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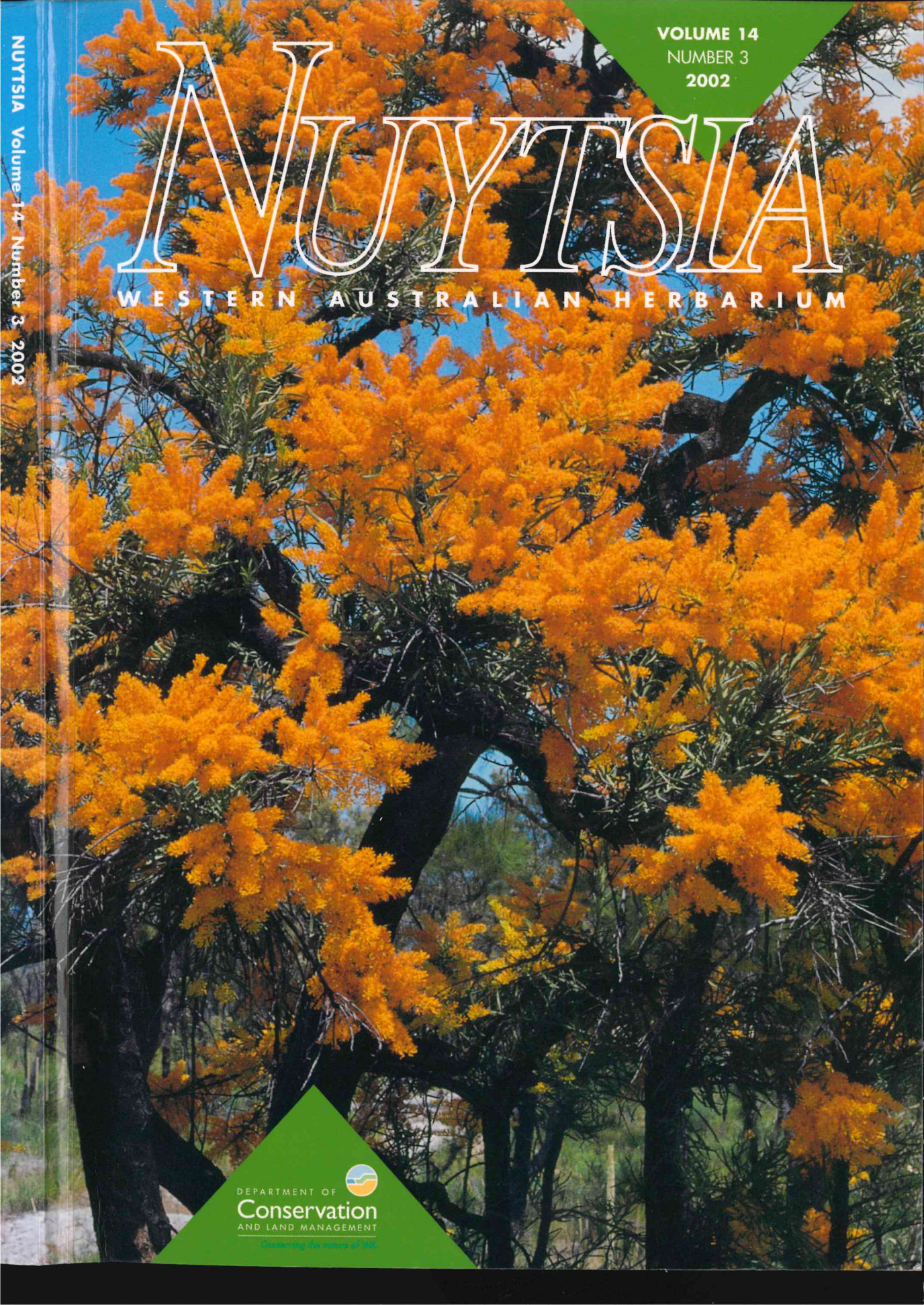

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

NUYTSIA Volume 14 Number 3 2002

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Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) – the Western Australian Christmas Tree is one of the few arborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn icommemerates Pieter Nuijts, an ambassador of the Dutch East India Company, who in 1627 accompanied the "Gulde Zeepard" on one of the first explorations along the south coast of Australia.

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Photograph: A.S. George

Elatine macrocalyx (Elatinaceae), a new species from central and western Australia

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Abstract

Albrecht, D.E. *Elatine macrocalyx* (Elatinaceae), a new species from central and western Australia. *Nutysia* 14(3): 319–324 (2002). *Elatine macrocalyx* Albr. *sp. nov.* is described and illustrated, with notes on its distribution, conservation status and ecology. A key to Australian species of *Elatine* L. is provided.

