutely angled at extremities, sometimes narrowly winged, often thick, dark red-brown, glabrous. *Phyllodes* usually elliptic to oblanceolate and obtuse, sometimes retuse, usually 3-7 cm long and 1-3 cm wide with l:w = 1.5-4.5, coriaceous, often slightly undulate, glabrous, glaucous or sometimes pale green; *midrib* and *marginal nerves* prominent, penninerved although often obscurely so; *pulvinus* either distinct and articulate or only partially articulate with the lower edge of the broad-based phyllodes continuous and shortly decurrent with branchlets. *Peduncles* axillary, initiated on developing new shoots, 1-2.5 cm long, stout, glabrous. *Flower-heads* globular, deep golden, c. 10 mm diam., densely 60-130-flowered. *Bracteole laminae* more or less circular, brown, golden (occasionally white)-fimbriolate. *Flowers* 5-merous. *Calyx* gamosepalous, c. ¾ length of corolla. *Legumes* narrowly oblong, usually not or barely constricted between seeds, usually to 6 cm long, 10-15 mm wide, firmly crustaceous to woody, glabrous. *Seeds* transverse, c. ½ encircled by funicle.

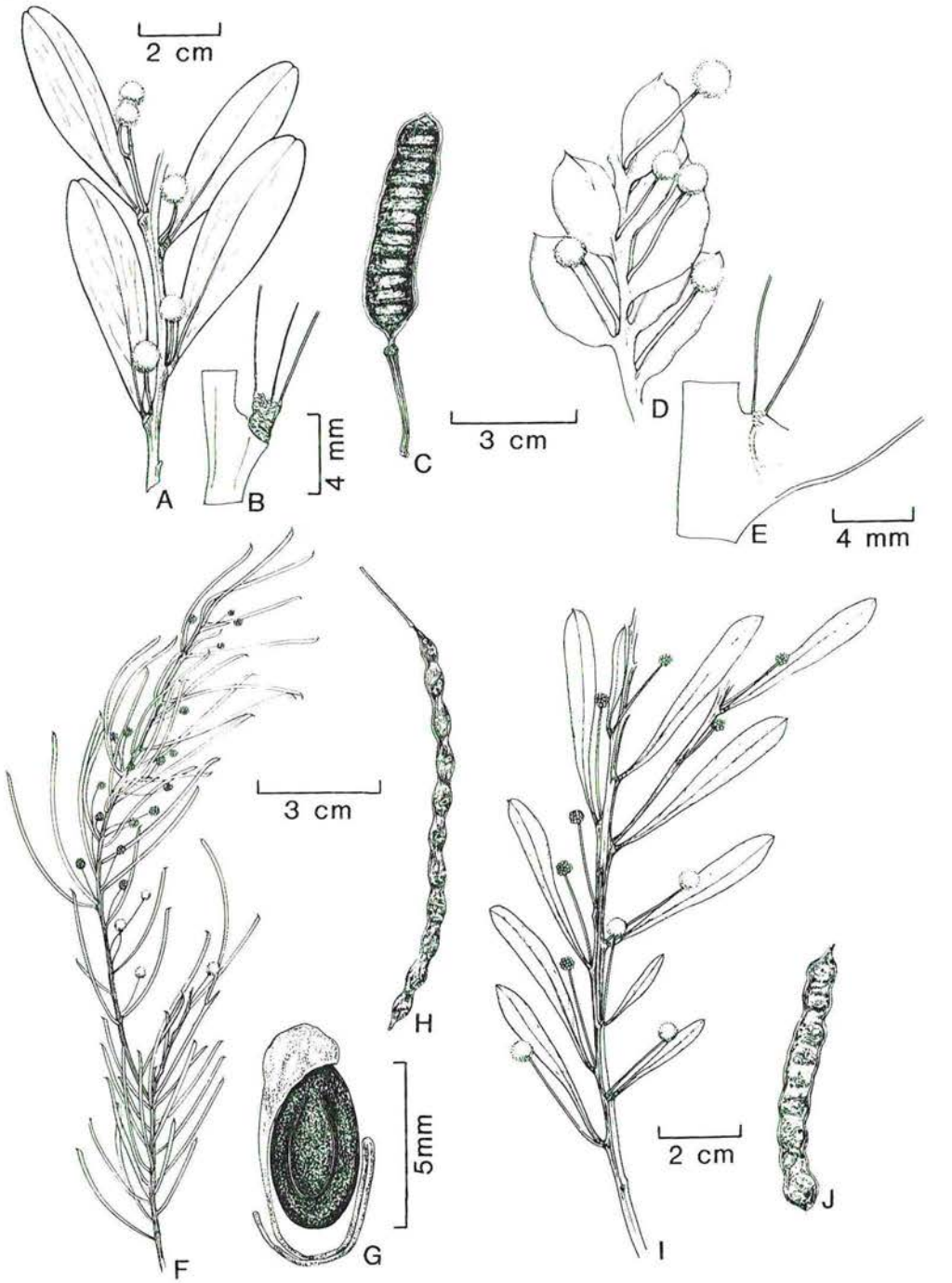

Figure 2. *Acacia anceps* (A-E). A — Flowering branchlet. B — Phyllode base (enlarged) showing distinct, articulate pulvinus. C — Legume with transverse seeds. D — Flowering branchlet. E — Phyllode base (enlarged) showing very reduced pulvinus and lower edge of phyllode continuous with branchlet. *A. nematophylla* (F-H). F — Flowering branchlet. G — Seed (longitudinal) showing reddish brown funicle ¼ encircling seed. H — Legume. *A. anceps* x *nematophylla* (I-J). I — Flowering branchlet. J — Legume. A from *A.S. George* 8565; B from *I.O. Maroske* s.n. (MEL 104130); C from *H.H.D. Griffith* s.n. (AD 96748215); D and E from *J.B. Cleland* s.n. (AD 96705036); F from *J.W. Wrigley* WA/68 7632; G and H from *J.B. Cleland* s.n. (AD 96921030); I and J from *I. Brown* s.n. (AD 98006133).

Distribution. Principally confined to coastal areas of Western Australia and South Australia from Middle Island (Recherche Archipelago, W.A.) east to the southern Eyre and Yorke peninsulas as far as Sturt Bay, S.A.

Selected specimens examined. WESTERN AUSTRALIA: Twilight Cove, *A.S. George* 8565 (PERTH); Middle Island, *A.S. Weston* 8932 (PERTH); Eucla, 1882, *J. Oliver* s.n. (MEL).
SOUTH AUSTRALIA: Port Lincoln, 17 Dec. 1941, *J.B. Cleland* s.n. (AD 96705036) and 10 Oct. 1907, *H.H.D. Griffith* s.n. (AD 96748215); Streaky Bay, Sept. 1963, *I.O. Maroske* s.n. (MEL 104130); Ceduna, near Cape Thevenard, *B.R. Maslin* 4817 (PERTH); Hincks National Park, *J.R. Wheeler* 1091 (AD); Sturt Bay, *D.J.E. Whibley* 5531 (AD).

Type specimens. The holotype of *A. anceps* at herb. G-DC is a specimen sent to De Candolle from herb. P in 1821. The collecting locality is given as the east coast of New Holland. Annotations on isotypes at herb. P show that a duplicate was also sent to Robert Brown, viz. "Envoyé à Mr. Brown no. 9". On the herb. BM specimen someone has suggested that the gathering was made by J. Leschenault (who was one of the botanists on the French expedition under the command of N. Baudin). In February 1803 Baudin's expedition visited Murat Bay near the present-day township of Ceduna at the northern extremity of Eyre Peninsula, South Australia. As *A. anceps* occurs in this region it is quite possible that the type was collected by J. Leschenault from this locality.

The one syntype of *A. anceps* var. *angustifolia* that I have seen (at herb. K) also originated from herb. BM. This specimen has a Robert Brown label bearing the Iter Austral. no. 4352; the only locality data given is "S. Coast". According to Maiden and Blakely (1927: 172) there is a specimen of no. 4352 at herb. NSW which is labelled in Brown's handwriting "..near Bay III [Fowlers Bay, South Australia, fide Stearn 1960], South Coast, 1802..". I have not seen the herb. NSW specimen nor have I been able to locate at herb. BM a Robert Brown specimen labelled as having been collected from Bay III. Fowlers Bay is about 100 km north-west of Ceduna and *A. anceps* does occur in this general area (see hybrid no. 3 below). Morphologically this syntype of var. *angustifolia* is very similar to the holotype of *A. anceps* (both represent the oblanceolate, pulvinate variant of this species which is discussed below).

The holotype of *A. muelleri* at herb. K is a specimen originating from the Sonder Herbarium and its label suggests that F. Mueller was the collector. However, Mueller probably never visited the west coast of the Eyre Peninsula (D. Kraehenbuehl, pers. comm.), the area from where the type was said to have been gathered (viz. between mounts Dutton and Greenly). In all likelihood this gathering was made by C. Wilhelmi because another sheet at Kew, supporting specimens (not types) matching the holotype of *A. muelleri*, is annotated: "Port Lincoln propes, west-coast. Legit. C. Wilhelm. exam. Dr. ferd. Mueller." Wilhelmi collected from southern Eyre Peninsula from 1851-1852 and again in 1854 (D. Kraehenbuehl, pers. comm.).

Variation. Two phyllode variants are recognized within *A. anceps* but morphologically they intergrade and are here not considered worthy of formal rank. The most widespread variant is one that has been collected from Middle Island (Western Australia) east to near Streaky Bay (northern Eyre Peninsula, South Australia) and Sturt Bay (southern Yorke Peninsula, South Australia). It is characterized by rather long, oblanceolate phyllodes which are not continuous with the branchlets and which have well developed pulvini that are articulate at their bases (Figure 2A-B). This variant includes the types of both *A. anceps* and *A. anceps* var. *angustifolia* but in the past it usually went under the latter name, fide Whibley (1980: 64). Of more restricted distribution is a second variant which differs from the first in its less elongate, elliptic phyllodes whose lower edges are clearly continuous and shortly decurrent with the branchlets and whose pulvini are very reduced (Figure 2D-E). Also, it tends to have

thicker, more acutely angled branchlets. This variant has been collected mainly from the vicinity of Port Lincoln (southern Eyre Peninsula, South Australia). In many parts of the southern Eyre and Yorke peninsulas plants have been collected which are morphologically intermediate between these two extremes and in some cases both phyllode types are present on the same specimen. The type of *A. muelleri* appears to represent this intermediate form. *Acacia pterigoidea* and *A. glaucescens* are also probably referable to this form.

Hybridity. Judging principally from morphological evidence derived from herbarium specimens it appears as though *A. anceps* hybridizes with a number of related taxa. Only rarely were we able to examine these taxa in the field. Our purpose here is to draw attention to these putative hybrids and thus lay a foundation for future studies.

1. *A. anceps* x *nematophylla*. See *A. nematophylla* below.

2. ? *A. anceps* x *leiophylla*. See *A. alcockii* above.

3. ? *A. anceps* x *notabilis* .

Some specimens from Streaky Bay and Fowlers Bay (northern Eyre Peninsula) possess characters which suggest they are somewhat intermediate between *A. anceps and A. notabilis*. Many of these specimens have previously been determined as *A. notabilis* at herb. AD and mapped as such by Whibley (1980: 122). Their coarsely angular branchlets, thickly coriaceous phyllodes, golden fimbriolate bracteole laminae and calyx lobes and more or less woody legumes clearly relate them to *A. anceps*. However, a few characters suggest intergradation with *A. notabilis*, viz. inflorescences a mixture of axillary peduncles and racemes, phyllodes occasionally with 2 glands and/or sub-attenuate. Although *A. anceps* occurs in the same general area as these putative hybrids, current collections show *A. notabilis* to be distributed considerably further east. Specimens referable to this possible 80/72 hybrid are *C.R. Alcock* 3395 (AD), N. Hall 80/72 (MEL, PERTH), *A.E. Orchard* 3142, (AD), *Veitch* s.n. (AD 96716196) — all Streaky Bay area, *A.E. Orchard* 3144 (AD) — Fowlers Bay. Specimens with oblanceolate, obtuse phyllodes superficially resemble *A. alcockii* (southern Eyre Peninsula — see above) but are distinguished by their larger flower-heads (50-60-flowered), golden-fimbriolate bracteoles and more or less woody legumes.

Key to *A. anceps* and some allied taxa (including putative hybrids)

1a. Flowering peduncles never racemosely arranged; legumes coriaceous-crustaceous to woody 2
b. Flowering peduncles all or some arranged in racemes of 1(2) or more flower-heads; legumes as above or firmly chartaceous 3
2a. Phyllodes 0.7-1.5 mm wide, flat or terete, never continuous with branchlets; flowers 28-41 per head; legumes 5-6 mm wide; seed longitudinal (S.A., not common.) ..... *A. nematophylla*
b. Phyllodes 1-3 cm wide, flat, sometimes continuous; flowers 60-130 per head; legumes 10-15 mm wide; seeds transverse (W.A., S.A.) ..... *A. anceps*
c. Some or all above characters intermediate (S.A., rare) *A. anceps x nematophylla*
3a. Phyllodes 1-5 mm wide, 3-10 cm long, flat or terete; *racemes* with (1)2-4(13) flower-heads; flowers 25-40 per head; legumes 3-6 mm wide, coriaceous to crustaceous; seeds longitudinal (S.A., N.S.W., Vic.) ..... *A. calamifolia*
b. Phyllodes all or mostly more than 5 mm wide, flat 4
4a. Legumes 5-6 mm wide, firmly chartaceous to slightly coriaceous; seeds longitudinal; bracteole laminae c. 1 mm diam., golden-fimbriolate; phyllodes falcate, thinly coriaceous, 10-13 cm long and 15-22 mm wide (S.A.) ..... *A. leiophylla*

b. Legumes broader; seeds transverse; bracteole laminae smaller.....5
5a. Phyllodes 4-5.5(6.5) cm long, rather thickly coriaceous; flowers 50-60 per head; bracteoles golden-fimbriolate; peduncles mostly axillary, a few arranged in axillary racemes, legumes woody to sub-woody (S.A., rare)? *A. anceps* x *notabilis.*
b. Phyllodes 6-13 cm long; flowers 25-40 per head; bracteoles white-fimbriolate; peduncles mostly arranged in racemes, sometimes a few axillary.....6
6a. Phyllodes rather thickly coriaceous, more or less straight, glaucous to grey-green; flower-heads bright golden; legumes firmly chartaceous to slightly coriaceous. (S.A., N.S.W., Vic.).....*A. notabilis*
b. Phyllodes thinly coriaceous, straight or shallowly recurved, dark green; flower-heads pale yellow; legumes thinly coriaceous-crustaceous .....*A. alcockii*

3. **Acacia cretacea** Maslin and Whibley, sp. nov. Figure 3.

Frutex fusiformis vel arbor parva 3.5-4(5) m alta, corona plerumque effusa aperta. Ramuli pruinosi glabri. Phyllodia plerumque anguste elliptica ad anguste oblanceolata, obtusa, plerumque 7-10 cm x 9-18 mm longitudio : latitudo = 4.5-9, tenuiter ad moderate coriacea, ad extremos ramulos sat congesta, ascendentia vel erecta, recta, glabra, griseo-viridia ad glauca, uninervia, tenuiter penninervia. Racemi plerumque 2-4 cm longi, capitulis floriferis (3)5-9(14-20), axibus pruinosis et glabris. Pedunculi 4-11(17) mm longi, pruinosi, glabri. Capitula globosa, citrina ad aurea, 35-45(55)-flora. Flores 5-meri. Calyx gamosepalus. Legumen angustissime oblongum, ad 9(10) cm x 5-6 mm, solide chartaceum ad tenuiter coriaceum, juvenile pruinosum, glabrum. Semina longitudinalia, 5-7 x 3-3.5 mm, nigra, funiculo rubescente semicirculari vel circulari cincta.

Typus: NE of Coolanie, Eyre Peninsula, S.A., 19 Oct. 1983, *J.D. Briggs* 1391 (holo: PERTH; iso: AD, CBG, K).

Spindly, usually single-stemmed *shrub* or *small tree* 3.5-4(5) m tall, crowns open and straggly, rarely bushy, trunks slender, sometimes suckering from base, phyllodes concentrated towards the ends of the sometimes arching to sub-pendulous branches. *Bark* smooth, grey to red-brown on lower parts of trunks. *Branchlets* finely nerved, terete but slightly to prominently angular towards their apices, glabrous, conspicuously pruinose, marked with distant, prominent, raised leaf bases which are evident on mature branches where phyllodes have fallen. *New shoots* reddish. *Stipules* triangular, minute, c. 0.5 mm long. *Phyllodes* narrowly elliptic to narrowly oblanceolate but some occasionally broadly linear, apices rather abruptly narrowed and obtuse, with a minute, straight or uncinate mucro, (6)7-10(11) cm long, usually 9-18 mm wide but occasionally a few reaching 45 mm, length to width ratio usually 4.5-9 but a few to 2.5, thinly to moderately coriaceous, sometimes very finely wrinkled when dry, rather crowded, ascending to erect, usually straight although occasionally a few very slightly arcuate-recurved or more rarely arcuate-incurved, slightly undulate especially when broad, glabrous, greyish medium-green but glaucous when young; *midrib* central to very slightly excentric, reasonably pronounced, slightly raised when dry, often yellow (although often drying light brown); *marginal nerves* reasonably pronounced, yellow (often drying light brown); lateral nerves numerous, fine but reasonably evident when dry, diverging from the midrib at a very acute angle, openly anastomosing; *pulvinus* terete, 1.5-2 mm long, light to dark brown and wrinkled when dry, often pruinose. *Gland* not very prominent, situated on upper margin of the phyllode at distal end of pulvinus to 4 mm above it, occasionally slightly raised, c. 0.5 mm diam.

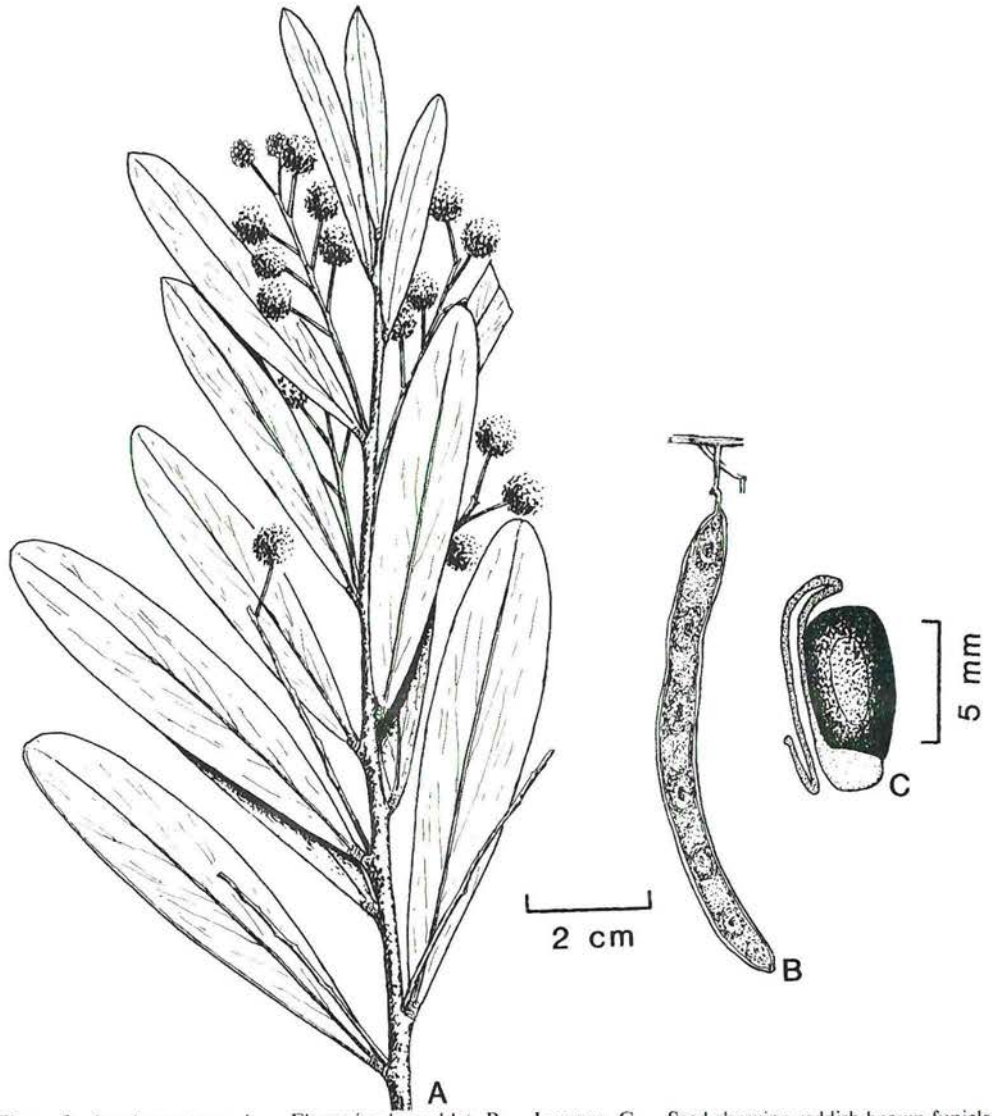

Figure 3. *Acacia cretacea*. A — Flowering branchlet. B — Legume. C — Seed showing reddish brown funicle ½ encircling seed. A from *M. Simmons* 1722; B from *D.J.E. Whibley* 7316; C from *B. Copley* 3898.

Inflorescences 1-2 per node, very fragrant, racemose, rarely interspersed with a few simple peduncles. *Racemes* (1)2-4(6) cm long, with (3)5-9(14-20: B. Copley, pers. comm.) heads; raceme axes straight or slightly flexuose, somewhat angular, glabrous, pruinose, sometimes growing out, base ebracteate. *Peduncles* 4-11(17) mm long, mostly alternate but the lower 2 sometimes opposite, finely longitudinally sulcate when dry, glabrous, pruinose; receptacle capitate; *basal peduncular bract* 1, persistent, ovate to narrowly ovate, 0.5-1 mm long, glabrous. *Flower-heads* globular, 4-5 mm diam. when dry, to 10 mm diam. when fresh, lemon yellow to golden yellow, with 34-45(55) densely arranged flowers, the buds conspicuously pruinose. *Bracteoles* sub-peltate, 1.2-1.5 mm long, glabrous; *claws* narrowly linear, glabrous; *laminae* observable between flowers but not overly prominent in the bud, not thickened, more or less circular and usually minutely apiculate, pruinose. *Flowers* 5-merous, glabrous. *Calyx* ¾ the length of corolla, gamosepalous, divided for c. ¼ its length into oblong, rounded lobes; calyx tube

turbinate, membranous, with 5 light brown stripes (sepal nerves) with white, diaphanous tissue between them. *Petals* c. 1.7 mm long, free to base, narrowly obovate and abruptly acute, not reflexed at anthesis, nerveless. *Ovary* sessile. *Legumes* very narrowly oblong, gently raised over the seeds and usually very slightly constricted between them although occasionally a few random deep constrictions occur, to 9(10) cm long, 5-6 mm wide, with up to 10 seeds per legume, firmly chartaceous to slightly coriaceous, straight to very slightly curved, glabrous, pale brown, conspicuously pruinose at least when young, very obscurely reticulate, apex abruptly acute, basal stipe c. 5 mm long. *Seeds* longitudinal with aril facing apex of legume, oblongoid, 5-7 mm long, 3-3.5 mm wide, rather turgid to somewhat compressed (2-2.5 mm thick), slightly shiny, black; *pleurogram* very obscure, either continuous or with a narrow opening towards the hilum; *areole* c. 2.5-3.5 mm long, 1.3-1.5 mm wide; *funicle* thickly filiform, c. 15 mm long (expanded length), light brown to reddish brown and very brittle when dry, usually with a short fold (which frequently extends over top of the aril) near attachment to legume and then extending below seed to ½ or wholly encircle it before doubling back and terminating in a thickened, yellow, clavate *aril*.

Specimens examined. SOUTH AUSTRALIA: *J.D. Briggs* 1390 (AD, CBG) and 1392 (AD, CBG, MEL, PERTH); *B. Copley* 3896 (AD), 3897 (AD, MEL), 3898 (AD, PERTH); *P. Copley* 362 (AD); 9 July 1968, *I.J. Duggin* s.n. (AD 96904005); 3 February 1962, *W.S. Reid* s.n. (AD 97609087 ex ADW); *M. Simmons* 1722 (CANB, PERTH); 22 July 1971, *M. Smith* s.n. (AD 97135211 and 97135212); 3 February 1962, *South Australian Pastoral Board* s.n. (AD 97630321 and 98025053); *D.J.E. Whibley* 5691, 7313 and 7316 (all AD).

Distribution. Endemic in northeast Eyre Peninsula, South Australia, where it occurs in a very restricted area north of Cowell.

Habitat. Low shrubland and mallee scrub on deep red sand in gently undulating country with low sand ridges. Some associated species include *Eucalyptus incrassata, Melaleuca uncinata, Triodia irritans, Phebalium bullatum,* etc. (J.D. Briggs, pers. comm.).

Flowering and fruiting period. Seemingly with a long flowering period. Specimens in flower (often also with mature or immature legumes) have been collected from July to February. Mature legumes have been collected in January, February and October.

Affinities. Acacia cretacea belongs to a group of *Acacia* section *Phyllodineae* DC. species characterized by usually racemose inflorescences and by seeds which are partly or wholly encircled by their reddish, filiform funicle. This is an Australia-wide group and on the Eyre Peninsula is represented by the following species: *A. anceps* DC., *A. alcockii* Maslin and Whibley, *A. calamifolia* Sweet ex Lindley, *A. gillii* Maiden and Blakely, *A. leiophylla* Benth., *A. nematophylla* F. Muell. ex Benth. and *A. notabilis* F. Muell. *Acacia cretacea* is distinguished from all these species by its prominently pruinose branchlets, inflorescences and legumes. Its growth habit is similar to the more southerly distributed *A. gillii* which is readily distinguished by its prominently flexuose, non-pruinose branchlets, usually longer phyllodes (7-17 cm) which are mid-green and shallowly curved, larger flower-heads (43-72-flowered) and longer legumes (to 15 cm) which are not pruinose. *Acacia notabilis* which grows in the same general area as *A. cretacea* (but the two are not sympatric) is readily recognized by its coriaceous phyllodes, non-pruinose branchlets and broad legumes (8-12 mm wide) with transverse seeds. *Acacia steedmanii* Maiden and Blakely (Western Australia) resembles the new species in its pruinose branchlets and general phyllode, inflorescence and carpological features. However, *A. steedmanii* is distinguished from *A. cretacea* by its (2)3-4 glands per phyllode, shorter, stouter peduncles (4-5 mm long), dark brown to black, fimbriolate bracteoles and its not (or only slightly) pruinose legumes.

Conservation status. Endangered (Leigh et al. 1981). Known only from a few hundred plants occurring along a road verge and on adjacent lease-hold land within a very restricted area (about 4 x 2 km).

Etymology. Cretaceus (L.) — chalk-white. Refers to the conspicuously pruinose branchlets, inflorescences and legumes.

4. **Acacia nematophylla** F. Muell. ex Benth., Linnaea 26: 612 (1855). Figure 2F-H.

Type citation. "Boston Point Novae Hollandiae australioris (F. Müll.)". *Type:* Boston Point, S.A., *C. Wilhelmi* (holo: K; iso: C, K, MEL 615302, 615306, 615307, 615310 — see note below).

Bushy *shrub* to c. 2.5 m tall. *Branchlets* angled at extremities, glabrous. *Phyllodes* narrowly linear, (14) 20-40 mm long, 0.7-1.5(2) mm wide, ascending to erect, straight to shallowly curved, uncinate, flat to terete, usually drying finely wrinkled, glabrous, grey-green, 4-nerved in all; *midrib* impressed or sometimes (when phyllodes flat) slightly raised; *pulvinus* distinct and articulate. *Peduncles* axillary, 1 per node, 4-15 mm long, glabrous, base ebracteate. *Flower-heads* globular, 28-41-flowered. *Flowers* 5-merous. *Calyx* gamosepalous. *Legumes* linear, raised over seeds and slightly to moderately constricted between them, to 11 cm long, 5-6 mm wide, coriaceous-crustaceous to sub-woody, glabrous, longitudinally rugose. *Seeds* longitudinal, oblongoid to ellipsoid, 4.5-5 mm long, c. 2.5 mm wide, black, ½-¾ encircled by the filiform, reddish brown *funicle.*

Distribution. Coastal dunes of S.A. from near Drummond Point to Point Boston (southern Eyre Peninsula) and Innestone to Sturt Bay (southern Yorke Peninsula). Also recorded from Venus Bay (c. 125 km N of Drummond Point) and Myponga on the Fleurieu Peninsula.

Selected specimens examined. SOUTH AUSTRALIA: Near Sleaford Mere, about 15 km SW of Port Lincoln, 9 Nov. 1968, *J.B. Cleland* s.n. (AD 96921030); Myponga, *R.B. Filson* 3002 (MEL); About 2 km S of Whalers Well Swamp, Coffin Bay Peninsula, *T.R.N. Lothian* 3709 (AD); Sturt Bay, c. 15 km S of Warooka, *B.R. Maslin* 4538 (PERTH); 13.5 km S of Port Lincoln silo, *L.D. Williams* 9713 (AD); 12 mi [19 km] from Port Lincoln along Memory Cove road, *J.W. Wrigley* WA/68 7632 (AD 97302081).

Type specimens. The holotype of *A. nematophylla* at herb. Kew is annotated "Boston-point, Dr. F. Mueller". The specimen originated from the Sonder Herbarium and the sheet is stamped Herbarium Benthamianum 1854. An isotype of this taxon, also at herb. K (duplicates at MEL), shows that the plant was in fact collected by C. Wilhelmi, not F. Mueller. This Kew isotype sheet is stamped Herbarium Hookerianum 1867 and is annotated (in Mueller's hand) "Boston Point, Port Lincoln. Legit. Carl Wilhelmii exam. Dr. ferd. Mueller". Although Bentham determined this specimen as *A. nematophylla* he seemingly did not do so prior to the publication of the protologue otherwise C. Wilhelmi would presumably have been given as the collector. Above Bentham's annotation someone has written "*A. calamifolia* Sweet var." and underlined the species name in red. This underlining indicates that the specimen was examined by Bentham prior to the publication of *Acacia* in Fl. Austral. vol. 2 (see footnote on p. 8 of Fl. Austral. vol. 1, 1863). In Fl. Austral. vol. 2 (1864) Bentham included the name *A. nematophylla* under *A. calamifolia,* presumably following Mueller (1863: 12).

The Murray scrub specimens referred to in the protologue of *A. nematophylla* are *A. wilhelmiana* F. Muell. (fide Court 1972: 160).

Affinities. Until now this name has been included in synonymy under *A. calamifolia* Sweet ex Lindley, fide Bentham (1864, 1875), Court (1972), Whibley (1980). *Acacia nematophylla* is certainly closely related to the highly variable *A. calamifolia* but they can be distinguished by their inflorescences and to some extent their phyllodes. The two species are allopatric with *A. nematophylla* occurring on coastal dunes and *A. calamifolia* inland. In *A. nematophylla* the peduncles are almost always solitary in the axils of the phyllodes. Only very rarely at a few nodes near the base of some branchlets are the subtending phyllodes absent (distal nodes on these branchlets possess solitary peduncles in axils of phyllodes). In most cases it is clear that the phyllodes were once present since a scar occurs on the branchlet on the abaxial side of the peduncle. In the very few cases where scars cannot be observed the phyllodes may have dropped early in their development. Even if phyllodes were never developed at these nodes the structure does not have the general appearance of a raceme which has grown out. In *A. calamifolia* the peduncles are arranged in axillary racemes. Often, however, some of these racemes grow out and on the new growth the peduncles are solitary in phyllode axils as in *A. nematophylla.* The racemes are commonly 1-4 mm long with 2-4 peduncles but they sometimes reach up to 4 cm long with 13 peduncles.

The phyllodes of *A. calamifolia* are very variable but generally they fall into one of two categories, namely, linear (usually 3-10 cm x 1-1.5 mm) and terete to flat, or narrowly oblanceolate (usually 3.5-6 cm x 2-5 mm) and flat. In *A. nematophylla* the phyllodes are frequently shorter than this but where overlap occurs (with phyllodes of the first category above) they tend to dry more coarsely wrinkled than those of *A. calamifolia.*

The differences between *A. nematophylla* and *A. calamifolia* may seem slight. However, when taken in combination the inflorescence, phyllode and geographic attributes argue for the separation of the two taxa. The differences between them appear to be as significant as differences between some other species in this Australia-wide taxonomic group (e.g. *A. calamifolia* from *A. x grayana* J.H. Willis, *A. leptopetala* Benth. from *A. meisneri* Lehm. ex Meissner) and therefore specific rank is considered appropriate for *A. nematophylla.*

Acacia nematophylla is also allied to *A. anceps* and, as discussed below, the two species appear to hybridize in some places. The differences between the two species are given in the key under *A. anceps.*

Hybrids. Probable hybrids between *A. nematophylla* and *A. anceps* are recorded from a few localities on southern Yorke and Eyre Peninsulas. These plants possess various combinations of characters which are intermediate between the two putative parents, viz. phyllode width and texture, legume width, number of flowers per head (Figure 2I-J). The localities from which these probable hybrids have been collected are: Sturt Bay, Yorke Peninsula (*I. Brown* s.n., AD 98006133, 98006136, 98006137; *B. Copley* 2929, NSW and 2933, NSW; *B.R. Maslin* 4540, PERTH); 28 mi [45 km] from Yorketown towards Foul Bay, Yorke Peninsula (*M.E. Phillips* SA/66 429, AD); Lincoln Flora and Fauna Reserve, Eyre Peninsula (*C.R. Alcock* C138 and 1257, AD). These putative hybrids resemble oblanceolate phyllode forms of *A. calamifolia* (which are often erroneously called *A. microcarpa* var. *linearis* J. Black) in phyllode shape and size but are readily distinguished by their axillary, ebracteate peduncles which are not arranged in short racemes and also by their phyllodes which lack recurved apical mucros.

5. **Acacia notabilis** F. Muell., Fragm. 1:6 (1858). Notable Wattle; Flinders Wattle.

Type citation. "In vicinitate portus Lincoln. C. Wilhelmi. Ad montes Flinders Range in deserto." *Lectotype* (here selected): Spencers Gulf near Port Lincoln, S.A., C. *Wilhelmi* s.n. (MEL 616151). *Para-lectotypes*: Flinders Range, S.A., Oct. 1851, *F. Mueller* s.n. (K, MEL 616149 and 616150, PERTH-fragment from MEL 616149).

Bushy spreading *shrub* to 3 m tall, rarely taller. *Branchlets* slightly angled at extremities, dark red-brown, glabrous. *Phyllodes* narrowly elliptic to oblanceolate or narrowly oblanceolate, usually 6-13 cm long and 8-25 mm wide with l:w = 4-10, coriaceous, glabrous, glaucous to dull green; *midrib* and *marginal nerves* prominent, obscurely penninerved; *pulvinus* prominent and 4-6 mm long. *Racemes* usually 2-6 cm long with 4-16 flower-heads, axes glabrous. *Peduncles* 2.5-6 mm long, rather stout, glabrous. *Flower-heads* globular, occasionally oblongoid in bud, bright golden, 27-36-flowered. *Bracteole laminae* evident in buds, dark brown to black, white-fimbriolate. *Flowers* 5-merous. *Calyx* gamosepalous. *Legumes* narrowly oblong, to 7 cm long, 8-13 mm wide, firmly chartaceous to slightly coriaceous, convex on opposite sides over alternate seeds, glabrous, stipitate. *Seeds* transverse, oblongoid-ellipsoid, 4.5-5.5 mm long, 3-3.5 mm wide, black, encircled by the filiform, red-brown *funicle*.

Distribution. South Australia, Victoria and New South Wales. In S.A. ranging from Tintinara (South-eastern Region) north through the Lofty Ranges and northern Yorke Peninsula to Arkaba Station (Flinders Range) and then east to Gawler Ranges and near Cummins (southern Eyre Peninsula). Less common in N.S.W. and Victoria. In N.S.W. recorded for Broken Hill and near Menindee and in Victoria from Nathalia and near Meringur.

A number of South Australian specimens previously included under *A. notabilis* have now been transferred to either *A. alcockii* or ? *A. anceps* x *notabilis* (see above).

Affinities. Allied to *A. anceps* from which it is distinguished by its shorter peduncles which are arranged in axillary racemes, smaller flower-heads and firmly chartaceous to slightly coriaceous legumes (see key under *A. anceps*). Possible hybrids between these two species are discussed under *A. anceps*. Also allied to *A. beckleri* Tind. from which it is readily distinguished by its glabrous peduncles (not densely minutely tomentellose) and transverse seeds (not longitudinal). The N.S.W. specimen cited by Bentham (1864) under *A. notabilis* is *A. beckleri*.

Acknowledgements

Prof. K.H. Rechinger is gratefully acknowledged for providing the Latin descriptions. John Briggs and Fraser Vickery are thanked for providing valuable field data and specimens of *A. alcockii* and *A. cretacea*. John is further thanked for very constructive criticism of the manuscript. Marion Simmons and the late Bruce Copley also provided very useful observations on *A. cretacea*. This species was first drawn to D.J.E.W.'s attention by the late Merv Smith of Cowell. David Keane is thanked for illustrating Figures 1E, 1F and 3B. Suzanne Curry, employed by the first author under a grant from the Bureau of Flora and Fauna is thanked for competent technical assistance. The work was conducted at the Western Australian Herbarium, Perth (B.R.M.) and the State Herbarium, Adelaide (D.J.E.W.).

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Notes on *Acacia* (Leguminosae: Mimosoideae) in Central Australia

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Abstract

Maslin, B.R. Notes on *Acacia* (Leguminosae: Mimosoideae) in Central Australia. Nuytsia 6(1):33-34 (1987). A new name, *A. desmondii* Maslin, is provided for the later homonym, *A. nelsonii Maslin*. A new subspecies, *A. macdonnelliensis* subsp. *teretifolia* Maslin, endemic in the Rawlinson Range-Petermann Range area, is described.

Introduction

The purpose of this paper is to provide names for two taxa intended for inclusion in the forthcoming second edition of the Flora of Central Australia.

Acacia desmondii Maslin, nom. nov.

Based on *A. nelsonii* Maslin, J. Adelaide Bot. Gard. 2: 314 (1980), non Staff., J. Wash. Acad. Sci. 4: 363 (1914).

The new epithet, as with the replaced synonym, honours Desmond J. Nelson. The species is described in Maslin (1980).

Acacia macdonnelliensis Maconochie subsp. **teretifolia** Maslin, subsp. nov.

Acacia macdonnelliensis subsp. *teretifolia* ; differt a subsp. *macdonnelliensis* phyllodiis teretibus.

Typus: 6 km W of Docker River, just W of the W.A./N.T. border, Western Australia, 28 June 1983, *A. Kalotas* 1570 (holo: PERTH; iso: NT).

Selected specimens examined. WESTERN AUSTRALIA: Schwerin Mural Crescent, near Rebecca Hill, *D.J. Edinger* 124 (PERTH); Bungabiddy Rockhole, Walter James Range, *A.S. George* 12071 (NT, PERTH); Rawlinson Range, c. 3 km due N of Giles Meteorological Station, *S. Midgley* 578 (PERTH).

NORTHERN TERRITORY: E of Dean Range, Learmonth Park, *A. Kalotas* 1552 (NT, PERTH); c. 11 km N of Wangkari (Mount Bearteaux), *A. Kalotas* 1558 (NT, PERTH).

Distribution. Rawlinson Range (W.A.) east to the Petermann Range (N.T.). The typical subspecies occurs mainly in the Macdonnell Range, N.T., about 300 km NE of the Petermann Range with a few scattered occurrences between the two ranges; it is rare in W.A. having been recorded only from the Pollock Hills, about 250 km N of the Rawlinson Range.

Subspecies *teretifolia* is readily distinguished from subsp. *macdonnelliensis* by its terete phyllodes. Except for this character and also its often shorter racemes (1-5 mm long compared with 4-12 mm long) the new subspecies appears indistinguishable from the typical subspecies. The two subspecies grow in rocky ranges and their geographical distributions are not known to overlap.

The new subspecies is similar to *A. tenuissima* F. Muell. on account of its filiform phyllodes, spicate inflorescences and long, narrow legumes. It can, however, be distinguished in the following ways: branchlets sometimes hoary and not marked with such obvious crenulated resin-ribs, peduncles shorter, spikes longer, calyx smaller and villous, arils whitish. Descriptions of both *A. tenuissima* and *A. macdonnelliensis* are given in Maslin (1981).

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The identity of *Acacia microcarpa* F. Muell. (Leguminosae: Mimosoideae) and some related taxa

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Abstract

Maslin, B.R. The identity of *Acacia microcarpa* F. Muell. (Leguminosae: Mimosoideae) and some related taxa. Nuytsia 6(1):35-46 (1987). *Acacia halliana,* a new species hitherto confounded with the eastern Australian species *A. microcarpa* F. Muell. is described and its distribution mapped. Confusion surrounding the application of the name *A. microcarpa* is discussed and the name is lectotypified. Descriptions and distribution maps are provided for *A. microcarpa* and the three species considered most closely related to it, namely *A. acinacea* Lindley, *A. imbricata* F.Muell. and *A. triquetra* Benth. A key to the recognition of these species is given. *Acacia triquetra* is lectotypified; until now this name had been considered synonymous with *A. acinacea. Acacia rotundifolia* Hook. is not considered specifically distinct from *A. acinacea. Acacia subretusa* Maiden and Blakely is relegated to synonymy under *A. microcarpa* .

Introduction

In the past much confusion has surrounded the application of the name *A. microcarpa* F. Muell. Most authors, including Mueller (1863 and 1887), Bentham (1864 and 1875), Court (1973) and Whibley (1980), included under this name specimens referable to both *A. microcarpa* and a new species described here as *A. halliana* Maslin. The historical reason for this confusion appears to be that Mueller himself confounded the two taxa. The original description published in 1858 was based on a number of fruiting specimens (see below). In the following year Mueller (1859) republished this description (practically unaltered) and in 1863 provided an expanded description in which flower details were included. It is clear from this 1863 account, as well as from specimens examined in the course of the present study, that at least some material referable to *A. halliana* was used to compile this description. For example, at herbs. K, MEL and NSW there are flowering specimens of *A. halliana*, collected from the Murray River, which Mueller has labelled *A. microcarpa.* Another herb. K sheet of interest supports two gatherings, both of which are labelled by Mueller as *A. microcarpa.* The fruiting specimens on this sheet are *A. halliana* and were collected from the Darling River, while the flowering specimen, which was cultivated at the Melbourne Botanic Garden, is *A. microcarpa.* This latter specimen is one of those mentioned by Bentham (1864) as approaching *A. acinacea* Lindley. The Murray and Darling River specimens were perhaps collected by J. Dallachy (Mueller gives the collector simply as "D"). The confusion between these two species, which commenced with Mueller's (1863) interpretation of *A. microcarpa,* has persisted to the present.

Besides *A. halliana,* descriptions are provided in this paper for *A. microcarpa* and three closely allied species, namely *A. acinacea* Lindley, *A. imbricata* F.Muell. and *A. triquetra* Benth. In the past, specimens referable to *A. triquetra* have been included under *A. acinacea.* Lectotypes are selected where necessary.

Acacia halliana Maslin, sp. nov.

Frutex dumosus effusus ad 2.5 m altus. Ramuli plerumque breves, pilis brevibus rectis appressis obsiti, interdum glabri. Surculi juveniles primum pilis pallide flavis appressis tecti. Stipulae (l.5)2-3(4) mm longae, fragiles, basi tantum ad nodos nonnullos persistentes, plerumque nigrescentes. Phyllodia subassymetrica, plerumque anguste oblanceolata usque anguste oblonga vel anguste elliptica, apice in punctum atrobrunneum distinctum oblique attenuata, (2.2)3-7(9) cm x 4-15(30) mm, longitudo: latitudo 4-12, coriacea, recta ad levissime recurva, glabra, uninervia, nervis lateralibus nullis vel valde indistinctis. Glandula (2)5-12(17) mm supra pulvinum sita. Pedunculi (1)2(3-4) per nodum, exsiccando plerumque atrate rubro-brunnei, (3-4)5-10 mm longi, glabri. Florum capitula globularia, aurea, 35-55-flora. Flores 5-meri. Sepala libera. Legumen submoniliforme, plerumque laxe et irregulariter tortum, ad 6 cm longum, 3 mm latum, nigrum. Semina longitudinalia, obloidea ad ellipsoidea, 3-4 x 2-2.5 mm, arillus conicus.

Typus: 10 km N of Bute on the road to Port Broughton, S.A., 22 Sept. 1985, *B.R. Maslin* 6003 (holo: PERTH; iso: AD, CANB, G, K, MEL, NSW, NY).