Introduction

The genus *Elatine* L. (Elatinaceae), with approximately 30 species, has a cosmopolitan distribution, though most species occur in temperate or cool areas. The classification of some taxa is in a state of flux, with few authors in agreement (Schmidt-Mumm & Bernal 1995) and the genus is in need of revision on a worldwide basis.

A single species, *Elatine gratioloides* Cunn., has been recognised for Australia. It is widely distributed, occurring in all States and Territories. Various other names have been applied to the Australian species. For example Backer (1951) included it under a very wide circumscription of *E. triandra* Schkuhr, and Tucker (1986) considered that it should be referred to *E. americana* Arn. Backer's proposition has not gained acceptance in Australia (Willis 1973; Aston 1977) and it is unlikely that Tucker's has been seriously investigated. The Australian material is referred to here as *E. gratioloides sens. lat.* as it differs from the type of *E. gratioloides* from New Zealand and may require a new name (Dennis Morris pers. comm.).

During the course of ground-truthing a vegetation map of the Alice Springs municipality (Albrecht & Pitts, in press), shortly after a period of exceptional rainfall in central Australia, material of an apparently new species of *Elatine* was collected. Subsequent examination of *Elatine* material housed at DNA revealed that this taxon had been collected on several previous occasions, as long ago as 1973, but has hitherto been included with *E. gratioloides.* This new species is here described.

Taxonomy

Key to species of *Elatine* in Australia

1. Sepals 2–3 mm long, equal to or longer than the petals; fruit indehiscent, firm-textured, not moulded to the shape of the enclosed seed mass; seeds with 7–10 pits in each longitudinal row; diminutive herb forming small prostrate mats on margins of clay pans ..... **E. macrocalyx**
1. Sepals < 1 mm long, *c.* half the length of the petals; fruit dehiscent, thin-textured, in dried specimens collapsed and moulded to the shape of the enclosed seed mass prior to dehiscence; seeds with *c.* 12 or more pits in each longitudinal row; weak herb growing either as an aquatic or in wet mud beside waterbodies and watercourses ..... **E. gratioloides** *sens. lat.*

Elatine macrocalyx Albr., *sp. nov.*

Herba annua prostrata. Folia opposita, obovata plerumque, 3–7 mm longa, 1–3 mm lata, nervatura non manifesta. Flores trimeri, solitarii, sessiles, in axilla uni folii ulli paris. Sepala 2–3 mm longa. Petala 1.5–2.5 mm longa, sepala aequantes vel breviores. Stamina carpellis alternantibus. Fructus globosus depressus, non membranaceus, 1–2 mm longus, 2–4 mm latus. Semina brunnea, subcylindrica, recta vel curva parum, 0.4–0.5 mm longa; testa tesselata, foveis plus minusve hexagonis in 7–10 seriebus dispositis.

Typus: 6 km S of Newhaven Homestead, Northern Territory, 2 October 2000, *P.K. Latz* 16798 (*holo:* DNA (A100434); *iso:* NT, PERTH).

Prostrate glabrous annual *herb* forming dense small mats. *Stems* rooting at the nodes. *Leaves* opposite, light to mid green when plants are alive, lamina mostly obovate, sometimes somewhat spathulate, tapering to an indistinct petiole, 3–7 mm long, 1–3 mm wide, entire but usually with an apical hydathode and 1–3 marginal hydathodes, venation not evident in fresh material, apex obtuse; stipules membranous, narrowly triangular-subulate, 1.4–2.4 mm long, attenuate apically, ± toothed. *Flowers* 3-merous, solitary and sessile in axil of only one leaf of any pair. *Sepals* 3, shortly united at base, oblong-elliptic to oblong-ovate or oblong-obovate, 2–3 mm long, 1.2–1.8 mm wide, sometimes with irregular marginal teeth, obtuse. *Petals* 3, white, sometimes with a green tinge externally towards the distal end, strongly concave, mostly oblong-elliptic, occasionally oblong-ovate or oblong-obovate, 1.5–2.5 mm long, 1.1–1.8 mm wide, equal to or shorter than the sepals. *Stamens* 3, alternating with the carpels, filaments 1.6–2.2 mm long, appressed to carpel surface, anthers 0.2–0.3 mm long, apiculate. *Carpels* 3; styles 3, *c.* 0.1 mm long. *Fruit* green or pink-tinged, drying brown, depressed globose, not membranous, 1–2 mm long, 2–4 mm wide, apparently indehiscent. *Seeds* brown, subcylindical, straight to slightly curved, 0.4–0.5 mm long, *c.* 0.2 mm thick, obtuse at both ends but also with a tiny apiculum at one end; seed coat tessellate with longitudinal rows of 7–10 more or less hexagonal pits. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Lake Cronin (near Forrestiana, E of Hyden), 7 May 1978, *G.J.Keighery* 1666 (PERTH); Goongarrie Station, 21 km NNE of homestead, 5 Nov. 1995, *G.J.Keighery* 14142 (PERTH).

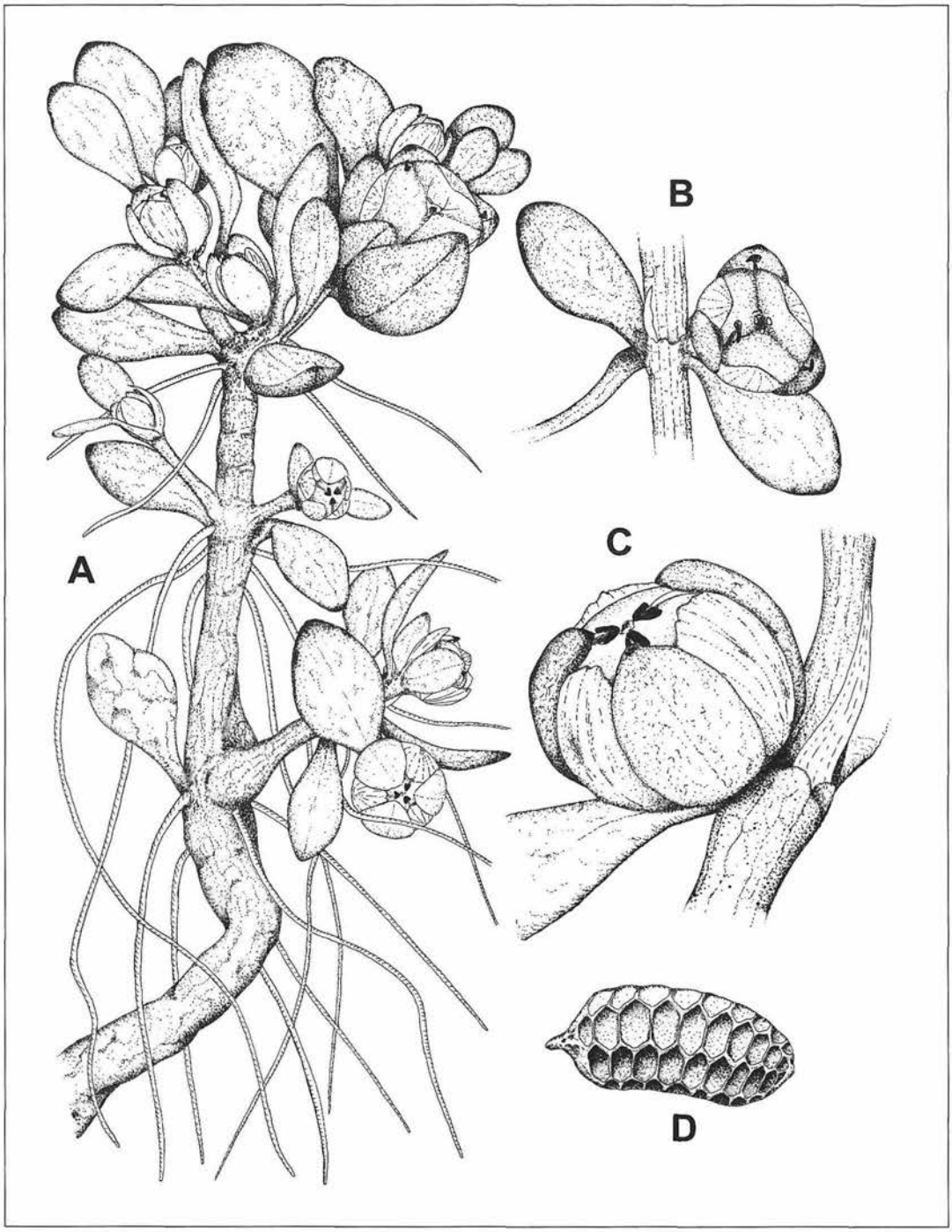

Figure 1. *Elatine macrocalyx*, drawn from *Albrecht* 9320. A – habit, x7; B – flower, x6; C – fruit, x12. D – seed, x80.