Illustrations (as *A. microcarpa*). F. Mueller, Iconography of Australian species of *Acacia* and cognate genera. Decade 4 (1887) — upper left-hand flowering twig and all fruiting specimens; D.J.E. Whibley, Acacias of South Australia 63 figs. A,L,S (1980); G.M. Cunningham et al., Plants of Western New South Wales 367 (1981).

Bushy spreading *shrub*, either domed and procumbent or with a mallee-like habit, to 2.5 m tall and 4-5 m diam. *Bark* dark grey to brownish grey, fibrous towards base of main branches otherwise smooth. *Branchlets* slightly to prominently angled at extremities, soon terete, finely ribbed, occasionally glabrous but usually with a sparse to dense indumentum of very short, straight, antrorsely appressed, fine white hairs. *New shoots* at initiation densely clothed with pale yellow, appressed hairs. *Stipules* linear-triangular, (l.5)2-3(4) mm long, 0.3-0.5 mm wide at base, straight or shallowly incurved, usually drying blackish, glabrous or sparsely appressed-hairy on abaxial surface, slightly thickened and very brittle, frequently absent from some nodes having broken off at base, sometimes persisting at nodes after phyllodes have fallen. *Phyllodes* usually slightly to moderately asymmetric with the upper margin more convex than the lower which is frequently more or less straight, oblanceolate or narrowly oblong to narrowly elliptic, sometimes more or less linear, (2)3-7(9) cm long, 4-15(30) mm wide, l:w = 4-12, coriaceous, usually patent to inclined, straight or (especially near apices) very slightly recurved, usually glabrous or sometimes (especially when young) with a sparse indumentum of short, straight, white, appressed hairs, light green to dark green; *midrib* more or less central; *lateral nerves* absent or scarcely apparent; *marginal nerves* narrow and yellow to light brown, adaxial marginal nerve occasionally bifurcating near the gland; *apex* obliquely narrowed (either somewhat gradually or more usually rather abruptly so) into a distinct, dark brown, brittle, sometimes slightly pungent, acute, straight or slightly curved mucro 1-2 mm long; *pulvinus* 1-2 mm long, drying finely transversely wrinkled and brown. *Gland* situated on adaxial margin (2)5-12(17) mm above the pulvinus, oblong, 0.5-0.8 mm long, not prominent, slightly raised to very shallowly concave, drying medium brown to dark brown. *Peduncles* axillary or less commonly 1-2 on very reduced racemes to 1 mm long, (1)2(3-4) per node, (3-4)5-10 mm long, glabrous, usually drying dark red-brown to black, very occasionally light brown; basal peduncular bracts solitary, caducous, more or less cymbiform, c. 2 mm long, concave, sessile, densely hairy abaxially with indumentum as on branchlets. *Flower-heads* globular, 9 mm diam. at anthesis (fresh), mid-golden, 35-55-flowered. *Bracteoles* similar to sepals. *Flowers* 5-merous. Sepals linear-spathulate, ⅓-⅔ length of petals, claws glabrous, laminae sparsely hairy and usually brown. *Petals* 2-2.3 mm long, glabrous, sometimes the apices drying blackish, nerveless to very obscurely 1-nerved. *Ovary* glabrous to sub-glabrous. *Legumes* sub-moniliform,

circinnate to sigmoid or more usually loosely and irregularly twisted, to 6 cm long, 3 mm wide, with up to 10 seeds per legume, firmly chartaceous to very thinly crustaceous, glabrous to sparsely appressed-hairy, black. Seeds longitudinal in legumes, oblongoid to ellipsoid, 3-4 mm long, 2-2.5 mm wide, shiny to more or less dull, dark brown; *pleurogram* "u"-shaped, open towards the hilum; *areole* 0.5-1 mm long, 0.3-0.5 mm wide; *funicle* filiform and c. 2 mm long; *aril* conical and situated at top of seed, 2-2.5 mm long, c. 2 mm wide at base, the hard, brown, central core surrounded by a thin layer of creamy tissue which may exfoliate.

Selected specimens examined. SOUTH AUSTRALIA: Gluepot Station north of Waikerie, *N. Gemmell* 312 (AD); Opposite the Electricity Substation at the western end of Kimba on the Eyre Highway, *N. Hall* H80/56 (MEL, PERTH); Yorke Valley, Yorke Peninsula, [*J.G.O.*] *Tepper* 803 (MEL); 1.5 km NE of Murray Bridge-Palmer road (from Pallamana intersection) towards Murray Bridge-Mannum road, 35° 01' 30" S, 139° 13' 00" E, *B.R. Maslin* 5983 (PERTH); Thurlga gate, c. 55 km NE of Minnipa on road to Yardea, *A.E. Orchard* 2320 (AD); About 0.8 km N of Yeelanna, *M.D. Tindale* 579 (NSW, PERTH).

NEW SOUTH WALES: 26 miles [41.8 km] W of Balranald on Euston road, c. 34° 36' S, 143° 47' E, 11 Oct. 1947, *E.F. Constable* s.n. (NSW 51735); 26.9 km E of Monak on Sturt Highway, 34° 26' S, 142° 28' E, *L. Thomson* 55 (NSW, PERTH).

VICTORIA: South-west corner, Hattah Lakes National Park, 13 Nov. 1969, *G.W. Anderson* s.n. (MEL 1500708); Big Desert, 9 km S of Murrayville on Nhill road, 35° 21' S, 141° 11' E, *M.G. Corrick* 6385 (MEL); 21 km along road running west from Sunset Tank-Merrinee track, 34° 43' S, 141° 28' E, *M.G. Corrick* 6622, *P.S. Short* and *B.A. Fuhrer* (MEL, PERTH); Shire of Borung, 10 Oct. 1901, *F.M. Reader* s.n. (MEL 616115); Swan Hill, *W.W. Watts* 1124 (MEL).

Distribution (Figure 1). S.A., N.S.W. and Vic. South Australia: Eyre Peninsula from near Port Lincoln north to the vicinity of Kimba. One collection from Calca and another from Thurlga Gate in the Gawler Ranges (north- western Eyre Peninsula). Northern Yorke Peninsula from Yorke Valley north to near Wallaroo and Bute and eastwards through the Northern Lofty Region to Waikerie and Gluepot Station in the Murray Region. Also from Lameroo-Pinnaroo area near the Vic. border (south-eastern Murray Region). Victoria: Principally in the Mallee and Wimmera Regions of western Vic. from the S.A. border near Murrayville east to Gunbower. New South Wales: Restricted to a small area near the Vic./N.S.W. border in the southern part of the Far Western Plains Region from Mildura to Balranald.

Habitat. Appears to favour flat or gently undulating topography in red or red-brown sand or light brown calcareous loam; with mallee eucalypts.

Flowering and fruiting period. Flowering extends from August to November but the main flush occurs in September and October. Legumes with mature seeds have been collected in December. Dehisced legumes sometimes persist on plants.

Affinities. Formerly confounded with *A. microcarpa* (see below) but *A. halliana* differs significantly in the following ways. Stipules (1.5)2-3(4) mm long and persistent (however, because of their brittle nature they are not always present at all nodes). Phyllode apices acute and eglandulose. Aril conical and situated at top of seed. Considering these differences it is surprising that *A. halliana* and *A. microcarpa* have remained confused for so long. Also, in *A. halliana* the new shoots and usually the branchlets are appressed-hairy and the heads are 35-55-flowered (however, in variant 2 of the species (see below) the indumentum is lacking and the heads are 16-25-flowered — in these two characters the variant agrees with *A. microcarpa*).

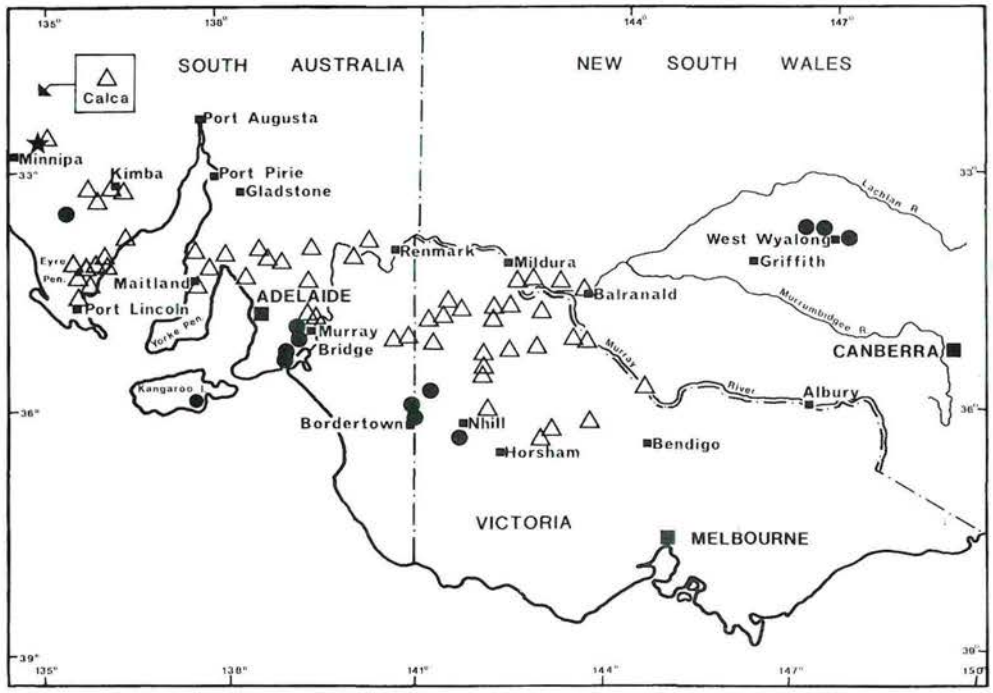

Figure 1. Distribution of *Acacia halliana*. Open triangle — typical variant; closed circle — variant with small flower-heads; closed star — variant with long peduncles.

Acacia halliana appears to be most closely related to the widespread, variable species *A. merrallii* but is readily distinguished by its much longer phyllodes.

Etymology. I am pleased at having this opportunity to name this new species in honour of Mr Norman Hall who has done so much to assist me with *Acacia* projects in recent years.

Variants. The following two variants are not included in the above description but their distribution is mapped in Figure 1.

1. This variant has atypically long peduncles (23-26 mm) and sub-falcate phyllodes (6.5-7.5 x c. 1.5 cm). It is known from a single flowering specimen (*A.E. Orchard* 2314, AD) which was collected from the Gawler Range, S.A., about 40 km north-east of Minnipa on the road to Yardea. Typical *A. halliana* also occurs in the Gawler Range which is the north-western limit of distribution of the species. In the absence of legumes and field studies it would seem best to regard this plant as an aberrant form of *A. halliana* and not attribute formal (infraspecific) rank to it.

2. The second variant is widespread and has been recorded from discontinuous localities in South Australia (Eyre Peninsula — one specimen only, lower Murray and Southern Lofty Regions — common around Monarto South, South-eastern Region — Bordertown area, Kangaroo Island — uncommon), Victoria (Little and Big Deserts) and New South Wales (near West Wyalong) — Figure 1. The disjunction between north-west Victoria and West Wyalong area is similar to that found in *A. microcarpa* (see Figure 3). The variant is distinguished from typical *A. halliana* in the following ways. Branchlets consistently glabrous and often more prominently angled at extremities. New shoots glabrous. Stipules often not drying blackish, usually completely deciduous on specimens from N.S.W.. Phyllodes always oblanceolate, usually 2-4 cm long and (2)3-7 mm wide with l:w = 4-10, rarely a few phyllodes

longer (to 7 cm), shorter (to 1-1.5 cm) or wider (to 13 mm) or more elongate (l:w to 16), ascending to erect, straight or more usually shallowly incurved. Peduncles drying yellowish to black. Flower-heads 16-25-flowered, 8 mm diam. at anthesis, light- to mid-golden. Legumes uniformly strongly curved, terete but not or barely constricted between the seeds.

Selected specimens examined. SOUTH AUSTRALIA: About 10 km N of Wolseley, *K.M. Alcock* 115 (AD); Eyre Peninsula, north of Lock, *R. Bates* 829 (AD); Goolwa, 14 Dec. 1940, *J.B. Cleland* (AD 97427361, MEL 1500364 — mounted on holotype sheet of *A.* x *grayana*); Finniss Railway Station, 19 Dec. 1964, *J.B. Cleland* s.n. (AD 966061159); Monarto South, about 3 km south of railway crossing on road to Chauncey's line, *Hj. Eichler* 15106 (AD, MEL); Lower Murray River on Lake Alexandrina, ca. 15 km to Milang, *N. Gemmell* 159 (AD); Kangaroo Island, about 1 km S of top of Macgillivray Hill, *G. Jackson* 1457 (AD); Kangaroo Island, about 11 km south of top of Macgillivray Hill, *G. Jackson* 1459 (AD); 3.5 km by road S of Monarto South, *B.R. Maslin* 5977 (PERTH); About 10 km E of Bordertown, *R.L. Specht* 1669 (AD).

VICTORIA:- 8 mi [13 km] S of Red Bluff, *R.V. Smith* (*B.J. Conn* no. 59/220) (MEL 672784); Little Desert, Sept. 1930, *H.B. Williamson* s.n. (MEL 616109).

NEW SOUTH WALES: Wyalong, 22 Sept. 1906, *J.L. Boorman* s.n. (NSW 121885); 3 miles [4.8 km] NE of West Wyalong, *R. Coveny* 2376 (NSW, PERTH); 62 miles (129 km) WSW of Forbes towards West Wyalong on Mid-Western Highway, *R. Coveny* 2546 (NSW, PERTH); Merringreen and other stations in the Lachlan District, *T. Duff* (MEL 616110 and 674568); Kikoira-Weethalla road, 20 Sept. 1956, *C.K. Ingram* s.n. (NSW 121887).

In the absence of more detailed studies (especially morphological investigations of closely related taxa in W.A.) it is difficult to ascertain whether or not this variant should be afforded specific rank. It therefore seems prudent to exclude it from the circumscription of *A. halliana.* The variant is most readily distinguished from typical *A. halliana* by its frequently smaller, incurved phyllodes, smaller flower-heads and uniformly curved legumes which are not or only slightly constricted between the seeds. It superficially resembles *A.* x *grayana* (which also occurs at Monarto South, S.A.) but is distinguished by its usually rather prominent stipules (N.S.W. specimens excluded), its glabrous new shoots, branchlets and peduncles, its narrower legumes and its prominent, conical aril situated on top of the seed. When describing *A. grayana* J.H. Willis (1957) contrasted his new species with *A. microcarpa.* The two specimens (both ex herb. J.M. Black) thought by Willis to be *A. microcarpa* are mounted with the holotype of *A.* x *grayana* (MEL 1500364), however, neither is *A. microcarpa.* The flowering specimen from Mannum is *A. calamifolia* (specimen with relatively short oblanceolate phyllodes) while the fruiting specimen from Goolwa is this variant 2 of *A. halliana.*

Acacia microcarpa and its allies

Acacia microcarpa belongs to a small group of closely related section *Phyllodineae* taxa which share the following important features. Gland present at phyllode apices adjacent to the innocuous mucro. Racemes extremely reduced, axes 0.5-1 mm long and usually supporting a single peduncle subtended by a solitary basal bract. Flowers relatively few per head (8-22). Sepals free. Seeds longitudinal or almost so, provided with a slight peripheral ridge. Aril clavate and extending down one side of the seed. In addition to *A. microcarpa* this group comprises *A. acinacea, A. imbricata* and *A. triquetra.*

Key to *A. microcarpa* and its allies

1. Gland (often small — observe at x10 mag.) present on upper margin of all or most phyllodes near or below their centre.....2

1a. Gland absent (very rarely present on a few phyllodes) from lower half of phyllodes; legumes linear and straight to shallowly curved.....3
2. Legumes slightly to prominently curved (not coiled); phyllodes usually 20-55 mm long and 4-10 mm wide with l:w = 4-10, apices obtuse (frequently obliquely so) or retuse; marginal gland rather prominent, greater than 0.5 mm long, usually recessed.....*A. microcarpa*
2a. Legumes circinnate to irregularly twisted or spirally coiled; phyllodes usually 4-15 mm long and 2-8 mm wide with l:w = 1-5, apices + obtuse and usually excentrically mucronulate; marginal gland usually not prominent, less than 0.5 mm long and not recessed.....*A. acinacea*
3. Phyllodes 1-2(3) mm wide (and 10-18 mm long with l:w = 5-10), crowded, imbricate and uniformly erect; legumes 4.5-6 mm wide .....*A. imbricata*
3a. Phyllodes 2-6 mm wide (and usually 10-25 mm long with l:w = 3-8), less crowded and not as conspicuously imbricate as above, mostly inclined to ascending; legumes 3-4 mm wide.....*A. triquetra*

Acacia acinacea Lindley in T.L. Mitch., Three Exped. Australia, edn 1, 2: 265 (1838). Gold-dust Wattle.

Syntypes: Between Hopkins River and Stavely, c. 35 km S of Mt. William, Vic., 19 Sept. 1836, *T.L. Mitchell* 114 (CGE, K); Near Lake Charm, Vic., 22 June 1836, *T.L. Mitchell* 187 (CGE, K, MEL).

Acacia obliqua A. Cunn. ex Benth., London J. Bot. 1: 334 (1842), nom. illeg., non Desv. (1841). *Type:* Between the Lachlan and Macquarie Rivers, N.S.W., July 1817, *A. Cunningham* 410 (holo: K; iso: K).

Acacia rotundifolia Hook., Bot. Mag. 69: t. 4041 (1843). *Type:* Cultivated at Hort. Kew in 1843, comm. *J. Backhouse* [specimen questionably originating from Hunter River, N.S.W., cf. protologue] (holo: K).

Acacia latrobei Meissner in Lehm., Pl. Preiss. 1: 10 (1844). *Type:* Port Phillip, Vic., *C.J. Latrobe* (holo: NY; iso: G).

Acacia cyclophylla Schldl., Linnaea 20: 663 (1847). *Type:* Murrayscrub [apparently refers to that part of the Murray Mallee, S.A., south of the modern Truro-Blanchtown highway, towards The Marne River, fide D.K. Kraehenbuehl (1981)], Aug. 1845, *H.H. Behr* 186 (holo: HAL; iso: NY).

Illustrations. W.J. Hooker (loc. cit.); F. Mueller, Iconography of Australian *Acacia* species and cognate genera. Decade 4 (1887); D.J.E. Whibley, Acacias of South Australia 45 (1980) — as *A. rotundifolia;* L. Costermans, Native trees and shrubs of south-eastern Australia 310 (1981); G.M. Cunningham et al., Plants of Western New South Wales 352 (1981).

Bushy or straggly *shrub* usually to c. 2.5 m tall. *Branchlets* somewhat angled at extremities, glabrous to puberulous or hirtellous. *Phyllodes* somewhat asymmetric, narrowly oblong-elliptic to oblanceolate or widely obovate or circular, more or less obtuse and usually excentrically mucronulate, (3)4-15(25) mm long and 2-8(11) mm wide with l:w = 1-5(7), indumentum as on branchlets, green; *midrib* not prominent or obsolete (on broad, ± orbicular phyllodes a minor second longitudinal nerve may develop on adaxial side of midrib); *lateral nerves* obsolete. *Glands* 2; distal gland adjacent to the mucro; proximal gland near or below middle of adaxial margin, not prominent or recessed as in A. *microcarpa,* 0.2-0.5 mm diam. *Racemes* usually of one flower-head (occasionally 2-4-headed) on axes c. 0.5 mm long, 1-2 per node. *Peduncles*

4-20 mm long, slender, glabrous, cymbiform *basal bract* sub-persistent. *Flower-heads* prolific, globular, bright golden, small, 4-5 mm diam., 8-20-flowered. *Flowers* 5-merous. *Sepals* free. *Legumes* circinnate to irregularly twisted or spirally coiled, 3-4.5 mm wide, glabrous. *Seeds* longitudinal, more or less oblongoid, 4-5 mm long, 2.5-3 mm wide, obscurely ridged; *aril* clavate and extending ¼-½ down one side of seed.

Selected specimens examined. SOUTH AUSTRALIA: Dutton Park, Kapunda, *B. Copley* 3301 (AD, PERTH); Shipley Hill, c. 26 km NE of Keith, *N.N. Donner* 177 (AD); Central Tothill Range, *D.N. Kraehenbuehl* 2148 (AD); 3 mi [5 km] S of Monarto, *M.E. Lawrence* 216 (MEL); c. 15 km N of Overland Corner, *D.J.E. Whibley* 3631 (AD, PERTH); c. 8 km W of American River on road to Kingscote, Kangaroo Island, *P.G. Wilson* (AD, MEL).

NEW SOUTH WALES: Goonoo State Forest, Eumungerie, *G.M. Chippendale* and *E.F. Constable* s.n. (NSW 19474); 1 km N of Sutton turn-off on Federal Highway, *M.D. Crisp* 2194 (AD, MO, NSW); Brocklesby Road, 2 mi [3 km] W of Burrumbuttock, *E.J. McBarron* 3408 (NSW, PERTH).

VICTORIA: 4.5 mi [7.2 km] S of Kamarooka, Bendigo district, *H.I. Aston* 437 (MEL); Chiltern district, c. 3.5 mi [5.6 km] E of township, 4 June 1962, *A.B. Court* and *J.H. Willis* s.n. (MEL 518441); Red Shirt Gully Road, St. Andrews, *R.A. Kilgour* 22 (MEL); Wyperfeld National Park, *J. Landy* and *A.C. Beauglehole* 9685 (MEL).

Distribution (Figure 2). S.A., Vic. and N.S.W. South Australia: Principally confined to the Lofty and Murray Regions from Victor Harbour north to Gulnare and east to the Murray River. Also from the Loxton area (Murray Region) and the Keith-Bordertown-Lucindale area (South-eastern Region). One collection from Melrose (Flinders Ranges) and also near American River (Kangaroo Island). Victoria: Widespread in Vic. (excluding the north-west, south-west and eastern extremities of the state) and extending from Lillimur (near Vic./S.A. border) east to near Bright. New South Wales: Principally confined to the Central and South Western Slopes and South Western Plains from the Goonoo State Forest (Eumungerie) and Gulgong south to Albury and west near and along the N.S.W./Vic. border to Barham. Also from Bathurst and Abercrombie Caves (Central Tablelands). One isolated occurrence near Sutton (Southern Tablelands).

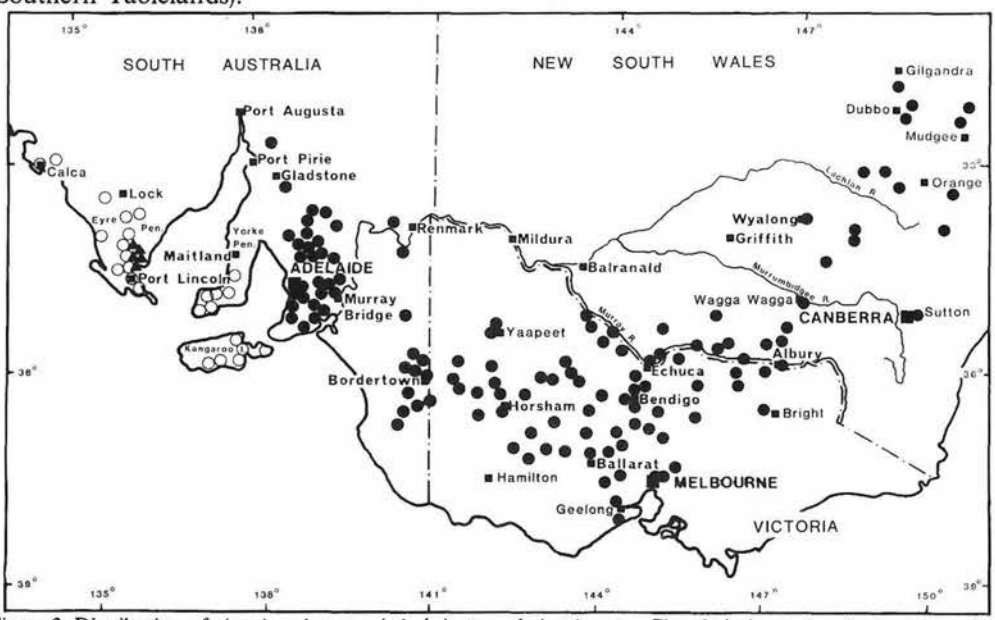

Figure 2. Distribution of *Acacia acinacea, A. imbricata* and *A. triquetra.* Closed circle — *A. acinacea;* open circle — *A. triquetra;* closed triangle — *A. imbricata.*

Variation. Very polymorphic with respect to phyllode shape, size and indumentum. Specimens with more or less orbicular phyllodes have sometimes been called *A. cyclophylla* (phyllodes hairy on type) or more commonly *A. rotundifolia* (phyllodes glabrous on type).

A variant known only from flowering material occurs at a few localities in the North Mount Lofty Ranges between Hamley Bridge and Burra, S.A. Its proximal phyllode gland is larger than normal (to 0.9 mm long) and is sometimes recessed. In these respects it resembles *A. microcarpa* from which it is distinguished by its smaller phyllodes (8-16 x 2.5-6 mm) which are usually markedly mucronulate. Specimens referable to this variant are: Manoora to Auburn, *B. Copley* 5311 (AD); About 3 km N of Waterloo, *R. Hill* 1040 (AD); 1 km S of Alma, *J. Howie* s.n. (AD 98232152); 2.5 km S of Alma, *E.N.S. Jackson* 1688 (AD); Hanson, S.A. Pastoral Board s.n. (AD 97918218); Burra, 1895, ex herb. O. Menzel (AD 97612449); About 8 km N of Manoora, *D.J.E. Whibley* 2063 (AD). Typical *A. acinacea* also occurs in the North Mount Lofty Ranges.

The few specimens with longer than normal phyllodes (15-25 mm) may resemble *A. microcarpa* but *A. acinacea* is recognized by its phyllodes which have a distinct mucro and a smaller marginal gland and its legumes which are twisted or coiled.

Affinities. As discussed below, many South Australian specimens referable to *A. triquetra* were formerly included under *A. acinacea.*

Acacia imbricata F. Muell., Fragm. 1:5 (1858).

Type citation: "In fruticetis prope sinum Tumbey Bay litoris Spencer's Gulf." *C. Wilhelmi. Type:* n.v.

Illustration. D.J.E. Whibley, Acacias of South Australia 53 (1980).

Dense, spreading, glabrous *shrub* 1-2 m tall, branches somewhat willowy. *Branchlets* very acutely angled towards apices, ribbed below raised leaf bases. *Phyllodes* narrowly oblong to oblanceolate, abruptly narrowed (more or less truncate) at the excentrically rostellate apices, 10-18 mm long, 1-2 mm wide (rarely 3 mm), l:w = 5-10, crowded, imbricate, erect, straight, dark green, *midrib* not prominent, *lateral nerves* absent. *Gland* solitary, adjacent to apical mucro. *Racemes* of 1 flower-head, 1-2 per node, axes c. 0.5 mm long. *Peduncles* 4-10 mm long, slender. *Flower-heads* prolific, globular, bright yellow, 9-15-flowered. *Flowers* 5-merous. *Sepals* free. *Legumes* linear, to 7 cm long, 4.5-6 mm wide, more or less straight, firmly chartaceous, light brown to medium brown. *Seeds* more or less longitudinal, oblongoid to widely ovoid-ellipsoid, 3.5-4 mm long, 2.5-3 mm wide, slightly ridged.

Selected specimens examined. SOUTH AUSTRALIA: Ungarra to Yeelanna road, *B. Copley* 2979 (AD); Between Yalunda Flat and Tumby Bay, *D.J.E. Whibley* 1945 (AD).

Distribution (Figure 2). Restricted to a small area on southern Eyre Peninsula, S.A., from Koppio and Warunda north to the Yeelanna-Ungarra road.

Affinities. Closely allied to *A. triquetra* and perhaps not specifically distinct from it. *Acacia imbricata,* however, can be recognized by its broader legumes and by its narrower, more uniformly erect phyllodes. *Acacia triquetra* is more widespread than *A. imbricata.* The two species are not known to be sympatric.

Bentham (1864) considered *A. imbricata* to be conspecific with *A. lineata* A. Cunn. ex Don. As pointed out by Maiden (1916) the South Australian specimens cited by Bentham

under *A. lineata* are *A. imbricata*. *Acacia lineata* is widespread in S.A., Vic., N.S.W. and Qld (Maslin and Pedley 1982) and is readily distinguished from *A. imbricata* by its phyllodes with prominent, excentric midribs and eglandulose apices.

Acacia microcarpa F. Muell., Fragm. 1:6 (1858); 2nd Gen. Rep. 11 (1854), nom. nud. Manna Wattle.

Type citation. "Ad margines dumetorum juxta Tumbey Bay. *C. Wilhelmi.* Prope flumina Avoca et Murray." *Lectotype* (here selected): Near Port Lincoln (Port Lincoln is 50 km south of Tumby Bay), S.A., *C. Wilhelmi* (MEL 616142). *Para-lectotypes:* MEL 501392 and 616143 (see discussion below).

A. subretusa Maiden and Blakely, J. and Proc. Roy. Soc. W. Australia 13: 11, pl.8, figs. 7-11 (1928), synon. nov. *Type:* Victorian Expedition, June 1861, comm. *F. Stoward* from herb. MEL (holo: NSW).

Illustrations. J.H. Maiden and W.F. Blakely (loc. cit.); F. Mueller, Iconography of Australian species of *Acacia* and cognate genera. Decade 4 (1887) — right-hand flowering twig; D.J.E. Whibley, Acacias of South Australia 63 (1980) — upper right-hand twig.

Bushy, spreading, glabrous *shrub* to 2.5 m tall. *Branchlets* somewhat angled at extremities. *Stipules* insignificant. *Phyllodes* usually oblanceolate, obtuse but frequently obliquely so, often retuse, (1.6)2-5.5(6.5) cm long and (3)4-10(19) mm wide with l:w = (2.5)4-10(13), smooth, slightly thickened, patent to erect, straight to shallowly incurved, green; *midrib* not prominent; *lateral nerves* absent or very obscure. *Glands* 2, one at phyllode apex, the second near or below middle of adaxial margin 3-13 mm above the pulvinus, lower gland usually shallowly concave. *Racemes* of one flower-head on axes usually c. 0.5 mm long, 2-5 per node. *Peduncles* 4-10 mm long, drying yellow or blackish. *Flower-heads* globular, bright mid-golden, 14-22-flowered. *Flowers* 5-merous. *Sepals* free. *Legumes* linear, prominently raised over seeds and slightly constricted between them, to 8 cm long, 2-5 mm wide, slightly to prominently curved (not coiled), firmly chartaceous. *Seeds* longitudinal, ellipsoid to ovoid-oblongoid, 3-4 mm long, 2-2.5 mm wide, turgid, with a slightly raised peripheral ridge; *aril* more or less clavate and extending ¼-⅓ down one side of seed.

Selected specimens examined. SOUTH AUSTRALIA:- On side track about 6 km along Beetaloo Reservoir Road from Gladstone, *R. Bates* 796 (AD); Chauncey's Line, c. 20 km SW of Murray Bridge, 30 Nov. 1963, *J.B. Cleland* s.n. (AD 96444019); c. 6 km N of Arthurton, *B. Copley* 2789 (AD); Wudinna, *R.H. Kuchel* 3302 (AD, PERTH); c. 0.5 km N of Port Vincent, *J.Z. Weber* 3941 (AD); Roadside near southern end of Marble Range, *D.J.E. Whibley* 1892 (AD); Between Cambrai and Sedan, *D.J.E. Whibley* 4474 (AD, MEL); 22 km ESE of Canopus Homestead, 33° 39' 30" S, 140° 50' E, *L.D. Williams* 7782 (AD).

NEW SOUTH WALES: Near Weethalle, *G.W. Althofer* 17A (NSW); Mid Western Highway, 42 mi [67.5 km] WNW from West Wyalong towards Rankin Springs, *R. Coveny* 2553 (NSW, PERTH); 5 km NE of Goolgowi, *G.M. Cunningham* 3347 and *P.L. Milthorpe* (NSW, PERTH).

VICTORIA: Moonlight Tanks, the Big Desert, 30.6 mi [49 km] N of Yanac on the Yanac-Murrayville track, *H.I. Aston* 1042 (MEL); Wyperfeld National Park, *A.C. Beauglehole* 28768 (MEL); Big Desert, 21 km N of Broken Bucket bore, *M.G. Corrick* 6344 (MEL, PERTH); 3.3 km W of Walpeup on Ouyen Highway, *N. Hall* H80/40 (MEL, NSW, PERTH); Gunbower, Oct. 1913, *Anon.* s.n. (MEL 1500691).

Distribution (Figure 3). S.A., N.S.W. and Vic. South Australia: Eyre Peninsula from slightly south of Port Lincoln north to Wudinna and Kimba. Yorke Peninsula from Yorketown north

to near Wallaroo then north to the Northern Lofty Region as far as Gladstone. Murray Region from near Sedan south to the Murray Bridge-Tailem Bend district and east to Pinnaroo near the S.A./Vic. border. Just extending into the south-eastern portion of the Southern Lofty Region to Finniss and Goolwa. It has also been collected from Canopus Station in the Murray Region, c. 160 km N of Pinnaroo. The south-eastern limit of distribution in S.A. occurs in the South-eastern Region near Tintinara. Victoria: Occurring in the Mallee and Wimmera Regions of north-western Victoria from near Meringur south to Lillimur and east to Sea Lake. One isolated occurrence in the Murray Valley Region at Gunbower, c. 140 km ESE of Sea Lake. New South Wales: Known only from two areas:- Montarna, c. 35 km NE of Mildura in the South Far Western Plains Region and between Goolgowi and West Wyalong on the border of the South Western Plains and Central Western Slopes Regions.

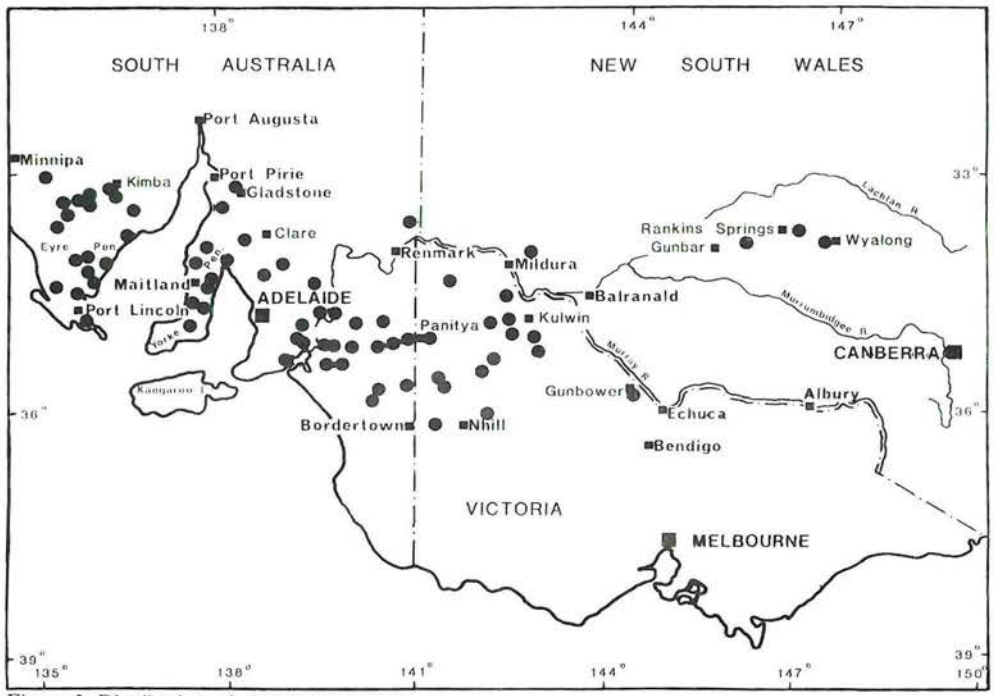

Figure 3. Distribution of *Acacia microcarpa*.

Type specimens. The herb. MEL specimen selected as the lectotype of *A. microcarpa* is labelled by Mueller thus: "Acacia microcarpa... Near Port Lincoln, Wilhelm." This specimen is in fruit and agrees with the protologue. There are two other probable syntypes at MEL. One (with two labels, viz. "Murray!" and "... near the Avoca" - MEL 501392) is sterile and may represent *A. acinacea.* The other (labelled "Dombey bay" - MEL 616143; I am unsure as to who collected this plant) is an excellent match for the lectotype. My experience with Mueller collections has often been that the extant specimens do not always match exactly those cited in his original descriptions. It is therefore assumed that although the label accompanying the lectotype is not annotated exactly as in the protologue, the specimen nevertheless formed part of the collection upon which the name *A. microcarpa* was based. There are no types of this name at herb. K.

Affinities. Short phyllode forms (around 2 cm long) approach *A. triquetra,* however, *A. microcarpa* is distinguished by its generally less acutely angled branchlets, its phyllodes with a marginal gland on their lower half and its generally more obviously curved legumes. Short phyllode forms may also resemble *A. acinacea.*

In parts of Eyre Peninsula, S.A., the phyllodes of *A. microcarpa* are sometimes unusually broad (10-19 mm) and superficially resemble *A. anceps* DC. However, *A. anceps* is readily recognized by its thick peduncles which are not racemosely arranged, its larger flower-heads (60-130-flowered) and its more or less woody legumes with transverse seeds which are c. ½ encircled by their funicles.

The name *A. microcarpa* var. *linearis* J. Black is considered synonymous with *A* . x *grayana* J.H. Willis.

Acacia triquetra Benth., London J. Bot. 1: 358 (1842).

Type citation: "K. George's Sound, Bagster." *Lectotype* (here selected): Probably Kangaroo Island, S.A., *W. Baxter;* K (fruiting specimen on sheet stamped Herbarium Hookerianum 1867). *Para-lectotype:* K — flowering specimens. See discussion below.

Illustration. D.J.E. Whibley, Acacias of South Australia 55 (1980) — as *A. acinacea.*

Spreading glabrous *shrub* to 1.5 m tall. *Branchlets* acutely angled towards apices, ribbed below raised leaf bases. *Phyllodes* narrowly oblong to oblanceolate or narrowly elliptic, rarely linear, abruptly narrowed at the more or less rounded and excentrically rostellate apices, (6)10-25(28) mm long, 2-6 mm wide, l:w = 3-8 (an elongate phyllode variant is discussed below), patent to erect but usually inclined to ascending, straight or slightly curved, dark green; *midrib* not prominent; *lateral nerves* absent or few and very obscure. *Gland* adjacent to apical mucro, rarely a few phyllodes with an additional gland near middle of upper margin. *Racemes* of 1 flower-head on axes 0.5-1.5 mm long, 1-2 per node. *Peduncles* 3-8 mm long, slender. *Flower-heads* globular, 10-18-flowered. *Flowers* 5-merous. *Sepals* free. *Legumes* linear, to 6 cm long, 3-4 mm wide, straight to shallowly curved, firmly chartaceous, mid-brown to dark brown. *Seeds* more or less longitudinal, mostly oblongoid, 2.5-3.5 mm long, 1.3-2.5 mm wide, slightly ridged.

Selected specimens examined. SOUTH AUSTRALIA: c. 3 km N of Elliston, *N.N. Donner* 2430 (AD); About 8 km SE of Bascombe Well Homestead, Eyre Peninsula, *E.N.S. Jackson* 1165 (PERTH); Formby Bay road area, Southern Yorke Peninsula, 15 Sept. 1962, *M.J. Hancock* s.n. (AD 96302162); Bay of Shoals, Kangaroo Island, *J.C. Noble* 624 (AD).

Distribution (Figure 2). Endemic in South Australia on the Eyre Peninsula, southern Yorke Peninsula and Kangaroo Island. Eyre Peninsula: Lincoln National Park north to near Tooligie and Bascombe Well Conservation Park. Also in the Elliston Conservation Park, c. 150 km NW of Tooligie. Yorke Peninsula: Cape Spencer north to Port Rickaby. Kangaroo Island: Hanson Bay east to Cape Willoughby.

Typification. The type collection at herb. K comprises both flowering and fruiting specimens and although this material is not in a good state of preservation it all seems to represent the one taxon. The lectotype is a fruiting specimen labelled by W. Hooker "K.G. Sound N. Holl. Baxter" and annotated "triquetra" by Bentham. As discussed by Maslin and Whibley (1977) it is probable that this specimen (as well as the types of *A. leiophylla*) was collected from Kangaroo Island, South Australia, not King George Sound, Albany, Western Australia as given in the protologue. Although Bagster is given as the collector of the type in the protologue, Bentham (1864) correctly altered this to read Baxter.

Bentham (1864) erroneously regarded *A. triquetra* as a Western Australian species. This resulted in part from the incorrectly labelled type collection (see above) and also from Bentham's regarding of *Drummond* 109 and 292 as *A. triquetra* (these two collections are in fact *A.*

meisneri, a W.A. species). Whibley (1980) treated *A. triquetra* as a synonym of *A. acinacea*. However, *A. triquetra* is distinguished from the more easterly distributed *A. acinacea* by its straight to shallowly curved legumes and its phyllodes which lack a marginal gland near or below their middle. Furthermore, on *A. triquetra* the branchlets and phyllodes are always glabrous, its phyllodes are frequently longer and more parallel-sided and its seeds are slightly smaller. *Acacia triquetra* is most closely allied to *A. imbricata* (see latter species for discussion).

Variation. There occurs on Kangaroo Island a variant with unusually elongate, linear phyllodes (23-38 mm long, 2-3 mm wide, l:w = 8-16). Typical *A. triquetra* also occurs on the Island.

Acknowledgements

Prof. K.H. Rechinger is gratefully acknowledged for providing the Latin description of *A. halliana*. The Directors of herbaria cited are thanked for allowing me access to specimens. Mr D.J.E. Whibley provided useful comments on the taxonomic status of the included species. Suzanne Curry is thanked for competent technical assistance. The work was conducted at the Western Australian Herbarium (PERTH) as part of the Flora of Australia project and was partially funded by the Bureau of Flora and Fauna.

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A New Species of *Conostephium* (Epacridaceae) from South-Western Western Australia

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Abstract

van der Moezel, Paul G. A new species of *Conostephium* (Epacridaceae) from south-western Western Australia. Nuytsia 6(1):47-50 (1987). A new species of *Conostephium* is described: *C. uncinatum* Moezel is restricted to the mallee region north of Esperance, Western Australia.

Introduction

Conostephium Benth. (Epacridaceae) is a small genus in the tribe Styphelieae comprising six species, all of which are endemic to Western Australia. It is distinguished from the thirteen other genera within the Styphelieae by having wholly enclosed anthers and a conical corolla tube with minute erect lobes (Bentham 1867). Within the genus the main characters used to separate individual species are: the shape of the corolla tube, leaf size and shape, flower size and peduncle shape and length (Blackall & Grieve 1981). To these must now be added the presence and distribution of hairs. Collection of material from the mallee district north of Esperance, Western Australia has revealed the occurrence of two species which, among other distinguishing characters, have hairs on the leaves and young branches as well as on floral parts. One of these species, *C. marchantiorum,* has only recently been described (Strid 1986). That the other species is undescribed has been established by examination of material from the Western Australian, Melbourne and Kew Herbaria. A new key to all the species of *Conostephium* is included here.

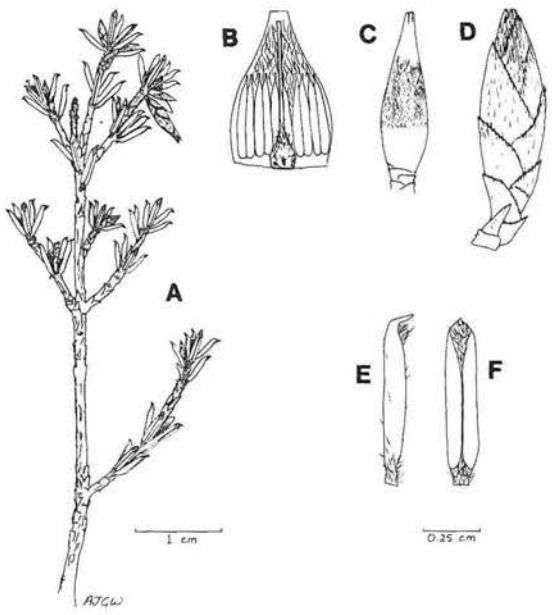

Figure 1. *Conostephium uncinatum:* A-Flowering branch. B- Flower LS, opened out showing stamens, ovary and style. C- Corolla tube, external. D-Flower with bracteoles. E-Leaf (side view). F-Leaf (abaxial view). From *P.G. van der Moezel* 213 (Type).