NORTHERN TERRITORY: Ilparpa clay pans, 4 Aug. 2000, *D.E.Albrecht* 9320 (NT); Napperby Station, 8 May 1975, *Henshall* 1014 (DNA); 14 miles [22 km] S of Rabbit Flat, 21 July 1973, *P.K. Latz* 4069 (DNA, NT, BRI, CANB); 4 km E of Wycliffe Well, 24 June 1974, *P.K. Latz* 5545 (DNA); Rabbit Flat Road House, 30 May 1980, *P.K. Latz* 8391 (DNA, PERTH); Fat Dingo Swamp, Tanami Desert, 14 July 1980, *P.K. Latz* 8415 (DNA, NSW, MEL); 75 km NW of Lake Surprise, 19 Aug. 1991, *P.K. Latz* 12212 (DNA, NT, AD, MEL).

Distribution. *Elatine macrocalyx* is presently known from eight locations in arid parts of the Northern Territory and two locations in Western Australia (Figure 2). Most collections made in the Northern Territory are from the Tanami bioregion, with fewer collections from the Great Sandy Desert and MacDonnell Ranges bioregions. In Western Australia collections have been made from the Murchison and Mallee bioregions.

Habitat and ecology. With the exception of a single occurrence in the South West Botanical Province of Western Australia, *Elatine macrocalyx* appears to be restricted to locations with an Eremaean climate. All known populations occur in herbfields on temporarily moist margins of playa lakes and clay pans. The soils are typically shallow sands over clay. The soil pH at one site tested (Ilparpa clay pans) is 9. In the Northern Territory associated species include *Peplidium aithocheilum* W.R.Barker, *Glossostigma diandrum* (L.) Kuntze, *Triglochin calcitrapum* Hook., *Eragrostis kennedyae* F.Turner, *Schoenoplectus dissachanthus* (S.T.Blake) Raynal, *Cyperus rigidellus* (Benth.) J.M.Black, *Centipeda thespidioides* F.Muell., *Centipeda* D18576 Andado, *Bergia trimera* Fisch. & C.A.Mey., *Marsilea exarata* A.Braun and *Eucalyptus victrix* L.A.S.Johnson & K.D.Hill.

The extent of occurrence spans a considerable latitudinal range and includes several bioclimatic zones. In the north of its geographic range rainfall occurs predominantly in summer, whereas in the south rainfall occurs predominantly in winter. It is probable therefore that the species is able to germinate over a range of temperatures provided there is sufficient rain. There is anecdotal evidence that *Elatine macrocalyx* may require exceptional rainfall events to germinate, at least at some locations. It was seen for the first time near Alice Springs following the big rains of 2000 in an area that has been closely scrutinised for a number of years by local botanists. At this site the sandy claypan margins were fully inundated for several weeks in 2000. Some other co-occurring annual species in arid NT, such as *Elacholoma hornii* F.Muell. & Tate and *Stylidium inaequipetalum* J.M.Black have a similar germination strategy and are rare in 'time' rather that 'space'.

Phenology. Flowering and fruiting specimens have been collected between May and October. It is likely that flowering and fruiting could occur at any time of the year if there were sufficient moisture. Transplants grown in glasshouse conditions flowered and fruited throughout summer in Alice Springs.

Conservation status. Conservation codes for Western Australian Flora: Priority Three. *Elatine macrocalyx* occurs within a region that is relatively poorly surveyed and further field work after good rains is required to determine the area of occupancy throughout the rather large extent of occurrence. The species may be locally common at some sites following adequate rainfall, however, individual populations are spatially very small. *Elatine macrocalyx* is unlikely to be threatened at present, however, it may be rare. As a tentative measure *Elatine macrocalyx* is assigned a risk code of 3K. No populations are presently known from a gazetted biological reserve, though the type population occurs on a former pastoral station being managed for conservation by Birds Australia.