Key to the species of *Conostephium*

1a. Corolla tube cylindrical and glabrous inside....2
b. Corolla tube wider in the middle and hairy inside....3
2a. Ovary glabrous; leaves obovate-oblong to narrow-oblong....*C. preissii*
b. Ovary hairy on upper half; leaves ovate-lanceolate to linear-lanceolate, flat or concave, 1.2 cm long....*C. drummondii*
3a. Ovary glabrous; leaves flat or with recurved margins....4
b. Ovary hairy on upper half; leaves all revolute....5
4a. Peduncles greater than 2 mm long; leaves linear- oblong to obovate-oblong, flat or with recurved margins, 2-3 cm long; flowers 1.5-2.0 cm long....*C. pendulum*
b. Peduncles less than 2 mm long; leaves ovate to obovate or linear-cuneate, flat or with recurved margins, 1 cm long; flowers 1 cm long....*C. roei*
5a. Leaves with deflexed apex....*C. uncinatum.*
b. Leaves without deflexed apex....6
6a. Leaves narrow-linear, 1.5-1.8 cm long, glabrous; bracteoles minutely pubescent on outer surface....*C. minus*
b. Leaves narrowly oblong-linear, 6.5-7.0 mm long, hairy on both surfaces; bracteoles densely silky-hairy on outer surface....*C. marchantiorum*

Conostephium uncinatum Moezel, sp. nov. (Figure 1)

Differt a *C. minus* folliis brevioribus, revolutioribus, apicibus deflexis, paginis foliorum adaxialibus villosis.

Typus: 14 km E of Grass Patch on Steddy's Rd, Western Australia (33° 14' S, 121° 52' E), 18 October 1982, *P.G. van der Moezel* 213 (holo: PERTH; iso: CANB, K, MEL).

Erect *shrub* to 1 m high. *Branches* grey, densely puberulent at extremities, the hairs c. 0.3 mm long, patent, straight, silky. *Bark* finely longitudinally fissured toward base of branches, ± smooth in upper branches. *Leaves* erect, clustered into several groups at ends of branches, narrowly oblong-linear, 3.5-4.5 mm long, 0.5 mm wide, tightly revolute, ± abruptly narrowed at apex into indurate, brittle, brown cusps 0.6-0.7 mm long, cusps deflexed at an angle of 45°-90°, adaxial surface smooth and more or less glabrous, abaxially striate and covered with long, straight, silky hairs; *petioles* flat, broad c. 0.7 mm long, hairy. *Flowers* solitary in upper axils, subnutant, 6-7 mm long, 1.5 mm wide, sub-sessile. *Bracteoles* nearly as long as calyx, appressed silky hairy abaxially, glabrous and shiny adaxially. *Calyx* 4.5-5 mm long, 2 mm wide, chartaceous, shiny. *Corolla* 7-7.5 mm long, 1 mm wide, broadest near the middle and tapering towards the lobes, externally pubescent in upper half, lower half and lobes glabrous, internally villous throughout. *Stamens* inserted at broadest part of corolla. *Filaments* flat, short, villous. *Anthers* c. 2 mm long, lobed. *Anther lobes* c. 0.3 mm long terminating in a hooked point. *Ovary* obovoid, with long straight, soft, silky hairs at the apex c. 0.5 mm long. *Style* slender, lower ½ - ⅔ covered in long, soft, silky, patent hairs.

Other specimens examined. WESTERN AUSTRALIA: Mt Heywood, *K. R. Newbey* 7968 (PERTH); Clyde Hill, *M. Burgman* 1834 (PERTH).

Distribution. Restricted to the mallee region of central south-western Western Australia between Grass Patch and Clyde Hill (Figure 2).

Ecology. Found in deep sandy soils and also in red sand and clay in a depression near a claypan. This species is only known from three localities and could be considered rare and restricted (category 2V; Leigh et al. 1981) until further collections prove otherwise.

Etymology. The species name refers to the hooked apex of the leaves.

Conostephium uncinatum is closely allied to *C. minus* and *C. marchantiorum.* All three species have short peduncles, pubescent ovaries and a corolla tube wider in the middle and tapering towards the lobes. *C. uncinatum* differs from the other two species by having a deflexed leaf apex, shorter floral parts and shorter, more tightly revolute leaves. *C. marchantiorum* is also restricted to the mallee region of south-central Western Australia, between Peak Charles and Scaddan (Figure 2). The distribution of *C. minus* is over 700 km away in the Perth regional area and north to Gingin.

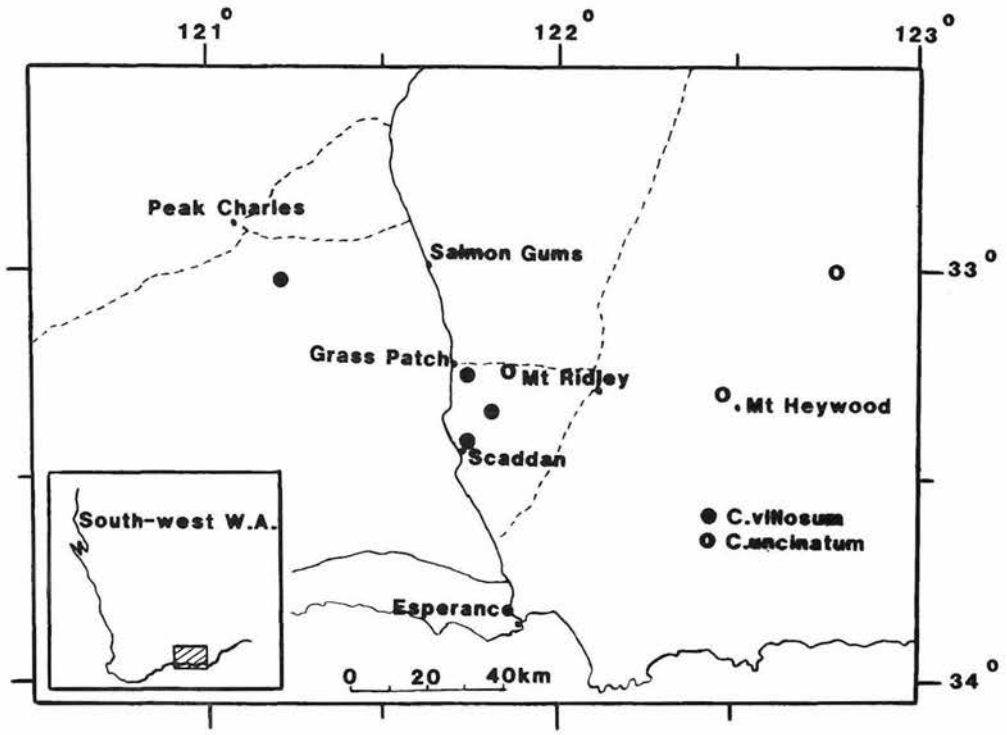

Figure 2. Distribution of *C. marchantiorum* (circles) and *C. uncinatum* sp. nov. (triangles).

Acknowledgements

My thanks go to staff members of the Western Australian Herbarium for their assistance and encouragement, particularly Bruce Maslin for his comments on the manuscript. The Latin diagnosis was provided by Dr N. Brittan. Floral illustrations were prepared by Miss Annette Wilson. P.G. Wilson kindly examined type specimens at MEL. N.S. Lander, whilst Australian Botanical Liaison Officer at Kew, provided photographic types. This research was funded by the Western Australian Mining and Petroleum Research Institute, Western Collieries Ltd and Alcoa of Australia Ltd.

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The genus *Porana* (Convolvulaceae) in Australia

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Abstract

Staples, G.W. The genus *Porana* Burm. f. (Convolvulaceae) in Australia. Nuytsia 6(1):51-59 (1987). The monotypic, endemic, Australian *Duperreya* Gaud. is discussed as a synonym of *Porana* Burm. f. A new species, *Porana commixta,* long confused with *Porana sericea* (Gaud.) F. Muell., is described and figured. The ranges and ecological preferences of the two species are described. The occurrence of *Porana paniculata* Roxb., which is cultivated as an ornamental, in Australia is documented.

Introduction

Generic delimitation in the Convolvulaceae has been a recurrent and at times intractable problem. Recent revisionary treatments have clarified some generic limits and provided a foundation for reassessing the classification within the family as a whole. Other genera, and even tribes, have not yet been critically examined; *Porana* Burm. f., and the tribe Poraneae are two such taxa. A revision of this genus and an examination of the tribal composition and relationships were begun in 1983. This paper discusses the occurrence of *Porana* in Australia as a preliminary to a generic revision. The single species initially described from this continent was assigned to the monotypic genus *Duperreya* Gaud. Later it was included in *Porana* sensu lato. Subsequent treatments have variously included the Australian plant in *Porana* or maintained the monotypic *Duperreya.* In this paper I present evidence for including the taxon in *Porana* and describe a second, heretofore unrecognized, species. I then discuss the relationships of the two species with others in the genus.

Taxonomic history

In its broadest circumscription the genus *Porana,* with some 49 available specific epithets, included plants from Africa, Madagascar, continental Asia, Malesia, Australia and Middle America. Prior to my work several of these taxa were recognized as extraneous and removed to other genera as follows: the African plants were reassigned to *Neuropeltis* Wall., *Turbina* Raf., and *Metaporana* N. E. Br.; the Madagascan plants to *Metaporana;* the American plants to *Calycobolus* Willd. My own research confirms these assignments and leads to a narrower concept of *Porana* as a genus of about 20 taxa, largely confined to continental Asia, with a few species in Malesia, and two in Australia. Taxonomic treatment of the Australian plants has varied since they were discovered.

The monotypic Australian genus *Duperreya* was described by Charles Gaudichaud in 1826, based on *D. sericea.* Mueller named *Ipomoea modesta* in 1860. Later (1867), after examining fruiting material collected by Drummond, Mueller realized that both these names referred to the same plant, accepted Gaudichaud's epithet, and transferred it to *Porana.*

Duperreya was accepted as a valid genus by George Don (1837), Choisy (in Decandolle 1845), Schneider (in Sargent 1916) and Roberty (1952, 1964). Among those who regarded *Duperreya* as a synonym of *Porana* are Mueller (1867, 1889), Kurz (1873), Peter (in Engler & Prantl 1891), and most Australian floristic treatments, e.g. Bentham (1869), Blackall & Grieve (1974), and Johnson (in Jessop 1981). Both Schneider and Roberty maintained *Duperreya* for the Australian plants although each was aware that Mueller had transferred them to *Porana;* their reasons for doing so are discussed below.

Schneider (1916) was the last to survey the genus *Porana,* albeit incompletely. His purpose was to describe new taxa collected in China by E.H. Wilson, and his synopsis served mainly to propose relationships between his new taxa and those already assigned to the genus. Material, and even the descriptions, of several taxa were unavailable to him. A single fruiting specimen (*J. Drummond* 223 (A)) of the Australian plant was available to him for study. Based on his examination of this sheet, and the literature, Schneider excluded the Australian plant from *Porana* on the basis of its solitary, axillary flowers, linear leaves with short petioles, flower shape, and silky pubescence. Aside from the flower shape, which Schneider could not have observed firsthand, the other characters he enumerated do set the Australian plants apart from the rest of the genus. I believe they should be evaluated in light of the desert habitats where the plants grow; these characters are reinterpreted in the discussion of relationships which follows.

Roberty (1952) divided *Porana* sensu lato into several segregate genera, recognized *Duperreya,* and attempted to ally them with plants of more distant affinities, e.g. *Cardiochlamys* D. Oliver, another genus of the Poraneae, and *Turbina* Raf., a genus belonging to another subfamily. This approach allied morphologically similar plants without carefully analyzing the nature of their similarities, failed to distinguish shared common features from cases of parallel or convergent evolution, and obscured the natural affinities within the family. Like other recent workers, I find little merit in Roberty's superficial system of generic classification and elect to deal only with the nomenclatural changes he effected.

Examination of herbarium material of Australian *Porana* revealed two morphologically distinct entities. After further study it was clear that these are indeed two species, which have long passed under one name. Collections of the Australian plants are few in most herbaria and only when loans from several institutions were examined at one time was sufficient material available for differences to become apparent. The specific epithet *"commixta"* denotes this case of mistaken identity.

Description

1. **Porana commixta** Staples, sp. nov. (Figure 1)

Suffrutex volubilis, ad multos annos cum *P. sericea* confusus, sed indumento argyreo, et sepalis per anthesin anguste elliptico-lanceolatis, post anthesin anguste elliptico-oblongis vel subovatis, differt.

Typus: Western Australia, 52 km W of Wiluna, 29 Aug. 1970, *P. G. Wilson* 8965 (holo: PERTH!; iso: A!, CANB, K!).

Perennial, *suffrutescent twiner* to 4 m. *Indumentum* shining silvery-gray in the dried state, consisting of two-armed hairs, up to 1 mm long; the arms mostly opposite, equal, appressed (Figure 2c, d), occasionally erect and unequal; vegetative organs with equal-armed, appressed hairs, sepals with a few unequal-armed hairs also, the longer arms pointing toward the sepal apex, the corolla with equal numbers of equal and unequal-armed hairs, the longer arms

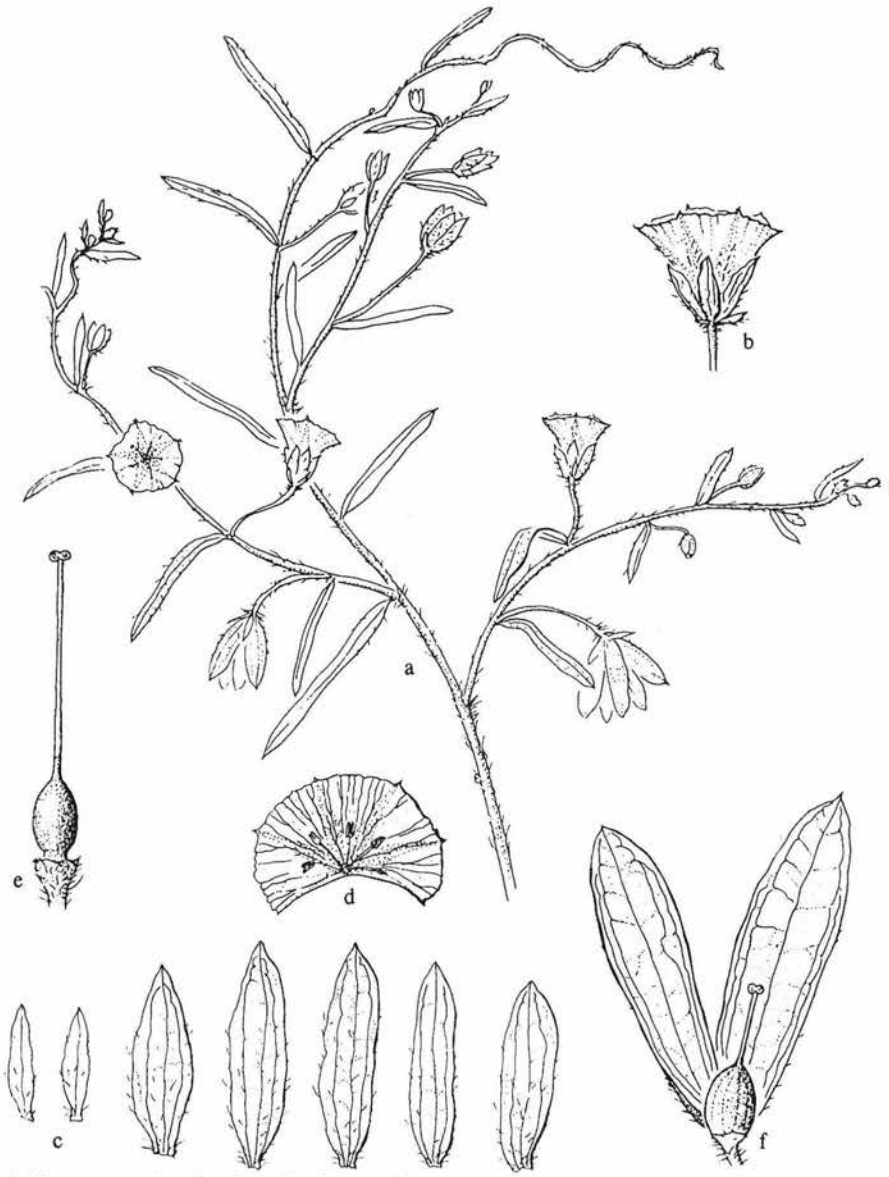

Figure 1. *Porana commixta* Staples, a) habit x1; b) flower x2; c) bracts and sepals, sequentially from outermost (left) to innermost (right) x7; d) corolla opened, with androecium, x2; e) gynoecium x10; f) utricle and fruiting sepals x4; after *Wilson* 8965 (A) and *Mitchell* N657A (A).

pointing toward the corolla apex. *Older stems* woody, cylindrical, smooth to faintly longitudinally fissured, 3-5 mm diameter, glabrate, brownish-red, with sparse paler lenticels, bark peeling with age; younger stems smooth, cylindrical, densely appressed silvery sericeous. *Leaves* alternate, horizontal to erect; *petiole* slender, <1 mm long; *blade* linear to narrowly lanceolate or narrowly oblong, 16-57 x 1.5-5 mm, herbaceous, smooth, densely sericeous and lighter coloured below, sparsely appressed pubescent and darker above, base cuneate to obtuse, margins simple, entire, apex acuminate to acute, rarely obtuse or rounded, midvein prominulous below. Axillary buds densely pubescent. *Flowers* axillary, solitary, epedicellate, erect, diurnal; buds ellipsoidal, apex obtuse. *Peduncle* slender, up to one half the length of the subtending leaf, 6-8 mm long. *Bracts* 2, subopposite, immediately subtending the calyx,

narrowly elliptic-lanceolate, subequal, 2-5 mm long, < 1 mm wide, persisting and slightly enlarging in fruit. *Calyx* quincuncial, imbricate, about ¾ the length of the corolla, which is visible between the sepals. *Sepals* equal in length, outer 2 broader than inner 3, narrowly elliptic to tapering lanceolate, 5-7 x 1-2.5 mm, chartaceous when dry, sparsely pubescent on backs, glabrous within, base rounded to truncate, margins entire, apex acute, visible longitudinal nerves 3; sepals accrescent in fruit, all approximately equally enlarged, narrowly elliptic-oblong to narrowly ovate, 11-15(-20) x 3-6(-10) mm, divergent from the utricle, chartaceous, glabrate, with 5 longitudinal nerves evident. *Corolla* contortiplicate in bud, campanulate at anthesis, as broad as long, limb entire to toothed or shallowly lobed with obtuse, apiculate lobes, 7-13 x 8-15 mm, blue, purple-blue, purple or white, membranous, glabrous except for small tufts on the tips of the interplicae. *Stamens* alternate with petals, subequal, included within corolla tube; filaments basally fused to tube, free above, glabrous, 2-3 mm long; anthers dorsifixed, introrse, parallel, 1.5-2 mm long, dehiscing in bud; pollen 3-colpate, minutely punctate, non-spinose (Figure 2a, b). *Ovary* ovoid-ellipsoid, glabrous, unilocular, c. 1 mm tall; ovules 2, basal, erect; disc annular, dark brown; style simple or with a joint just above ovary, filiform, glabrous, 3.5-5 mm long; stigma barely exserted from corolla tube, biglobose, wrinkled, < 1 mm diameter. *Utricle* ellipsoid, apiculate by style or style base, 5-5.5 x 3.5-4.5 mm, chartaceous, brownish-tan with darker striations, glabrous or nearly so, sometimes with a few hairs apically. *Seed* ellipsoid to nearly spherical or obovoid, smooth, 4 mm diameter, glabrous, reddish-brown.

Specimens examined. QUEENSLAND: Warrego district, Cunnamalla area, Feb. 1972, *J.D. Pike* 24 (BRI); Norley Homestead, c. 30 km N of Thargomindah, 3 June 1955, *L. S. Smith* 6344 (BRI).

NEW SOUTH WALES: Cobar, 5 Feb. 1912, *Archdeacon Haviland* s.n. (F, G, US).

WESTERN AUSTRALIA: South Barbee Range, 7 Sept. 1959, *A. Robinson* s.n. (PERTH); Belele Station, NW of Meekatharra, Yarbingulla paddock, 5 Nov. 1965, *D.W. Goodall* 3271 (UWA); Dale Gorge, 24 Aug. 1960, *A.S. George* 1029 (PERTH); Discovery Gorge, Edmund Station, 20 Aug. 1961, *R.D. Royce* 6622 (PERTH); Laverton, 25 Sept. 1920, *C.A. Gardner* 820 (PERTH); Laverton, Aug. 1963, *H.H. Kretchmar* s.n. (PERTH); Cape Range, 6 km from Learmonth Camp, on Wapet #4 well road, S 250 miles, 1 Sept. 1964, *Y. Chadwick* 1490 (PERTH); Cape Range, 31 Aug. 1964, *Y. Chadwick* CR8101 (UWA); 10 km S of Meekatharra, July 1931, *C.A. Gardner & W.E. Blackall* s.n. (PERTH); Meekatharra, 2 Oct. 1958, *N.H. Speck* 1501 (L, PERTH); 15 miles from Meekatharra, Carnarvon road, 16 Oct. 1962, *D.W. Goodall* 95 (UWA); Mt Magnet, Sept. 1903, *W.V. Fitzgerald* s.n. (PERTH), Sept. 1905, *J. Staer* s.n. (E); 3 miles S of Mt Magnet, 10 Oct. 1963, *F. Lullfitz* 2542 (PERTH); Mullewa to Mt Magnet, 13 July 1973, *C.G.G.J. van Steenis* 21919 (L); 30 km W of Turce Creek, 4 Oct. 1978, *A.A. Mitchell* N657A (A, PERTH); Williambury, E side of Lynden-Williambury road, 9 Aug. 1981, *R.J. Cranfield* 1842 (PERTH); near Wilson's Creek and Lake Darlot, 13 Sept. 1927, *C.A. Gardner* 2164 (PERTH, mixed with *P. sericea*); 52 km W of Wiluna, 29 Aug. 1970, *P.G. Wilson* 8965 (A, K, PERTH); 21 miles [34 km] S of Wiluna, 20 Aug. 1963, *T.E.H. Aplin* 2407 (PERTH, MO 2312124); 51 km from Wiluna, road to Agnew, no date, *A. Strid* 20160 (K); Windich Springs, Canning Stock Route, Aug. 1964, *R. Aitken & D. Hutchinson* HA62 (PERTH); Wittenoom Gorge, 18 Aug. 1963, *J.S. Beard* 2871 (PERTH); Sept. 1957, *K. Stewart* 6 (PERTH); 9 miles E of Wittenoom, 16 Aug. 1965, *A.C. Beauglehole* 11546 (PERTH); between Yampire (Gorge) and Dale Gorge, Oct. 1959, *C.A. Gardner* 12286 (PERTH); no locality, 21° 35′ to 21° 58′ S, 121° 11′ to 120° 47′ E, 10 Aug. 1979, *G.Davis* 112 (PERTH).

Distribution and ecology. Porana commixta occurs primarily in inland situations of southwestern and northeastern Western Australia. Three collections have been seen from eastern Australia in southeastern Queensland and northwestern New South Wales (Figure

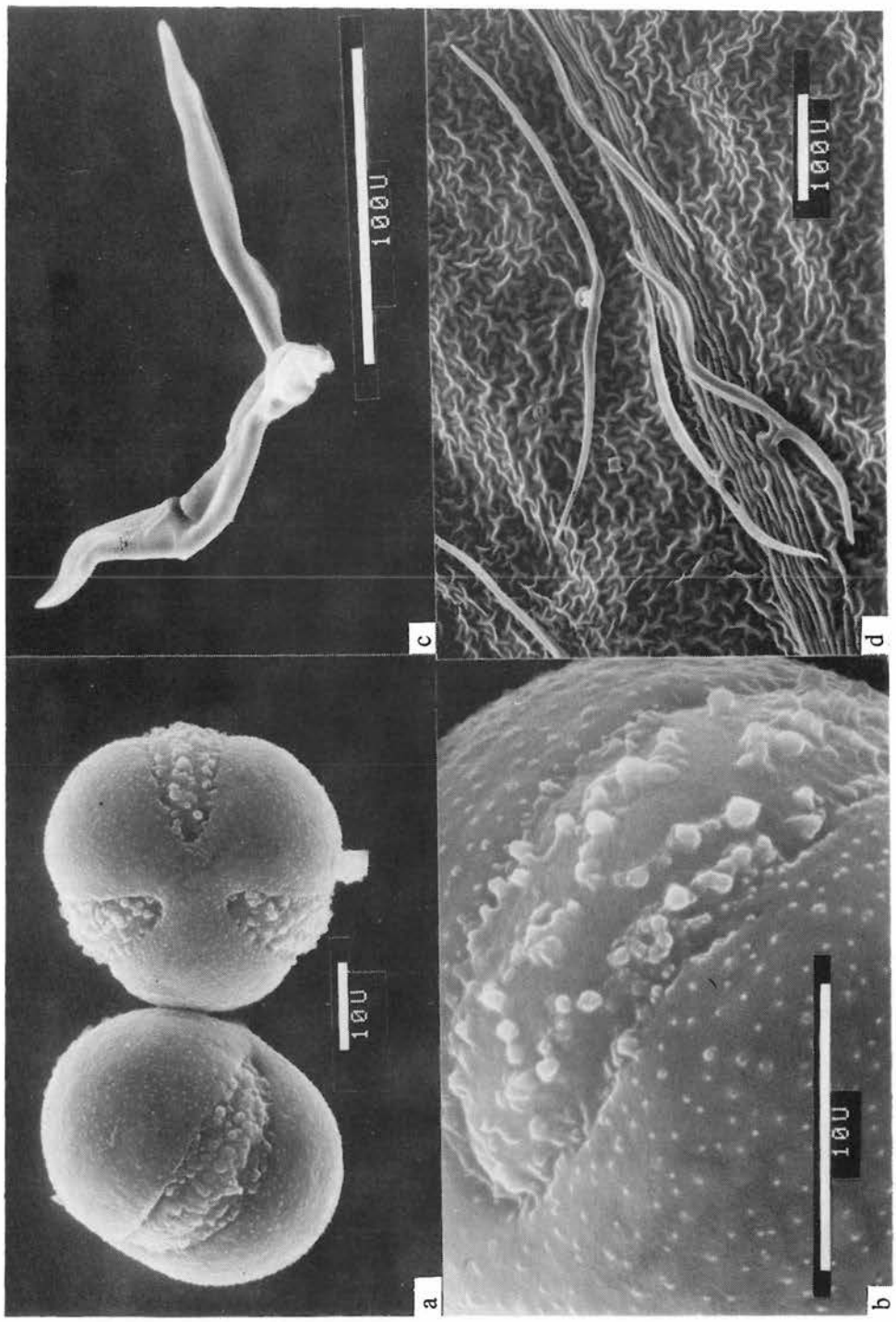

Figure 2. Pollen and trichomes of *P. commixta*, a) pollen grains x1500; b) enlargement of colpus region x5000; c) detached leaf trichome x520; d) trichomes on the abaxial surface of a fruiting sepal x170; a, b after *Wilson* 8965 (A), c, d after *Mitchell* N657A (A).

3). It seems likely that the species occurs in the intervening region of Australia as well; further collections are necessary to document this distribution. The range of *P. sericea* is primarily coastal in Western Australia; it overlaps with *P. commixta* in the central area of that state.

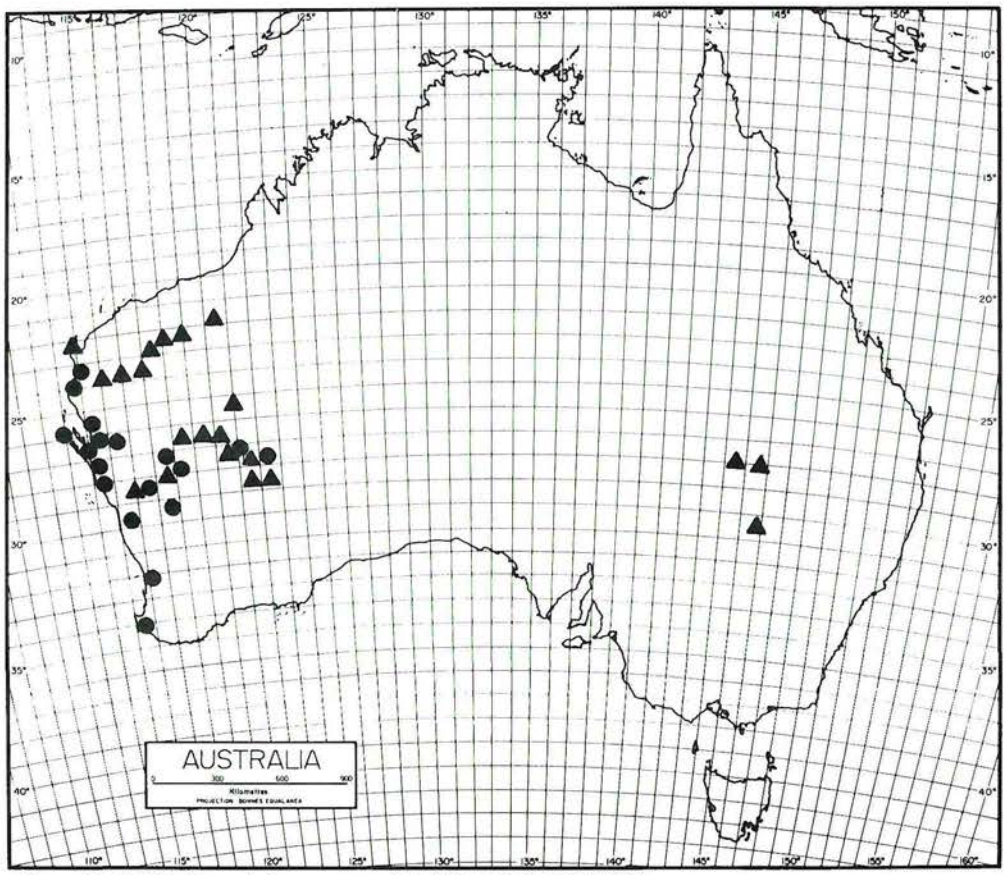

Figure 3. Distributions of *Porana commixta* (▲), and *P. sericea* (●).

Porana commixta has been collected in dry habitats near pools or watercourses on sandy, loamy or sandy-clay soils. It has been found growing on mulga, bloodwood and in lancewood escarpments. Like most members of the Convolvulaceae it prefers sunny situations and is reported from thickets, among rocks or at forest margins. Elevational data are few but range from sea level to about 200 m.

Phenology. Flowering collections have been made between the months of July and October, with the greatest number in August. Fruiting specimens have been collected sporadically between August and February.

2. **Porana sericea** (Gaudich.) F. Muell., Fragm. Phyt. Austral. 6: 100. (1868). *Duperreya sericea* Gaudichaud in Freycinet, "Voyage Autour du Monde" 1: 452, t. 63 (1826). *Type:* Novae Hollandiae ora occidentali (baie des Chiens-Marins), *C. Gaudichaud* s.n. (holo: P!; iso: G!) (Figure 4).

Ipomoea modesta F. Muell., Fragm. Phyt. Austral. 2: 22 (1860). *Type:* Australia, "in virgultis ad flumen Murchison," *A.F. Oldfield* s.n. (holo: MEL; iso: K!).

A detailed description and discussion of this species will be presented in the forthcoming revision. The following specimens have been examined to date.

Specimens examined. WESTERN AUSTRALIA: W of Ajana, 28 Sept. 1962, *J.S. Beard* 2082 (PERTH); Barnong Station, 20 Sept. 1951, *A.W. Humphries* s.n. (PERTH); Blackwood River, sine date, *A.F. Oldfield* s.n. (K); S of Cue, ca. 560 km NNE of Perth, 25 Aug. 1963, *T.E.H. Aplin* 2547 (K, PERTH); Dirk Hartog Island, near Sandy Point, 4 Sept. 1972, *A.S. George* 11533 (K, PERTH); S of Gravaloo Homestead, 3 Sept. 1970, *A.S. George* 10185 (A, PERTH); between Moore and Murchison Rivers, anno 1853, *Drummond* 223 (K, L); Murchison River, 4 Oct. 1980, *N. Byrnes* 4028 (BRI), *A.F. Oldfield* 288 (K), *A.F. Oldfield* s.n. (K); Nanga Station, 20 miles W of Overlander, *J.S. Beard* 3636 (PERTH); Northwest Coastal Highway, near #2 Tank, 22 Aug. 1967, *A.M. Ashby* 2266 (PERTH); Payne's Find, 10 Oct. 1963, *E. Lullfitz* 2527 (PERTH); Sandstone, July 1918, *D.A. Herbert* s.n. (PERTH); Shark Bay Road, 17 Oct. 1972, *Demarz* D4037 (PERTH), 27 Aug. 1931, *C.A. Gardner & W.E. Blackall* 552 (PERTH); Shark Bay (Baie des Chiens-Marins), sine date, *C. Gaudichaud* s.n. (G, P); Swan River, anno 1854, *J. Drummond* 223 (G); Talisker Station, 14 Aug. 1971, *H. Demarz* D3326 (PERTH); Tamala Station road, 1.5 miles from turnoff of Denham Road, 16 Mar. 1968, *S.G.M. Carr* 376 (PERTH); near Wilson's Creek and Lake Darlot, 13 Sept. 1927, *C.A. Gardner* 2164 (PERTH, mixed with *P. commixta*); Woodleigh Station, E of Perth-Carnarvon road, 2 Sept. 1959, *N.T. Burbidge* 6456 (BRI); near Yandal, 56 km SE of Wiluna, Sept. 1927, *C.A. Gardner & W.E. Blackall* s.n. (PERTH); sine loc., anno 1854, *J. Drummond* 223 (A, BM, P).

Relationships

Porana commixta is morphologically similar to *P. sericea,* with which it has been confused until now. The differences are apparent when the two are seen together. *Porana sericea* (Figure 4), in the dried state, often has an overall golden to tawny aspect due to its distinctly yellowish indumentum; the sepals are broadly ovate, elliptic to broadly elliptic, widest near the middle at flowering, enlarging to elliptic-ovate or subcircular in fruit; the stigma is bilobed, with each lobe cordiform in shape and deflexed in presentation. In contrast, *P. commixta* (Figure 1) has an overall silvery-gray aspect, the flowering sepals are narrowly elliptic to slenderly lanceolate, gradually tapering from the base, enlarging to narrowly elliptic-oblong or narrowly ovate in fruit; the stigma is biglobose with each half wrinkled and directed horizontally from the style. The corolla of *P. commixta* is clearly visible between the narrow sepals whereas that of *P. sericea* is covered by the wider sepals of that species. While the shapes of stigmas are an important characteristic in identifying species and even genera of Convolvulaceae, the descriptive vocabulary is inadequate and confusing and it is difficult to visualize the shapes based only on written descriptions. The situation is further complicated by the distortion of the delicate tissues which takes place during drying; thus some individual flowers may not have representative stigma shapes. Nonetheless the character is useful in separating these two similar taxa, though several flowers must be examined to gain an idea of its variability.

The endemic Australian species of *Porana* stand apart from the mainland Asiatic species in several characteristics. As noted by Schneider (1916) the solitary, axillary flowers, linear leaves, and appressed indumentum differ from the racemose or paniculate inflorescences, cordate-ovate leaves, and sparse to tomentose indumentum of the remainder of the genus. I interpret the former characters as adaptations to desert conditions. Reductions in leaf area and inflorescence size, and development of an appressed indumentum are characters associated with life in xeric conditions; similar reductions are known in other genera of the Convolvulaceae, e.g. *Wilsonia* R. Br. (Austin & Staples 1985) and in desert-dwelling species belonging to large genera known primarily from mesic habitats, e.g. *Bonamia* Thouars, *Ipomoea* L., and *Merremia* Dennst.

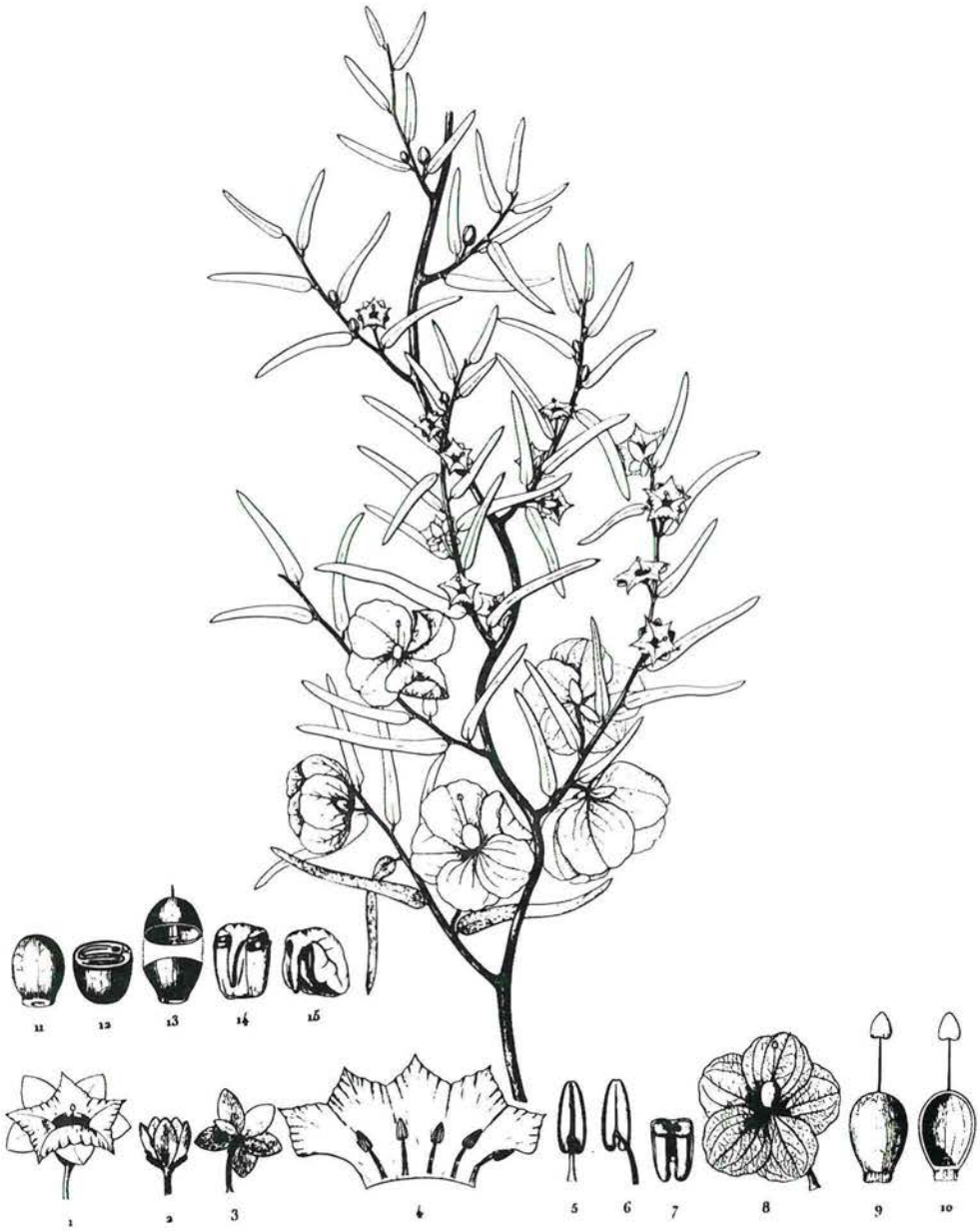

Figure 4. *Porana sericea,* reproduced from the original plate of *Duperreya sericea* Gaud.

Schneider, however, erred in stating that the floral morphology of *P. sericea* was unlike that of the other species in the genus. It is actually similar to that of *P. volubilis:* the enlarged calyx, covering ¾ the length of the corolla, the campanulate corolla, and the pistil morphology are all remarkably similar and I interpret these as indicating relationship. *Porana commixta, P. sericea,* and *P. volubilis* form a group of closely related species within *Porana* sensu lato. Additional characters shared by these taxa include the presence of lenticels on the stems, and the arrangement and proportions of the fruiting sepals. This suite of characters sets these three species apart from the remaining members of the genus which are alike in having smooth

to striate stems lacking lenticels, palmate leaf venation, small flowering sepals which just cover the base of the corolla tube, funnelform, campanulate-funnelform, or salverform corollas, and fruiting sepals which are unequally enlarged and clasp the utricle, or if they are equally enlarged then they are more or less markedly reflexed from the utricle at maturity. The relationships of the species of *Porana* will be discussed fully in the forthcoming revision.

In terms of distributions, most *Porana* species are mainland Asiatic, ranging from Pakistan across India south of the Himalayas, through Burma and China into Southeast Asia. *Porana volubilis'* range fringes that of its congeners, extending from Southeast Asia south and eastward through Malaysia and Indonesia. The Australian species are isolated from the rest of the *Porana* species and occupy the extreme geographic range of the genus.

Cultivated species

Two species of *Porana* are cultivated as ornamentals in various areas of the world. One of these, *Porana paniculata* Roxb., has been recorded from Australia (QUEENSLAND: Tinana, via Maryborough, May 1974, *F. Nebe* s.n. (BRI)). This is an expansive woody climber, whitish or tawny tomentose on the vegetative parts, with palmate leaf venation and large paniculate inflorescences of small, white, fragrant flowers. The species is native to northern India and the countries bordering the southern flank of the Himalayas.

Acknowledgements

Thanks are due to the curators at BM, BRI, E, G, K, L, MO, PERTH, US, and UWA for loaning specimens essential for this revision. Elizabeth Shaw of the Gray Herbarium corrected the Latin diagnosis, for which help I am very grateful. Helpful comments on the manuscript were tendered by D.F. Austin, M.D. Bowers, R.A. Howard, E.A. Kellogg and P.F. Stevens. The illustration of the new species was prepared by M. Dykens.

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New combinations in *Camptacra* N. Burb. (Asteraceae: Astereae)

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Abstract

Lander, N.S. New combinations in *Camptacra* N. Burb. (Asteraceae: Astereae). Nuytsia 6(1):61 (1987). Examination of type material of *Eurybia gracilis* Benth. has shown this to be an earlier name for *Aster brachycomoides* F. Muell., the basionym for *Camptacra brachycomoides* (F. Muell.) N. Burb., a species found in coastal areas of the Northern Territory and northern Queensland and on the north-western slopes of New South Wales. The new combinations *Camptacra gracilis* (N. Burb.) Lander, *C. gracilis* f. *arachnoidea* (N. Burb.) Lander and *C. gracilis* f. *lanata* (N. Burb.) Lander are provided.

Introduction

Amongst the supplementary collections of *Olearia* (Asteraceae) held at the National Herbarium of Victoria (MEL) I recently encountered isotype material of *Eurybia gracilis* Benth. in the form of a small packet from the Sonder herbarium bearing the name *Eurybia gracilis* Benth. and that of its collector, the artist Ferdinand Lukas Bauer. Inside is a small branch of a plant hitherto known as *Camptacra brachycomoides* (F. Muell.) N. Burb., a species occurring in coastal areas of the Northern Territory and northern Queensland and on the north-western slopes of New South Wales. Its subglabrous, narrowly linear leaves which are three-toothed at the apex but otherwise entire conform to those of the type form.

Subsequent to its publication the name *Eurybia gracilis* Benth. (1837) appears to have been overlooked, even by Bentham himself in his "Flora Australiensis". As this name predates that of *Aster brachycomoides* F. Muell. (1865) the following new combinations are necessary.

Camptacra gracilis (Benth.) Lander, comb. nov.; *Eurybia gracilis* Benth. in Endlicher et al., Enum. Pl. Hueg. 59, in nota (1837). *Type:* s. loc., s. dat., *Bauer* (holo: ? W, non vidi; iso: MEL, ex herb. Sonder).

Aster brachycomoides F. Muell., Fragm. 5: 86 (1865); *Vittadinia brachycomoides* (F. Muell.) Benth., Fl. Austral. 3: 490 (1867); *V. brachycomoides* var. *latifolia* Benth., Fl. Austral. 3:490 (1867); *Camptacra brachycomoides* (F. Muell.) N. Burb., Brunonia 5: 12-15 (1982). *Lectotype* (designated in Burbidge, loc. cit.): "Arnheim's Land, 14 juli [18]56", *F. Mueller* (lecto: MEL 1004273).

Camptacra gracilis f. **arachnoidea** (N. Burb.) Lander, comb. nov.; *Camptacra brachycomoides* f. *arachnoidea* N. Burb., Brunonia 5: 14 (1982). *Type:* Rockingham's Bay, *Dallachy* (holo: MEL 1004261).

Camptacra gracilis f. **lanata** (N. Burb.) Lander, comb. nov.; *Camptacra brachycomoides* f. *lanata* N. Burb., Brunonia 5: 14-15 (1982). *Type:* near source of Poison Creek, about 90 miles N of Hughenden, Queensland, 11 Nov. 1935, *S.T. Blake* 8545 (holo: BRI 084813, non vidi).

Acknowledgement

I wish to thank Dr J.H. Ross, Curator of the National Herbarium of Victoria, and his staff for their hospitality and for making facilities available to me whilst visiting their institution.

New combinations in *Minuria* DC. (Asteraceae: Astereae)

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Abstract

Lander, N.S. New combinations in *Minuria* DC. (Asteraceae: Asterae). Nuytsia 6(1):63-66 (1987). *Olearia tridens* D.A. Cooke is transferred to the genus *Minuria* DC. *M. chippendalei* Lander & R. Barry and *Olearia aspera* W. Fitzg. are shown to be conspecific with *Eurybiopsis macrorhiza* DC. The new combinations *M. tridens* (D.A. Cooke) Lander and *M. macrorhiza* (DC.) Lander are made. A new record of *M. tridens* for Western Australia is noted. A key to all species of *Minuria* is provided.

Introduction

In the course of my revisionary studies in the genus *Olearia* I have examined specimens of *O. tridens* D.A. Cooke, namely those cited by Cooke (1986). This species is clearly misplaced in *Olearia;* it must be referred instead to the genus *Minuria* DC.

It has been suggested to me (C.R. Dunlop, pers. comm.) that *Eurybiopsis macrorhiza* DC. and *Minuria chippendalei* Lander & R. Barry might be conspecific. Examination of type material and other specimens of the former and a re-examination of specimens of the latter show that this is indeed so. Further, examination of type material and other specimens of *Olearia aspera* W. Fitzg. shows that it, too, is conspecific. I believe that this taxon is best placed in *Minuria.*

Discussion

Contrary to Cooke's (1986) description of *Olearia tridens,* I find that the achene and pappus are dimorphic between its ray and disc florets. The ray achenes are fertile, terete, opaque and sericeous with appressed twin hairs; those of the disc are sterile, flattened, translucent and glabrous. The ray pappus hairs are of one kind, long and uniformly barbellate; those of the disc are of two kinds with approximately equal numbers of short, uniformly barbellate bristles and long ones with barbs longer and denser towards the tips. In several specimens, however, the achene and pappus morphology of ray and disc florets is more or less uniform: both ray and disc achenes are fertile, the former with a greater number of pappus bristles than the latter.

Further, the style arms of the disc florets of *O. tridens* conform to those of the second type of sterile style described by Grau (1977) in which the disc stigma lobes are pubescent on their dorsal surfaces with hairs which extend below the point of bifurcation. Amongst Astereae such styles are characteristic of *Calotis, Erodiophyllum, Ixiochlamys, Kippistia* and *Minuria* (Grau 1975, 1977; Dunlop 1980; Lander & Barry 1980a, b). They have not been observed in the genus *Olearia* in the course of my ongoing study of that genus, nor are they noted in any of the literature relating to it.

The characters described above are sufficient to exclude this species from *Olearia*. Indeed, in combination with the naked receptacle, biseriate ray florets and the obtuse anther bases observed in all specimens examined they indicate that *O. tridens* in fact belongs in *Minuria* (see Lander & Barry 1980b). Thus the following new combination is necessary.

Minuria tridens (D.A. Cooke) Lander, comb. nov. *Olearia tridens* D.A. Cooke, Muelleria 6: 182-3 (1986). *Type:* 4 km W of Trephina Gorge, 23° 32' S, 134° 22' E, Northern Territory, 17 July 1983, *P.K. Latz* 9589 (holo: NT; iso: AD, DNA, PERTH).

To the specimens of this taxon from the Macdonnell Ranges cited by Cooke (1986) must be added the following recent collection made in the Austin District of the Eremaean Botanical Province of Western Australia.

Additional specimen examined. WESTERN AUSTRALIA: 22 km S of Cue on Great Northern Highway, *R.M. King* 9581 (MEL, PERTH, US).

The genus *Eurybiopsis* DC. (1836) has been reinstated by Burbidge (1982) who noted its affinity with *Minuria*. Its single species, *E. macrorhiza* DC., is clearly conspecific with *Minuria chippendalei* Lander & R. Barry. So too is *Olearia aspera* W. Fitzg. However, the weakly dimorphic achene and pappus of the ray and disc florets of this species, the sterile disc achenes, and the characteristic disc stigma lobes of the type described above noted by Lander & Barry (1980) and Gray (in Burbidge 1982, footnote p. 10) argue strongly for its placement in *Minuria* rather than *Olearia* or in an isolated, monotypic genus. Thus *Eurybiopsis* is here designated a synonym of *Minuria* DC. (1836): the following new combination is necessary.

Minuria macrorhiza (DC.) Lander, comb. nov. *Eurybiopsis macrorhiza* DC., Prod. 5: 260 (1836); Burbidge, Brunonia 5: 10-11 & t. 1 (1982). *Vittadinia macrorhiza* (DC.) A. Gray, Proc. Am. Acad. Arts Sci. 5: 118 (1862); Benth., Fl. Austral. 3: 492 (1867); Beard, Descript. Cat. Western Austral. Pl., edn 2, 137 (1970); Diment et al., Cat. Nat. Hist. Drawings Joseph Banks 97 (1984); Green, Census Vasc. Pl. Western Australia, edn 2, 166 & 224 (1985). *Type:* "At the foot of cliffs, Prince Regent's river, North-west coast, Australia, lat. 15° So., Octr 1820", *A. Cunningham* 19 (holo: G-DC; iso: K — as *A. Cunningham* 279).

Aster macrorhiza A. Cunn. ex DC., loc. cit. non Thunb., pro syn. (nom. inval.).

Minuria chippendalei Lander & R. Barry, Nuytsia 3: 225-6 (1980). *Type:* Wade Creek, Vansittart Bay, Western Australia, Oct. 1921, *C.A. Gardner* 1537 (holo: PERTH).

Olearia aspera W. Fitzg., J. Proc. Roy. Soc. Western Australia 3: 220 (1919); Beard, Descript. Cat. Western Austral. Pl., edn 2, 135 (1970); Green, Census Vasc. Pl. Western Australia, edn 2, 168, 263 (1985). *Syntypes:* Packhorse Range, Western Australia, May 1905, *W.V. Fitzgerald* 1006 (NSW, PERTH); Isdell River, near Mt Barnett, Western Australia, June 1905, *W.V. Fitzgerald* 1045 (K, PERTH); Packhorse Range, Western Australia, June 1905, *W.V. Fitzgerald* s.n. (NSW); Packhorse Range, Western Australia, July 1905, *W.V. Fitzgerald* s.n. (BM); between the Isdell and Precipice Range, Western Australia, Sept. 1905, *W.V. Fitzgerald* 1505 (BM, K, PERTH).

To the collections of this species cited by Fitzgerald (1919), Lander & Barry (1980) and Burbidge (1982) can be added the following specimens from the Gardner Province of the Northern Botanical District of Western Australia and the Darwin and Gulf Pastoral District of the Northern Territory.

Additional specimens examined. WESTERN AUSTRALIA: Gibb River — Kalumburu Mission road, 11.3 km NNW of Drysdale River Crossing, *A.C. Beauglehole* 51725 (PERTH); 1 km NE of Carson River Crossing, Gibb River — Kalumburu Mission road, 175 km NW of Wyndham, *A.C. Beauglehole* 51985 (PERTH); 'Beverly Springs', 16° 43' 0" S, 125° 27' 4" E, *B.G. Muir* et al. 649 (PERTH); near Walcott Inlet, *W.R. Easton* 1139 (PERTH); 15 km W of airstrip, Mitchell Falls road, Mitchell Plateau, *T.P. Farrell* 955 (PERTH); 1.5 km SE of CRA mining campsite, Mitchell Plateau, *K.F. Kenneally* 7866 (PERTH); 26.5 km N of mining campsite, Port Warrender track, *K.F. Kenneally* 8564 (PERTH).

NORTHERN TERRITORY: 5 miles (8 km) S of Leanger Swamp, Darwin, 12° 21' S, 130° 55' E, *P.K. Latz* 3637 (NT).

A revised key to the species of *Minuria*

1. Stems and peduncles glabrous
   2. Heads large, to 35 mm in diameter when open; ray achenes with glochidial twin-hairs ..... *M. macrocephala* Lander & R. Barry
   2.* Heads small, to 12 mm in diameter when open; ray achenes with notched or glochidial twin-hairs
      3. Uppermost leaves overtopping heads..... *M. annua* (Tate) Tate ex J. Black
      3.* Uppermost leaves not overtopping heads
         4. Ray pappus longer than achene; disc pappus hairs uniform with 8-10 barbellate bristles 1.5-2.0 mm long; ray achene with notched twin-hairs ..... *M. integerrima* (DC.) Benth.
         4.* Ray pappus shorter than or equal to achene; disc pappus hairs dimorphic with short barbellate bristles c. 0.8 mm long, and c. 8 longer bristles 2.5-3.0 mm long; ray achenes with glochidial twin-hairs..... *M. rigida* J. Black

1*. Stems and peduncles sparsely to densely pubescent
   5. Stems more or less woolly with stellate hairs; leaves somewhat pubescent with simple hairs; leaf margins conspicuously denticulate, apices often denticulate or entire..... *M. denticulata* J. Black
   5.* Stems pubescent with simple hairs; leaves glabrous or pubescent with simple hairs; leaf margins entire, apices entire or distinctly 3-toothed
      6. Leaf apices distinctly 3-toothed..... *M. tridens* (D.A. Cooke) Lander
      6.* Leaf apices entire
         7. Leaves glabrous
            8. Ray florets large and conspicuous, ligules 5-7 mm long; ray achenes pubescent with glochidial twin-hairs; disc achenes glabrous..... *M. cunninghamii* (DC.) Benth.
            8.* Ray florets small and inconspicuous, ligules less than 1 mm long; ray achenes with a sparse cover of notched twin-hairs; disc achenes pubescent..... *M. gardneri* Lander & R. Barry
         7.* Leaves sparsely to densely pubescent
            9. Innermost involucral bracts glabrous..... *M. leptophylla* DC.
            9.* Innermost involucral bracts pubescent ..... *M. macrorhiza* DC.) Lander

Acknowledgements

This work was, in part, carried out during my assignment as Australian Liaison Botanist at Kew 1984-5.

I wish to thank Mr Clyde Dunlop for drawing my attention to the fact that *Eurybiopsis macrorhiza* and *Minuria chippendalei* are conspecific and for his helpful comments on the draft of this paper. I am grateful to the heads of the herbaria BM, G and K for making facilities available to me whilst visiting their institutions.

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A taxonomic revision of the genus *Calothamnus* Labill. (Myrtaceae: Leptospermoideae). Part 1. The 4-merous species

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Abstract

Hawkeswood, T.J. A taxonomic revision of the genus *Calothamnus* Labill. (Myrtaceae: Leptospermoideae). Part 1. The 4-merous species. Nuytsia 6(1):67-126 (1987). A taxonomic account is provided for the 23 4-merous *Calothamnus* species presently recognized. Two new subgenera are described. Two taxa are elevated from variety or form to species: *C. crassus* (Benth.) T.J. Hawkeswood and *C. pallidifolius* (Benth.) T.J. Hawkeswood. In addition, 2 species are raised from synonomy: *C. huegelii* Schauer and *C. robustus* Schauer. A key is provided for the 23 species; distributional and ecological data are provided where known for each taxon.

Introduction

The genus *Calothamnus* Labill. (Myrtaceae: Leptospermoideae) is endemic to Western Australia. The concentration of species is in the coastal heathlands, woodlands, and dry sclerophyll forests from Shark Bay on the west coast to Cape Arid on the Great Australian Bight. No species are known from any of the offshore islands near the Western Australian coast.

The original description of the genus was published in 1806 by J.J.H. de Labillardiere following a visit he made to Australia. Since Labillardiere's (1806) publication and his description of *C. sanguineus,* numerous other species have been described. Robert Brown (1812) added three species (viz. *C. quadrifidus, C. gracilis* and *C. villosus*) based on collections he made as naturalist aboard the ship *Investigator* with Matthew Flinders during December 1801 and January 1802 at King George Sound (Albany district). All three names are still currently accepted. J.C. Schauer (1843) and Schauer in Lehmann (1844), was the first botanist to thoroughly study the genus but he had very little material at his disposal. Despite this disadvantage he produced the first reasonably reliable account of *Calothamnus* (and of the closely related genus *Beaufortia*). Bentham (1867) modified the work of Schauer and previous authors. Since then many additional species have been discovered and some extensive collections of the more common species have been built up in herbaria within Australia, in particular, the Western Australian Herbarium (PERTH). Hence Bentham's treatment is now of limited use and has led to numerous misidentifications on herbarium specimen sheets, in published papers and in popular gardening and plant identification guides. Most of the new species collected this century have been published by Hawkeswood (1984a, 1984b). Since some of these new species are rare and endangered, the papers were published ahead of the main revision. *Calothamnus accedens* T.J. Hawkeswood, one such species, is only known from 14 plants, hence it was necessary to induce awareness of these in the light of further threats to their survival.

Morphology and terminology

The genus *Calothamnus* in general exhibits little inter- or intra-specific variation. Most are shrubs growing to about 2 or 3 m high with terete often pungent leaves, densely crowded and randomly distributed on the stem. The oil glands are usually prominent, but in some species such as *C. planifolius* Lehm., *C. pallidifolius* (Benth.) T.J. Hawkeswood and *C. torulosus* Schauer they are usually obscure. Some species such as *C. rupestris* Schauer and *C. formosus* T.J. Hawkeswood grow to small trees about 3 or 4 m high, while others such as *C. schaueri* Lehm., *C. preissii* Schauer and *C. lehmannii* Schauer usually grow as decumbent shrubs to about 30 cm high. All species in the genus are evergreen, and only one, *C. sanguineus* Labill., is known to naturally drop its fruits. The root systems are usually extensive with a lateral network of rootlets. One species, *C. tuberosus* T.J. Hawkeswood, is very unusual in having tuberous roots (Hnatiuk 1977, Pate & Dixon 1982) although most species have not been examined for this character.

Most species have terete leaves, without evident venation, although in some such as *C. pallidifolius, C. planifolius, C. blepharospermus* F. Muell. and *C. homalophyllus* F. Muell. they are flat and oblanceolate with large central, marginal and smaller cross veins.

The flowers of *Calothamnus* are sessile and are usually arranged in unilateral or, more commonly, in cylindrical spikes, often in scattered clusters, rarely solitary. The name "One-sided Bottlebrush" has been given to the group but this is rather an improper common vernacular due to the fact that many species do not have unilateral spikes or clusters. The flowers are embedded (or partially so) in the often corky rhachis. In some species, the buds break through a protective membranous structure, e.g. *C. graniticus* T.J. Hawkeswood. The calyx-tube is usually covered in oil glands. The calyx-lobes are usually thick with membranous margins. The petals, usually with large oil glands in the centre and smaller ones on the margins, are deciduous and usually fall soon after the stamens have unfolded. In some species, e.g. *C. graniticus* and *C. rupestris,* the petals have a prominent basal claw, but in the majority the claw is absent or poorly developed. The styles are usually thick and often continue growth before and after anthesis. The staminal claws are usually equal in length and width, and deep red to orange-red in colour. However, the staminal claws in *C. sanguineus* are unusual in that the upper two are fused to form a single broad claw, while the lower ones are reduced to a single stamen. The staminal claws of *C. pachystachyus* Benth. are also unusual in that the two upper ones are broad, while the lower ones are narrow; all are yellow-brown (brown at base) in colour. The anthers of *Calothamnus* are basifixed, mostly glabrous, arranged marginally on the staminal claws. In one species, *C. torulosus,* there are also submarginal filaments and the anthers and filaments are covered in a peculiar cobweb-like substance. The nature of this phenomenon has not been examined by the author. The number of marginal filaments on the staminal claws is of some taxonomic significance. The ovary is inferior, 3-locular, with numerous ovules per loculus. Usually few fertile seeds are produced per capsule. The shape and size of the seeds and colour of the testa is of considerable taxonomic significance. The angled seeds are usually linear to linear-cuneate in shape, (truncate at one or both ends), 1-3 mm long and yellow, yellow-brown, red-brown or dark brown and even grey in colour. They are usually glabrous (sometimes shiny), but in some species, e.g. *C. blepharospermus,* each angle has a row of closely arranged, stiff, erect cilia. The ovulodes (sterile ovules) are usually smaller than the fertile seeds; they are glabrous and usually coloured yellow to orange-brown. The fruit is perhaps the most variable and taxonomically useful character in the genus. It is a dry, sessile capsule, depressed globular to cylindrical or ovoid in shape; the calyx-lobes (2, 3 or 5) may be thickened and persistent, or absent so that the fruit is $\pm$ truncate. The fruit is smooth or wrinkled, glabrous or pubescent, embedded (or partially so) in the corky or non-corky rhachis. As soon as the capsule dries, the seeds are released (usually within the first year after flowering) the valves open and the seeds fall from the fruit through the action of gravity and wind. The capsules usually remain on the plant for a number of years.

The terminology used in this paper follows that of Hawkeswood (1980, 1984a, 1984b). The term "calyx-tube" has been adopted and follows the terminology of Bentham (1867) since there appears to be little agreement amongst modern authors on the correct use of terms to describe this floral structure and its associated appendages. The correct interpretation of calyx, stamens and petals must await the results of embryological and developmental studies.

This revision is based mainly on the collections in the Western Australian Herbarium (PERTH) which undoubtedly holds the most comprehensive collections of *Calothamnus* of any herbarium.

The Botany Department Herbarium of the University of Western Australia (UWA) and the Kings Park Botanic Garden Herbarium, Perth (KP) have both contributed useful material and additional records to those of PERTH. In addition, the holdings of *Calothamnus* at the Royal Botanic Gardens, Sydney (NSW) have been examined and annotated. While I was in Western Australia during 1979-80 I attempted to examine as many *Calothamnus* species as possible in the field but I was unable to collect all of them. Further collections of all species growing in the Stirling Ranges and the Fitzgerald River area, where I was unable to visit, are needed.

In addition to the usual herbarium abbreviations (Holmgren, Keuken & Schofield 1981), KP has been used for herb. Kings Park Botanic Garden, Perth. Where a herbarium holds more than one sheet of a collection, this has been indicated by the relevant number in brackets after the specimen's citation.

For some of the species described herein, not every specimen seen by the author has been cited. In these cases, specimens with no collection data have not been cited and for well collected species such as *C. quadrifidus* and *C. sanguineus* not all collections have been cited due to space limitations; however, those collections omitted have been included in the figure for total number of specimens examined.

Taxonomy

Schauer (1843) divided the genus into two sections, i.e. *Callithamnus,* those species with staminal claws having numerous anthers ("phalanges polyandrae") and *Stromnothamnus,* those with 3-7 anther filaments ("phalanges 3-7-andrae"). Since I regard this as too artificial a division, and consider a more natural splitting of the genus to be on the basis of the number of floral parts, two subgenera are proposed below.

Calothamnus Labill., Nov. Holl. Pl. Sp. 2:25, t.164 (1806); R. Br. in W.T. Aiton Hort. Kew. ed. 2, 4:418 (1812); DC., Prod., 3:211 (1828); Lindley, Sketch Veg. Swan. Riv. Col. 9 (1839); Lehm., Del. Sem. Hort. Bot. Hamb. 7 (1842); Endl. in Endl. et al., Enum. Pl. Hueg. 48 (1837); Schauer, Regelia Beaufortia Caloth. 24 (1843); Schauer in Lehm., Pl. Preiss. 1:151 (1844); Kunze, Linnaea 20:58 (1847); Turcz., Bull. Soc. Imp. Naturalistes Moscou 20:168 (1847); Turcz., op. cit. 22:25 (1849); Turcz., Bull. Cl. Phys. -Math. Acad. Imp. Sci. Saint Petersbourg 10:428 (1852); F. Muell., Fragm. 3:111 (1862); Benth., Fl. Austral. 3:172 (1867); F. Muell., Fragm. 10:31 (1876); Niedenzu in Engl. & Prantl, Die Nat. Pflanzen. 3:97 (1893); J.D. Hook., Bot. Mag. 129, t. 7906 (1903); S. Moore, J. Linn. Soc. Bot. 14:205 (1921); Domin, Vestn. Kral. Ceske. Spoceln. Nauk. Tr. Mat.-Prir. 2:91 (1923); Blackall, How to Know Western Austral. Wildfl. 305 (1954); Beard, Descr. Cat. Western Austral. Plants 72 (1954); Fairall, Western Austral. Pl. in Cult. 8 (1970); Erickson, George, Marchant & Morecombe, Fl. & Pl. of Western Austral. (1973); Hawkeswood, Austral. Pl. 11:5 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:146-155 (1980); Hawkeswood, Nuytsia 5:123 (1984); Hawkeswood, Nuytsia 5:310 (1984). *Type: C. sanguineus* Labill.

Billotia Colla, Hortus Ripul. 20 t. 23 (1824). *Type: B. acerosa* Colla (= *Calothamnus quadrifidus* R.Br.).

Shrubs, erect or decumbent, compact to spreading, single or multi-stemmed, much-branched, glabrous or if pubescent often glabrous with age, 30 cm to about 3.5 m high (rarely 4 m). *Bark* smooth and thin when young, often hard, grey, splitting near base of trunk with age. *Older stems* usually with prominent leaf scars. *Root system* extensive, in one species tuberous. *Leaves* scattered or densely crowded at ends of branches, sessile, linear to oblanceolate, terete or flattened, erect or semi-erect, rigid or flaccid, shortly mucronate, obtuse or acuminate, sometimes pungent, glabrous, or pubescent; *oil glands* variable in size, randomly distributed, more prominent in living plants. *Flowers* few to numerous per inflorescence, in clusters or in unilateral to cylindrical spikes, usually on portions of the stems from which the leaves have fallen. Flowers 4- or 5-merous. *Calyx-tube* small to large, extended globular, campanulate to almost cylindrical, glabrous or pubescent, usually green, verrucose with prominent oil glands, embedded (or partially so) in the rhachis. *Rhachis* often swollen or dilated at base of calyx-tube. *Calyx-lobes* erect or spreading, glabrous or pubescent outside, usually shortly pubescent within, equal or unequal, if equal then usually all thickened and persistent on fruit, or only one retained and deflexed over fruit orifice; in some 4-merous species two opposite lobes are thicker and wider than the other two; lobes usually deltoid, acute or obtuse, concave or slightly so, usually thick but with thin, scarious, often fimbriate (or partially so) margins. *Petals* 4 or 5, elliptical to broadly ovate, obtuse to slightly acute, concave, glabrous, some species with a prominent claw, pink to pale orange-brown, deciduous, usually with prominent oil glands in the centre and smaller glands towards the margins. *Staminal claws* ± equal or unequal; if unequal, upper two broad, fused together (in one species) or free, lower two reduced in size and with reduced number of filaments; glabrous (or covered in whitish cobweb-like hairs in one species), pink, to crimson, orange-red, purple-red, or greenish-brown in colour, usually paler at base; *marginal filaments* few to numerous; (several submarginal filaments on the upper two staminal claws in one species); *anthers* basifixed, linear to linear-oblong, yellow, pale brown, dark brown or black. *Style* usually thick, tapering towards the tip, glabrous, stigma usually small. Summit of *ovary* usually densely pubescent. *Fruit* sessile, ± ovoid, cylindrical, globular to depressed globular, smooth, wrinkled or verrucose, glabrous or if pubescent often becoming glabrous with age, style often persistent. *Capsules* usually retained on plant for several years (in one species, the fruit falls in the first or second year after flowering). *Fertile seeds* few to many per capsule, linear to linear-cuneate, linear-oblong or oblong, usually truncate at one or both ends, angular (angles sharp or rounded), glabrous or (in several 5-merous species) with hirsute angles; testa usually dull, grey, dark grey, buff-brown, orange-brown, reddish-brown to chocolate brown. *Ovulodes* numerous per capsule, linear to linear-cuneate, usually smaller than the fertile seeds, truncate, angular (angles sharp or rounded), glabrous, cream, yellow, yellow-brown, orange-brown or light brown in colour.

Key to subgenera

Flowers 4-merous.....subg. *Calothamnus*
Flowers 5-merous.....subg. *Pentacalothamnus*

Calothamnus Labill. subg. **Calothamnus**

Billotia Colla, op. cit. (1824). *Calothamnus* b. *Billotia* (Colla) Reichb., Consp. Regni Veg. 175 (1828). *Type: Billotia acerosa* Colla

Calothamnus sect. *Callithamnus* Schauer, Regelia Beaufortia Caloth. 24 (1843), nom. illeg. (includes type of *Calothamnus*).

Calothamnus sect. *Stromnothamnus* Schauer, op. cit. 31 (1843). *Lectotype: C. lehmannii* Schauer, lecto nov.

Flowers 4-merous.

Calothamnus subg. **Pentacalothamnus** T.J. Hawkeswood, subgenus nov.

Typus: Calothamnus gracilis R.Br.

Calothamnus sect. *Pentaphalanx* Reichb. ex T. Post et Kuntze, Lex. Gen. Phan. 93 (1903); Reichb., Consp. Regni Veg. 175 (1828) nomen nudum. *Neotype: Calothamnus gracilis* R.Br., neo nov.

Flores pentameri.

Key to species of *Calothamnus* subg. *Calothamnus*

1. Two upper staminal claws broad, flat; two lower ones narrow.....2
1.* Staminal claws all narrow.....5
2. Calyx-tube (at time of flowering) entirely immersed in the thick, swollen rhachis...3
2.* Calyx-tube (at time of flowering) not immersed in the rhachis (rhachis not prominently swollen).....4
3. Leaves flat, 8-15 cm long (Mogumber, Moora area).....1. *C. pachystachyus* Benth.
3.* Leaves terete, 15-30 cm long (Eneabba area).....2. *C. longissimus* F. Muell.
4. Two upper staminal claws fused; anthers glabrous; leaves mostly 1-2 cm long (Cape Naturaliste to Kalbarri).....3. *C. sanguineus* Labill.
4.* Two upper staminal claws free; anthers covered in long, cobweb-like hairs; leaves mostly 2-4 cm long (Perth to Eneabba) .....4. *C. torulosus* Schauer
5. Calyx-tube (at time of flowering) ± immersed in the swollen rhachis or rhachis somewhat dilated at base of calyx-tube.....6
5.* Calyx-tube (at time of flowering) not immersed in the rhachis.....14
6. Rhachis swollen.....7
6.* Rhachis not swollen.....8
7. Flowers in unilateral spikes 4-10 cm long (Perth along south-west coast to Albany).....5. *C. lateralis* Lindley
7.* Flowers in unilateral spikes 3-4 cm long (Hyden to Woodanilling, Stirling Range to Fitzgerald River).....6. *C. huegelii* Schauer
7.**Flowers in ± cylindrical spikes 3-8 cm long (Scott River, Stirling Range .....7. *C. crassus* (Benth.) T.J. Hawkeswood
8. Leaves flat.....9
8.* Leaves terete.....11
9. Leaves with two longitudinal grooves both adaxially and abaxially (Stirling Range).....9. *C. microcarpus* F. Muell.
9.* Leaves without grooves.....10
10. Leaves linear to linear-cuneate, mostly 4-5 cm long, 3-5 mm wide (Pingelly to Albany).....13. *C. planifolius* Lehm.
10.* Leaves oblanceolate, mostly 5-6 cm long, 6.5-10 mm wide (Whicher Range) .....14. *C. pallidifolius* (Benth.) T.J. Hawkeswood
11. Staminal claws more than 1.5 cm long.....12

11.* Staminal claws less than 1 cm long.....13
12. Staminal claws ± equal, mostly with 7 filaments; shrubs to 2 m high (Stirling Ranges).....8. *C. affinis* Turcz.
12.* Staminal claws not equal, the upper two with 5 or 7 filaments, the lower two with 1 or 2 filaments; shrubs to 40 cm high (Tutanning Reserve, Cranbrook, Frankland).....10. *C. preissii* Schauer
13. Leaves 10-20 cm long; staminal claws ± equal, each with 2-4 filaments (Stirling Range, Mt Barker).....11. *C. schaueri* Lehm.
13.* Leaves 1-2.5 cm long; staminal claws not equal, the upper two with 4 or 5 filaments, the lower two reduced to 1 or 2 filaments (Bowelling to the Stirling Range).....12. *C. lehmannii* Schauer
14. Fruit retaining all 4 lobes (two of which are reflexed and prominently thickened, the other two less thickened, deflexed).....15
14.* Fruit retaining 2 lobes that are prominently thickened and reflexed (or fruit very shortly 4-lobed).....16
15. Leaves short, mostly 2-2.5 cm long, stiff, pungent; calyx-tube densely pubescent; fruit mostly 15-20 mm long, 13-18 mm wide (Red Hill, Gosnells, Boyagin Rock) .....15. *C. rupestris* Schauer
15.* Leaves long, mostly 5-7 cm long, shortly mucronate; calyx-tube usually glabrous; fruit mostly 16-18 mm long, 12-15 mm wide (Cape Naturaliste, Dwellingup, Collie).....16. *C. graniticus* T.J. Hawkeswood
16. Fruit shortly 4-lobed (leaves 8-12 cm long, glaucous; fruit depressed globular, 5-7 mm wide) (Peak Charles, Knapp Rock, Barbalin Rock, Spinifex Rock) .....23. *C. tuberosus* T.J. Hawkeswood
16.* Fruit with two prominently thickened lobes.....17
17. Leaves pungent, rigid, densely crowded (flowers hidden by the dense foliage) (Mt Barren Range).....18. C. *pinifolius* F. Muell.
17.* Leaves not pungent..... 18
18. Flowers usually 2-5 (8) together in a small cluster amongst leaves 19
18.* Flowers usually arranged in a dense spike..... 22
19. Leaves flat..... 20
19.* Leaves terete..... 21
20. Leaves mostly 1.5-2 cm long, 1.4-2 mm wide, narrowly oblanceolate (Wongan Hills).....17. *C. asper* Turcz.
20.* Leaves mostly 2-4 cm long, 3-8 mm wide, usually oblanceolate (Geraldton to the Kalbarri National Park).....21.*C. homalophyllus* F. Muell.
21. Calyx-tube densely hirsute; flowers 3-5 in a cluster (Cape Riche) .....19. *C. robustus* Schauer
21.* Calyx-tube usually glabrous, (sometimes finely pubescent); flowers mostly 3 together in a cluster (Mt Barren Range).....20. *C. validus* S. Moore
22. Leaves mostly oblanceolate (sometimes narrowly oblanceolate), glabrous (Geraldton to the Kalbarri National Park).....21. *C. homalophyllus* F. Muell.
22.* Leaves linear, usually with spreading hairs (occasionally glabrous) (Shark Bay to Cape Arid).....22. *C. quadrifidus* R. Br.

1. **Calothamnus pachystachyus** Benth., Fl. Austral. 3:173 (1867); Blackall, How to Know Western Austral. Wildfl. 305 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 8 (1970); Hawkeswood, Austral. Pl. 11:6 (1980); Blackall

& Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:149 (1980). *Type:* Swan River, *J. Drummond* 3rd Coll. no. 53 (lecto, here designated: ? K, n.v.; isolecto: MEL n.v., NSW).

Erect, much branched, often straggly, pubescent shrub to 1 m high, with thick, corky branches; leaf scars prominent on older branches. Young shoots densely pilose. *Leaves* scattered or crowded at the ends of branches, sessile, thick, flat, attenuate at base, (8) 10-12 (15) cm long, (2.5) 3-5 (6) mm wide, acuminate to acute, dark green, pilose (especially on the margins), often glabrous with age, oil glands prominent. *Flowers* 5-20 in loose or densely crowded clusters amongst leaves, partially embedded in the corky rhachis. *Calyx-tube* broadly campanulate, 3-5 mm long, shortly pubescent; *calyx-lobes* ± equal or opposite pair slightly larger than the other two, deltoid or narrow-deltoid, obtuse to slightly acute, (2) 2.5-3 mm long, 2-3 mm wide, slightly concave, erect or slightly spreading, finely pubescent outside and inside. *Petals* broadly elliptical to oblong-elliptical, concave, obtuse, 5-7 mm long, glabrous, papery, thin, orange-brown to pale brown, margins scarious, partially ciliate. *Staminal claws* not equal; upper two claws broad, flat, (20) 22-25 (30) mm long, 5-7 mm wide, glabrous, dirty green-yellow in life (dark red to black in dried specimens); marginal filaments 25-30; lower two claws short, 12-18 mm long, c. 2 mm wide at the base, narrowing at the apex, dirty green-yellow, each with one anther; *anthers* linear, 1.5-2 mm long, dark brown. *Style* 20-25 mm long, slender, glabrous, yellow-green; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, truncate, conical to almost ovoid, 6-8 mm diameter at base, 4-5 mm wide at apex and 5-7 mm long (including the short, thickened calyx-lobes); two opposite lobes thickened (slightly reflexed), other two lobes initially present but wearing away with age; fruit embedded in the corky, pubescent rhachis; orifice 3-4 mm diameter. *Fertile seeds* few per capsule, oblong, truncate at widest end, attenuate at other, 1.2-1.5 mm long, 0.6-0.8 mm wide, slightly flattened, testa grey-brown, smooth, glabrous. *Ovulodes* few per capsule, linear, 1-1.5 mm long, c. 0.2 mm wide, glabrous, yellow-brown.

Derivation of name. From the Greek *pachys*, meaning "thick", and *stachyus*, meaning "flower-spike", referring to the spike of flowers situated in the swollen, corky stems.

Habitat. Grows in sand over laterite or in lateritic gravel in sandplain heath communities. Flowers mostly from September to October.

Distribution. Presently only known from the Mogumber-Bindoon area (c. 31°00' S, 116°00' E) where it is only locally common. Map 1. This species has probably suffered extinction in some areas through clearing of land for agriculture and is thus in need of protection. Recommendations for its conservation have been provided by Leigh, Boden & Briggs (1984).

Specimens examined. WESTERN AUSTRALIA: W. Australia. *J. Drummond*, 1844, 2nd Coll., no. 71, NSW 144109 (NSW); Murchison (?), Oct. 1902, *C. Andrews* s.n. (PERTH); 76 m.p. Great Northern Highway, 23 Aug. 1976, *H. Demarz* D6140 (PERTH, KP); Yenert, 1842, *J. Gilbert* 46 (PERTH); Moore River, Aug. 1901, *F.L.E. Diels & E. Pritzel* s.n. (PERTH); Moore River, Oct. 1934, *C.A. Gardner* 12708 (2) (PERTH); Mogumber, 30 Sept. 1932, *W.E. Blackall* 2944 (2) (PERTH); Mogumber, Moore River, 16 Oct. 1903, *A. Morrison* s.n. (PERTH); Mogumber, 1903, *W.V. Fitzgerald* NSW 144110 (NSW); Mogumber, 26 Oct. 1955, *R.D. Royce* 5201 (PERTH); Mogumber, 19 Dec. 1922, *C.A. Gardner* 1393 (PERTH); 5-6 miles S of New Norcia, 1 Oct. 1947, *C.A. Gardner* 8676 (2) (PERTH); W of Bindoon, 9 July 1952, *R.D. Royce* 3828 (PERTH); 8 miles N of Mogumber on road to Moora, 10 May 1964, *A.R. Fairall* 1495 (KP); Mogumber and north to Moora, 25 Sept. 1954, *B.J. Grieve* s.n. (UWA); Wannamal-Mogumber road, 12 Sept. 1955, *B.J. Grieve* s.n. (UWA).

Total number of specimens examined. 20.

Comments. This species is closely related to *C. longissimus* F. Muell. but can be readily distinguished by its flat leaves mostly 10-12 cm long, 3-4 mm wide with pilose margins and staminal claws which are yellow-green in colour. *Calothamnus longissimus* has terete, glabrous leaves mostly 15-25 cm long, 1-1.5 mm wide, and staminal claws red in colour.*Calothamnus longissimus* exhibits little intra-specific variation throughout its range.

The ranges of these two species do not appear to overlap. *Calothamnus pachystachyus* has a more southerly distribution while *C. longissimus* occurs from Arrino, Three Springs and Eneabba to Dandaragan and Badgingarra. The locality of one record from the Murchison River (?) (*C.R. Andrews* s.n., PERTH) is thought to be incorrect as it is outside the present known distribution area.

Bentham (1867) noted that the upper staminal claws of *C. pachystachyus* material that he examined had 15-20 marginal filaments while the lower ones were undivided and without anthers. This discrepancy has undoubtedly arisen due to damaged material.

Figure 1. Holotype of *Calothamnus longissimus* F. Muell. (MEL 105190).

2. **Calothamnus longissimus** F. Muell., Fragm. 3: 112 (1862); Benth., Fl. Austral. 3:174 (1867); Blackall, How to Know Western Austral. Wildfl. 305 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 8 (1970); Hawkeswood, Austral. Pl. 11: 6,8,9 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:149 (1980). *Type:* "In planitiebus arenosis prope Cujong Australiae occidentalis. Oldfield" (holo: MEL, Figure 1).

Erect, much-branched, often straggly, low, bushy shrub to 1 m high, with thick, corky branches; leaf scars prominent on older branches. Young shoots shortly but densely pubescent; leaves and stems becoming ± glabrous with age. *Leaves* crowded, often arranged in whorls, sessile, slender-terete, somewhat scabrous, (13-)16-25 (-30) cm long, (1-) 1.2-1.5 (-2) mm wide, acuminate, not pungent, usually glabrous but sometimes retaining hairs at base, usually with a layer of corky tissue extending from base to about 1 cm along the leaf; oil glands prominent. Flowers 5-15 (-25) in short, dense, unilateral or cylindrical spikes amongst leaves. *Calyx-tube* almost campanulate, somewhat narrowed at base, 4-5 mm long, densely covered in short silver-white hairs (sometimes ± glabrous at the base), embedded in the swollen (sometimes softly pubescent) corky stems. *Calyx-lobes* unequal, an opposite pair slightly broader than the other two, erect, broadly deltoid, obtuse, concave, (3-) 4-5 mm long, 2.5-4 mm wide, thick, densely but shortly pubescent outside, inside, and on the margins. *Petals* broadly obovate-oblong to broadly elliptical, concave, obtuse, 7-10 mm long. glabrous (margins often with a few scattered cilia), narrowed at base, pale brown, with thin, wide, scarious margins; central vein often prominent. *Staminal claws* unequal, upper two claws broad, equal in size (25-) 30-32 (-35) mm long, 3-4 mm wide, glabrous, deep red; marginal *filaments* 30-36; two lower staminal claws sterile, short, glabrous, 14-16 mm long, 2-2.5 mm wide at the base, gradually tapering to a point; *anthers* linear-oblong, c. 1.5 mm long. *Style* (25-) 30-35 mm long, slender, glabrous, deep red, tapering upwards; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, truncate-conical, 8-9 mm diameter at base and 4-5 mm wide at apex, 6-7 mm long; immature fruit usually at least half embedded in the corky stems and retaining calyx-lobes, mature fruit on old stems often embedded and without corky covering, ± smooth and truncate; orifice c. 3 mm wide. *Fertile seeds* few per capsule, oblong, truncate at widest end, attenuate at other, 1.2-1.5 mm long, 0.6-0.8 mm wide, slightly flattened, testa grey-brown, smooth, glabrous. *Ovulodes* few per capsule, linear, 1-1.5 mm long, c. 0.2 mm wide, glabrous, yellow-brown.

Derivation of name. From the Latin *longissimus*, meaning "very long", referring to leaves of this species.

Habitat. Grows in lateritic gravelly soils in low shrubby heath associations. Flowers August to September.

Distribution. Confined to areas from Arrino, Three Springs, Eneabba to Dandaragan and Badgingarra. Map 1. This species is now probably very localized due to clearing of land for agriculture. Recommendations for its conservation have been provided by Leigh, Boden & Briggs (1984).

Selected specimens examined. WESTERN AUSTRALIA: Swan River, 1844, *J. Drummond* 2nd Coll. no. 74, NSW 144108 (NSW); Arrino, Sept. 1903, *W.V. Fitzgerald* NSW 144105, 144107 (NSW); 5 miles W of Arrino, 30 Aug. 1965, *K.R. Newbey* 2244 (PERTH); N of Eneabba, on road to Dongara, 7 Sept. 1969, *A.M. Ashby* 3030 (PERTH); 30 miles W of Three Springs, Sept. 1940, *W.E. Blackall* 4877 (2) (PERTH); 35 km NE of Eneabba on Three Springs Road, (29°39' S, 115°34' E), 27 April 1977, *R.J. Hnatiuk* 770012 (PERTH); Eneabba Creek, 27 Aug. 1948, *C.A. Gardner* 9126 (5) (PERTH); Eneabba Creek, Sept. *C.A. Gardner* 9301 (PERTH); Coorow, 29 Aug. 1941, *C.A. Gardner* s.n. (PERTH); less than 19 km E of Eneabba on Three Springs Road, (c. 29°48' S, 115°09' E), 12 Sept. 1978, *R.J. Hnatiuk* 780136

(PERTH); small valley E of "Western Titanium" leases, 8 km S of Eneabba, (29°53' S 115°19' E), 13 Sept. 1977, *R.J. Hnatiuk* 770917 (PERTH); Hill River, 22 Sept. 1951, *N.H. Speck* s.n. (3) (UWA); Badgingarra, Sept. 1965, *F.G. Smith* 1837 (PERTH); 5 miles E of Moora, 11 Sept. 1932, *W.E. Blackall* 2533 (2) (PERTH); Dandaragan, Sept. 1953, *H. Smith* s.n. (PERTH); 5 miles W of Moora, 23 Sept. 1962, *J.S. Beard* 1841 (PERTH, KP); 63 mile tank, 22 Sept. 1953, *N.H. Speck* s.n. (UWA).

Total number of specimens examined. 28.

Comments. This species is closely related to *C. pachystachyus* Benth., but can be readily distinguished on leaf characters and the colour of the staminal claws (see comments under *C. pachystachyus*).

The species exhibits little variation throughout its range.

Figure 2. Illustration of *Calothamnus sanguineus* Labill. from *J.C. Labillardiere* (1806 tab. 164).

3. **Calothamnus sanguineus** Labill., Pl. Nov. Holl, 2:25, t. 164 (1806); DC., Prodr. 3: 211 (1828); Schauer, Regelia, Beaufortia & Caloth. 24 (1843); Schauer in Lehm., Pl. Preiss. 1:151 (1844); Benth., Fl. Austral. 3: 174 (1867); Blackall, How to Know Western Austral. Wildfl. 305 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 84 (1970); Hawkeswood, Austral. Pl. 11: 6,10 (1980); Blackall and Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:149 (1980). *Type*: "Habitat in terra van-Leuwin" (Geographe Bay) (lecto, here designated: FI, photograph seen, Figure 2).

Calothamnus eriocarpa Lindley, Sketch Veg. Swan Riv. Col. 9 (1839). *Type:* no citation (holo: CGE, photograph seen).

Calothamnus blepharantherus F. Muell. Fragm. 3:112 (1862); Benth., Fl. Austral. 3:174 (1867): F. Muell., Fragm. 10:55 (1876). *Type*: "In plagis aridis ad flumen Murchison, Oldfield" (holo: MEL, Figure 3).

Erect, much-branched, usually single-stemmed, compact shrub 30-80 cm high; branches smooth, or often with prominent leaf scars with age. *Leaves* crowded on older branches, erect to perpendicular, sessile, terete or slightly flattened, (1-) 1.5-2 (-2.5) cm long, 0.8-1 mm wide, densely pilose when young, ± glabrous with age, often S-shaped, acute but not pungent; oil glands usually prominent. *Flowers* 3-25 in small clusters or in short, ± unilateral or cylindrical spikes amongst leaves at the end of older branches. *Calyx-tube* campanulate to broadly campanulate, 2.5-4 mm long, densely pubescent, rhachis slightly to prominently dilate at its base; *calyx-lobes* ± equal, or two opposite ones slightly wider than the other two, deltoid, obtuse to slightly acute, concave, 2-2.5 (-3) mm long, densely pubescent outside, shortly and finely pubescent inside; margins thin, scarious and fimbriate. *Petals* oblong, oblong-elliptical to broadly obovate, 5-7 mm long, concave, obtuse, glabrous, papery, dark orange-brown, oil glands prominent in centre; margins thin, scarious, orange, often partially ciliate. *Staminal claws* unequal, glabrous, blood red, often yellow at base; the upper two claws fused together to form a very broad single claw (20-) 22-25 (-30) mm long, (4-) 5-7 (-8) mm wide, with 26-36 marginal filaments; the two lower claws undivided, linear (4-) 8-9 (-10) mm long, each with usually one sterile anther (some populations possess 2, 3 or 4 sterile anthers per lower claw); *anthers* linear, sparsely ciliate; 1.2-1.5 mm long, dark brown to black. *Style* thick at base otherwise slender, (8-) 15-25 (-30) mm long, blood red, glabrous; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ovoid to almost globular, 8-12 mm long (including calyx-lobes), (6.5-) 7-8 (-9) mm wide, initially pubescent, becoming glabrous with age, then smooth or wrinkled; calyx-lobes dry, persistent, an opposite pair becoming thickened, remaining two not thickened, wearing away with age; orifice almost covered by thick lobes, 2-3 mm in diameter. *Fertile seeds* few per capsule, linear-oblong, 1.5-2 mm long, 0.6-0.8 mm wide, glabrous, somewhat shiny, smooth, outer ones curved, testa chocolate brown. *Ovulodes* numerous, linear-clavate, 1.5-2 mm long, 0.2-0.4 mm wide, glabrous, angular, usually obliquely truncate at wider end, pale brown.