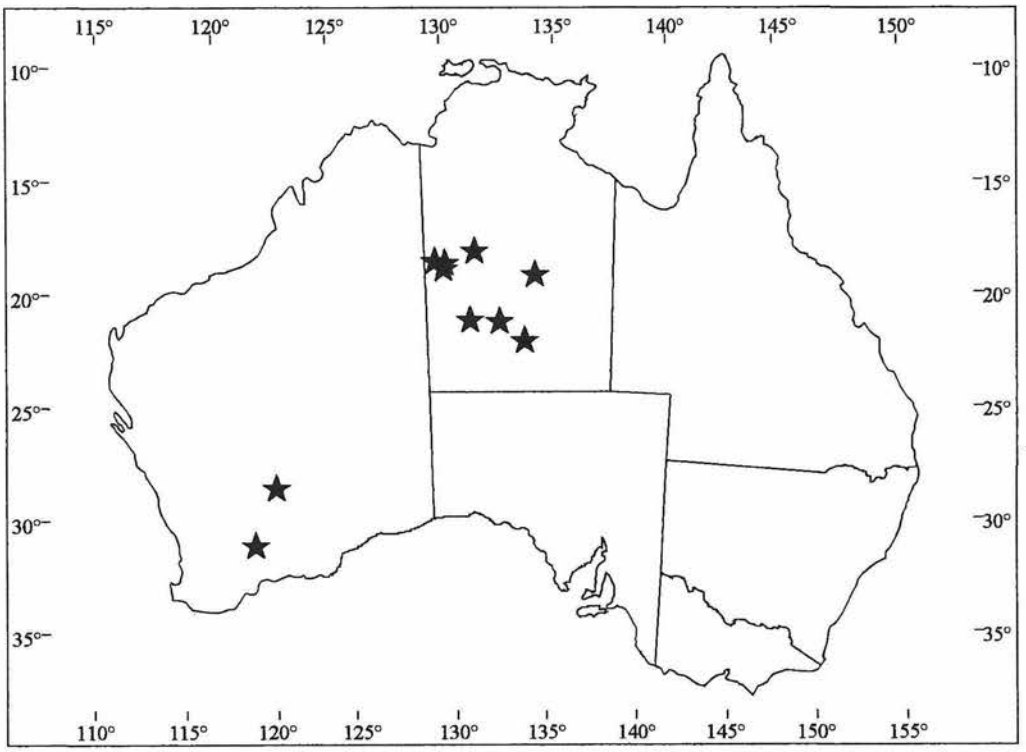

Figure 2. Distribution of *Elatine macrocalyx* based on herbarium specimens lodged at DNA and PERTH.

Etymology. The specific epithet is of Greek origin and refers to the large calyx, one of the salient characteristics distinguishing this new species.

Notes. Within the Northern Territory *Elatine macrocalyx* has been informally known by the phrase name *Elatine* D14201 (claypans).

Elatine macrocalyx is placed in the section *Crypta* (Nutt.) Seub., having opposite (rather than whorled) leaves and stamens equal in number to the petals. Available descriptions and keys for extra-Australian *Elatine* species (e.g. Niedenzu 1925; Fasset 1939; Schmidt-Mumm & Bernal 1995) were consulted, however, specimens of extra-Australian *Elatine* were not examined. Resolution of the relationship between *Elatine macrocalyx* and other members of the genus will only be possible when *Elatine* is monographed on a worldwide basis.

Elatine macrocalyx can be distinguished from *E. gratioloides sens. lat.*, the only other recognised Australian species, using the key provided above. Additional characters differentiating *E. macrocalyx* from *E. gratioloides* are the narrower stipules with an attenuate tip and leaf venation that is not obvious. The two species are sympatric in central Australia, however, *E. macrocalyx* occurs on the margins of playa lakes and claypans, whereas *E. gratioloides* occurs in or around permanent or semi-permanent waterholes in range systems.

Compared with *E. gratioloides*, specimens of *E. macrocalyx* show relatively little variation in vegetative characteristics, however, there is some variation in the colour of the fresh fruit, ranging from green to pink-tinged, and in fruit width.

All specimens observed in the herbarium and in the field have had cleistogamous flowers. Keighery (1984) reported cleistogamy in *E. gratioloides*, citing two specimens, one of which (*Keighery* 1666 from Lake Cronin) is *E. macrocalyx*. The Lake Cronin specimen is also illustrated in this paper. Cleistogamy has been reported in other taxa of *Elatine* (Salisbury 1967; Tucker 1986).

Elatine macrocalyx is possibly unusual in the genus in having apparently indehiscent fruits with non-membranous walls. The population at Ilparpa Swamp near Alice Springs was examined on several occasions between August 2000 and February 2001. Plants died in late September 2000 owing to lack of available moisture. Over the following five months of observation the plants turned a rich brown colour and the fruit remained indehiscent. An accumulative total of approximately 50 mm of rain fell during this five-month period, producing no influence on fruit dehiscence.

Acknowledgements

Greg Keighery and Dennis Morris kindly checked specimens in PERTH and HO respectively and provided useful comments on the distinctiveness of *E. macrocalyx*. Robyn Barker and Dean Cunningham checked material in AD. Jurgen Heucke and Birgit Dorges translated Niedenzu's treatment from German. Neville Walsh prepared the Latin description, Angus Duguid prepared the map and Thomas Bosch prepared the illustration.