Figure 3. Holotype of *Calothamnus blepharantherus* F. Muell. (MEL 98614).

Derivation of name. From the Latin *sanguineus*, meaning "blood- coloured", referring to the usual colour of the staminal claws. Naturally occurring yellow-flowering variants may also occur (Figure 4).

Habitat. Commonly grows on sandplains north of Perth in heath and mallee-heath communities in association with dominant species of *Acacia*, *Hakea*, *Grevillea*, *Banksia* and *Eucalyptus*. In many localities, *C. sanguineus* occurs sympatrically with *C. quadrifidus* R. Br., *C. torulosus* Schauer, *C. blepharospermus* F. Muell, and *C. glaber* (Benth.) T.J. Hawkeswood. *Calothamnus sanguineus* is uncommon in coastal jarrah (*Eucalyptus marginata*) forests in shallow sand over laterite or granite from Perth to the Whicher Range (33°47' S, 115°31' E). Flowers mostly June to October but in some areas flowering occurs for most of the year.

Distribution. From Kalbarri National Park in the north (c. 27°45' S, 114°20' E) to Perth in the south. The species has a disjunct distribution south of Perth, occurring at Cape Naturaliste (33°35' S, 115°02' E), Dwellingup (32°42' S, 116°02' E), Narrogin (32°56' S, 117°10' E), Stirling Range (c. 34°20' S, 118°10' E) and the Perup River (34°17' S, 116°42' E). Map 2.

Selected specimens examined. WESTERN AUSTRALIA: Murchison River, 6 Sept. 1949, *N.H. Speck* s.n. (UWA); Murchison River, 20 Sept. 1948, *C. Morrison & D.L. Serventy* s.n. (PERTH); Kalbarri sandplain reserve, 17 July 1966, *A.M. Ashby* 1833 (PERTH, NSW); 5 km E of Kalbarri, 12 May 1968, *P.G. Wilson* 6723 (PERTH); near mouth of Murchison R., 10 July 1963, *F.G. Smith* 1689 (PERTH); Loop Road, Kalbarri Nat. Park, 7 Aug. 1976, *R.J. Hnatiuk* 760508 (PERTH); between Geraldton and Mullewa, 23 Sept. 1932, *W.E. Blackall* 2752 (PERTH); 4 miles W of Ellendale, 5 July 1971, *R.A. Saffrey* 1551 (PERTH); 37 miles W of Coorow, Sept. 1967, *C.H. Gittins* 1693 (PERTH); Mingenew, June 1901, *Diels* and *Pritzel* s.n. (PERTH); S of Dongara on Eneabba road, 7 Sept. 1969, *A.M. Ashby* 3016 PERTH); Irwin River, 28 May 1950, *W.A. McArthur* s.n. (UWA); N of Arrowsmith River, (29°34' S, 115°13' E), 4 Aug. 1976, *R.J. Hnatiuk* 760278 (PERTH); S of Arrowsmith R., 10 Sept. 1967, *A.C. Burns* 57 (PERTH); E of Greenhead, 24 Sept. 1962, *J.S. Beard* 1907 (PERTH, KP); Mt Lesueur, 16 Sept. 1976, *J.S. Beard* 7823 (PERTH); Hill River, June 1943, *C.A. Gardner* s.n. (PERTH); 35 miles W of Watheroo on Badgingarra road, 18 July 1965, *J.C. Anway* s.n. (UWA); 5 km SW of Badgingarra, 9 Sept. 1979, *G.J. Keighery* 2576 (PERTH); 65 miles NNW of Gingin, 2 Sept. 1970, *T.E.H. Aplin* and *R.G. Coveny* 3138 (PERTH, NSW); Cataby, near Dandaragan West, 2 Sept. 1973, *E.C. Nelson* ANU 17273 (PERTH); 14.4 km S of Dandaragan West, (30°45' S, 115°40' E), 17 March 1979, *T.J. Hawkeswood* A2 (NE); 35 km N of Gingin, (31°05' S, 115°46' E), 17 March 1979, *T.J. Hawkeswood* A1, A2, A4 (NE); Wongan Hills, 9 Aug. 1949, *E. Salisbury* s.n. (PERTH); 2 miles W of Wongan Hills, 5 June 1969, *M.I.H. Brooker* 1830 (PERTH); Mimegarra-Mt Misery, 22 Sept. 1951, *N.H. Speck* s.n. (UWA); Waddington, 24 July 1952, *G.M. Storr* s.n. (PERTH); near New Norcia, 4 Sept. 1962, *F.W. Went* 89 (PERTH); 122 miles N of Perth on Wongan Hills to Northam Rd., S of Ballidu, 4 Aug. 1977, *G.J. Keighery* 2238 (KP); Bindoon area, 25 April 1963, *A.H. Larner* (2) (PERTH); Mogumber, Aug. 1929, *W.E. Blackall* s.n. (PERTH); 14 miles from Gingin, 29 Sept. 1968, *M.E. Phillips* CBG028454 (NSW); 65 km SW of Three Springs, 19 April 1979, *T.J. Hawkeswood* s.n. (PERTH); 50 km SW of Three Springs, (29°35' S, 115°35' E), 19 April 1979, *T.J. Hawkeswood* 90, 91, 92, 93, 94 (PERTH); 8 miles W of Calingiri, 24 April 1959, *T.E.H Aplin* 456 (PERTH); 15 km E of Gingin, 14 Dec. 1978, *A. Coates* S4470 (KP); 60 m.p. Perth-Moora, 4 May 1964, *A.R. Fairall* 1433 (KP); Yanchep, 11 Aug. 1971, *M. Miller* s.n. (UWA); Yanchep, 17 Oct. 1963, *A.M. James* 65 (PERTH); Wanneroo, 25 July 1963, *F.G. Smith* 1721 (PERTH); Wanneroo to Yanchep, 24 Sept. 1970. *H. Salasoo* 4213 (NSW); S of Wanneroo, 22 Sept. 1970, *H. Salasso* 4135 (NSW); Toodyay Rd., 31 Aug. 1976, *H. Demarz* 6150 (KP); 2 miles E of Mullaloo, July 1965, *J.R. Knox* 650718 (PERTH); Greenmount, May 1901, *C.R Andrews* s.n. (PERTH); Maddington, 24 July 1952, *G.M. Storr*

s.n. (UWA); Kalamunda-Darlington, 15 May 1930, *R.F. Williams* s.n. (UWA); Darlington, 11 June 1949, *B.A. Roark* (?) (UWA); Helena Valley, 10 July 1977, *J. Seabrook* 46 (PERTH); Kalamunda, western slopes, 6 May 1948, *N.H. Speck* s.n. (UWA); Whicher Range, cr Jacka and Smith Forestry Roads, 23 March 1976, *M.E. Trudgen* 1656 (PERTH); Sabina Road, Whicher Range, 15 May 1980, *T.J. Hawkeswood* 287 (PERTH); Whicher Road, Whicher Range, 16 May 1980, *T.J. Hawkeswood* 288, 297 (PERTH); Cape Naturaliste, 1 Sept. 1952, *N.H. Brittan* s.n. (UWA); Meelup Brook, Cape Naturaliste, 25 Dec. 1927, *H.C. Guvney* s.n. (UWA); Meelup Beach, Cape Naturaliste, 16 May 1980, *T.J. Hawkeswood* 289 (2) (PERTH); Eagle Bay, Cape Naturaliste, 23 June 1979, *M. Peterson* 1 (PERTH); Clackline, May 1950, *J. Kennedy* s.n. (PERTH); Yallingup, 30 May(?), no collector or year given (UWA); SW of Cunderdin, 27 Sept. 1970, *H. Salasso* 4365 (NSW); Tuttaning Reserve, 17 miles SE of Pingelly, 24 May 1966, *A.S. George* 7747 (PERTH); Narrogin, 18 Aug. 1916, *F. Stoward* s.n. (PERTH); 15 miles S of Borden, 11 Aug. 1962, *K.R. Newbey* 307 (PERTH); East Stirling Range at Moir Hill, 15 Oct. 1972, *E.C. Nelson* ANU 16778 (PERTH); Red Gum Hill, Stirlings, 10 May 1979, *G.J. Keighery* 2280 (PERTH, KP); South Stirling Range, May 1950, *A. Holland* s.n. (UWA); Perup River, 30 April 1974, *P. Christensen* 814 (PERTH).

Figure 4. Naturally occurring yellow-flowered variant of *Calothamnus sanguineus* Labill. (Mt Lesueur, W.A.; photo: M. Peterson).

Total number of specimens examined. 254.

Comments. This is one of the most common and widely distributed of the *Calothamnus* species. It is most closely related to C. *torulosus* Schauer with which it occurs sympatrically in the Eneabba-Badgingarra sandplain habitats north of Perth. *Calothamnus sanguineus* can be easily distinguished from *C. torulosus* in having the upper two staminal claws fused together whereas in the latter species they are free, as is the case with all other *Calothamnus* species. One characteristic feature of *C. sanguineus*, not present in other species, is the sparsely ciliate anthers, although *C. torulosus* possesses anthers with unusual, long, cobweb-like hairs.

Bentham (1867) noted that the two fused upper staminal claws of *C. sanguineus* readily separated. In the field these claws do not separate but in some herbarium specimens some degree of splitting has occurred no doubt as a result of drying. Bentham also noted that the lower staminal claws did not possess anthers. This is erroneous since flowers of all specimens I have examined in the field (localities: Murchison River, Dandaragan, Gingin, Yanchep, Kalamunda, Dwellingup, Cape Naturaliste, and the Whicher Range), possessed lower staminal claws with one anther. Populations at Kalamunda were found to possess 2-4 anthers per lower staminal claw. The anthers of the short, tapering lower staminal claws are weakly attached, and it is likely that the specimens Bentham examined had lost these anthers as a result of handling. Another distinctive feature of *C. sanguineus* is its habit of dropping the fruiting capsules when the seeds are mature.

Specimens of *C. sanguineus* from Perth to Cape Naturaliste are generally more bushy and spreading, possess more densely crowded, thinner, usually cylindrical leaves and possess fewer flowers and smaller fruits than plants growing in sandplains from Perth to Kalbarri, the wheatbelt localities (e.g. Narrogin, Borden) and the Stirling Range. However, the variability is not sufficient to warrant a separate subspecies being created for these populations. Differences in soil type (i.e. lateritic soils in the Darling Range and granitic soils at Cape Naturaliste) from that from Kalbarri to Perth (i.e. sandy, quartzite soil) may be one factor contributing to this variation. However, the soil at the Stirling Range where *C. sanguineus* occurs is also a sandy quartzite soil, yet the populations there resemble those at Cape Naturaliste.

Calothamnus sanguineus is one of only a few species of the genus that are widespread and exhibit variation throughout their range. Its apparent disjunct distribution in south-west Western Australia is of much interest, since it is unlikely that limited collecting and/or land clearing in this vast area would account for the paucity of records.

Although specimens of *C. sanguineus* may be seen in flower in many areas throughout the year, its main flowering period is during the spring months, August to October. The occasional yellow-flowering plant has been observed in the Mt Lesueur area, north of Perth (Hawkeswood 1980). Figure 4.

4. **Calothamnus torulosus** Schauer, Regelia, Beaufortia & Caloth. 25 (1843); Schauer in Lehm., Pl. Preiss. 1:152 (1844); Benth., Fl. Austral. 3:175 (1867); Blackall, How to Know Western Austral. Wildfl. 305 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 8 (1970); Hawkeswood, Austral. Pl. 11:10, 11 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:150 (1980). *Type*: "In calculosis ad radices iugi montium Darling-Range dicti, haud procul a villa Maddington, Novembri a, 1839; L. Preiss! J. Drummond!" (lecto, here designated: Preiss 212, LD, Figure 5).

Low, erect or prostrate, somewhat rigid or sprawling, many-stemmed, sometimes glaucous shrub to about 40 cm high, with stems often possessing irregularly distributed bulges (thickenings). Young shoots with scattered, erect to spreading hairs; stems and leaves becoming glabrous with age. *Leaves* sessile, crowded, erect to semi-erect, slender terete, (1.5-) 2-4 (-5) cm long, 0.5-1 (-1.4) mm wide, shortly mucronate, slightly pungent, usually somewhat scabrous, pale olive green or sometimes glaucous, glabrous, or with scattered, erect or semi-erect simple hairs (especially at the base). *Flowers* 2-5 together in short clusters almost hidden by the crowded, erect leaves, strongly and characteristically scented. *Calyx-tube* short, broadly campanulate, 2-3 mm long, covered in short, appressed, whitish hairs, rhachis prominently dilated at its base; *calyx-lobes* unequal, two opposite lobes (or only one lobe) thick, broadly ovate, acute or slightly obtuse, concave, 3-4 mm long, the remaining lobes shorter, thin, ovate-oblong, concave, acute or slightly obtuse, 2.5-3 mm long, glabrous outside (or sparsely covered in short, white hairs), sparsely pubescent inside, thin and fimbriate on margins. *Petals* obovate-oblong to obovate-elliptical, obtuse, concave, 7-8 mm long, glabrous, papery, thin, with thin scarious margins, orange-brown. *Staminal claws* unequal: upper two claws broad, 22-35 mm long, 4-6 (-7) mm wide, scarlet, becoming orange towards base with 30-40 marginal filaments; lower two claws narrow, 20-25 mm long, 1.5-2 mm wide, scarlet, becoming orange and green towards base with 25-35 marginal filaments; upper staminal claws with *fertile anthers* (linear, c. 2 mm long) at apex of claw, and *sterile anthers* (short, oblong, 0.3-0.5 mm long) lower down; anthers and filaments covered in loose, coiled, cobweb-like hairs. *Style* filiform, glabrous, 25-30 mm long, curved near apex, scarlet; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, few per plant, nearly globular, 5-9 mm long, 6-8 mm wide, densely pubescent, usually hidden by the leaves; two calyx lobes thickened and enclosing the orifice; style sometimes persistent in young fruit. *Fertile* seeds few to many per capsule, oblong or oblong-cuneate, 1.5-1.8 (-2) mm long, truncate at wider end, glabrous, light chocolate-brown. *Ovulodes* numerous, linear, 1.5-2 mm long, truncate at one end, glabrous, cream to yellow-brown.

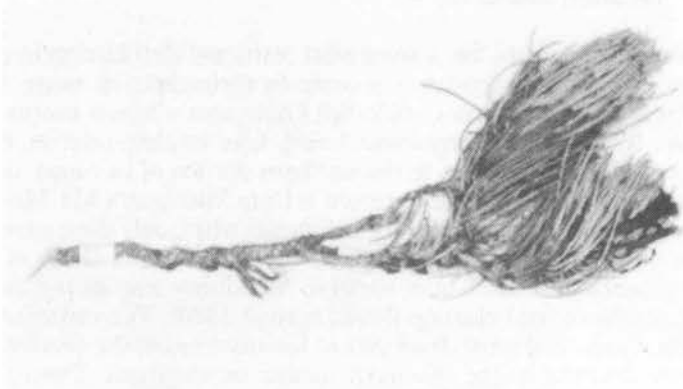

Figure 5. Lectotype of *Calothamnus torulosus* Schauer (LD).

Derivation of name. From the Latin *torulus*, meaning "a little bulge or protuberance", and *-osus*, meaning "abounding in". This name, which probably refers to the occasional irregular thickenings on the branches, is somewhat of a misnomer.

Habitat. Grows in deep grey or light-coloured sands in low coastal heath (from the Arrowsmith River to Mt Misery) with species of *Eremaea*, *Hakea*, *Verticordia*, *Isopogon* and *Xanthorrhoea*, or in rocky, granitic soils amongst open woodland vegetation (in the Darling Range east of Perth). Flowers September to October.

Distribution. This species appears to have a disjunct distribution. The northern populations occur from near the Arrowsmith River (c. 29°35' S, 115°10' E) to Eneabba, Cockleshell Gully, Mt Lesueur, Hill River, Badgingarra and to Mt Misery (30°56' S, 115°22' E). Only three records

are known from near Perth i.e. Swanview (*Royce* 6395), Crystal Brook Hill (*George* 11041), and Lesmurdie (*Muldownie* s.n.). Map 3.

Selected specimens examined. WESTERN AUSTRALIA: 8 miles S of Arrowsmith River, 18 Oct. 1971, *H. Demarz* 3470 (PERTH, KP); c. 12 km N of Eneabba, 4 Aug. 1976, *R.J. Hnatiuk* 760249 (PERTH); Eneabba, (29°50' S, 115°18' E), 19 April 1979, *T.J. Hawkeswood* s.n. (PERTH, UWA, NE); Eneabba turnoff, (29°50' S, 115°17' E), 19 April 1979, *T.J. Hawkeswood* 7,8,9 (PERTH); On Eneabba-Cockleshell Gully road, Sept. 1969, *C. Brindley* s.n. (PERTH); Mt Lesueur, 4 Nov. 1962, *R.D. Royce* 7737 (PERTH); slopes of Mt Lesueur, *N.H. Speck* s.n. (UWA); top of Mt Lesueur, *N.H. Speck* s.n. (UWA); 23 miles from Jurien Bay towards Eneabba, 24 Sept. 1968, *M.E. Phillips* CBG 027196 (NSW); Cockleshell Gully, Sept. 1931, *W.E. Blackall* 3556 (PERTH); Cockleshell Gully, Aug. 1967, *S.H. James* (UWA); Hill River, 30 Sept. 1969, *C.A. Gardner* 12793 (2) (PERTH); 7 miles NW of Badgingarra, 3 Oct. 1960, *B.G. Briggs* NSW 144103 (NSW); 7 miles from Jurien Bay turnoff on road to Watheroo, 16 Oct. 1966, *F. Lullfitz* 5628 (PERTH); 4 miles NW of Dinner Hill, 31 Aug. 1975, *K.R. Newbey* 2301 (PERTH); Badgingarra, 18 Sept. 1959, *C.A. Gardner* 12316 (PERTH); Badgingarra, Aug. 1968, *C.A. Gardner* s.n. (PERTH); Badgingarra, 10 Sept. 1960, *L. Steenholm* s.n. (PERTH); Badgingarra, 23 Sept. 1962, *J.S. Beard* 1869 (PERTH); Badgingarra, Sept. 1965, *C.A. Gardner* s.n. (2) (PERTH); Badgingarra, 18 Sept. 1977, *A.C. Burns* 112 (PERTH); 67 miles NNW of Gingin, 2 Sept. 1970, *T.E.H. Aplin* and *R.G. Coveny* 3142 (NSW); between Dandaragan and Jurien Bay, 27 Sept. 1932, *W.E. Blackall* 2901, 2923 (PERTH); Mingenew-Mt Misery, (undated), *N.H. Speck* s.n. (PERTH); Swanview, 1 Oct. 1960, *R.D. Royce* 6395 (PERTH); Crystal Brook Hill, Darling Scarp, (32°01' S, 116°01' E), 15 Sept. 1971, *A.S. George* 11041 (PERTH); Melaleuca Road, Lesmurdie, 29 Sept. 1969, *C. Muldownie* (UWA); Swan River, *J. Drummond* no. 128 (NSW).

Total number of specimens examined. 40.

Comments. Although the species has a somewhat restricted distribution in comparison to a number of other *Calothamnus* species, it is common throughout its range. It is especially common in the Eneabba-Badgingarra-Cockleshell Gully area where it occurs sympatrically with *C. quadrifidus* R. Br. and *C. sanguineus* Labill. Like its close relative, *C. sanguineus*, *C. torulosus* has a disjunct distribution in the southern portion of its range. In the northern part of its distribution, the most southerly record is from Mimegarra-Mt. Misery. There are no collections between here and Perth (c. 100 km distance) where only three records are known. There are no morphological differences between these plants and those of the northern populations. The absence of records from Perth to Mt Misery may be indicative of lack of collections or the results of land clearing (Hawkeswood 1980). The collections from Perth are from suburbs in which residential development has occurred so the survival of the species in this area appears doubtful in the advent of further development. The size and ecology of the three known populations of *C. torulosus* in the Perth area has not been documented and, clearly, field studies should be initiated in order to secure areas for its conservation.

Bentham (1867) stated that *C. torulosus* may be a variety of *C. sanguineus*. However, although they are similar and closely related, they differ in many characters, not least by the fused upper staminal claws in *C. sanguineus* which is lacking in *C. torulosus*. Bentham's (1867) description of *C. torulosus* is inaccurate due to the inclusion of specimens of *C. graniticus* T.J. Hawkeswood.

5. **Calothamnus lateralis** Lindley, Sketch Veg. Swan Riv. Col. 9 (1839); Benth., Fl. Austral; 3:177 (1867); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 8 (1970);

Hawkeswood, Austral. Pl. 11:11 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:152 (1980). *Type*: Swan River, *Anon.* (holo: CGE, photograph seen).

Calothamnus longifolia Lehm., Del. Sem. Hort. Bot. Hamb. 7 (1842); Schauer, Regelia, Beaufortia, Caloth. 34 (1843); Schauer in Lehm., Pl. Preiss. 1:155 (1844); *Calothamnus lateralis* forma *longifolius* (Lehm.) Benth., Fl. Austral. 3:177 (1867). *Type*: "In locis turfosis hieme inundatis prope oppidulum Perth in Australia meridionali legit Cl. L. Preiss" (Herb. Preiss. No. 200) (lecto, here designated: LD, Figure 6).

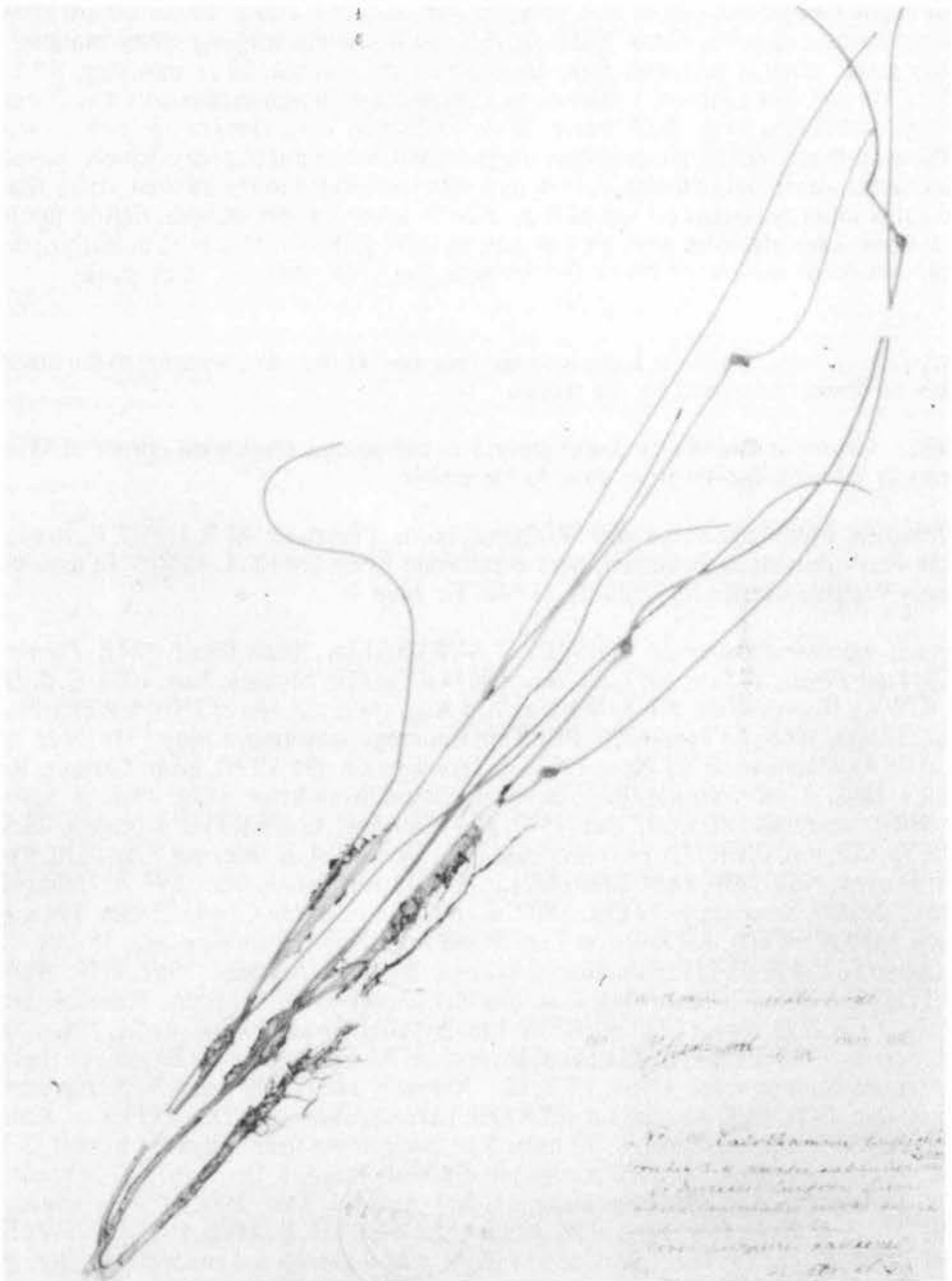

Figure 6. Lectotype of *Calothamnus longifolia* Lehm. (LD).

Erect, slender, straggly, single-stemmed, few-branched, glabrous, shrub to 2.5 m high. Young stems and leaves glabrous. *Leaves* scattered, often 4 or 5 leaves together arising from about the same position on the stem, sessile, slender terete, semi-erect to erect, rigid, (10-) 25-30 (-35) cm long, 1.5-2 mm wide, obtuse or shortly mucronate, slightly pungent to pungent, oil glands not prominent. *Flowers* numerous, arranged in unilateral spikes, (4-) 7-10 (-13) cm long, usually on leafless portions of stems. *Calyx-tube* short, broadly campanulate, 1.5-2 mm long, glabrous, green, embedded in the swollen, corky rhachis; *calyx-lobes* erect, deltoid, acute, slightly concave, 0.7-1 mm long, 0.5-0.8 mm wide, glabrous outside and within; two opposite lobes slightly larger than other two; margins thin, scarious, ciliate. *Petals* narrow obovate, obtuse, concave, 2.5-3mm long, glabrous, thin, with scarious partially ciliate margins; pale yellow-green, often tinged with pink. *Staminal claws* ± equal, 20-25 mm long, 0.7-1 mm wide, glabrous, dark crimson, yellow-green towards base; marginal filaments 4 or 5; *anthers* oblong, f.7-0.8 mm long, dark brown. *Style* 15-28 mm long, slender, tapering to stigma, glabrous, pale red, yellow-green at base; stigma small. Summmit of *ovary* densely pubescent. *Fruit* sessile, depressed globular, 2-3 (-4) mm wide, embedded in the swollen, corky rhachis; two calyx lobes persistent on top of fruit. *Fertile seeds* few per capsule, narrow-pyriform, 0.7-0.8 mm long, glabrous; testa grey-brown, smooth, glabrous. *Ovulodes* numerous, linear, linear-clavate or narrow pyriform, 0.7-0.8 mm long, thin, glabrous, dark cream.

Derivation of name. From the Latin *lateralis*, meaning "at the side", referring to the unilateral spikes of flowers possessed by the species.

Habitat. Grows in swamps or damp ground in the coastal south-west corner of Western Australia. Flowers mostly from June to December.

Distribution. From Lake Pinjar near Wanneroo, north of Perth (31°40' S, 115°47' E), to swamps in the Perth district, to Busselton, near Blackwood River (34°10' S, 115°15' E) then to the Albany-Walpole district (c. 35°00' S, 117°40' E). Map 4.

Selected specimens examined. WESTERN AUSTRALIA: Swan River, 1843, *Turner* s.n. (BRI); Lake Pinjar, 24 June 1977, *J.S. Beard* 8034 (PERTH); Muchea, Nov. 1964, *G.G. Smith* s.n. (UWA); Neaves Road, NE of Wanneroo, 3 Aug. 1966, *J.J. Havel* 310 (PERTH); Neaves Road, 12 Oct. 1966, *J.J. Havel* 327 (PERTH); Cannington Swamp, 6 May 1948, *N.H. Speck* s.n. (UWA); Cannington, 21 Nov. 1903, *A. Morrison* s.n. (PERTH); lower Canning River, 12 Nov. 1898, *A. Morrison* s.n. (BRI); Bayswater, lower Swan River, 5 Dec. 1908, *A. Morrison* s.n. (BRI); sandplain, Perth, 12 Oct. 1977, *R.J. Cranfield* 49 (PERTH); Jandakot, 28 Sept. 1979, *R. Cary* s.n. (PERTH); near Banksiadale, 1 Dec. 1968, *E. Wittwer* 735a (KP); 9 miles W of Harvey, Nov. 1958, *D.M. Churchill* s.n. (UWA); Serpentine, Oct. 1899, *R. Helms* NSW 144012 (NSW); Serpentine, 29 Oct. 1899, *R. Helms* s.n. (BRI); Capel, 27 Oct. 1946, *R.D. Royce* 1320 (PERTH); 4.9 miles on Lake Road from North Dandalup bog, 15 Oct. 1969, *H. Demarz* 1754 (PERTH, KP); along road near Busselton, 13 Sept. 1962, *F.W. Went* 36 (PERTH); Busselton, 27 Sept. 1944, *C.A. Gardner* s.n. (PERTH); Tutunup, Busselton district, 13 Sept. 1956, *R.D. Royce* 5462 (PERTH); Flooded Gum Swamp, Muja, Collie, 1 Nov. 1979, *R.A. Saffrey* 1779 (PERTH); 3 km E of Blackwood River Crossing on Brockman Highway on Augusta-Nannup road, 3 Nov. 1978, *G.J. Keighery* 1879 (KP); near Chorkerup near Mt Barker, Dec. 1939, *W.E. Blackall* s.n. (PERTH); Lake Chorkerup, 20 Dec. 1939, *C.A. Gardner* 4330 (PERTH); Merven Lake, c. 12 miles S of Bridgetown near Wilgarup turnoff, 3 Dec. 1962, *W.A. Loneragan* 244 (UWA); Windy Harbour Road, 8 Jan. 1967, *E. Wittwer* 570 (KP); Torbay junction (between Denmark and Albany), Dec. 1902, *C.R Andrews* s.n. (PERTH); Bow River, Dec. 1912, *S.W. Jackson* s.n. (PERTH, K, MEL, CANB, NSW); Scott River Road, 7 Jan. 1967, *E. Wittwer* 554 (KP); near Ravenswood roadside, 13 Oct. 1965, *A.R. Fairall* 1693 (KP); King George's Sound, 1828-1829, *W. Baxter* s.n. (BRI).

Total number of specimens examined. 42.

Comments. *Calothamnus lateralis* is closely related to *C. huegelii* Schauer, but can be clearly distinguished by growth habit and the length of the leaves, mostly 25-30 cm long (only mostly 4-6 cm long in *C. huegelii*). In the field, the two species can also be distinguished by the lengths of the flowering spikes; mostly 7-10 cm long in *C. lateralis* and mostly 3-4 cm long in *C. huegelii*. *Calothamnus lateralis* exhibits little morphological variation throughout its range.

The habitat favoured by *C. lateralis* is swampy ground. In the Perth district the species appears to have suffered from fires and residential development. Populations should be monitored closely.

6. **Calothamnus huegelii** Schauer, Regelia, Beaufortia & Caloth. 34 (1843); Schauer in Lehm., Pl. Preiss. 1: 154 (1844). *Type*: "In Australia meridionali-occidentali, ad Sinum Regis Georgii III. l. ill. L.B. de Hügel!" (holo: W, photograph seen, Figure 7).

Calothamnus nodosus Turcz., Bull Soc. Imp Naturalistes Moscou 20: 168 (1847). *Type*: "Nova Hollandia, Drummond no. 60" (holo: KW, photograph seen).

Calothamnus lateralis Lindley forma *rigidus* Benth., Fl. Austral. 3:177 (1867). *Type*: *J. Drummond*, 3rd Coll. no. 60 (n.v.)

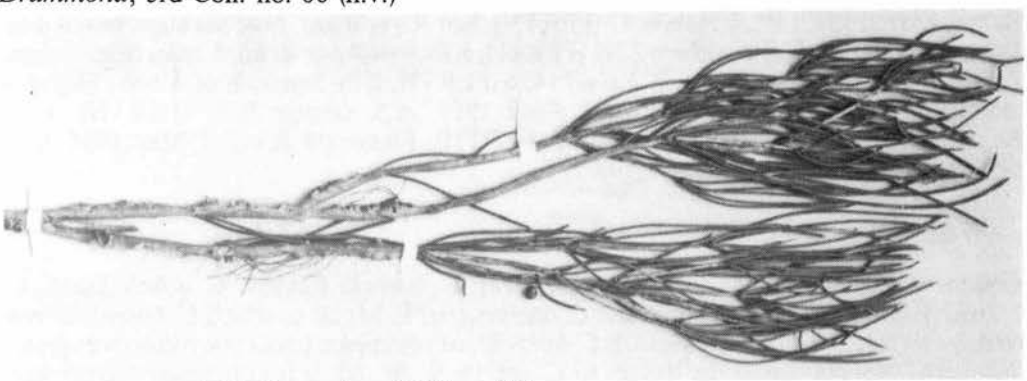

Figure 7. Holotype of *Calothamnus huegelii* Schauer (W).

Erect, slender to slightly spreading, single-stemmed, much-branched, glabrous shrub to about 2 m high. Young stems and leaves glabrous. *Leaves* scattered to crowded, sessile, slender, terete, semi-erect to erect, rigid, (3) 4-6 (9) cm long, c. 1 mm wide, shortly mucronate, glabrous, pungent, oil glands not prominent. *Flowers* numerous, arranged in unilateral spikes, (2) 3-4 (6) cm long, usually on portions of stems without leaves. *Calyx-tube* short, broadly campanulate, 1.5-2 mm long, glabrous, embedded in the swollen, corky rhachis; *calyx-lobes* erect, deltoid, acute, slightly concave, 0.6-1 mm long, 0.5-0.7 mm wide, glabrous outside and within; two opposite lobes slightly larger than the other two; margins thin, scarious, ciliate. *Petals* narrow obovate, obtuse, concave, 2.5-3 mm long, glabrous, thin with partially ciliate margins; pale yellow-green, often tinged with pink. *Staminal claws* ± equal, 20-25 mm long, 0.7-1 mm wide, glabrous, dark crimson, yellow-green towards base; marginal filaments 4-5 (-7); *anthers* oblong, 0.7-0.8 mm long, dark brown. *Style* 15-28 mm long, slender, tapering to stigma, glabrous, pale red, yellow-green at base; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, depressed globular, 2-3 (4) mm wide, embedded in the swollen, corky rhachis; two calyx lobes persistent on top of fruit. *Fertile seeds* few per capsule, narrow-pyriform, 0.7-0.8 mm long, glabrous; testa grey-brown, smooth, glabrous. *Ovulodes* numerous, linear, linear-clavate or narrow pyriform, 0.7-0.8 mm long, thin, glabrous, dark cream.

Derivation of name. Named after Karl Alexander Anselm Freiherr von Hügel (1794/96-1870), German born Austrian soldier and horticulturist, who collected in Australasia during 1830-1837.

Habitat. Grows in sandy or gravelly clay or sand over laterite in heath or tall mallee scrub. Locally common. Flowers mostly from April to May and sometimes to September, depending on local environmental conditions.

Distribution. From Hyden (32°28' S, 118°42' E), Corrigin (32°25' S, 117°48' E) to near Woodanilling (33°35' S, 117°30' E) then to areas north of the Stirling Range such as Ongerup, Jerramungup (33°55' S, 118°58' E) and the Fitzgerald River. Map 4.

The distribution of this species in the wheatbelt has most certainly been reduced through land clearing; the lack of collections in these areas may be largely attributed to this factor.

Specimens examined. WESTERN AUSTRALIA: Hyden, 8 Sept. 1966, *M. Barrow* 80 (PERTH, KP); NW Plantagenet, June 1901, *E. Pritzel* 346 (PERTH, NSW); Avon Locations 19769, SE of Corrigin (32°31' S, 117°56' E), 7 April 1977, *A.S. George* 14433 (PERTH, CANB); sandplain S of Pootenup (between Tambellup and Cranbrook), 11 Sept. 1947, *N.T. Burbidge* 2460 (BRI); Cranbrook, May 1901, *F.L.E. Diels & E. Pritzel* s.n. (PERTH); 10 miles E of Ongerup, 22 April 1962, *A.S. George* 3684 (PERTH); 14 miles E of Ongerup, 29 April 1962, *K.R. Newbey* s.n. (PERTH); Jerramungup, 26 Aug. 1964, *F. Lullfitz* L3644 (KP); N of Stirling Range, March 1952, *W.A. Atkins* 97 (PERTH); Salt River Road, N of Stirlings, near Camel Lake, 7 May 1979, *G.J. Keighery* 2296 (PERTH, KP); Salt River Road, 5 miles from Chester Pass, Stirlings, 3 April 1964, *A.R. Fairall* 1430 (PERTH, KP); 3 miles E of Albany Highway along road W from Woodanilling 27 April 1969, *A.S. George* 9307 (PERTH); W of Ravensthorpe, May 1964, *A. Kessell* 86 (PERTH); Fitzgerald River, 5 May 1964, *C.A. Gardner* 14716 (PERTH).

Total number of specimens examined. 19.

Comments. This species has been confused with *C. lateralis* Lindley, *C. affinis* Turcz., *C. crassus* (Benth.) T.J. Hawkeswood and *C. microcarpus* F. Muell. to which *C. huegelii* is most closely related. For comparisons with *C. huegelii* see comments under the respective species. Schauer (1843) compared the species to *C. gracilis* R. Br. but it is not closely related since *C. gracilis* is a 5-merous species.

There is need to examine the biology and conservation of this species since there are few collections and it appears likely that there has been significant range reduction due to clearing in the wheatbelt.

7. **Calothamnus crassus** (Benth.) T.J. Hawkeswood, stat nov.

Calothamnus lateralis Lindley forma *crassus* Benth., Fl. Austral. 3:177 (1867); Blackall and Grieve, How to Know Western Austral. Wildfl. ed.2,3A:152 (1980). *Type*: Swan River, *J. Drummond*. 2nd Coll. no. 73. (lecto, here designated: K, n.v.; isolecto: NSW, Figure 8).

Erect, much-branched, usually compact but sometimes straggly, shrub to 1.5 m high, often with thick, corky branches; leaf scars prominent on older branches. Young shoots glabrous. *Leaves* crowded at the ends of branches, sessile, slender, terete, glabrous, semi-erect to erect, rigid, (5-) 7-9 (-10) cm long, 0.8-1.2 (-1.5) mm wide, shortly mucronate, pale green; oil glands prominent. *Flowers* in dense, ± cylindrical spikes 3-8 (-9) cm long on portions of stems from

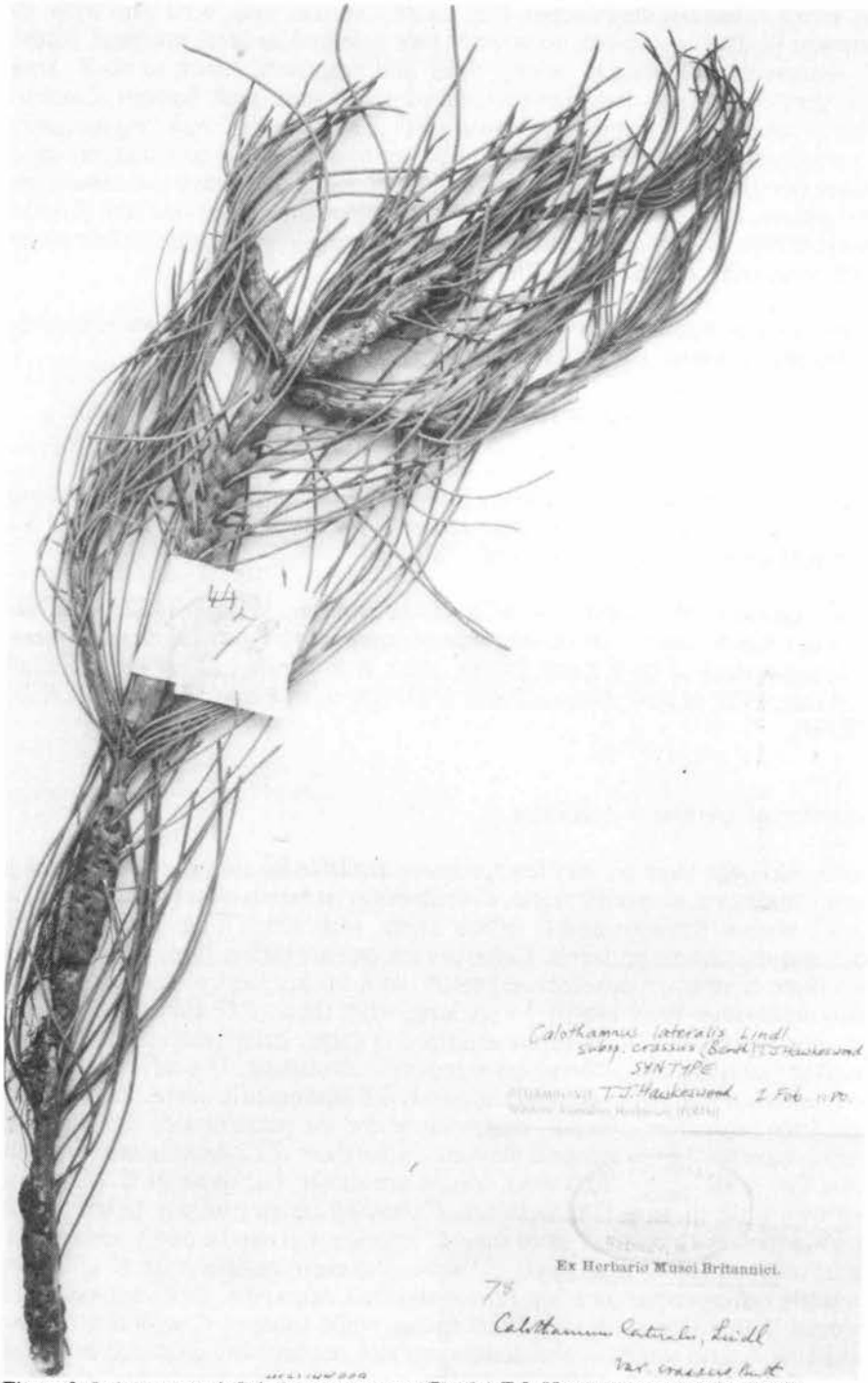

Figure 8. Isolectotype of *Calothamnus crassus* (Benth.) T.J. Hawkeswood (NSW 144009).

which the leaves have fallen. *Calyx-tube* narrowly campanulate, 2-2.5 mm long, glabrous, embedded in the swollen, corky rhachis; *calyx-lobes* erect, deltoid, acute, slightly concave, 0.7-1 mm long, 0.5-0.8 mm wide, glabrous outside and within. *Petals* narrow elliptical, concave, acute, 2.5-3 mm long, glabrous, papery, thin, orange-brown to pale brown; margins scarious,

partially ciliate. *Staminal* claws equal, (22-) 25-28 (-30) mm long, 0.7-1 mm wide, glabrous, dark crimson to dark purple-red, sometimes pale coloured at base; marginal filaments (6-) 7-8 (-9); *anthers* linear-oblong to oblong, 0.8-1 mm long, dark brown to black. *Style* 20-25 mm long, slender, glabrous, dark crimson to purple-red, stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ± depressed globular, 3-4 (-5) mm wide, 3-5 mm long (including calyx-lobes), embedded in the swollen corky rhachis; two opposite lobes persistent on top of fruit, the thinner two wearing or breaking away with age. *Fertile seeds* few per capsule, pyriform to almost oblong, 0.7-1 mm long, 0.4-0.7 mm wide, often truncate at one end, glabrous; testa pale orange-brown. *Ovulodes* numerous per capsule, linear, linear-clavate or narrow-pyriform, 0.6-1 mm long, thin, glabrous, pale buff-brown.

Derivation of name. From the Latin *crassus*, meaning "thick", probably referring to the thick, swollen rhachis in which the fruits are embedded.

Habitat. Grows in sand in heath associations. Flowers October to November.

Distribution. Presently known only from Bluff Knoll in the Stirling Range National Park (34°23' S, 118°17' E). There is an isolated record from the Scott River (c. 34°20' S 118°15' E) which appears to belong to this species. Map 5.

Specimens examined. WESTERN AUSTRALIA: Stirlings, 22 Aug. 1952, *N.H. Speck* s.n. (UWA); Bluff Knoll, lower part on east side of summit, 12 Nov. 1961, *A.S. George* 3140 (PERTH); south slope of Bluff Knoll, 28 Oct. 1962, *K.R. Newbey* 633 (PERTH); Bluff Knoll massif, 24 Dec. 1979, *H.E.M. Dobson* 79022 (PERTH); Scott River, 17 Jan. 1945, *R.D. Royce* 84 (PERTH).