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Taxonomy of species deriving from the publication of *Eucalyptus* subseries *Cornutae* (Myrtaceae)

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Abstract

M.I.H. Brooker & S.D. Hopper. Taxonomy of species deriving from the publication of *Eucalyptus* subseries *Cornutae* (Myrtaceae). *Nuytsia* 14(3): 325–360 (2002). The *Eucalyptus* subseries *Cornutae* Benth. comprised, in 1867, seven species endemic to the southern part of Western Australia. Since that time many more taxa have been published and given association with the subseries. We have studied the diagnostic characters of the subseries, as based on *E. cornuta* Labill., and, consequently, maintain the numerous taxa that have affinity with this species and reject others that do not comply, e.g. *E. gomphocephala* DC. The main diagnostic feature of the subseries is the erect orientation of the stamens in bud, a character not seen outside of this group. All together, nine new species, two of which comprise two subspecies, and two new subspecies of previously published species are published in this study.

Some taxa traditionally given association with the *Cornutae*, e.g. *Eucalyptus cernua* Brooker & Hopper *sp. nov.* (formerly and incorrectly known as *E. nutans* F. Muell.) have been treated as a sister group based on leaf surface characters, but are distanced morphologically from the *Cornutae* by the stamens which are inflexed. In this respect, examination of the type of *E. vegrandis* L.A.S. Johnson & K.D. Hill reveals that the stamens are inflexed. Thus we reassign it to the species group that includes *E. cernua*.

Other new taxa published in this study are, *Eucalyptus* x *missilis* Brooker & Hopper (of probable hybrid origin), *E. arborella* Brooker & Hopper, *E. astringens* (Maiden) Maiden subsp. *redacta* Brooker & Hopper, *E. diminuta* Brooker & Hopper, *E. mcquoidii* Brooker & Hopper, *E. mimica* Brooker & Hopper subsp. *mimica*, *E. mimica* subsp. *continens* Brooker & Hopper, *E. incerata* Brooker & Hopper, *E. sporadica* Brooker & Hopper, *E. thamnoides* Brooker & Hopper subsp. *thamnoides*, *E. thamnoides* subsp. *megista* Brooker & Hopper, *E. utilis* Brooker & Hopper and *E. vesiculosa* Brooker & Hopper. The unpublished taxon *E. olivacea* ined., so-named in CANB, NSW and PERTH, is regarded as the same as *E. macrandra*. Similarly, *E. recondita* ined. is included in *E. vegrandis* L.A.S. Johnson & K.D. Hill.

A revised classification for species deriving from the publication of *Eucalyptus* subser. *Cornutae* is presented, following Brooker (2000), in which all the species with erect stamens fall into subsection *Hadrotes* Brooker and into several series of subsection *Glandulosae* Brooker. We discuss the diagnostic characters for each infra-generic taxon relevant to the taxa treated, and provide keys to the subsections, series and subseries, as well as keys to the species and subspecies. Representative specimens are illustrated in the plates and a distribution map for each new taxon is given.

The term 'marlock' is defined and applied to two of the species included in this study.

Introduction

The species treated in this paper either belong to the various infra-generic taxa deriving by natural affinity from *Eucalyptus* subser. *Cornutae* Benth. (Table 1) or have been incorrectly given taxonomic association with the subseries. All relevant species are endemic to the southern half of Western Australia and are now greatly increased in the number of published taxa since Bentham (1867). There are more than 30 species ranging geographically from *E. sargentii* Maiden subsp. *fallens* K.D. Hill & L.A.S. Johnson on Eurardy Station north of the Murchison River to *E. occidentalis* Endl. near Mt Ragged south of Balladonia, although both species are better known in their southern wheatbelt distributions. One species of the subseries occurs near the highest rainfall zone (*E. cornuta*) while *E. eremophila* (Diels) Maiden extends to the southern part of the Great Victoria Desert east of Kalgoorlie.

In bud morphology, the great majority of these species are probably the most easily recognised of all eucalypts by the long operculum accommodating completely erect stamens. No species of eastern or northern Australia could be confused in this character with the *Cornutae* (we use this name broadly in what may be regarded as the traditional sense to include *E.* ser. *Lehmannianae* D.J. Carr & S.G.M. Carr, *E.* ser. *Cornutae* (Benth.) Blakely and *E.* ser. *Erectae* Brooker), although Bentham alluded to similarities in *E. marginata* Sm. and *E. tereticornis* Sm. and related species. *E. fibrosa* F. Muell., another eastern species, could be included with these latter as it has many erect stamens but within much shorter opercula.

Two new taxa treated below, *E. cernua* Brooker & Hopper, and *E. vesiculosa* Brooker & Hopper, share the leaf surface, venation and oil gland pattern with *E.* subser. *Abundae* Brooker of *E.* ser. *Erectae*, *E. cernua* (incorrectly known as *E. nutans* F. Muell., see below) having invariably been included in this series. These two species plus *E. vegrandis* (see later) have much shorter opercula and differ fundamentally in stamen disposition.

At the beginning of this study we were uncertain as to the best way to treat related mallets and mallees, e.g. the established taxon, *E. astringens*, and the new taxa *redacta* (mallet), *thamnoides* (mallee), and *megista* (mallee) (see later). We have been to a certain extent guided by the recent DNA work of M. Byrne of the Western Australian Herbarium (pers. comm.). Her research showed that related tree taxa in the *E.* ser. *Loxophlebae* were genetically similar and distinct from the mallee taxa in the series. In other words, for the *Loxophlebae*, the specific boundary is clearly between habit form and not within habit. We cannot be certain that conclusions made from such a restricted study can be applied unequivocally to other series. However, we consider the two morphologically similar mallets in *E. astringens* and two morphologically similar mallees in the new species *E. thamnoides* fit the pattern in the *Loxophlebae*. By contrast, the more distinct but obviously related *E. lehmannii* (mallee) and *E. arborella* (mallet) are better recognised as species.

Conservation status is described only for those taxa currently declared as Rare Flora or given a priority code by the Department of Conservation and Land Management. Further survey is needed to document the distribution and status of most of these taxa (Kelly *et al.* 1995).

Use of the term marlock

The categorisation of habit in south-west Australian eucalypts has long been contentious. Brooker & Hopper (1991) discussed the history of the exclusively Western Australian terms 'marlock' or 'maalock' which have been used variously over the years. They pointed out that the term, which we prefer to standardise as 'marlock', has been used for quite different habit forms rendering it useless in

description and diagnosis. However, as the word continues to be used (e.g. Brooker & Kleinig 1990), but to this date without agreed definition, we consider it might as well be used for one of the characteristic habit forms. We apply it to the more or less pure stands of short, erect, thin-stemmed 'trees', that do not produce lignotubers. These are easily seen and recognised in stands of *E. platypus, E. vesiculosa,* and the unrelated *E. stoatei.* They can be distinguished from mallets which are taller and have a characteristic steep branching habit.

History of the *Cornutae*

Of the many characters Bentham (1867) used to delineate his subseries *Cornutae*, only one is usefully, though not exclusively (see above), diagnostic, viz., "Stamens erect or flexuose in the bud...". The species he included in the subseries (Table 1) all have erect stamens and the descriptive term "flexuose" is misleading.

Blakely (1934) recognised nineteen species in the group and raised the subseries to series. *Eucalyptus gomphocephala* DC., which was included elsewhere by Bentham, was placed in the new *E.* ser. *Cornutae* by Blakely (1934) and retained in this series by Pryor & Johnson (1971) and Chippendale (1988).

In the description of *E.* ser. *Cornutae,* Blakely, virtually paraphrasing Bentham, stated, "Stamens straight or flexuose in the bud." Of the listed species one, *E. nutans sens.* Blakely, has inflexed filaments which may be the reason he used the character "flexuose", not that this is a particularly apt term for the inflexion seen in this species. Within the series he recognised two subseries – *Sessiles* and *Pedicellatae.* We consider Blakely's diagnoses for the subseries to be uninformative and the lists of species that compose them to be heterogeneous.

Pryor & Johnson (1971) in their informal classification recognised, to a degree, the singularity of *Eucalyptus gomphocephala* when they isolated it in a monotypic subseries in *E.* ser. *Cornutae.* They categorised the remaining species into two groups (series) comprising three polytypic subseries. In doing so, they foreshadowed recognition of "*lehmannii*", "*platypus*" and "*occidentalis*" groups. Carr & Carr (1980) formally erected the *E.* series *Lehmannianae* to account for *E. lehmannii* and related species (Table 1). From the new series they excluded *E. cornuta* Labill. on account of the presence in this species of pith glands. The remaining taxa, viz. the "*platypus*" and "*occidentalis*' groups were not treated by Carr & Carr.

Table 1. The species constituting *Eucalyptus* subser. *Cornutae* Benth. (Bentham 1867) and *Eucalyptus* ser. *Lehmannianae* D.J. Carr & S.G.M. Carr (Carr & Carr 1980). The type species of each group is asterisked.