Total number of specimens examined. 7.

Comments. Although there are very few specimens available for assessment, I have felt justified in elevating this taxon to specific status. *Calothamnus crassus* is closely related to *C. lateralis* Lindley, *C. huegelli* Schauer. and *C. affinis* Turcz. with which it has been confused in the literature and on herbarium labels. *Calothamnus crassus* differs from *C. lateralis* in being usually a more compact, multi-stemmed shrub, with thicker, corky branches. The leaves of *C. crassus* are shorter, being mostly 7-9 cm long, while those of *C. lateralis* are mostly 25-30 cm long. The flowers of *C. crassus* are arranged in dense, cylindrical spikes, while those of *C. lateralis* are arranged in unilateral spikes mostly 7-10 cm long. The calyx-tube of *C. crassus* flowers is narrowly campanulate, and the petals are prominently acute. In *C. lateralis* (and *C. huegelii*) the calyx-tube is broadly campanulate and the petals obtuse. The staminal claws of *C. crassus* have (6-) 7-8 (-9) marginal filaments, while those of *C. lateralis* have 4 or 5 marginal filaments. The fertile seeds of all three species are similar but those of *C. crassus* are pale orange-brown while those of *C. lateralis* and *C. huegelii* are grey-brown. In leaf morphology, *C. crassus* resembles *C. huegelii* more than *C. lateralis*, but can be easily recognized by the differences outlined above. In addition, *C. crassus* has been confused with *C. affinis*, but they can be clearly distinguished on a few flower and fruit characters. In *C. crassus*, the flowers are arranged in uninterrupted, cylindrical spikes, while those of *C. affinis* are arranged in interrupted, unilateral spikes — the flowers are also prominently clustered in threes. In *C. crassus*, the flowering spikes are usually on portions of the stems from which the leaves have fallen, while in *C. affinis* they are usually situated amongst the leaves. In *C. crassus* the calyx-tube and fruit are embedded in the prominently corky rhachis, while those of *C. affinis* are only partially embedded in the slightly corky rhachis. The fruit of *C. affinis* is also usually larger than in *C. crassus*.

Although *C. crassus* is a rare and localized species its survival in the Stirling Range National Park seems assured, although fires may be an occasional threat. Its present status in the Scott River area is unknown since no material has been collected since 1945.

8. **Calothamnus affinis** Turcz., Bull. Cl. Phys-Math. Acad. Imp. Sci. Saint Petersbourg 10:346 (1852); F. Muell, Fragm. 8:184 (1874); Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Prir. 2:92 (1923); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Hawkeswood, Austral. Pl. 11:12,13 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:152 (1980). *Type*: *J. Drummond*, 5th Coll. no. 182 (holo: KW, photograph seen).

Calothamnus microcarpus F. Muell. var. *teres* Benth., Fl. Austral. 3:177 (1867). *Type*: *J. Drummond*, 5th Coll. no. 182 (holo: K, photograph seen, Figure 9).

Calothamnus affinis var. *teres* Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:152 (1980), nomen invalidum.

Calothamnus affinis var. *longistamineus* Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Prir. 2:92 (1923); Blackall & Grieve, How to Know Western Austral. Wildfl. ed. 2, 152 (1980). *Type*: "Cranbrook to Warrungup, sandy plains, A.A. Dorrien-Smith" (holo: PR, n.v.).

Erect, compact or spreading, rigid, single- or multi-stemmed, much-branched, usually glabrous shrub to 1.5 mm high. Young shoots glabrous or pilose (becoming glabrous with age). *Leaves* crowded or scattered, sessile, slender, terete, semi-erect to erect, rigid, (4.5-) 6-8 (-9) cm long, 0.7-1 mm wide, glabrous, usually shortly mucronate, sometimes obtuse, oil glands prominent and randomly scattered. *Flowers* in short prominent clusters of 2-4 (mostly 3) arranged in interrupted, unilateral spikes (2-) 3-6 (-7) cm long usually on portions of younger stems amongst leaves. *Calyx-tube* short, broadly campanulate, 1.5-2 mm long, glabrous, partly immersed in the slightly corky rhachis; *calyx-lobes* erect, deltoid, acute to obtuse, concave, 1-1.5 mm long, 0.6-0.8 mm wide, glabrous outside and within; two opposite ones slightly larger than the other two; margins thin, scarious, ciliate. *Petals* oblong-elliptical, obtuse or slightly acute, concave, 2-2.5 mm long, glabrous, orange-brown, thin, with thin, scarious, partially ciliate margins; central vein prominent. *Staminal claws* ± equal, 20-25 (-30) mm long, 0.5-1 mm wide, glabrous, purple-red becoming yellow-green at base; marginal filaments (5-) 7 (-9); *anthers* oblong, 0.5-0.7 (-1) mm long, black. *Style* 20-30 mm long, slender, tapering to stigma, glabrous, scarlet, becoming yellow-green at base; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, depressed globular, densely crowded, (3.5-) 5-6 (-6.5) mm wide, 2-4 mm long, only the base immersed in the rhachis; lobes initially present, inflexed, two opposite lobes prominently thickened, the remaining two thin, dry, often wearing away with age. *Fertile seeds* few per capsule, narrow-pyriform, 0.7-0.9 mm long, testa smooth, glabrous, grey-brown. *Ovulodes* numerous, thin, linear to linear-clavate or narrow pyriform, 0.6-0.8 mm long, glabrous, cream.

Derivation of name. From the Latin *affinis*, meaning "neighbouring", "allied to", "akin to". I am not sure to which species Turczaninow related *C. affinis*.

Habitat. Grows in gravelly lateritic soil or sand in shrub woodland communities. Flowers mostly from August to October and occasionally as late as March depending on local environmental conditions.

Distribution. Confined to the Stirling Range National Park east of Chester Pass road to Bluff Knoll and north of Mt Success. Map 6.

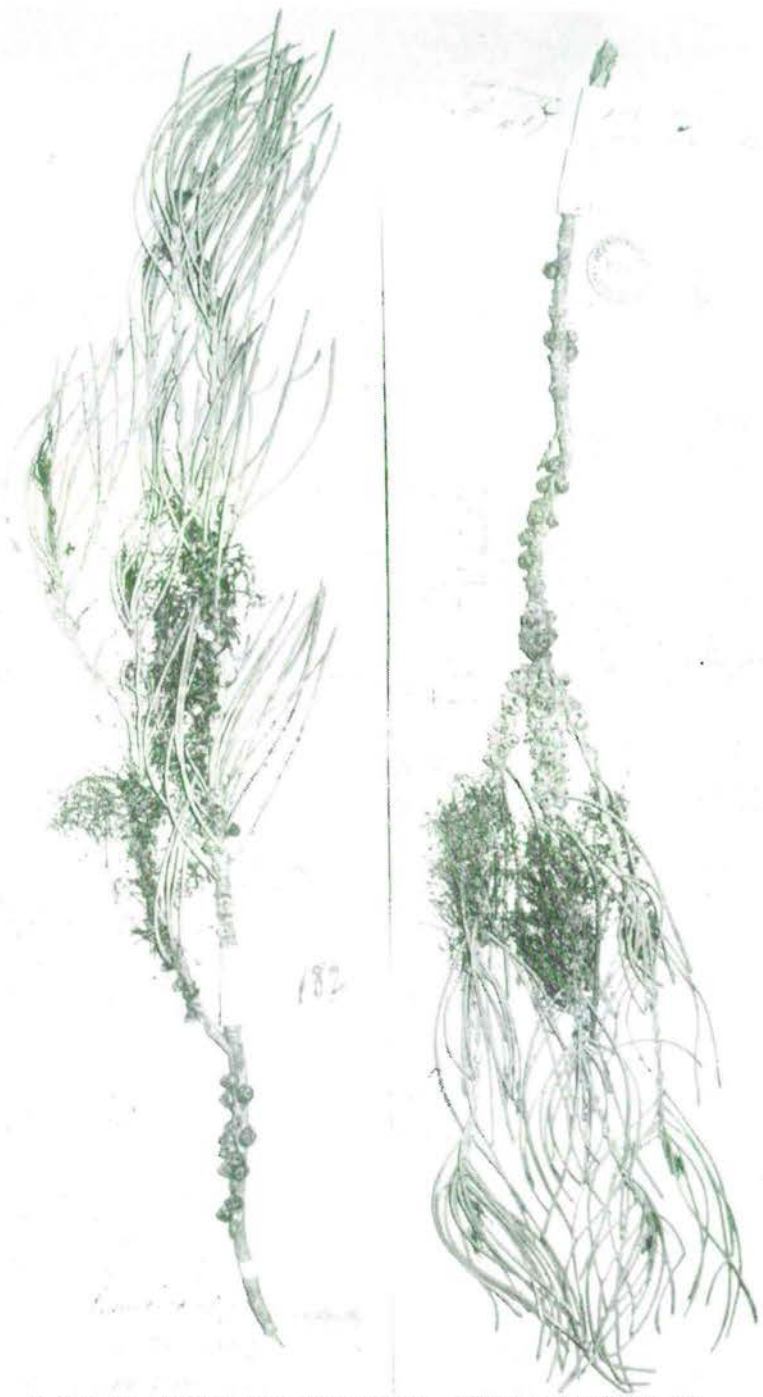

Figure 9. Syntypes of *Calothamnus microcarpus* F. Muell. var. *teres* Benth. (K).

Specimens examined. WESTERN AUSTRALIA: Stirlings, 22 Aug. 1952, *N.H. Speck* s.n. (UWA); Stirling Range, 5 Aug. 1968, *G. Byrne* s.n. (UWA); Chester Pass-Stirling Range, 11 Oct. 1971, *Anon.* (UWA); Stirling Range Drive, 15 km E of Red Gum Pass, 5 Oct. 1976, *B.G. Briggs* 6648 (PERTH, NSW); Bluff Knoll, 16 Aug. 1964, *F. Lullfitz* L3381 (KP); 3 miles

N of Mt Success, 28 Oct. 1962, *K.R. Newbey* 588 (PERTH); Foot of Ellen's Peak, Stirling Range, Oct. 1928, *C.A. Gardner* & *W.E. Blackall* s.n. (PERTH); Stony foothills, Ellen's Peak, Stirling Range, 5 Oct. 1928, *C.A. Gardner* 2135 (2) (PERTH); on sandy land, Salt River Road, Stirling Range National Park, Mar. 1966, *F.A. Spratt* 15 (PERTH); gravelly country on Chester Pass Road, Stirling Range National Park, Mar. 1966, *F.A. Spratt* 6 (PERTH); Tolls Creek, 3 Oct. 1902, *A. Morrison* s.n. (PERTH).

Total number of specimens examined. 12.

Comments. Calothamnus affinis is closely related to *C. huegelii* Schauer. They are difficult to distinguish in the field since both have leaves of similar length; ((3-) 4-6 (-9) cm long in *C. huegelii* and (4.5-) 6-8 (-9) cm long in C. *affinis*) and the flowers in spikes usually measuring 2-6 cm long in both taxa. In addition, the fruit and seeds are identical. The differences between the two taxa are outlined in Table 1 below.

Table 1. Differences between *Calothamnus huegelii* Schauer and *C. affinis* Turcz.

C. huegelii	*C. affinis*
1. Flowers densely crowded, arranged in uninterrupted spikes (2-) 3-4 (-6) cm long.	Flowers in groups of (2-) 3 (-4) in usually interrupted spikes (2-) 4-6 (-7) cm long
2. Spikes usually on portions of stems without leaves	Spikes usually on portions of stems amongst leaves
3. Calyx-tube and fruit embedded in the swollen, corky rhachis	Calyx-tube and fruit only partially embedded in the slightly corky rhachis
4. Staminal claws with 4-5 (-7) marginal filaments	Staminal claws with (5-) 7 (-9) marginal filaments
5. Fruit 2-4 mm wide	Fruit 3.5-6.5mm wide

Calothamnus affinis is also closely related to *C. microcarpus* F. Muell. but the latter species possesses flat leaves 1.5-2.5 mm wide, and staminal claws with marginal filaments (3-) 5 or 7 (-9). In all other characters the two species are identical. They occur sympatrically in the Stirling Range National Park although *C. microcarpus* appears to have a wider distribution north of the Stirling Range. Map 7.

Calothamnus affinis is also closely related to *C. crassus* (Benth.) T.J. Hawkeswood which also occurs sympatrically in the Stirling Range National Park. The differences between these two species are outlined in the discussion of *C. crassus*.

There have been no attempts to study the ecology and conservation of *C. affinis*. It may form hybrids with the related species *C. huegelii*, *C. crassus* and *C. microcarpus* in the Stirling Range area.

9. **Calothamnus microcarpus** F. Muell., Fragm. 3:113 (1862); Benth., Fl. Austral. 3:117 (1867); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967). *Type*: "Ad flumen Kalgan Australiae occidentalis. Aug. Oldfield" (n.v.)

Erect, compact or spreading, rigid, single- or multi-stemmed, much-branched, usually glabrous shrub to 1.5 m high. Young shoots densely appressed pilose, becoming glabrous with age. *Leaves* sessile, linear, thick, flat, rigid, semi-erect to erect, (4-) 5-9 (-10) cm long, 1.5-2.5 mm wide, glabrous, shortly mucronate or sometimes obtuse, twice channelled above and below, tapering slightly at base, dark green; oil glands prominent and randomly distributed. *Flowers* in short, prominent clusters of 2-3 (mostly 3) arranged in interrupted, unilateral spikes (3-) 4-6 (-7) cm long, usually on portions of younger stems amongst leaves. *Calyx-tube* short, broadly campanulate, 1.5-2.5 mm long, glabrous, rhachis prominently dilated at base of calyx-tube; *calyx-lobes* erect, deltoid, acute to obtuse, 1-1.5 mm long, 0.6-0.8 m wide, glabrous outside and within; margins thin, scarious, ciliate. *Petals* oblong-elliptical, obtuse or slightly acute, concave, (1.5-) 2-2.5 mm long, glabrous, orange-brown, thin, with thin, scarious, partially ciliate margins; central vein prominent. *Staminal claws* ± equal, 20-25 (-28) mm long, 0.3-0.8 (-1) mm wide, glabrous, dark red, becoming yellow-green towards base; marginal filaments (3-) 5 or 7 (-9); *anthers* linear-oblong, 0.5-0.7 mm long, dark brown to black. *Style* 20-30 mm long, slender, tapering to stigma, glabrous, dark red, becoming yellow-green at base; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, depressed globular, densely crowded, (2-) 3-4 (-5) mm long, 4-6 mm wide, only the base immersed in the rhachis; lobes initially present, inflexed, two opposite lobes prominently thickened, the remaining two thin, dry, usually wearing away with age; orifice c. 1.5 mm diameter. *Fertile seeds* few per capsule, narrow-pyriform, 0.7-0.9 mm long, glabrous; testa grey-brown. *Ovulodes* numerous, thin, linear to linear-clavate or narrow-pyriform, 0.6-0.8 mm long, glabrous, cream.

Derivation of name. From the Greek *micros*, meaning "small", and *carpos*, meaning "fruit", referring to the small capsules. However, its closest relatives, *C. affinis C. schaueri*, *C. lehmannii*, *C. planifolius*, *C. lateralis* and *C. huegelii* and *C. preissii* all possess similar fruits which are the smallest type in the genus.

Habitat. Grows in lateritic clay soil in *Eucalyptus* scrub or sandy soil in mallee heaths. Flowers mostly from September to November.

Distribution. Cranbrook area (c. 34°20' S, 117°35' E) and the Stirling Range National Park to an area between Napier and Mt Many Peaks (c. 34°52' S, 118°05' E). Map 7.

This species has been poorly collected between the Stirling Range National Park and the Napier-Mt Many Peaks area. This may be due to lack of collecting, but more likely is a result of land clearing.

Specimens examined. WESTERN AUSTRALIA: 15 miles E of Cranbrook, 26 Sept. 1965, *K.R. Newbey* 1870 (PERTH); Albany Highway, Cranbrook turnoff, 11 Nov. 1961, *A.S. George* 3090 (PERTH); near Cranbrook, 10 Nov. 1927, *C.T. White* s.n. (PERTH); Stirling Range, 9 Oct. 1902, *A. Morrison* s.n. (2) (PERTH); Stirling Range, 10 Nov. 1927, *C.T. White* 5439 (BRI); Red Gum Pass, 9 Oct. 1902, *A. Morrison* s.n. (PERTH); E from Solomon's Well, 28 Sept. 1902, *A. Morrison* s.n. (2) (PERTH); Peak Donnelly, Oct. 1956, *C.A. Gardner* s.n. (PERTH); Stirling Range, Sept. 1921, *E.H. Pelloe* s.n. (PERTH); Stirling Range, Oct. 1951, *A.M. Baird* s.n. (UWA); Stirling Range, Oct. 1930, *E. Ashby* NSW 144001 (NSW); Stirling Ranges, Oct. 1901, *E. Pritzel* NSW 144002 (NSW); Mt Hamilla, Stirling Range, on Hancock property, 9 miles along Salt River road from Cranbrook, 9 Oct. 1968, *E.M. Canning* CBG 031863 (NSW); Between Napier and Mt Many Peaks, 5 Oct. 1967, *A.R. Fairall* 2245 (PERTH); Stirling Range, 9 Oct. 1902, *A. Morrison* s.n. (2) (PERTH).

Total number of specimens examined. 15.

There is a morphological variant of this species which may warrant subspecific category. It occurs in the Stirling Range area and differs from the typical form in having more rigid, erect, pale grey-green leaves measuring (2.5-) 3-4 (-8) cm long and 1.5-2.5 mm wide. However, there is not enough material available at present for this variant to be clearly assessed. It may represent a hybrid or be only a local variant.

Specimens examined. S of Stirling Range National Park on Red Gum Pass Road, 5 Oct. 1963, *R.D. Royce* 8074 (PERTH); Stirling Range, 8 Oct. 1964, *C.A. Gardner* s.n. (PERTH); top of breakaway overlooking plain between Kalgan River and Porongorups, Oct. 1951, *A.M. Baird* s.n. (2) (UWA); between Porongorups and Stirlings, Oct. 1963, *W. Rogerson* 74 (PERTH).

Total number of specimens examined. 5.

Comments. This species is most closely related to *C. planifolius* Lehm., *C. crassus* (Benth.) T.J. Hawkeswood and *C. huegelii* Schauer, but can be readily distinguished by the flat leaves which are characteristically two-channelled abaxially and adaxially. For further comments see discussion under *C. planifolius* and *C. affinis* Turcz.

Calothamnus microcarpus is a variable species, especially in leaf morphology, and complex hybridization with related species may be occurring in the Stirling Range area. Further collections and ecological studies should be undertaken in this area to shed light on its variation.

10. **Calothamnus preissii** Schauer, Regelia, Beaufortia & Caloth. 31 (1843); Schauer in Lehm., Pl. Preiss. 1: 154 (1844); Benth., Fl. Austral. 3: 177 (1867); Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Nat.-Prir, 2:92 (1923); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Desc. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11:8, 14 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:150 (1980). *Type*: "Habitat in Australia meridonali- occidentali: in solo glareoso silvae cis fluvium Gordon Novembri a 1840 legit. cl Preiss!" (Herb. Preiss. No. 209) (lecto, here designated: LD).

Calothamnus laxa Kunze, Linnaea 20: 58 (1847). *Type:* "E Nova Hollandia absque nomine dedit h.r. Berolinensis. Decbr. 1846" (holo: B, type destroyed).

Low, decumbent, often prostrate, mostly glabrous shrub to 0.3 m high with thin stems. Young shoots often pilose. *Leaves* scattered or arranged in loose whorls, sessile, slender, terete, (5-) 7-10 (-13) cm long, 0.7-1 mm wide, pale green to glaucous, glabrous or slightly pilose, shortly acuminate, slightly pungent. *Flowers* in dense, cylindrical spikes 3-5 cm long, usually amongst leaves at the end of the branches. *Calyx-tube* short, broadly campanulate, (1-) 1.5-2 mm long, glabrous, rhachis slightly dilate at base; *calyx-lobes* equal, 0.6-0.8 mm long, deltoid, acuminate-obtuse, glabrous outside and inside; margins partially fimbriate. *Petals* almost elliptical, acute to slightly obtuse, concave, 1.2-1.5 (-2) mm long, glabrous, papery, orange-brown with thin, pale, ciliate margins. *Staminal* claws unequal, glabrous, dark scarlet to violet-red, often pale at the base; upper two claws (10-) 12-15 (-20) mm long, 0.6-0.8 (-1) mm wide with 5 or 7 marginal filaments; lower two claws (7-) 8-10 (-12) mm long, 0.5-0.8 mm wide, with 1 or 2 marginal filaments; *anthers* oblong, 0.7-0.9 mm long, dark brown or black. *Style* slender, 5-20 mm long, glabrous, stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, densely crowded, truncate-conical to almost cylindrical, (3-) 3.5-4 (-5) mm long, (including lobes), 3-4 (-5) mm wide, smooth or sometimes wrinkled, dark grey; lobes initially present, two opposite lobes thinner, often wearing away with age. *Styles* often persistent in fruit. *Fertile seeds* few to many per capsule, 0.6-0.8 (-1) mm long, 0.5-0.7 mm wide, narrow-

pyriform to pyriform, usually truncate, glabrous; testa dark grey-brown. *Ovulodes* numerous per capsule, 0.5-0.8 mm long, linear or linear-cuneate, glabrous, pale yellow.

Derivation of name. Named after Dr Johann Augustus Ludwig Preiss (1811-1883), who collected plants in Western Australia during 1839-1841.

Habitat. Grows in well-drained gravelly sand or gravel-clay in closed heath with *Xanthorrhoea reflexa*, *Banksia sphaerocarpa*, *Calothamnus quadrifidus* etc., or in open heath with *Eucalyptus marginata*, *Banksia*, *Melaleuca* etc. Flowers mostly from July to October and early November.

Distribution. From Tutanning Reserve, east of Pingelly (c. 32°32' S, 117°25' E), to Kojonup (33°50' S, 117°10' E), Tambellup (34°03' S, 117°38' E) and Cranbrook (34°18' S, 117°32' E). The most southerly limit of the species' range occurs near Albany (34°59' S, 117°58' E). Map 8.

Specimens examined. WESTERN AUSTRALIA: Tutanning Reserve, 17 miles E of Pingelly, 19 Sept. 1962, *R.D. Royce* 7597 (PERTH); Tutanning Reserve, 17 miles E of Pingelly, 10 Oct. 1967, *G. Heinsohn* 41 (PERTH); Yornaning Reserve 18952, c. 19 km E of Yornaning Siding, 35 km SE of Pingelly, 12 Sept. 1975, *B.G. Muir* 489 (4.2) (2) (PERTH); Albany Highway, 144 km, 20 July 1967, *F. Lullfitz* 1122 (KP); Near Haddleton Springs, between Boyup Brook and Darkan (33°38' S, 116°34' E), 3 Oct. 1971, *A.S. George* 11135 (PERTH); 142 mile peg Albany Highway, (near Kojonup), 20 July 1962, *F. Lullfitz* 648/62/2 (PERTH); 147 mile peg, Albany Highway (Kojonup), 9 Aug. 1958, *A.S. George* 175 (PERTH); Tambellup (undated), *F. Lullfitz* s.n. (PERTH); 10 miles NW of Cranbrook, 20 Oct. 1963, *K.R. Newbey* 1162 (PERTH); 49 km SW of Kojonup on Frankland road (Towerlup Road), (34°10' S, 116°59' E), 3 Oct. 1978, *A.S. George* 15243 (PERTH); Ledge Point Road, (34°59' S, 117°58' E) (near Albany), 9 Nov. 1974, *D.J.E. Whibley* 5171 (PERTH); Denmark, 9 Dec, 1962, *A.S. George* 4288 (PERTH).

Total number of specimens examined. 15.

Comments. The type of this species was collected from near the Gordon River in 1840, west from the present site of Cranbrook. However, there appear to be no recent collections from the Gordon River, although one has been made north-west of Cranbrook. Most of the remaining populations are now confined to road verges, particularly in the southern part of the species range. Land clearing for agriculture has eliminated most of the original occurrence of the species. The future of the roadside populations seems tenuous in view of future roadworks, road maintenance and the invasion of weeds. Only a few plants of *C. preissii* are known to occur in reserves, i.e. at Tutanning and Yornaning, and a combination of increased fire frequency and drought appears to be placing the species under stress in these areas. Recommendations for the conservation of this rare species have been provided by Leigh, Boden & Briggs (1984).

It is interesting to note the differences in the type descriptions and the redescriptions of *C. preissii* regarding the number of marginal filaments (anthers) of the staminal claws. Schauer (1843) and Schauer in Lehmann (1844) noted that the largest staminal claws had 5 anthers, while the smaller ones had 3 each. On the other hand, Bentham (1867) stated that the largest staminal claws had 5-9 marginal filaments each, while the others possessed 1 or 2. Kunze (1847), in his description of *C. laxa* (which undoubtedly is a synonym of *C. preissii* despite the destruction of the type specimen during World War II), stated that the stamens each have 7 anthers. In the material I had available for dissection in 1980, the larger staminal claws possessed 5 or 7 anthers (in undamaged material) and the lower ones 1 or 2. It therefore appears that Bentham was the most accurate in regards to the description of these floral structures. Following Schauer's early diagnosis, I erroneously stated (Hawkeswood 1980) that

the two upper staminal claws of *C. preissii* had 3 to 5 marginal filaments; this should be amended to 5 or 7. *Calothamnus preissii* is closely related to *C. schaueri* Lehm. and *C. lehmannii* Schauer but may be distinguished by the combination of leaf length and the number of filaments (anthers) of the staminal claws. See discussion under these two species.

11. **Calothamnus schaueri** Lehm., Del. Sem. Hort. Bot. Hamb. 7 (1842); Schauer, Regelia, Beaufortia & Caloth. 32 (1843); Schauer in Lehm., Pl. Preiss. 1: 154 (1844); Benth., Fl. Austral. 3: 178 (1867); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Desc. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11: 14 (1980); Blackall & Grieve, How to Know Western Austral. Pl. ed.2,3A:153 (1980). *Type*: "In regionibus interioribus sterilibus Australiae meridionali- occidentalis collegit Cl. L. Preiss". (Herb. Preiss No. 202) (lecto, here designated: LD).

Calothamnus schoenophylla Schauer, Regelia, Beaufortia & Caloth. 33 (1843); Schauer in Lehm., Pl. Preiss. 1: 154 (1844). *Type*: "Habitat in Nova-Hollandia austro-occidentali: in solo subturfoso-arenoso inter frutices silvae ad planitiem prope oppidulum Albany, districti Plantagenet, Decembri m.a. 1840 fructiferam legit cl. Preiss!" (Herb. Preiss. No. 201) (lecto, here designated: LD, Figure 10).

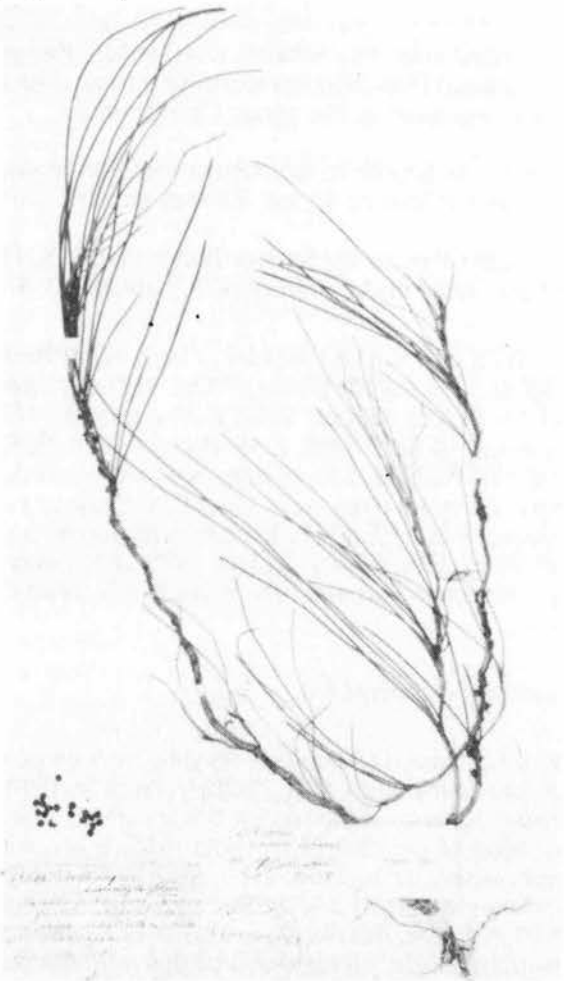

Figure 10. Lectotype of *Calothamnus schoenophylla* Schauer (LD).

Low, often prostrate, spreading shrub to 30 cm high, with thin stems. Young shoots usually glabrous but sometimes pilose. *Leaves*, scattered or arranged in loose whorls, sessile, linear, terete or slightly flattened, (10-) 12-20 (-25) cm long, 0.6-1 mm wide, pale green, glabrous or slightly pilose, finely acuminate, not pungent. *Flowers* in dense cylindrical spikes 2-3.5 cm long, usually on portions of stems without leaves. *Calyx-tube* short, broadly campanulate, 1.5-2 mm long, glabrous, rhachis slightly dilate at base; *calyx-lobes* equal, deltoid, acuminate-obtuse, 0.5-0.8 mm long, 0.5-0.8 mm wide, slightly concave, erect or slightly spreading, glabrous outside and inside, margins slightly fimbriate. *Petals* almost elliptical, concave, acute, 1-1.5 (-2) mm long, glabrous, papery, pale brown with thin, pale, ciliate margins. *Staminal claws* equal, (4-) 5-6 mm long, 0.3-0.5 mm wide, glabrous, deep red-brown; marginal filaments 2-4; *anthers* oblong-elliptical, 0.6-0.7 mm long, dark brown. *Style* slender, 5-8 mm long, glabrous; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, densely crowded, truncate-conical to almost cylindrical, (2.5-) 3-4 mm diameter at base, (2.5-) 3-4 mm long (including calyx-lobes), smooth or sometimes wrinkled, dark-grey; calyx-lobes initially persistent; thinner two opposite lobes wearing with age. *Styles* often persistent in fruit. *Fertile seeds* few to many per capsule, narrow-pyriform to pyriform, 0.6-0.8 mm long, 0.5-0.7 mm wide, usually truncate at one end, glabrous, testa dark grey-brown. *Ovulodes* numerous per capsule, linear or linear-cuneate, 0.5-0.8 mm long, glabrous, pale yellow.

Derivation of name. Named after J.C. Schauer (1813-1848), who published on Myrtaceae (*Beaufortia* and *Calothamnus*) from Western Australia during 1843-1845 and who provided the first comprehensive treatment of the genus *Calothamnus*.

Habitat. Grows in sand over laterite in the Albany area and in sand on edges of swamps near Mt Barker and near the Stirling Range. Flowers mostly from October to December.

Distribution. From Chester Pass in the Stirling Range (34°22' S, 118°08' E) to Mt Barker (34°37' S, 117°38' E) and areas in the vicinity of Albany (35°02' S, 117°53' E). Map 9.

Specimens examined. WESTERN AUSTRALIA: 3 km S of Mt Barker, 20 Oct. 1974, *K.F. Kenneally* 2375 (PERTH); 3 km S of Mt Barker, 25 Oct. 1977, *K.F. Kenneally* 6476 (PERTH); 4 miles (6.4 km) S of Mt Barker, 11 Dec. 1973, *K.F. Kenneally* 1223 (PERTH); 4.1 miles S from Chester Pass Road, 14 Sept. 1966, *E.M. Bennett* 1019 (PERTH); Chester Pass, 10 Oct. 1962, *A.R. Fairall* 556 (PERTH, KP); 10 miles N of Albany, 29 Aug. 1966, *K.R. Newbey* 2503 (PERTH); Albany-Denmark road, April 1943, *C.A. Gardner* s.n. (PERTH); Denmark, 9 Dec. 1962, *A.S. George* 4288 (PERTH); King George Sound, (undated), *W. Baxter* s.n. (PERTH); Gull Rock Road, E of Albany, 22 Oct. 1975, *A.S. George* 14187 (PERTH); 2.5 miles W of Narrikup, junction of Hay and Lake Barns Roads, 10 Sept. 1971, *K.F. Kenneally* 71/255 A & B (UWA).

Total number of specimens examined. 13.

Comments. The type of *C. schaueri* and of its synonym *C. schoenophylla* were both collected from King George Sound (Albany) by (J.A.) Ludwig Preiss in 1840. Later collectors have not significantly extended the range of this species. It is apparently rare and localized, occurring in small populations. Most of the records are from road verges, with the remainder from private property. Land clearing for agricultural purposes has eliminated much of the original habitat of this species between Albany and the Stirling Range. There is only one record from the Stirling Range National Park, but the present status of *C. schaueri* at this locality is not known. Recommendations for the conservation of this rare, distinctive species have been provided by Leigh, Boden & Briggs (1984).

12. **Calothamnus lehmannii** Schauer, Regelia, Beaufortia & Caloth. 31 (1843); Schauer in Lehm., Pl. Preiss. 1: 153 (1844): Benth., Fl. Austral. 3: 178 (1867); Domin, Vestn. Kral. Ceske Spolecn. Nauk. Tr. Mat.-Prir. 2:92 (1923); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11: 15 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:151 (1980). *Type*: "In regionibus interioribus Australiae meridionali-occidentalis, in itinere a Sinu Regis Georgii III ad oppidulum York, Februario m.a. 1840, legit cl. Preiss!" (Herb. Preiss. No. 218) (lecto, here designated: LD, Figure 11).

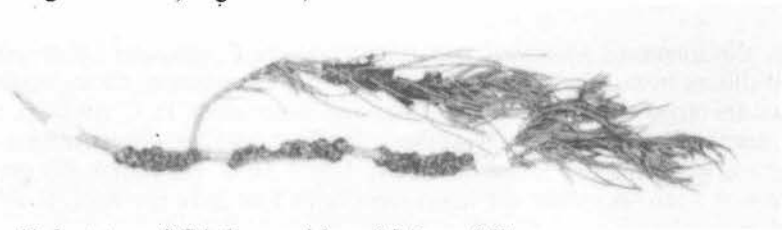

Figure 11. Lectotype of *Calothamnus lehmanii* Schauer (LD).

Calothamnus plumosus Turcz., Bull. Soc. Imp. Naturalistes Moscou 22: 25 (1849). *Type*: "Nova Hollandia. Drum. n. 59" (3rd Coll.) (holo: KW, photograph seen; iso: K, Figure 12).

Low, decumbent, often prostrate, few-branched, mostly glabrous shrub to 40 cm high, with thin stems. Young shoots usually pilose. *Leaves*, scattered or densely crowded, sessile, slender, terete, 1-2.5 (-3.5) cm long, 0.5-1 mm wide, glabrous or sometimes finely pubescent, shortly mucronate but not pungent, erect or slightly spreading, pale green; oil glands often prominent. *Flowers* in dense cylindrical spikes (sometimes ± unilateral), 2-4 (-7) cm long, usually amongst leaves at the ends of branches , rhachis usually prominently dilate beneath flowers. *Calyx-tube* short, almost campanulate, 1-1.5 mm long, glabrous, green, *calyx-lobes* equal, 0.5-1 mm long, deltoid, acute or slightly obtuse, slightly concave, erect, glabrous outside and inside; margins scarious, ciliate. *Petals* obovate, obtuse, slightly concave, 1-2 mm long, glabrous, papery, orange-brown to brown with ciliate margins. *Staminal claws* unequal, glabrous, deep purple-red; two upper claws 5-8 (-12) mm long, c. 0.5 mm wide, with 4 or 5 marginal filaments; two lower claws 2.5-6 mm long, 0.2-0.3 mm wide, with 1 or 2 marginal filaments; *anthers* oblong, c. 0.5 mm long, dark brown to black. *Style thick*, tapering, 2-10 mm long; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ± depressed globular, densely crowded, 2.5-3 mm wide, c. 2 mm long, glabrous, calyx-lobes usually persistent (sometimes two absent). Styles often persistent in fruit. *Fertile seeds* few per capsule, narrow obovoid to narrow pyriform, 0.6-0.8 (-1) mm long, 0.5-0.7 mm wide, usually truncate at one end, glabrous; testa chocolate brown, finely wrinkled. *Ovulodes* numerous, c. 1 mm long, linear-oblong to oblong, glabrous, pale yellow.

Derivation of name. Named in honour of Johann Georg Christian Lehmann (1792-1860), a German botanist who described three species of *Calothamnus* (viz. *C. planifolius*, *C. schaueri* and *C. longifolius*, the last being a synonym of *C. huegelii* Schauer).

Habitat. Grows in sandy soil on laterite in open *Eucalyptus-Banksia* mallee-heathlands. Flowers August to October.

Distribution. From near Bowelling (c. 33°32' S, 116°32' E), Frankland (c. 34°28' S, 117°00' E) to Tenterden (34°22' S, 117°33' E) to the Stirling Range (34°30' S, 117°30' E). Map 10.

Specimens examined. WESTERN AUSTRALIA: N.W. Plantagenet District, Sept. 1901, *E. Pritzel*, NSW 144004 (NSW); 7 miles S of Bowelling, Aug. 1959, *M.J. Tichborn* s.n. (PERTH); 2 miles S of Tambellup, 20 Oct. 1963, *K.R. Newbey* 1165 (PERTH); Red Gum Springs, 17

Sept. 1965, *F.W. Humphreys* s.n. (PERTH); 2 miles N of Red Gum Pass, Stirling Range, 10 Sept. 1960, *B.G. Briggs* NSW 144005 (NSW); Stirling Range, 8 Oct. 1964, *C.A. Gardner* F340 (PERTH): Western Stirlings, 27 Sept. 1963, *E. Wittwer* 294 (PERTH, KP); 49 km SW of Kojonup on Frankland Road (Towerlup Road), (34°10' S, 116°59' E), 3 Oct. 1978, *A.S. George* 15238 (PERTH); S of Tenterden, 25 Sept. 1902, *A. Morrison* s.n. (2) (PERTH); south border of Stirling Range National Park, 8 Oct. 1962, *A.R. Fairall* 430 (KP).

Total number of specimens examined. 12.

Comments. Calothamnus lehmannii is closely related to *C. schaueri* Lehm. and *C. preissii* Schauer. It differs from the former species in having the staminal claws unequal (the two upper claws are larger with more anthers than the lower ones). In *C. schaueri*, the staminal claws are more or less equal with 2-4 anthers. In *C. preissii*, the upper staminal claws have 5 or 7 anthers, while the two lower ones have 1 or 2. In *C. lehmannii*, the upper staminal claws have 4 or 5 anthers while the lower ones have 1 or 2. In the field, *C. lehmannii* can be easily distinguished from these other two species in having shorter leaves mostly 1.5-2.5 mm long and shorter staminal claws usually less than 1 cm long. In the original description of Schauer (1843) (and also that of Schauer in Lehmann, 1844), the upper staminal claws are described as having 7 anthers only, with the lower ones being sterile (without anthers). This is clearly erroneous. Likewise, the description of Bentham (1867) is somewhat misleading. He claimed that the staminal claws are narrow, "one with 5 to 7 filaments, one with 3 to 5, the two others tapering into a single filament with one anther". Turczaninow (1849) in his description of *C. plumosus* noted the upper staminal claws possessed 3 anthers only while the lower ones were reduced to one anther. It should be noted that the anthers of *Calothamnus* have weak connectives and in dried specimens they break off with the slightest disturbance.

Figure 12. Isolectotype of *Calothamnus plumosus Turcz. (K).*

This may explain the low numbers of anthers (i.e. inaccurate counts) noted by the early authors, although there may be populations of the species of which I am unaware that have reduced anthers. In the material I have examined, however, the upper staminal claws possessed 4 or 5 anthers while the lower ones possessed 1 or 2.

Calothamnus lehmannii is a poorly collected species only known from the Frankland and Tenterden areas and the southern slopes of the Stirling Range. A collection made over 20 years ago from near Bowelling, is the most northerly record of the species but it has not been re-collected from that area. The paucity of herbarium specimens is most likely due to its being uncommon throughout its range and therefore seldom encountered in the field. Apart from Stirling Range, the species is now largely restricted to small populations on a few road verges. Only a few plants are known from within the Stirling Range National Park. Much of the original populations have been eliminated by land clearing, grazing and fires. Surviving roadside populations are liable to elimination by roadworks and are at risk from habitat invasion by weeds. The very small populations in the Stirling Range National Park are adjacent to farmlands and may be threatened by increased fire frequency. Recommendations for the conservation of this rare species have been provided by Leigh, Boden and Briggs (1984).

13. **Calothamnus planifolius** Lehm., Del. Sem. Hort. Bot. Hamb. 7 (1842); Benth., Fl. Austral. 3: 176 (1867); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11: 15, 16 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:151 (1980). *Type*: "In solo glareoso plantiei prope lacum Mathilda (distr. Hay), Novembri 1840 florens" (Herb. Preiss. No. 205) (lecto, here designated: LD).

Calothamnus planifolius forma *angustifolius* Schauer, Regelia, Beaufortia & Caloth. 35 (1843); Schauer in Lehm., Pl. Preiss. 1: 155 (1844), nom. illeg. Based on type of *Calothamnus planifolius* Lehm. (Herb. Preiss. No. 205).

Calothamnus planifolius forma *latifolius* Schauer, Regelia, Beaufortia & Caloth. 36 (1843); Schauer in Lehm., Pl. Preiss. 1: 155 (1844). *Type*: "In interioribus plagis Sinum Regis Georgii et oppidulum York interjacentibus Februario 1840" (Herb. Preiss. No. 206) (lecto, here designated: LD).

Erect, much-branched, glabrous shrub to 1.5 m high. Young shoots usually glabrous, sometimes shortly pilose. *Leaves* scattered or crowded at ends of branches, sessile, flat, linear to linear-cuneate, slightly attenuate at base, (3.5-) 4-5 (-7) cm long, 3-5 mm wide, obtuse or shortly mucronate, not pungent, usually olive green, slightly scabrous, glabrous, mid-vein prominent on undersurface; oil glands prominent. *Flowers* 2-4 (mostly 3) in dense ± uninterrupted unilateral spikes 3-7 cm long, embedded in the swollen, corky rhachis. *Calyx-tube* broadly campanulate, 2-2.5 (-3) mm long, glabrous; *calyx-lobes* ± equal, erect to semi-erect, acute to slightly obtuse, 0.7-1 mm long, c. 0.8 mm wide, concave, acute, 2-2.5 mm long, glabrous, papery, thin, pale brown; margins scarious, partially ciliate. *Staminal claws* ± equal (20-) 22-25 (-30) mm long, 0.7-1 mm wide, glabrous, purple-red in upper half to two-thirds, yellow-green in lower portion; marginal filaments (5-) 7 (-9); *anthers* oblong, 0.8-1 mm long, black. *Style* 20-35 mm long, slender, stigma small. Summit of ovary densely pubescent. *Fruit* densely crowded, depressed globular, 3-5 mm diameter, 3-4 mm long, usually embedded in the swollen corky rhachis; two opposite lobes thick, persistent and deflexed, remaining two lobes wearing away with age; orifice 1.5-2 mm wide. *Fertile seeds* few per capsule, pyriform to narrow-pyriform, 0.8-1 mm long, 0.5-0.7 mm wide, usually truncate at one end, glabrous, testa dark grey-brown. *Ovulodes* numerous per capsule, linear-oblong to oblong, mostly clavate, 0.5-1 mm long, mostly truncate at one end, glabrous, buff in colour.

Derivation of name. From the Latin *planus*, meaning "flat", and *folium*, meaning "leaf".

Habitat. Grows in gravelly clay soil in mallee-heath communities. Near Nyabing the species grows in clay in mallee-*Melaleuca* scrub. Flowers September to November.

Distribution. From Boyagin Rock Reserve (32°30' S, 116°55' E) and Pingelly Reserve (32°31' S, 117°25' E) to the Kukerin-Tarin Rock area (33°06' S - 33°11' S, 118°00' E - 118°13' E) and the Nyabing-Pingrup area (33°30' S, 118°05' E - 118°35' E) with an isolated record from near Kojonup (33°38' S, 117°05' E). Map 9.

Specimens examined. WESTERN AUSTRALIA: 1844, *Drummond.* 2nd Coll. No. 58. NSW 144014 (NSW); Narrogin, 18 Oct. 1957, *W.H. Butler* s.n. (PERTH); Tuttaning Reserve, 17 miles E of Pingelly, 19 Sept. 1962, *R.D. Royce* 7572 (PERTH); Tarin Rock, 29 Oct. 1961, *C.A. Gardner* 13648 (PERTH); 16 miles W of Lake Grace, 11 Nov. 1931, *W.E. Blackall* 1319 (3) (PERTH); 20 miles W of Lake Grace, 12 Oct. 1960, *A.S. George* 1532 (PERTH); 5 miles W of Kukerin, 29 Oct. 1962, *J.S. Beard* 2140 (PERTH, KP); 4 miles NW of Nyabing, 29 Sept. 1963, *K.R. Newbey* 992 (PERTH); 15 miles W of Pingrup, 14 Sept, 1961, *R.D. Royce* 6696 (PERTH); Boyagin Rock Reserve, 6 Nov. 1969, *H. Demarz* 1845 (KP); 1 mile SE of Nyabing, 14 Nov. 1969, *V. Mann* and *A.S. George* 153 (PERTH); Nyabing, Oct. 1956, *V.F. McDougall* 6182 (PERTH); 16 miles N of Kojonup on Albany Highway, 26 Oct. 1977, *J.S. Beard* 8197 (PERTH).

Total number of specimens examined. 16.

Comments. Calothamnus planifolius has been confused with *C. microcarpus* F. Muell. in herbaria. Although the leaves of both taxa are flat and similar in other morphological features, the leaves of *C. microcarpus* are mostly 5-9 cm long, 1.5 — 2.5 mm wide, with two, prominent longitudinal furrows both adaxially and abaxially. In *C. planifolius,* the leaves are mostly 4-5 cm long, 3-5 mm wide and without furrows; however, the midrib is prominent on the abaxial surface and in dried specimens becomes even more so due to shrinkage of tissue either side of the central vein. The fruit of *C. microcarpus* are usually larger (4-6 mm diameter) than those of *C. planifolius* (3-5 mm diameter). The flowers of *C. microcarpus* are arranged in groups of 2-4 (mostly 3) in interrupted spikes, whereas those of *C. planifolius* are crowded into more or less uninterrupted spikes. *Calothamnus microcarpus* occurs in the Stirling Range and associated areas to the south, while *C. planifolius* has a more northerly distribution.

There are no published studies on the ecology of this species and land clearing throughout the wheatbelt north of the Stirling Range has undoubtedly reduced its populations. Studies should be undertaken to monitor populations in these areas as further threats of fire and more clearing may lead to its extinction. Its status in Tuttaning Reserve (east of Pingelly) and Boyagin Rock Reserve should be examined in the near future since fire, drought and human disturbance may be threats to its survival in these areas.

14. **Calothamnus pallidifolius** (Benth.) T.J. Hawkeswood, stat. nov.

Calothamnus planifolius Lehm. var. *pallidifolius* Benth., Fl. Austral. 3:177 (1867); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:151 (1980). *Type*: "J. Drummond n.40, and 2nd Coll. n. 72" (lecto, here designated: *Drummond* 2nd Coll n. 72 (1844) ? K, n.v.; iso: NSW 144015, Figure 13).

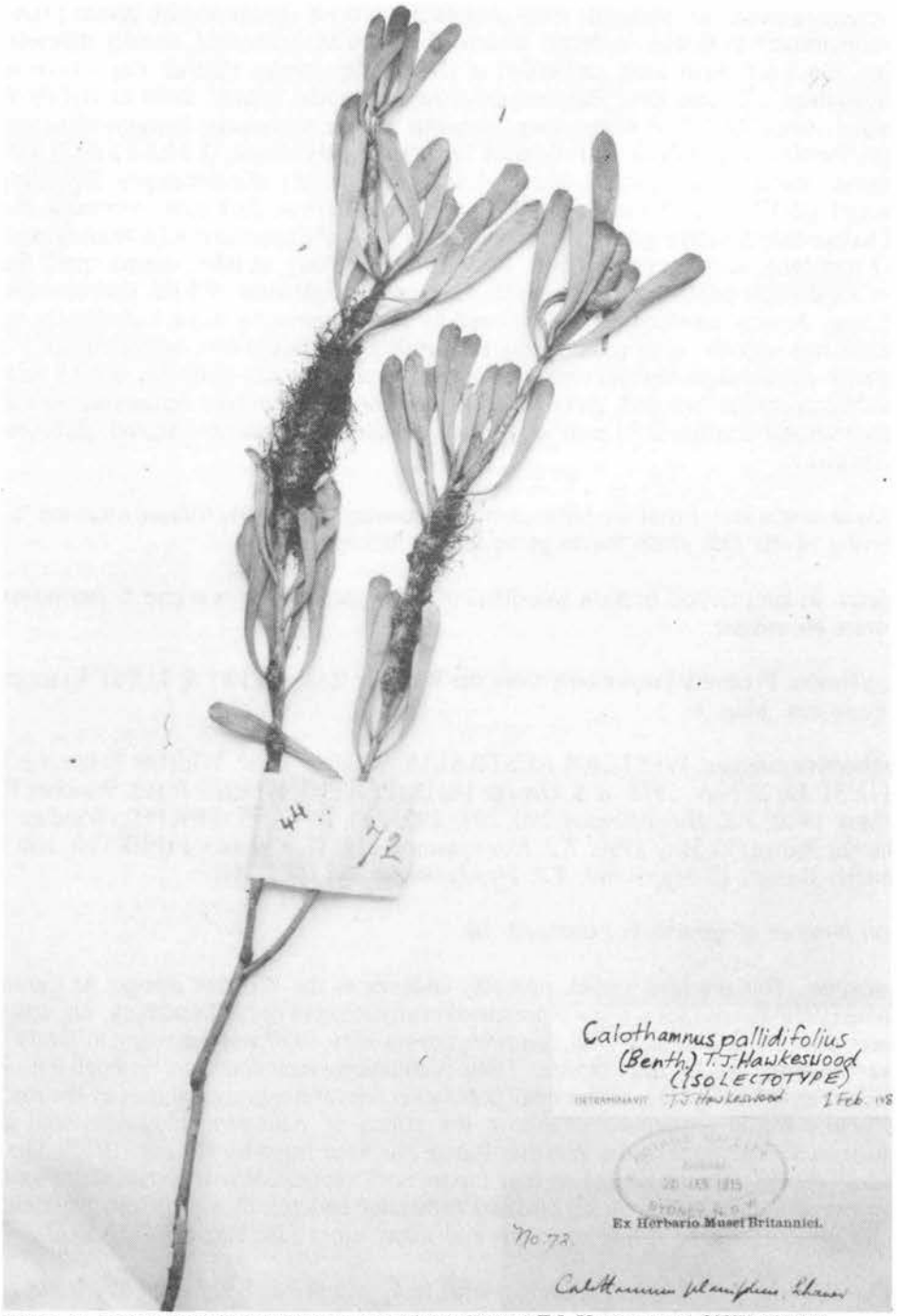

Figure 13. Isolectotype of *Calothamnus pallidifolius* (Benth.) T.J. Hawkeswood (NSW 144015)

Erect, straggly, much-branched, glabrous shrub to 0.5-0.7 (-1) m high, with thin branches, the older ones often becoming slightly corky. Young shoots glabrous. *Leaves* scattered at the ends of branches, sessile, flat, oblanceolate, (4.5-) 5-6 (-7) cm long, (6-) 6.5-10 (-13) mm wide, smooth, coriaceous, glabrous, glaucous, pale green, with a short, acuminate tip or

sometimes obtuse, not pungent; veins prominent in dried specimens; oil glands prominent. *Flowers* mostly in threes, in dense, unilateral to almost cylindrical, usually uninterrupted spikes, (3-) 4-6 (-7) cm long, embedded in the swollen, corky rhachis. *Calyx-tube* shortly campanulate, 2-2.5 mm long, glabrous; *calyx-lobes* ± equal, deltoid, acute to slightly obtuse, concave, erect, 0.8-1.2 (-1.4) mm long, glabrous outside and inside; margins thin, scarious, ciliate. Petals narrow-elliptical to elliptical, acute to slightly obtuse, (1.5-) 2-2.5 (-2.8) mm long, glabrous, orange-brown, papery, with thin, scarious, partially ciliate margins. *Staminal claws* ± equal, (20-) 22-25 (-30) mm long. 0.7-1 mm wide, glabrous, dark pink to crimson in upper half to two-thirds, yellow-green in lower portion; marginal filaments (5-) 7 (-9); *anthers* oblong, 0.7-1 mm long, dark brown or black. *Style* 20-35 mm long, slender, stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ± depressed globular, 4-5 (-6) mm diameter, 2-3 mm long, densely crowded, almost covered by the prominently dilate and slightly swollen rhachis; two opposite lobes prominently thickened and deflexed over orifice; orifice c. 2 mm diameter. *Fertile seeds* few per capsule, linear-clavate to broadly pyriform, 0.7-0.9 mm long, usually truncate at one end, glabrous, testa dark brown. *Ovulodes* numerous per capsule, linear to linear-clavate, 0.7-1 mm long, often obliquely truncate at one end, glabrous, pale buff-brown.

Derivation of name. From the Latin *pallidus*, meaning "pale", and *folium*, meaning "a leaf", referring to the pale green leaves possessed by this species.

Habitat. In lateritic soil in open woodland of *Eucalyptus marginata* and *E. haematoxylon*. Flowers November.

Distribution. Presently known only from the Whicher Range (33°47' S, 115°31' E) south-west of Busselton. Map 9.

Specimens examined. WESTERN AUSTRALIA: Whicher Road, Whicher Range, (± 33°47' S, 115°31' E), 23 Nov. 1975, *A.S. George* 14218 (PERTH); Whicher Road, Whicher Range, 15 May 1980, *T.J. Hawkeswood* 290, 291, 292, 293, 294, 295 (PERTH); Whicher Road, Whicher Range, 15 May 1980, *T.J. Hawkeswood & D.G. Knowles* 1 (PERTH); Hill Road, Whicher Range, 15 May 1980, *T.J. Hawkeswood* 296 (PERTH).

Total number of specimens examined. 10.

Comments. This is a rare species, probably endemic to the Whicher Range. At the time of writing (1980) the species was not represented in any Reserve or National Park. The specimens collected by the author and D.G. Knowles during May 1980 were growing in sandy soil in disturbed situations by the roadside. These populations were found to be small (i.e. < 100 plants) at each locality. Due to the small population sizes and exposed habitats by the roadsides, the plants would appear vulnerable to the effects of roadwork extensions and similar disturbances. The flora of the Whicher Range has been listed by Hussey (1977). The "new species" of *Calothamnus* listed in that report is *C. pallidifolius*. It would seem vital that protection should be given to this rare and vulnerable endemic by setting up a National Park in the Whicher Range to conserve this and many other rare taxa (Hussey 1977).

Calothamnus pallidifolius is closely related to *C. planifolius* Lehm. and to a lesser degree, *C. microcarpus* F. Muell. It is clearly distinguished from *C. microcarpus* by having oblanceolate, mostly glaucous, somewhat coriaceous, smooth leaves mostly 4-6 cm long and 6.5-10 mm wide. In *C. microcarpus*, the leaves are linear, dark green, mostly 5-9 cm long and 1.5-2.5 mm wide, with two distinct furrows adaxially and abaxially. It was Bentham (1867) who first noticed the close relationship between *C. pallidifolius* and *C. planifolius*, but he only recognized the former as a variety of the latter, stating that *pallidifolius* differed in

having larger, glabrous, thick, more obtuse leaves which were "more or less penninerved when dry". In the field, the morphology of the leaves immediately distinguishes the two species. *Calothamnus pallidifolius* also differs from *C. planifolius* in having the branches (rhachis) usually more corky than in *C. planifolius*. The flowers, fruits and seeds of *C. pallidifolius* are identical to those of *C. planifolius*. Bentham (1867) also stated that the stamens of *C. planifolius* var. *pallidifolius* were "apparently greenish-yellow". In the material I have examined only the lower portion of the staminal claws are pale-coloured, the remainder being dark pink to crimson.

Bentham (1867) cited two syntypes of *C. planifolius* var. *pallidifolius*. I have only been able to see a duplicate of *Drummond* 2nd Coll. n. 72 in herb. NSW (NSW 144015). Since the specimen possesses flowers, fruits and leaves (the majority of material of *C. pallidifolius* available for study at present (1980) is without flowers), I have chosen this as lectotype.

15. **Calothamnus rupestris** Schauer, Regelia, Beaufortia & Caloth. 26 (1843); Schauer in Lehm., Pl. Preiss. 1:152 (1844); Benth., Fl. Austral. 3:179 (1867); J. Hooker, Bot. Mag. 59, t. 7906 (1903); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult., 8 (1970); Erickson, George, Marchant & Morecombe, Western Austral. Pl. (1973); Hawkeswood, Austral. Pl., 11:16, 17 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:153 (1980). *Type*: "Inter rupes quarzinas ad latera montium Darling-Range, Novembri m.a. 1839, legit cl. L. Preiss!" (Herb. Preiss. No. 211) (lecto, here designated: LD, Figure 14).

Figure 14. Lectotype of *Calothamnus rupestris* Schauer (LD).

Erect, compact or spreading, single- or multi-stemmed, much branched, mostly glabrous shrub to 1.5 mm high (sometimes a small tree to 3 m tall), with hard bark often splitting at the base of the trunks. Older branches usually with prominent leaf scars. Young branches with a few, sparse, microscopic hairs, becoming glabrous with age. *Leaves* crowded on younger branches, sessile, slender terete, (1.5-) 2-2.5 (-3.5) cm long, 0.5-1 mm wide, glabrous, mucronate, pungent, grey green to dark green, oil glands prominent. *Flowers* 1-10, scattered or arranged in dense ± unilateral clusters or in loose, ± cylindrical spikes, usually on portions of the stem from which the leaves have fallen. *Calyx tube* broadly campanulate, (4-) 6-7 (-8) mm long, densely pubescent; rhachis slightly dilated at base of calyx-tube; *calyx-lobes* almost equal, densely pubescent outside and inside, thick, but with thin, fimbriate margins; two opposite lobes larger, broadly deltoid, (3-) 4-5 (-6) mm long, 4-5 mm wide ± acute, slightly concave, erect to semi-erect; two smaller lobes narrow-deltoid, (3-) 4-5 mm long, (2-) 2.5-3 mm wide, ± acute, slightly concave, erect to slightly spreading. *Petals* broadly obovate, obtuse, (6.5-) 7-8 (-8.5) mm long, including a short claw 2-3 mm long, concave, glabrous, yellow-brown to orange-brown, papery, with broad, thin, scarious margins. *Staminal claws* ± equal, (25-)

30-35 (-40) mm long, (2-) 2.5-3.5 (-4) mm wide, glabrous, pink to dark pink; marginal filaments (20-) 22-26 (-28); *anthers* linear, 2-2.5 mm long, yellow-brown. *Style* slender (20-) 25-32 (-35) mm long, glabrous, stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ovoid, 15-22 mm long (including the thickened calyx-lobes), 11-15 mm wide, densely pubescent but becoming glabrous with age; two opposite lobes prominently thickened, reflexed; remaining two lobes thinner, sometimes wrinkled, deflexed, often wearing away with age. *Fertile* seeds numerous per capsule, linear, 2-2.5 mm long, 0.3-0.6 mm wide, usually truncate at one end, angular, glabrous; testa chocolate-brown. *Ovulodes* numerous per capsule, similar to fertile seeds, c. 2 mm long, yellow-brown.

Derivation of name. From the Latin *rupes*, meaning "rock or cliff", referring to the habitat of this species.

Habitat. Grows amongst rocks or in rocky, skeletal granitic soil in heath or semi-woodland, usually along watercourses with *Grevillea pinnatifida*, *Petrophile biloba*, *Dryandra nivea*, *Daviesia pectinata*, *Hibbertia hypericoides* and *Xanthorrhoea preissii* (Darling Range) and species of *Dryandra*, *Melaleuca* and *Casuarina* (Boyagin Rock). Flowers mostly from August to October.

Distribution. This species has a restricted distribution, the northern limit is in the Red Hill area (on road to Toodyay) north-east of Perth, along the Darling Scarp to the Gosnells area (east of Perth). A disjunct population occurs at Boyagin Rock (32°30' S, 116° 54' E) which is the most eastern and southern record for the species. Map 11.

Selected specimens examined. WESTERN AUSTRALIA: O'Brien Road, off 21 m.p. Toodyay Road, "on granite rocks in gravelly sand", 14 Sept. 1964, *R.A. Saffrey* 129 (2) (PERTH); O'Brien Road, ± 3 miles N of Toodyay Road, 1 Oct. 1963, *A.S. George* 5921 (PERTH); towards top of Red Hill, Toodyay Rd., 16 Aug. 1961, *A.S. George* 2660 (2) (PERTH); c. 16 km from Albany Highway turnoff on Brookton Road, 3 Dec. 1968, *H. Demarz* D833 (PERTH, KP); near Canning Dam, 16 Nov. 1977, *R. Tinetti* s.n. (UWA); Red Hill on Toodyay Rd., at Darling Scarp, 5 Sept. 1969, *K.R. Newbey* 2977 (PERTH); Gosnells, 1 Sept. 1957 (1), 2 Dec. 1957 (3), 5 Oct. 1958 (2), *McLachlan* s.n. (PERTH); Pages Way, Gosnells, 1 Sept. 1978, *R.J. Cranfield* 521C (2) (PERTH); Pages Way, Gosnells, 20 June 1979, *T.J. Hawkeswood & R.J. Cranfield* 1 (PERTH); Pages Way, Gosnells, Darling Range, 4 Aug. 1979, *T.J. Hawkeswood* 82 (3) (PERTH); Barrington Quarry, 11 Sept. 1979, *H. Demarz* D7471 (PERTH); Boyagin Rock (32°30'S, 116°54'E), 21 Oct. 1972, *E. Wittwer* W877 (PERTH, KP); Boyagin Rock, 28 July 1976, *M.E. Trudgen* 1690 (PERTH); Boyagin Rock, 1 May 1980, *T.J. Hawkeswood* s.n. (PERTH).

Total number of specimens examined. 26.

Comments. This is a rare but distinctive species related closely only to *C. graniticus* T.J. Hawkeswood (see comments under this species).

This species is commonly called "Mouse-ears" because the fruiting capsules bear thickened calyx-lobes (Figures 15, 16), of which the two thinner opposite ones are curled backwards and resemble the ears of a mouse. The fruit is usually covered in short, dense, silver hairs adding to this appearance (Figures 15, 16). Sometimes only one lobe becomes thickened (Figure 16); this rarely occurs in other *Calothamnus* species.

Bentham (1867) related *C. rupestris* to *C. villosus* R.Br. but there is no close relationship because *C. villosus* is a 5-merous species. Schauer (1843) and Schauer in Lehmann (1844)

noted that the marginal filaments of *C. rupestris* numbered less than 15, but the actual number varies considerably from 20-28; Schauer undoubtedly examined damaged material.

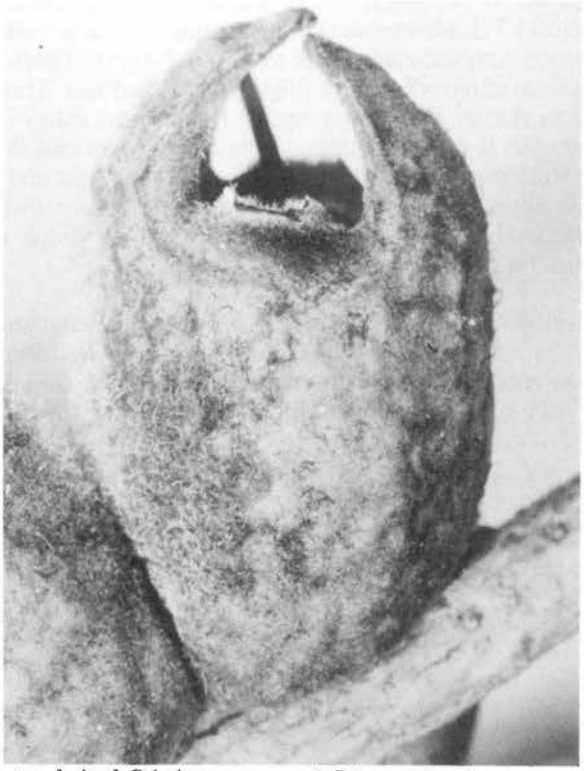

Figure 15. Close-up of mature fruit of *Calothamnus rupestris* Schauer, showing two opposite, thickened lobes and hairs wearing away with age.

The species is occasionally grown in Perth gardens but is generally not well known, due to its scarcity. It is probably the rarest species in the genus. In the Perth district it is threatened by urban development, quarrying and bauxite mining, fires and recreational pressures. A small population of about 30 plants occurs in the reserve at Boyagin Rock, but these plants must be considered to still be at some risk because of recreational pressures and fire. Recommendations for the conservation of this rare species have been provided by Leigh, Boden & Briggs (1984).

16. **Calothamnus graniticus** T.J. Hawkeswood, Nuytsia 5:127 (1984). *Type:* Little Meelup Beach, Cape Naturaliste area, 24 June 1979, *T.J. Hawkeswood* 110 (holo: PERTH; iso: CANB, MEL, NSW, PERTH).

Erect, single or multi-stemmed shrub to 2 m high. *Leaves* terete, mostly 4-8 cm long, 1-1.5 mm wide, shortly mucronate, pungent, glabrous or clothed with short white hairs. *Flowers* 2-25 in clusters or irregular spikes. *Petals* broadly ovate, mostly 6-7 mm long with a claw 5-7 mm long. *Staminal claws* 32-40 mm long, 3-5 mm wide, dark pink to crimson, marginal filaments mostly 20-22; *anthers* 2.5-3 mm long. *Fruit* almost ovoid, 15-22 mm long, 10-18 mm wide, smooth or slightly wrinkled. *Fertile seeds* 2-2.5 mm long, linear-cuneate, truncate, glabrous, testa dark brown. *Ovulodes* 1.5-2.5 mm long, linear to linear-cuneate, glabrous, light brown. For a more complete description of the species and its subspecies see Hawkeswood (1984a).

Distribution. Map 11; see also Hawkeswood (1984a).

During early 1984 Mr W.M. Molyneux of Victoria sent me specimens of *C. graniticus* ssp. *leptophyllus* (Benth.) T.J. Hawkeswood that he had collected from the Stirling Ranges. This collection represents a considerable range extension from the Dwellingup and Wellington Dam areas to which I stated (Hawkeswood 1984a) it was confined. This disjunct distribution is somewhat similar to that of the related species *C. rupestris* (Map 11). The conservation of subspecies *leptophyllus* is rather tenuous in the Dwellingup and Wellington Dam areas due to its small population sizes (less than 40 plants at each site) and the heavy industrial development in these areas. However, Mr Molyneux informs me (pers. comm. 1984) that the subspecies is common but locally distributed in the Stirling Range and its survival there seems assured at least for the short term.

The closest relative of *C. graniticus* is *C. rupestris* Schauer, but the two species can be clearly distinguished in leaf morphology and pubescence on the calyx-tube. The leaves of *C. graniticus* measure mostly 4-8 cm long, whereas those of *C. rupestris* are mostly 2-2.5 cm long. The calyx-tube of *C. rupestris* is densely pubescent, while that of *C. graniticus* is usually glabrous and verrucose.

Figure 16. Close-up of mature fruit of *Calothamnus rupestris* Schauer, showing one thickened lobe, (the small one is thin and will wear away with age), an unusual feature of *Calothamnus* fruit.

17. **Calothamnus asper** Turcz., Bull. Soc. Imp. Naturalistes Moscou 22: 25 (1849); Benth., Fl. Austral. 3: 180 (1867); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11:19 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:154 (1980). *Type*: *Drummond* 4th Coll. no. 60 (holo: KW, photograph seen, Figure 17; iso: LE, photograph seen, Figure 18).

Erect, single-trunked, much-branched, tall shrub mostly to 3.5 m high, branches often with leaf scars; trunks with thick bark often splitting at the base. Young shoots sparsely pilose. *Leaves* densely crowded at ends of branches, sessile, erect, broadly linear, attenuate towards

base, (1-) 1.2-1.8 (-2) cm long, 1.4-2 mm wide, scabrous, shortly and sparsely pilose especially on the margins, shortly acuminate but not pungent. *Flowers* 3-5 (-8) in short, sessile clusters, usually amongst leaves at ends of branches. *Calyx-tube* broadly campanulate, (4-) 5-6 (-7) mm long, verrucose, glabrous; *calyx lobes* ± equal, 2-2.5 mm long, broadly deltoid, obtuse, concave, glabrous outside and inside; margins thin, scarious, partially ciliate. *Petals* 5-6 (-7) mm long, elliptical, obtuse, concave, glabrous, deciduous; papery with thin scarious margins, brown. *Staminal claws* equal, 22-28 (-30) mm long, 2-2.5 (-3) mm wide, glabrous, blood-red; marginal filaments 27-30; *anthers* linear-oblong, 1-1.2 mm long, yellow brown. *Style* 20-25 mm long, glabrous; stigma small. *Fruit* ± ovoid to ellipsoid, 9-12 mm long, 8-10 mm wide, grey, rugose, two opposite lobes prominently thickened. *Fertile seeds* few per capsule, linear-cuneate, 1.5-2 mm long, glabrous, truncate at widest end, testa chocolate brown. *Ovulodes* numerous, linear-cuneate, 1.5-2 mm long, glabrous, truncate at widest end, brown.

Derivation of name. From the Latin *asper*, meaning "rough to the touch", referring to the scabrous leaves.

Habitat. Grows in red soil over laterite with *Melaleuca radula*, *Casuarina campestris* and *Hakea* spp., shrubland. Flowers September to March depending on climatic conditions of previous season.

Distribution. Presently only known from the Wongan Hills area (c. 30°49' S, 116°38' E) where it is locally common. Map 12.

Specimens examined. WESTERN AUSTRALIA: Wongan Hills (Monks Well Gully), 195 km NE of Perth, 3 Sept. 1975, *B.G. Muir* 509 (PERTH); Monks Well Gully, Wongan Hills (30°49' S, 116°38' E), 17 Feb. 1980, *T.J. Hawkeswood* 158, 159 (PERTH); 18.5 km NW of Wongan Hills towards Piawaning, (30°50' S, 116°39' E), 27 Aug. 1976, *R. Coveny* 7843 and *B.R. Maslin* (NSW); 6 miles from Wongan Hills, on Piawaning Rd., 3 Oct. 1972, *F. Lullfitz* L1655 (PERTH, KP).

Figure 17. Holotype of *Calothamnus asper* Turcz. (KW).

Total number of specimens examined. 6.

Comments. Bentham (1867) in his redescription of *C. asper* noted that the species was closely related to *C. quadrifidus* R.Br. but differed in the "foliage and in the large fruits". *Calothamnus asper* is certainly closely allied to *C. quadrifidus*, but several characters justify the retention of *C. asper* as a separate species. *Calothamnus asper* has flat, pilose leaves (especially pilose on the margins), mostly 1.2-1.8 mm long, 1.4-2 mm wide, the calyx-tube is broadly campanulate, mostly 5-6 mm long, glabrous, and the staminal claws have 27-30 marginal filaments. The fruit is 9-12 mm long, 8-10 mm wide and the testa of the fertile seeds is chocolate brown in colour. *Calothamnus quadrifidus* has slightly flattened to terete, pilose to hirsute leaves (sometimes glabrous), mostly 1.5-2 cm long, 0.8-1.5 mm wide; the calyx-tube is usually narrow campanulate, 3-4 mm long, glabrous or shortly pubescent; the staminal claws have mostly 18-20 marginal filaments. The fruit measures mostly 7-9 mm long and 7-8 mm wide, and the testa of the fertile seeds varies in colour from grey to light chocolate brown.

Kenneally (1977, p. 66) records *C. asper* in red soil at Monks Well Gully and Fowlers Gully. On the other hand, in the Wongan Hills area *C. quadrifidus* is recorded only from Mortlock Creek in the Mortlock Reserve (no. 23313) on yellow sand. My own observations there in 1980 verified that there was no overlap in distribution between the two species, and it seems probable that no gene flow occurs between them. *C. asper* is restricted to closed scrub with *Casuarina campestris*, *Melaleuca radula* and *Acacia acuminata* at Monks Well Gully (Kenneally 1977, p. 18) and on the alluvial gully floor with *Acacia ligustrina*, *Casuarina campestris*, *M. radula* and *Dodonaea* species (Kenneally 1977, p. 20). In the Mortlock Flora Reserve *C. quadrifidus* is restricted to shrubland with *Hakea*, *Acacia* and *Persoonia* species (Kenneally 1977, p. 16).

Calothamnus asper is also closely related to *C. homalophyllus* F. Muell., but differs in having leaves mostly 1.2-1.8 cm long, 1.4-2 cm wide, pilose on the margins, scabrous and densely crowded at the ends of branches, and the marginal filaments on the staminal claws number 27-30. In *C. homalophyllus*, the leaves are mostly 2.8-5 cm long, 3.5-10 mm wide, glabrous, smooth, coriaceous, scattered while the marginal filaments number 20-25.

Calothamnus asper, while protected in the Wongan Hills area, would still seem to be under threat from fires and drought. The populations should be monitored for any decline due to these factors.

18. **Calothamnus pinifolius** F. Muell., Fragm. 3:153 (1862); Benth., Fl. Austral. 3:179; (1867); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11:16-19 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:153 (1980). *Type*: "In locis saxosis aridis montium juxta rivum Phillips River. Maxw." (holo: MEL, Figure 19).

Erect, much-branched, prickly shrub to 2 m high. Young shoots pilose; stems and leaves often becoming glabrous with age, mature leaves often pilose on lower half. *Leaves* densely crowded, sessile, slender, terete, (1.2-) 1.8-2.5 (-3) cm long, 1-1.4 mm wide, mucronate, pungent, dark green, glabrous or pilose. *Flowers* in a short, cylindrical (sometimes ± unilateral) spike of 5-20 flowers, almost hidden by dense foliage. *Calyx-tube* ± campanulate, tapering somewhat at base, densely pubescent, 4-5 mm long, rhachis slightly dilate at base; *calyx-lobes* almost equal, two opposite lobes slightly larger than other two, narrow deltoid, acute, slightly concave, 3-4.5 mm long, densely pubescent outside, shortly pubescent inside. *Petals* narrow obovate, concave, obtuse, 2.5-3 (-3.5) mm long, glabrous, papery with thin, scarious, often partially ciliate margins, pale brown. *Staminal claws* ± equal, 20-25 mm long 1-1.4 mm wide, glabrous,

crimson; marginal filaments 12-15; *anthers* oblong, 1-1.4 mm long, dark brown to black. *Style* 14-25 mm long, thick, tapering towards stigma, glabrous; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, ovoid to almost globular, 7-12 mm long (including thickened lobes), 7-10 mm wide; two opposite lobes thickened, acute, persistent; two remaining lobes present on young fruit but wearing away with age. *Fertile seeds* few per capsule, linear-oblong, 1.2-1.5 mm long, glabrous, angular, often obliquely truncate at one end, testa dark buff-brown. *Ovulodes* many to numerous per capsule, oblong-clavate, 1.2-1.5 mm long, glabrous, angular, usually obliquely truncate at wider end, yellow to dark yellow-brown.

Derivation of name. From the Latin *pinus*, meaning "pine" and *folium*, meaning "leaf", referring to the pungent leaves of this species which, however, more resemble those of *Cedrus*.

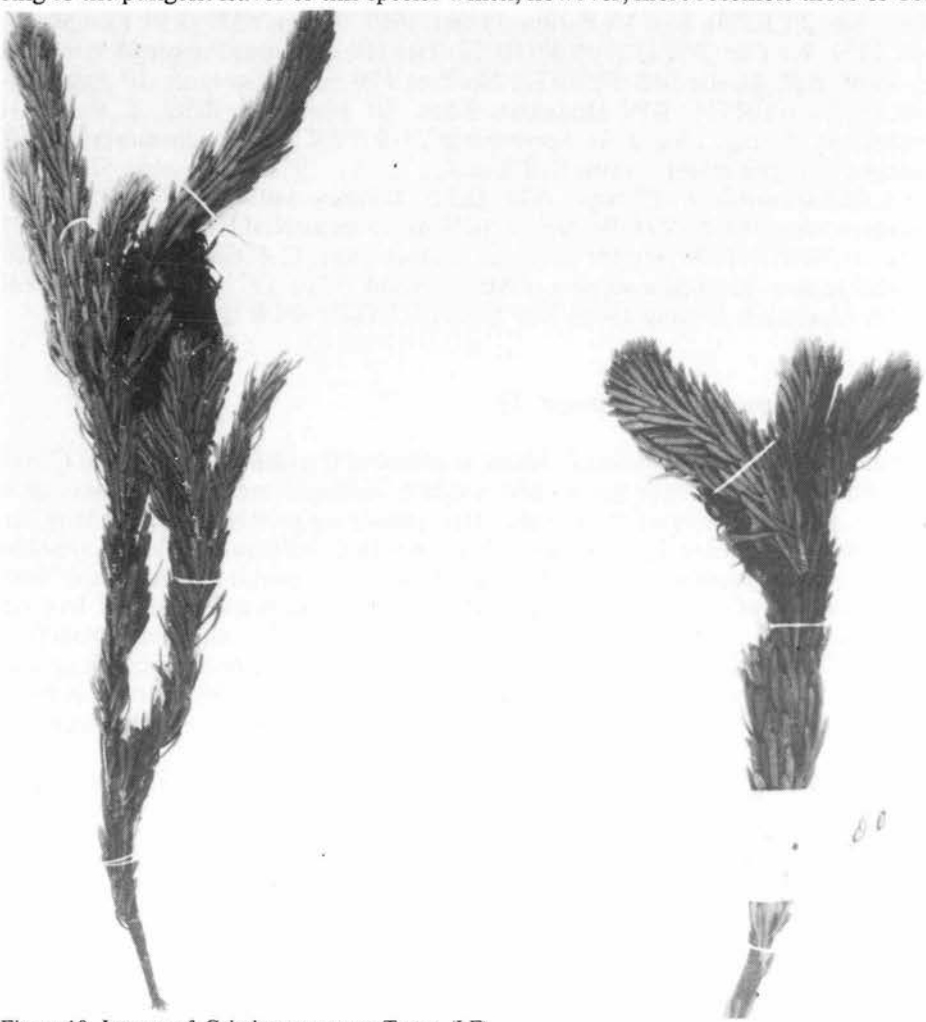

Figure 18. Isotype of *Calothamnus asper* Turcz. (LF).

Habitat. Grows in coastal sandplain mallee-heath vegetation in quartzite soil with species of *Banksia*, *Hakea*, *Acacia*, *Eucalyptus* etc. Flowers mostly from August to October but occasionally to December.

Distribution. From the Mt Barren Range near Qualup (34°15' S, 119°25' E) to the Mt Desmond-Ravensthorpe area (c. 33°40' S, 120°03' E). Map 12.

Specimens examined. WESTERN AUSTRALIA: 0.25 miles N of Qualup Homestead, 13 June 1969, *H. Demarz* D1109 (PERTH, KP); Hill behind Qualup Homestead, 28 Nov. 1960, *A.S. George* 1755 (PERTH); Hill behind Elverdton Coppermine, 12 Sept. 1959, *A.S. George* 293 (2) (PERTH); West Mt Barren, 29 Nov. 1960, *A.S. George* 1800 (PERTH); Fitzgerald Reserve, summit of Woolberup Range, 4 Aug. 1970, *K.M. Allan* 341 (PERTH); Thumb Peak Range, 31 Oct. 1965, *A.S. George* 7158 (PERTH); Middle Mt Barren, south of Ravensthorpe, Sept. 1925, *C.A. Gardner* and *W.E. Blackall* s.n. (PERTH); Middle Mt Barren, Nov. 1931, *C.A. Gardner* and *W.E. Blackall* s.n. (PERTH); Whoogarup Range, Hamersley River, 28 Nov. 1931, *C.A. Gardner* 2975 (2) (PERTH); East Mt Barren, Aug. 1924, *A. Johnson* 850a (PERTH); foot of East Mt Barren, 31 Oct. 1962, *J.S. Beard* 2194 (PERTH, KP); E of Barrens, 11 Oct. 1967, *A.R. Fairall* 2384 (PERTH, KP); East Mt Barren Range, 23 Sept. 1925, *C.A. Gardner* 1889 (PERTH); East Mt Barren, 11 Oct. 1967, *Young* Y289 (KP); East Mt Barren, 17 Nov. 1979, *R.J. Cranfield* 1324 (PERTH); No Tree Hill area, near Fitzgerald River Reserve, 2 Oct. 1970, *B.R. Maslin* 963 (PERTH); No Tree Hill near Hopetoun, 20 Aug. 1964, *F. Lullfitz* L3534 (PERTH, KP); Hopetoun Road, off Esperance Road, c. 9 miles E of Ravensthorpe, 30 Aug. 1968, *E.M. Scrymgeour* 2410 (PERTH); Ravensthorpe, Dec. 1929, *H. Steedman* s.n. (PERTH); 2 miles S of Kundip, 21 Oct. 1962, *K. Newbey* 571 (PERTH); 25 km S of Ravensthrope, 12 Nov. 1974, *D.J.E. Whibley* 5401 (PERTH); 15 miles N of Hopetoun, 13 Aug. 1951, *N.H. Brittan* s.n. (UWA); 15 miles N of Hopetoun, 13 Aug. 1951; *R.D. Royce* 3670 (2) (PERTH); Mt Desmond, 20 Oct. 1961, *C.A. Gardner* 13700 (PERTH); Ravensthorpe area, just below summit of Mt Desmond, 9 Jan. 1979, *Barnsley* 465 (PERTH, CBG); Mt Desmond, 19 July 1979, *R.J. Hnatiuk* 790022 (PERTH).

Total number of specimens examined. 33.

Comments. Calothamnus pinifolius F. Muell. is related to *C. validus* S. Moore and *C. robustus* Schauer but it is a distinctive species and is clearly distinguished by the densely crowded, mucronate, pungent leaves on most of the plant, measuring mostly 1.8-2.5 cm long, and the staminal claws which have 12-15 marginal filaments. In *C. robustus*, the leaves are obliquely acuminate, shortly mucronate but not pungent, and are crowded at the ends of branches only; the leaves are mostly 1.3-1.5 cm long and marginal filaments number 18-20. In *C validus*, the leaves are mostly 2-2.8 cm long, shortly mucronate and slightly pungent; marginal filaments number 12-20. In these characters, *C. validus* is perhaps intermediate between the two species. *C. pinifolius* can be clearly distinguished in the field from *C. validus* by the smaller fruit (7-12 mm long) (12-15 mm long in *C. validus*) and the pungent, densely crowded leaves.

The conservation of *C. pinifolius* in the Fitzgerald River National Park seems assured at this stage, but fires may be a constant threat. The populations outside the National Park are threatened due to clearing for agricultural purposes. It is recommended that populations of *C. pinifolius* are monitored in the face of decline.

19. **Calothamnus robustus** Schauer, Regelia, Beaufortia & Caloth. 26 (1843); Schauer in Lehm., Pl. Preiss. 1:152 (1844); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11:18, 20 (1980). *Type:* "Habitat in Australia meridionali-occidentali. In glareosis sterilibus ad radices collium Konkoberup promontorii Cape-Riche, Novembri a. 1840 defloratam legit cl. Preiss! (v.s. cult. ex Horto Berol.)" (Herb. Preiss. no. 213) (lecto, here designated: LD Figure 20).

Calothamnus knightii Hort. ex Schauer, Regelia, Beaufortia & Caloth. 27 (1843). No type designated.

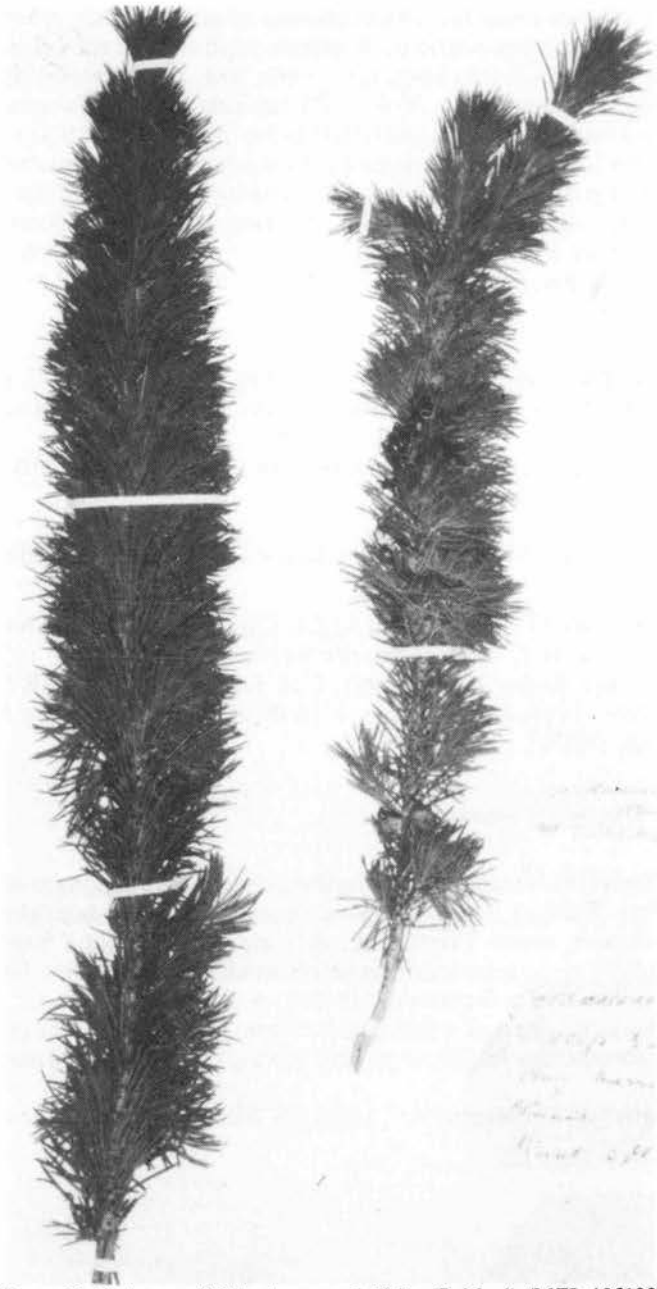

Figure 19. Holotype of *Calothamnus pinifolius* F. Muell. (MEL 105199).

Erect, much-branched, small, compact shrub to 0.8 m high; branches with prominent leaf scars. Young shoots densely pubescent; older stems and mature leaves glabrous. *Leaves* crowded at the ends of branches, sessile, slender, terete, rigid, mostly perpendicular or almost so to the stems, (1) 1.3-1.5 (1.8) cm long, c. 1 mm wide, glabrous, obliquely acuminate, shortly mucronate but not pungent, pale green. *Flowers* 2-8 in a tight or loose cluster amongst leaves or on portions of stems from which the leaves have fallen. *Calyx tube* shortly campanulate, c. 3 mm long, densely pubescent; rhachis slightly dilated at base; *lobes* narrow deltoid, acute, slightly concave, erect, 2.5-3 mm long, densely pubescent outside and within; two opposite

slightly larger than the remaining two. *Petals* obovate, concave, obtuse, 4-5 mm long, glabrous, orange-brown, papery, margins scarious, oil glands prominent in the centre. *Staminal claws* ± equal, free, glabrous, 25-28 mm long, 1.2-1.5 mm wide, dark crimson; marginal filaments 18-20; *anthers* linear, c. 1.5 mm long. *Style* 12-20 mm long, slender, glabrous, crimson; stigma small. *Fruit* almost ovoid but rounded and widest in the middle, sessile, 9-11 mm long (including thickened calyx lobes), 8-10 mm wide, pubescent but becoming glabrous with age; two larger lobes thickened on top of fruit, remaining two breaking off with age; style often persistent. *Fertile seeds* few per capsule, linear, 1.5-1.8 mm long, glabrous, variously angular, angles smooth or sharp; testa dark brown. *Ovulodes* few to many per capsule, linear to linear-subulate, 1.5-1.8 mm long, glabrous, yellow-brown, often obliquely truncate at wider end, variously angular, angles sharp.

Derivation of name. From the Latin *robustus*, meaning "strong", "robust", probably referring to the growth form of this species or perhaps to the branches and leaves.

Habitat. Grows on rocky quartzite or granitic soils in heath lands. Only locally common. Flowers October to November.

Distribution. Confined to the Cape Riche area (34°36' S, 118°47' E). Map 12.

Specimens examined. WESTERN AUSTRALIA: Cape Riche, on coast NE of Albany, Oct. 1928, *C.A. Gardner* and *W.E. Blackall* s.n. (PERTH); Cape Riche, Oct. 1928, *C.A. Gardner* s.n. (2) (PERTH); Cape Riche, 27 Oct. 1961, *C.A. Gardner* 13806 (PERTH); Mt Melville, (Cape Riche), 22 Nov. 1964, *K.R. Newbey* 1716 (PERTH); district West Plantagenet, July 1901, *E. Pritzel* s.n. (NSW).

Total number of specimens examined. 7.

Comments. Bentham (1867) included *C. robustus* Schauer, as a synonym of *C. villosus* R.Br. stating (p. 178) that "Schauer appears to have examined a flower accidentally 4-merous, in the specimen of Preiss's, which I have seen, they are mostly at least 5-merous". However, Schauer (1843) did not make an error in his determination of the species. Bentham may have examined damaged material or incorrectly labelled specimens of *C. villosus*. Apart from being 4-merous, *C. robustus* can be easily distinguished from *C. villosus* by the characteristic short leaves, mostly perpendicular to the stems and having obliquely acuminate tips.

The closest relative of *C. robustus* is *C. validus* S. Moore; for a comparison, see comments under the latter.

Figure 20. Lectotype of *Calothamnus robustus* Schauer (LD).

The ecology and conservation status of *C. robustus* is unknown. Its survival at this stage seems assured in the Cape Riche National Park. However, further collections and observations on its ecology and distribution are needed.

20. **Calothamnus validus** S. Moore, J. Linn. Soc. Bot. 14: 205, fig. 11C (1921); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 84 (1970); Ferguson, Bot. Mag. t. 614 (1972); Erickson, George, Marchant & Morcombe, Flowers & Pl. of Western Austral. 182, pl. 260 (1973); Hawkeswood, Austral. Pl. 11:20, fig. 3e (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. 154 (1980). *Type*: "W. Australia, in a rocky creek near West Mt Barren; Maxwell" (holo: BM, photograph seen, Figure 21).

Erect, rigid, much-branched, mostly glabrous shrub to 2 m high; branches with prominent leaf-scars. Young shoots glabrous or minutely and sparsely pubescent; branches becoming glabrous with age. *Leaves* crowded at the ends of branches, usually erect, slender, terete, sessile, rigid, pale green, (1.5-) 2-2.8 (-3.5) cm long, 0.5-1 mm wide, shortly mucronate, slightly pungent; oil glands prominent. *Flowers* 3-6 (mostly 3) together in a short, sessile cluster (often unilateral) amongst leaves. *Calyx-tube* campanulate, (3-) 4-7 mm long, verrucose, glabrous or finely pubescent, the base slightly immersed in the rhachis; *lobes* more or less equal, deltoid-oblong, obtuse, erect, slightly concave, 3-4 (-5) mm long, slightly concave, glabrous outside, finely pubescent within; margins narrow, scarious, ciliate. *Petals* obovate-elliptical, obtuse, concave, 4-5 mm long, with a short claw 2-3 mm long, glabrous, papery, yellow-brown; oil glands prominent. *Staminal claws* ± equal, (22-) 25-32 mm long, (1.5-) 2-3 mm wide, glabrous, rich crimson, orange-red or orange at the base; marginal filaments 12-20; *anthers* linear to linear-oblong, c. 2 mm long, dark brown. *Style* slender, glabrous, (12-) 20-25 mm long, red, becoming colourless at base; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, almost globular to nearly ovoid, 12-15 mm long, (including persistent lobes), 10-13 mm wide, reddish-brown, at first 4-lobed , later becoming grey, woody, wrinkled, with two persistent lobes; style often persistent. *Fertile seeds* numerous per capsule, linear-oblong (sometimes linear-cuneate), glabrous, 2-2.5 mm long, truncate (often obliquely so), angles rounded or sharp; testa thin, chocolate-brown. *Ovulodes* numerous per capsule, linear, sometimes linear-cuneate, c. 2 mm long, glabrous, truncate, yellow-brown, somewhat shiny, angles sharp.

Derivation of name. From the Latin *validus*, meaning "strong, stout", referring to the habit of this species.

Habitat. Grows in rocky quartzite hills in heath. Flowers July to October.

Distribution. Confined to the Mt Barren Range in the Fitzgerald River National Park and neighbouring areas. Map 13.

Specimens examined. WESTERN AUSTRALIA: East Mt Barren, 18 Sept, 1925, *C.A. Gardner* 1801 (PERTH); East Mt Barren, Sept 1925, *C.A. Gardner* & *W.E. Blackall* s.n. (2) (PERTH); Rocky terrace on south side of East Mt Barren, 1 Oct. 1970, *B.R. Maslin* 910 (PERTH); Between Hamersley River and East Mt Barren, 30 Sept. 1970, *B.R. Maslin* 901 (PERTH); Fitzgerald River National Park, 23 Oct. 1970, *R.D. Royce* 9271 (PERTH); N end of Thumb Peak Range, 31 Oct. 1965, *A.S. George* 7109 (PERTH); Middle Mt Barren, (34°03' S, 119°41' E), 16 July 1970, *A.S. George* s.n. (PERTH); Summit of West Mt Barren, 28 Oct. 1965, *A.S. George* 6973 (PERTH); West Mt Barren, 29 Nov. 1960, *A.S. George* 1796 (PERTH); Slopes of Mt Barren, (undated), *N.H. Speck* s.n. (UWA).

Figure 21. Holotype of *Calothamnus validus* S. Moore (BM).

Total number of specimens examined. 12.

Comments. This species is most closely related to *C. robustus* Schauer but can be readily separated from the latter by usually having a glabrous or sometimes finely pubescent calyx-tube. In *C. robustus* the calyx-tube is densely pubescent. The leaves of *C. robustus* are almost

invariably held perpendicular to the stem and usually have an oblique acuminate tip whereas the leaves of *C. validus* are usually held more or less erect to semi-erect. The fruit of *C. validus* is also larger (12-15 mm long, 10-13 mm wide) than those of *C. robustus* (9-11 mm long, 8-10 mm wide). The geographic ranges of the two species do not overlap, *C. robustus* is presently only known from Cape Riche.

The survival of *C. validus* in the Fitzgerald River National Park seems assured at this stage, but the populations of the species should be monitored for the effects of fires and disturbances through tourist development.

21. **Calothamnus homalophyllus** F. Muell., Fragm. 3:111 (1862); Benth., Fl. Austral. 3: 180 (1867); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Fairall, Western Austral. Native Pl. in Cult. 8 (1970); Erickson, George, Marchant & Morecombe, Western Austral. Pl. (1973); Hawkeswood, Austral. Pl. 11: 8,9,20,21 (1980); Blackall & Grieve, How to Know Western Austral. Pl. ed.2, 3A:155 (1980). *Type*: "In eremis flumen Murchison versus, nec non prope sinum litoralem Champion Bay. Walcott et Oldfield" (holo: MEL, Figure 22).

Calothamnus quadrifidus R.Br. var. *homalophyllus* Blackall, How to Know Western Austral. Wildfl. 306 (1954), nom. inval.

Erect, compact or straggly, glabrous shrub to 1.5 m high, with smooth, pale bark, often splitting at the base on older trunks. Young leaves and shoots usually densely pilose, becoming glabrous with age. *Leaves* scattered or crowded on younger branches, sessile, flat, narrow oblanceolate, (2-) 2.8-5 (-6) cm long, (3.5-) 5-10 (-14) mm wide, glabrous, coriaceous, narrowed into a prominent, short, acute apex, oil glands and veins usually obscure on live leaves, often prominent on dried material. *Flowers* 2-4 in short clusters on portions of stems from which the leaves have fallen or more frequently in loose interrupted or continuous, ± unilateral spikes 4-7 cm long containing 10-30 flowers. *Calyx-tube* broadly campanulate to almost cylindrical, (2.5-) 3-3.5 (-4) mm long, mostly glabrous, sometimes shortly and finely pubescent on lower half, prominently verrucose; rhachis slightly dilated at base; *calyx-lobes* short, erect, deltoid to narrow deltoid, (0.5-) 1-1.5 (-1.8) mm long, acute to obtuse, slightly concave, glabrous outside and inside, margins thin, somewhat scarious, partially ciliate. *Petals* obovate-oblong, obtuse, concave, (3.5-) 4-5 (-5.5) mm long, deciduous, papery with thin, scarious margins, pink to orange-brown. *Staminal* claws ± equal, 20-32 mm long, (1-) 1.5-2 (-2.5) mm wide, glabrous, crimson to blood-red; marginal filaments 20-25; *anthers* linear-oblong, (0.5-) 0.8-1 mm long, dark brown. *Style* slender, glabrous, (15-) 20-25 (-35) mm long, orange-red; stigma small. Summit of *ovary* densely pubescent. *Fruit* sessile, almost globular, bumpy, 8-10 mm long, 8-9 mm wide, usually densely crowded on stem; two opposite lobes prominently thickened at apex; remaining two lobes thin, occasionally persistent, usually wearing away with age; orifice c. 2 mm wide. *Fertile seeds* few to many per capsule, linear-oblong, 1.5-2 mm long, glabrous, angular, angles rounded; testa light grey-brown. *Ovulodes* many to numerous per capsule, linear-cuneate, c. 2 mm long, glabrous, usually obliquely truncate at one end, shiny, angular, light yellow-brown.

Derivation of name. From the Greek *homalos*, "level", "even", and *phyllon*, "a leaf", referring to the flat, smooth, coriaceous leaves of the species.

Habitat: Grows in white or yellow-brown sandy soil in low heath in association with species of *Acacia*, *Melaleuca*, *Banksia*, *Hibbertia*, *Beaufortia* etc. Flowers mostly from August to October.

Distribution. From the Kalbarri National Park (27°42' S, 114°10' E) to Mullewa, east of Geraldton (29°40' S, 115°15' E). (Map 13).

Figure 22. Holotype of *Calothamnus homalophyllus* F. Muell. (MEL 105185).

The specimen labelled "South of Hamelin", probably represents the most northerly occurrence of the species. Likewise, the specimen labelled "Between Arrino and Dongara" appears to represent the most southerly record. However neither record provides precise locality.

Selected specimens examined. WESTERN AUSTRALIA: South of Hamelin (Homestead?), 24 Sept. 1953, *N.H. Speck* s.n. (UWA); 255 miles S of Carnarvon, 5 Aug. 1967, *I. Olsen* 586 (NSW); 35 miles N of Galena on Carnarvon Road, 15 Sept. 1940, *W.E. Blackall* 4710 (PERTH); Red Bluff, Kalbarri National Park, 18 Sept. 1968, *M.E. Phillips* CBG 036050 (NSW); Red Bluff, 27 Sept. 1962, *J.S. Beard* 2023 (PERTH, KP); Ross Graham Lookout, Kalbarri National Park, 8 May 1968, *P.G. Wilson* 6635 (PERTH); Kalbarri, 8 Oct. 1972, *J.N. Hutchinson* 186 (PERTH); Murchison River mouth, 27 Sept. 1962, *J.S. Beard* 2071, 2072 (PERTH, KP); Kalbarri National Park, 4 Aug. 1979, *M. Peterson* s.n. (PERTH); Pot Alley Gorge, 5 miles S of Kalbarri, Oct. 1963, *W. Rogerson* 7 (PERTH); 0.5 miles from Kalbarri, 3 Sept. 1963, *A.R. Fairall* 1177 (KP); 5 miles inland from Murchison River, 27 Sept. 1962, *M.E. Phillips* CBG 022736 (NSW); Murchison River, 18 Sept. 1968, *M.E. Phillips* CBG 027255 (BRI); Murchison River, 31 Aug. 1966, *A.C. Burns* 1027 (PERTH); Murchison River gorge, ± 15 miles W of Ajana, 13 May 1961, *A.S. George* 2376 (PERTH); 25 miles

above Murchison River mouth, 27 Sept. 1972, *J.S. Beard* 2057 (PERTH, KP); Murchison River, 6 Sept. 1949, *N.H. Speck* s.n. (2)(PERTH); Murchison River, Sept. 1948, *D.L. Serventy* s.n. (PERTH); 0.25 miles S of Murchison River gorge, 7 Sept. 1966, *R. Filson* 8646 (PERTH); Murchison River 21 Aug. 1961, *C.A. Gardner* 13260 (PERTH); Ajana, Sept. 1960, *C.A. Gardner* 12814 (2)(PERTH); 12 miles NW of Northampton, 6 April 1975, *J.S. Beard* 7386 (PERTH); Northampton, Oct. 1909, *J.H. Maiden* NSW 143985 (NSW); Northampton, Sept. 1928, *C.A. Gardner* s.n. (2)(PERTH); Northampton, 14 Nov. 1959, *L. Steenholm* and *F. Lullfitz* s.n. (PERTH); Oakajee Reserve (12 miles N of Geraldton), 13 Oct. 1972, *R. Edmiston* E287 (PERTH); 12.9 miles from Geraldton, 21 Sept. 1968, *E.M. Canning* CBG 027367 (NSW); Geraldton, Jan. 1951, *H.C. Cheeshough* NSW 143988 (NSW); Utakarra, 3 miles E of Geraldton on Geraldton-Mullewa Road, 26 Aug. 1970, *R. Coveny* 3033 (PERTH, NSW); 10 miles NE of Geraldton, 8 Sept. 1962, *F.W. Went* 67 (PERTH); 30 miles E of Geraldton, 1 Aug. 1960, *J. Long* 41 (PERTH); Geraldton, Sept. 1903, *M.V. Fitzgerald* s.n. (PERTH); 37 miles Geraldton-Mullewa road, 3 Oct. 1966, *E.M. Scrymgeour* 1507 (PERTH); between Geraldton and Mullewa, 23 Sept. 1932, *W.E. Blackall* 2750 (2)(PERTH); between Arrino and Dongara, 15 Sept. 1932, *W.E. Blackall* 2622 (PERTH).

Total number of specimens examined. 62.

Comments. This species is closely related to *C. asper* Turcz. and *C. quadrifidus* R.Br. For comparisons of *C. homalophyllus* with these see comments under the respective species.

Calothamnus homalophyllus is a variable species in the shape of the leaves, height and in the number of flowers per inflorescence. It may hybridize with *C. quadrifidus* in the Geraldton area forming intermediates between the two species.

The survival of this species seems assured since most of the populations are situated within the Kalbarri National Park. However, it appears to have suffered considerable range restriction due to land clearing for agriculture in the Geraldton, Mullewa and Ajana areas.

Figure 23. Syntype of *Calothamnus quadrifidus* R.Br. (BM).

22. **Calothamnus quadrifidus** R.Br. in Sims, Bot. Mag. t. 1506 (Nov. 1812); R.Br. in W.T. Aiton, Hort. Kew. ed.2, 4:418 (Dec. 1812); Reichb., Icon et Descr. Pl. T. 9 (1822); G. Lodd., Bot. Cab. t.737 (1823); DC., Prod. 3:211 (1828); Schauer, Regelia, Beaufortia & Caloth. 29 (1843); Schauer in Lehmann, Pl. Preiss. 1:153 (1844); Benth., Fl. Austral. 3:179 (1867); F. Muell., Fragm. 10:31 (1876); Diels & Pritzel, Bot. Jahrb. 35:433 (1904); Blackall, How to Know Western Austral. Wildfl. 306 (1954); Beard, Descr. Cat. Western Austral. Pl. 72 (1967); Hawkeswood, Austral. Pl. 11:5,21,22 (1980); Blackall & Grieve, How to Know Western Austral. Wildfl. ed.2, 3A:154 (1980). *Calothamnus quadrifidus* f. *normalis* Benth.,Fl. Austral. 3:180 (1867), nom. illeg. *Type*: Lucky Bay, *Robert Brown* (syn: BM, photograph seen, Figure 23; isosyn.: NSW, Figure 24).

Calothamnus laevigata Schauer, Regelia, Beaufortia & Caloth. 31 (1843); Schauer in Lehm., Pl. Preiss. 1: 153 (1844). *Type*: "In Australia meridionali-occidentali, inter Sinum Regis Georgii et vicum Perth, Februario 1840 (Herb. Preiss. No. 215)" (lecto, here designated: LD).

Calothamnus purpurea Endl. in Endl. et al., Enum. Pl. Hueg. 48 (1837). *Type*: "In collibus littoris prope Freemantle/Swan-River (Huegel)" (holo: W, photograph seen, Figure 25).

Calothamnus clavata Mackay ex Schauer, Regelia, Beaufortia & Caloth. 28 (1843); Schauer in Lehm., Pl. Preiss. 1:152 (1844); G. Lodd., Bot. Cab. t. 1447 (1829), without analysis. *Type*: "In solo sublimoso ad ripam fl. Avon, prope praedium rusticum cl. Whitfield, Martio 1840, fructifera. Fructiferan legit cl. Preiss! Florentum, a cl. I. Drummond missam, vidi in Herb. Caes. Vindob. (v.v. cult.)" (lecto, here designated: Preiss 210, LD).

Billotia acerosa Colla, Hort. Ripul. 20, t. 23 (1824). *Calothamnus quadrifidus* f. *acerosus* Benth. Fl. Austral. 3:180 (1867). *Type*: Cult. Rivoli, n.v.

Calothamnus quadrifidus f. *obtusus* Benth., Fl. Austral. 3:179 (1867). *Type:* Murchison River, *Oldfield*. (holo: ? K, n.v.).

Calothamnus quadrifidus var. *hirsutus* Regel, Index Sem. quae Hort. Bot. Imp. Petro. 39 (1856). *Type*: not cited.

Erect, compact or spreading, multi-stemmed, much-branched, usually pilose shrub to 2.5 m high. Young shoots usually pilose. *Leaves* erect or spreading, densely crowded, sessile, linear, flat to almost terete, (1-) 1.5-2 (-3.5) cm long, 0.8-1.5 mm wide, shortly acuminate but not pungent, sometimes glabrous but usually sparsely pilose to hirsute, dark or light green; oil glands prominent and randomly distributed. *Flowers* mostly in dense unilateral spikes 2-8 cm long (sometimes 3-10 flowers in a dense cluster), amongst leaves or on portions of branches from which leaves have fallen. *Calyx-tube* narrow campanulate, (2.5-) 3-4 (-5) mm long, usually glabrous or sometimes finely pubescent, especially at the base, verrucose; *calyx-lobes* ± equal (or sometimes two opposite ones larger), deltoid, acute to obtuse, 1-2 mm long, erect or spreading, verrucose and usually glabrous outside, smooth and glabrous within; margins thin, scarious, often partially ciliate. *Petals* obovate-elliptical, broadly elliptical or elliptical, 3-5 (-6.5) mm long, deciduous, glabrous, pink-green to pale brown, papery, margins thin, scarious; oil glands prominent in centre. *Staminal claws* ± equal, (20-) 25-30 (-35)mm long, 1-1.5 mm wide, glabrous, scarlet; marginal filaments (17-) 18-20 (-22); *anthers* oblong to linear-oblong, 0.7-1 mm long, yellow, yellow-brown or dark brown. *Style* 20-35 mm long, slender, glabrous, scarlet becoming pale yellow-green at base; stigma small. *Fruit* sessile, almost ovoid, 7-9 mm long, 7-8 mm wide (widest in the centre), usually smooth or with wide, smooth undulations; two opposite lobes persistent and prominently thickened at apex; orifice 1.5-2.5 mm wide. *Fertile seeds* few per capsule, linear to linear-cuneate, 1.2-1.5 mm long, angular, truncate, glabrous; testa grey to light chocolate brown. *Ovulodes* numerous, linear to linear-cuneate, 1-1.5 mm long, angular, truncate, dark orange-brown.

Figure 24. Isosyntype of *Calothamnus quadrifidus* R.Br. (NSW 144091).

Derivation of name. From the Latin *quadrifidus*, meaning "split into four parts". R. Brown described two other species (viz. *C. villosus* and *C. gracilis*) both being 5-merous, hence the name of *quadrifidus* for the only 4-merous, actinomorphic species known at the time (*C. sanguineus* was known, but its flowers are zygomorphic).

Habitat. Grows in a wide variety of habitats from coastal sandplain heaths in sand, lateritic soils amongst rocks, mallee-heathlands in sand over laterite and occasionally in jarrah forests

in gravelly lateritic soil. Usually a dominant species in all these habitats. Flowers mostly from August to October.

Distribution. From Shark Bay (25°45' S, 113°35' E) down the western coast to just south of Perth, inland throughout the wheatbelt, then south to Albany and east to Cape Arid (33°30' S, 123°55' E). Appears to be absent from the deep south-west of Western Australia. Map 14.

Selected specimens examined. WESTERN AUSTRALIA: Peron Peninsula, 27 Aug. 1931, *C.A. Gardner* 2553 (PERTH); 5 miles E of Tamala Homestead, 23 Aug. 1979, *M. Peterson* s.n. (PERTH); 25 miles S of Shark Bay, 27 Aug. 1931, *W.E. Blackall* 551 (PERTH); 22 miles (35.2 km) W of Hamelin Homestead, (26°35' S, 113°55' E), 17 April 1979, *T.J. Hawkeswood* 57, 57a, 58, (PERTH); Tamala Road, on Nanga Station, Shark Bay, 26 Aug. 1973, *E.C. Nelson* ANU 17300 (PERTH); 46 and 60 miles S of Billabong Roadhouse, off North West Coastal Highway, 17 April 1979, *T.J. Hawkeswood* 33, 34 (PERTH); Dewar Creek, Badgingarra, 8 Oct. 1977, *J. Dodd* s.n. (UWA); between Moora and Watheroo, 13 Sept. 1932, *W.C. Blackall* 2549 (PERTH); E of Mingenew, 21 Sept. 1904, *A. Morrison* s.n. (PERTH); Wongan Hills Research Station, 3 Oct. 1962, *F.J. Lullfitz* L1641 (PERTH); between Arrino and Dongara, 15 Sept. 1932, *W.E. Blackall* 2622 (PERTH); Watheroo, 4 Nov. 1954, *R.D. Royce* 4939 (PERTH); c. 8 km W of Lake Indoon, 4 Aug. 1976, *R.J. Hnatiuk* 760224 (PERTH); Watheroo National Park, 7 Oct. 1971, *R.D. Royce* 9689 (PERTH); Moore River State Forest, 22 Sept. 1965, *J.J. Havel* 114 (PERTH); Mingenew, 20 Aug. 1977, *B. Jack* 2 (PERTH); 50 miles N of Moora, 6 Sept. 1962, *F.W. Went* 207 (PERTH); N of Wanneroo, 16 Oct. 1962, *F.G. Smith* 1583 (PERTH); Gingin-Lancelin Road, 1 Dec. 1974, *A.E. Orchard* 4270 (PERTH); Coomallo Creek, 19 April 1979, *T.J. Hawkeswood* 1,2,3,4,5,6 (PERTH); 1 km N of Badgingarra by Hill River, 1 Nov. 1965, *P.G. Wilson* 3788 (PERTH); 1 mile N of Eneabba, 19 Aug. 1971, *H. Demarz* 3390 (PERTH); 16 miles W of Winchester on road to Eneabba, 30 Sept. 1966, *E.M. Bennett* 1397 (PERTH); 6 miles N of Three Springs, 3 Sept. 1966, *R. Filson* 8509 (PERTH); Yanchep National Park, 18 Nov. 1963, *A.M. James* 92 (PERTH); W of Wanneroo, 28 Aug. 1961, *T.E.H. Aplin* 939 (PERTH); Mt Misery-Dandaragan, 22 Sept. 1951, *N.H. Speck* s.n. (2) (UWA); Yanchep, 32 miles N of Perth, 3 Nov. 1965, *F.G. Smith* 1881 (PERTH); Red Hill, 6 Nov. 1958, *T.E.H. Aplin* (PERTH); Red Hill, Toodyay Road, 5 Sept. 1969, *K.R. Newbey* 2976 (PERTH); Cottesloe, Aug. 1895, *A.M. Lea* s.n. (PERTH); Cottesloe, June 1902, *C.R Andrews* s.n. (PERTH); 15 mi. E of Perth, 27 Oct. 1964, *R.A. Saffrey* 143 (PERTH); Welshpool, 5 Nov. 1918, *F.M.C. Schock* 427 (PERTH); Cottesloe, 11 Aug. 1897, *R. Helms* s.n. (PERTH); Greenmount, Darling Range, 25 Aug. 1897, *R. Helms* s.n. (PERTH); Reabold Hill, 26 Nov. 1971, *B.R. Maslin* 2306 (PERTH); Helena Valley, 11 Sept. 1977, *J. Seabrook* 187 (PERTH); Forestfield, 17 Oct. 1978, *R.J. Cranfield* 891 (PERTH); Claremont, 30 Nov. 1907, *A. Morrison* s.n. (PERTH); N of Brookton, March 1970, *M.D. Tindale* 129 and *B.R. Maslin* (PERTH); 5 miles E of Piawaning, 9 Sept. 1959, *T.E.H. Aplin* s.n. (PERTH); Tuttaning Reserve, 17 mi. E of Pingelly, 17 Oct. 1967, *G. Heinsohn* 49 (PERTH); Nyabing, Oct. 1956, *V.F. McDougall* KO56182 (PERTH); between Corrigin and Quairading, 4 Oct. 1933, *W.E. Blackall* 3239 (PERTH); 3 km E of Woodanilling, 3 Nov. 1978, *R.J. Cranfield* s.n. (PERTH); Yornaning Reserve, 35 km SE of Pingelly, 12 Sept. 1975, *B.G. Muir* 473 (PERTH); Bonnie Rock, Wialki, 11 Sept. 1957, *A.R. Main* s.n. (PERTH); 15 km SW of Newdegate, 16 Jan. 1979, *J.M. Koch* N134 (PERTH); Pallarup Rocks, SE of Lake King, 13 Oct. 1960, *A.S. George* 1552 (PERTH); Muntagin, Sept. 1947, *T.W. Stove* 847 (PERTH); Cranbrook, 22 Sept. 1971, *F. Stoward* s.n. (PERTH); Trayning Reserve, 5 Nov. 1972, *A. Chapman* 6 (PERTH); Stirling Range(?), 25 Oct. 1902, *G. Berthoud* s.n. (PERTH); 1 mi. NE of King Rocks, 13 Oct. 1963, *K.R. Newbey* 1089 (PERTH); Oldfield River, 13 Oct. 1968, *N.N. Donner* 3007 (PERTH); Ravensthorpe, Nov. 1944, *C.A. Gardner* s.n. (PERTH); Stokes Inlet, 18 Oct. 1968, *A.E. Orchard* 1658 (PERTH); 25 km S of Ravensthorpe, 12 Nov. 1974, *D.J.E. Whibley* 5399 (PERTH); N of Thistle Cove, 21 Jan. 1966, *A.S. George* 7524 (PERTH); Lucky Bay, E of Esperance, 10 Sept. 1966, *E.M.*

Bennett 893A (PERTH); Howick Hill, 25 Oct. 1963, *T.E.H. Aplin* 2625a (PERTH); Boyatup Hill, 110 km E. of Esperance, 1 Oct. 1968, *H. Eichler* 20066 (PERTH); Wittenoom Hills, c. 50 km NNE of Esperance, 4 Oct. 1968, *N.N. Donner* 2874 (PERTH); Mt Ragged, 27 Oct. 1967, *J.S. Beard* 5246 (PERTH); 1 mi. NE of Isrealite Bay, 21 Sept. 1976, *R.J. Hnatiuk* 761239 (PERTH); Between Hamersley River and East Mt Barren, 30 Sept. 1970, *B.R. Maslin* 852 (PERTH); ± 19 miles SW of Mt Ragged, 6 Dec. 1960, *A.S. George* 2071 (PERTH); Fitzgerald River National Park, 21 Oct. 1970, *R.D. Royce* 9180 (PERTH); Cape Arid, 23 Oct. 1960, *C.A. Gardner* 12960 (PERTH); Cape Arid National Park, 29 Nov. 1971, *R.D. Royce* 9869 (PERTH).

Figure 25. Holotype of *Calothamnus purpurea* Endl. (W).

Total number of specimens examined. 526.

Comments. Calothamnus quadrifidus is the most variable and widely distributed species in the genus. This has resulted in the rather complex synonomy. The type specimens were collected from Bay 1 (Lucky Bay, east of Esperance)and very briefly described by Robert Brown in 1812. Subsequent authors described new species and varieties based mainly on leaf size (e.g. Bentham, 1867). Bentham (1867) recognized three distinct "forms". The first of these, forma *acerosus* was circumscribed by having slender, terete leaves "sometimes above 1 in long" (Bentham 1867, p. 180). This is the typical variant from districts around Perth and to Eneabba (Figure 26). The second form, *normalis*, encompassed the typical and common short-leaved variant from the south-west coastal areas of Western Australia ranging from Albany to Cape Arid in the wet coastal mallee-heath and heath associations (Figures 23 and 24). Bentham (1867) stated that this form had leaves under 1 inch (2.5 cm) long, more or less flattened and mostly acute. The leaves of this variant are more or less erectly held and its flowers are mostly in leafy spikes. Bentham's third form, *obtusus*, is the variant commonly encountered in the Murchison River area where *C. quadrifidus* overlaps the range of *C. homalophyllus* F.Muell. to which it is very closely related. It is possible that some hybridization has occurred in this overlap area but at the present time this variant with flat, thick, linear-clavate leaves will be included within the range of variation of *C. quadrifidus*. Bentham does not give form status to any of the arid adapted variants of *C. quadrifidus* which often have slightly larger flowers in less dense spikes, densely pilose leaves and slightly larger, pubescent fruit (becoming glabrous with age). Such variants occur from Shark Bay through the semi-arid areas of south-west Western Australia to Norseman, Zanthus and Cape Arid. Throughout this range, *C. quadrifidus* often grows sympatrically with *C. gilesii* F. Muell. and *C. tuberosus* T.J. Hawkeswood (at Peak Charles and associated granite outcrops).

From Shark Bay to Perth, along the coast, *C. quadrifidus* grows sympatrically with *C. formosus* T.J. Hawkeswood subsp. *formosus* (Shark Bay area), *C. sanguineus* Labill. (Kalbarri National Park to Perth), *C. asper* Turcz. (Wongan Hills) and *C. homalophyllus* F. Muell. (Murchison River area in the Kalbarri National Park). At present there are no substantiated records of *C. quadrifidus* from the peaks of the Stirling Range where other species, e.g. *C. crassus* (Benth.) T.J. Hawkeswood, *C. affinis* Turcz. and *C. schaueri* Lehm., appear to be endemic. There is one record, *Berthoud* s.n. (PERTH) from the Stirling Range, but there is no specific locality and the specimen may have been collected at the base or in the surrounding woodland or heathlands areas.

Calothamnus quadrifidus may be regarded as a very variable species which has adapted to a wide range of habitats which differ in climate, soil type and topography. It is one of the most widely distributed of all Western Australian plants and has the largest distribution for a *Calothamnus* species. It appears likely that it has given rise to *C. homalophyllus* F. Muell. and *C. asper* Turcz. (the only two species to which *C. quadrifidus* is closely related). It also appears likely that interbreeding occurs between *C. quadrifidus* and *C. homalophyllus* in the Kalbarri National Park resulting in the smaller-leaved variant (i.e. *C. quadrifidus* forma *obtusus* of Bentham).

Calothamnus quadrifidus can be distinguished from *C. homalophyllus* by the following characters: leaves (1-) 1.5-2 (-3) cm long, 0.8-1.5 mm wide, almost terete to sometimes flat, usually pilose or hirsute, flowers usually in dense unilateral spikes 2-8 cm long, staminal claws with 17-22 marginal filaments, testa of fertile seeds light chocolate-brown, and fertile seeds and ovulodes 1-1.5 mm long. *C. homalophyllus* has leaves (2-) 2.8-5 (-6) cm long, (3.5-) 5-8 (-12) mm wide, glabrous, flowers usually in clusters of 2 to 4 (or occasionally in a unilateral spike of up to 30 flowers), staminal claws with 20-25 marginal filaments, testa of fertile seeds light grey-brown, and fertile seeds and ovulodes c. 2 mm long.

The differences between *C. quadrifidus* and *C. asper* are given under comments for *C. asper*.

Calothamnus quadrifidus is well represented in National Parks and Reserves throughout its range, and since it is well known in cultivation, its survival is indeed assured, unlike many other species of the genus.

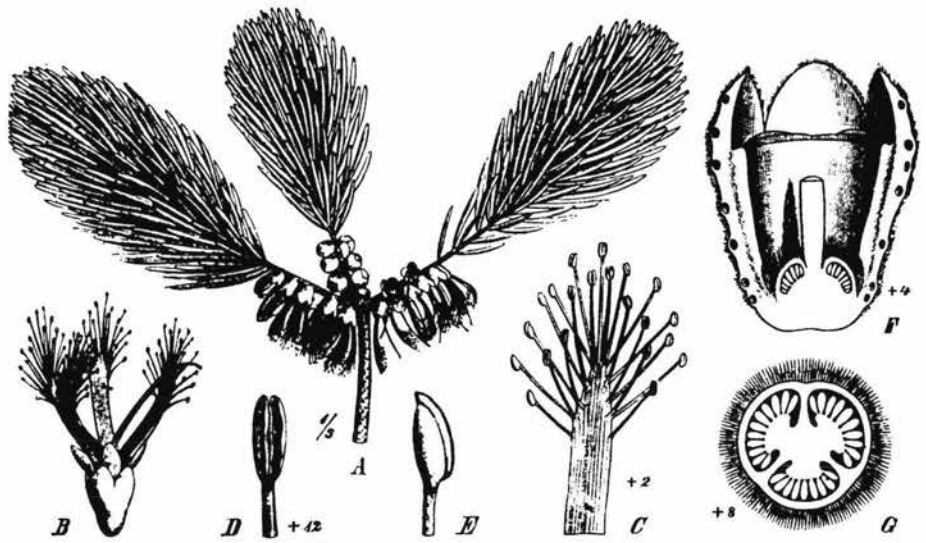

Figure 26. *Calothamnus quadrifidus* R.Br., showing the structure of the flower and the densely crowded leaves at the ends of the branches, and flowers on leafless portions (characteristic features of many *Calothamnus* species.

23. **Calothamnus tuberosus** T.J. Hawkeswood, Nuytsia 5:133 (1984). *Type:* Peak Charles, 10 April 1971, *A.S. George* 10626 (holo: PERTH).

Erect, compact, much-branched, glabrous, gnarled shrub mostly to 2.5 m high. *Leaves* terete, mostly 5-8 cm long, 1.2-2 mm wide, mucronate, pungent, glabrous. *Flowers* in dense spikes. *Petals* broadly elliptic, mostly 3-4 mm long. *Staminal claws* 22-28 mm long, 1-1.2 mm wide, deep orange-red; marginal filaments 12-16; anthers c. 1 mm long. Fruit depressed globular to globular, 4-5 mm long, 4-7 mm wide, smooth, shortly 4-lobed or almost truncate. *Fertile seeds* mostly 0.6-0.8 mm long, linear-oblong, truncate, glabrous; testa dark brown. *Ovulodes* 0.6-1 mm long, linear-oblong to oblong, glabrous, dark yellow-brown. (For a more detailed description, see Hawkeswood 1984a, 133).

Distribution. Map 15; see Hawkeswood (1984a, p. 140).

Comments. This tuberous species with its flowers and fruits mostly resembling those of some 5-merous species, rather than the 4-merous ones, is undoubtedly the most bizarre species of the genus and may be intermediate (or an ancestor) between the 4- and 5-merous groups. For further discussion on this species see Hawkeswood (1984a, pp. 134-135).

Acknowledgements

I would like to thank the following people for various assistance and who have made this work on *Calothamnus* possible: Mr P.G. Wilson, (W.A. Herbarium, PERTH) has assisted me greatly in literature searches, Latin diagnoses, translations and type acquisitions; I am also grateful for his continued correspondence over the several years since this research commenced in March 1979; Dr N.G. Marchant (W.A. Herbarium) for helpful discussions

on Myrtaceae and for much needed assistance while I was ill during the latter half of 1979 in Perth; Dr J.W. Green for facilities enabling the examination of preserved plant material and working space, discussions on *Calothamnus* and encouragement; Dr N.H. Brittan (University of Western Australia) and Mr M. Trudgen (W.A. Herbarium) provided helpful discussions and assisted me in a number of other ways during my stay in Perth; Mr A.S. George assisted with photography; other assistance has been provided by Messrs K.F. Kenneally and R.J. Cranfield, Mrs J.W. Lee-Frampton and Miss V. Hamley (all W.A. Herbarium). Assistance in field work has been provided by Messrs P. Johnson, S. Wilson, D. Knowles and M. Peterson, Miss M. Brady and Ms A. Kreger. Mr W.M. Molyneux of Victoria sent me specimens of *Calothamnus* during 1984. I am also very grateful to the curators of the following herbaria who sent photographs of types or specimens: CBG, W, KW, LD, K, FI, MEL and NSW. During 1982-85, assistance in the preparation of this paper has been obtained at the Queensland Herbarium, Brisbane, and I thank June Sawyer of that institution for encouragement and assistance with type photographs and library acquisitions. Mr P.I. Forster, of the Botany Department, University of Queensland, Brisbane, has provided me with enormous assistance and encouragement to proceed with the completion of this work. This research was commenced while I was a student in receipt of a Commonwealth Postgraduate Research Award at the Botany Department, University of Western Australia during April to October 1979 and February to June 1980. Since then, the majority of this research has been undertaken on private funds in Brisbane, Queensland, and finally I express my thanks to my mother, Mrs D.E. Hawkeswood for facilities and financial support, without which this paper would not be possible.

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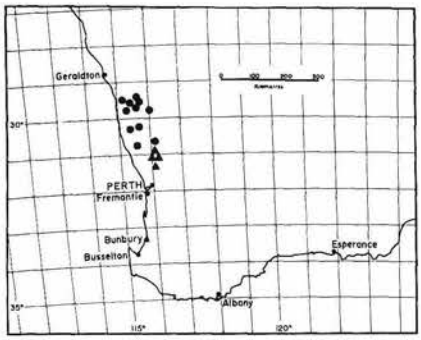
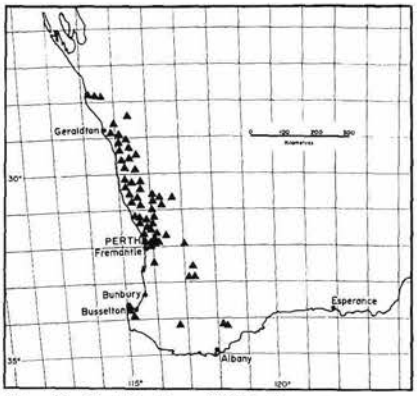
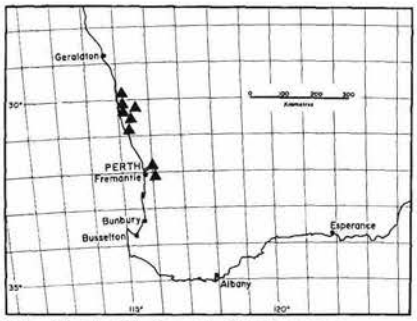


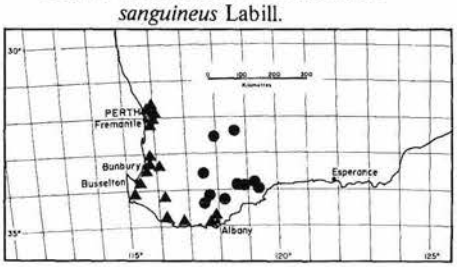
Map 1. Distribution of *Calothamnus pachystachyus* Benth. (▲) and *C. longissimus* F. Muell. (●).



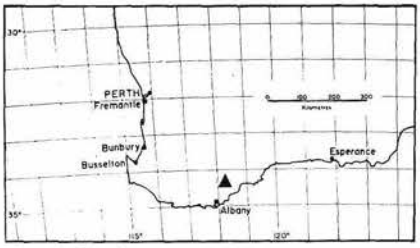
Map 2. Distribution of *Calothamnus sanguineus* Labill.



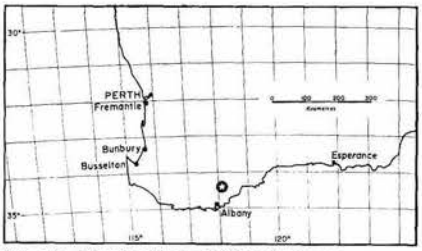
Map 3. Distribution of *Calothamnus torulosus* Schauer.



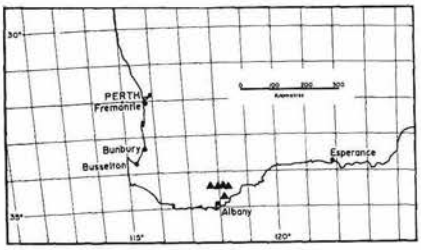
Map 4. Distribution of *Calothamnus lateralis* Lindley (▲) and *C huegelii* Schauer (●).



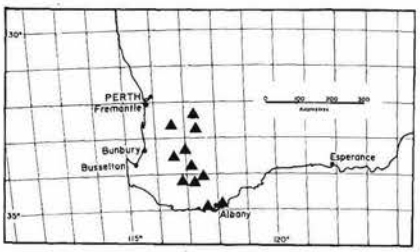
Map 5. Distribution of *Calothamnus crassus* (Benth.) T.J. Hawkeswood.



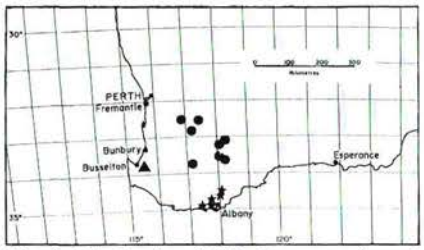
Map 6. Distribution of *Calothamnus affinis* Turcz.



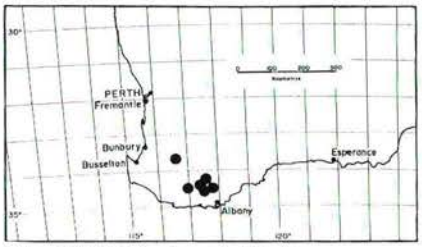
Map 7. Distribution of *Calothamnus microcarpus* F. Muell.



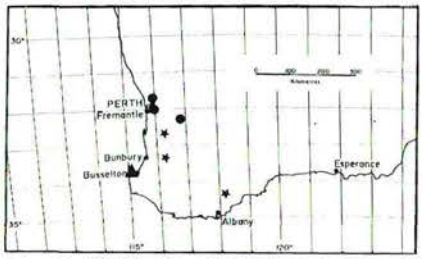
Map 8. Distribution of *Calothamnus preissii* Schauer.



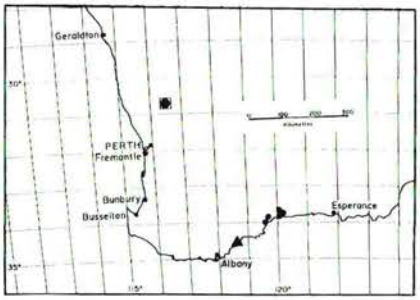
Map 9. Distribution of *Calothamnus schaueri* Lehm. (★), *C. planifolius* Lehm. (●) and *C. pallidifolius* (Benth.) T.J. Hawkeswood (▲).



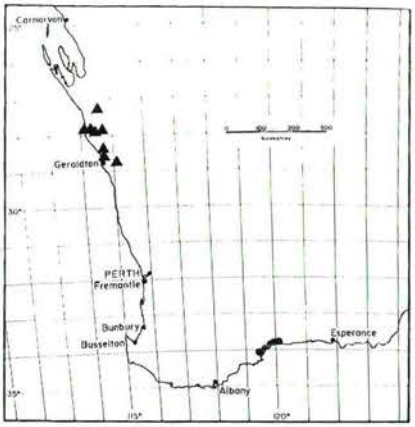
Map 10. Distribution of *Calothamnus lehmannii* Schauer.



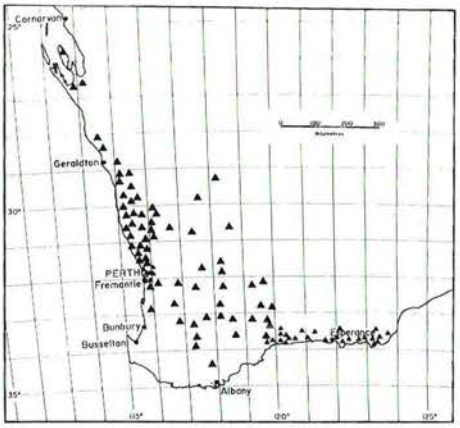
Map 11. Distribution of *Calothamnus rupestris* Schauer (●), *C. graniticus* T.J. Hawkeswood subsp. *graniticus* (▲), *C. graniticus* subsp. *leptophyllus* (Benth.) T.J. Hawkeswood (★).



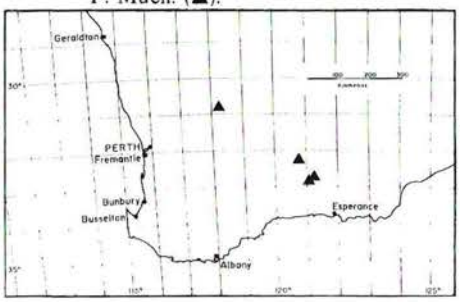
Map 12. Distribution of *Calothamnus asper* Turcz. (▣), *C. pinifolius* F. Muell. (●) and *C. robustus* Schauer (▲).



Map 13. Distribution of *Calothamnus validus* S. Moore (●) and *C. homalophyllus* F. Muell. (▲).



Map 14. Distribution of *Calothamnus quadrifidus* R.Br.



Map 15. Distribution of *Calothamnus tuberosus* T. J Hawkeswood.