Subsection *Cornutae*	Series *Lehmannianae*
E. annulata Benth.	*E. bennettiae* D.J. Carr & S.G.M. Carr
**E. cornuta* Labill.	*E. burdettiana* Blakely & Steedman
E. lehmannii (Schauer) Benth.	*E. conferruminata* D.J. Carr & S.G.M. Carr
E. macrandra F. Muell. ex Benth.	**E. lehmannii* (Schauer) Benth.
E. occidentalis Endl.	*E. megacornuta* C.A. Gardner
E. platypus Hook.	*E. newbeyi* D.J. Carr & S.G.M. Carr
E. spathulata Hook.	*E. talyuberlup* D.J. Carr & S.G.M. Carr

In the recent comprehensive treatment of the genus, Chippendale (1988) presented "the current situation" in the classification. This assertion is ambiguous or misleading as 'series 45 *Cornutae*' in Chippendale includes, without qualification or segregation, the *Lehmannianae* D.J. Carr & S.G.M. Carr which was published some years before in 1980.

In treating only part of the *Cornutae* complex, Hill & Johnson (1992) recognised two series, both extra-codical, viz. *Astringentes* and *Erythronemae*. This latter series includes *Eucalyptus* ser. *Elongatae* Blakely, a neatly circumscribed group of four species distinct from the remainder of the complex in the strongly diagnostic character of inflexed stamens. Yet Hill & Johnson in the diagnosis for the *Erythronemae* give "filaments erect well before maturity of the buds". Hence the integration by them of the *E. spathulata* group of species (the first-named species in Hill & Johnson's *Erythronemae*) with the *E. erythronema* group (*Elongatae* in the strict sense) must be an error and we reject the association, unless they imply that the stamens at maturity become inflexed.

The revised classification for species deriving from the publication of *Eucalyptus* subser. *Cornutae* Benth.

In assessing the taxa so far referred to, we found existing classifications of the genus to be inadequate. Consequently, we formulated a revised system for the relevant part of the genus (Table 2) which was published by Brooker (2000). We reject any association of *Eucalyptus gomphocephala* with *Cornutae* species where it appeared in Maiden (1929) and Blakely (1934), or in *E.* subser. *Robustae* in which it was placed by Bentham (1867). It is appropriately placed in a monotypic section (Brooker 2000).

It has long been recognised that cotyledon shape is a strongly unifying character in *Eucalyptus*. Based on outgroup comparisons (e.g. Hall 1914), it is likely that the primitive cotyledon shape in the genus is reniform. Evolutionary modification has resulted in emargination of the distal edge. This is seen at its most extreme in the large group of species in which the cotyledonary blade is deeply notched forming a Y-shaped structure. This condition was recognised by Maiden (1933) when he erected a 'Division' *Bisectae* to accommodate the numerous species with this type of cotyledon. Pryor and Johnson adopted this scheme with their informal, extra-codical *E.* sect. *Bisectaria*. We now refer the species to the formal *E.* sect. *Bisectae* Maiden ex Brooker.

Of the species of *Eucalyptus* sect. *Bisectae* treated in this study, we recognise three principal groups: one with massive, rigid inflorescence structures (peduncles, buds and fruits), viz. *E.* subsect. *Hadrotes;* and the remainder with smaller buds and fruits, recently divided into two much larger groups, one with glands in the pith, *E.* subsect. *Glandulosae* (with the exception of some rare reversals in *E.* ser. *Levispermae*), and one lacking glands, *E.* subsect. *Destitutae* (Brooker 2000).

Adult leaf characters can be distinctive in *Eucalyptus* subsect. *Hadrotes* and parts of *E.* subsect. *Glandulosae*. The leaves are very smooth-surfaced, glossy and slightly olive-green. We have used the term 'glazed' for this character which is as readily assessed in the fresh specimen as in the dried. It occurs, for example, in *E.* ser. *Cornutae*, *E.* ser. *Lehmannianae* and *E.* subser. *Abundae* of *E.* ser. *Erectae*. *E.* subser. *Pedicellatae* of *E.* ser. *Erectae* does not have this character and can be easily distinguished with experience on both fresh and dried specimens, although *E. stowardii* of this subseries has glossy, but green not olive-green leaves. Glazed, olive-green leaves occur as well in *E.* ser. *Clinatae* which differs in the nature of the staminophore and androecium (see later).

A further character that distinguishes *Eucalyptus* subser. *Abundae* from *E.* subser. *Pedicellatae* is the staminophore which, in the former is broad, bearing the filaments in detectable whorls, and in the latter is narrow. The *E.* ser. *Clinatae* also has a narrow staminophore, distinguishing it from the *E.* ser. *Abundae*, in as much as the ring of tissue actually bearing the filaments is narrow, although there may be an extension of barren tissue inwards as in the completely unrelated *E.* sect. *Liberivalvae*.

The complete classification of *Eucalyptus* subsect. *Hadrotes* and *E.* subsect. *Glandulosae* is given in Table 2 where the monotypic *E.* sect. *Bolites*, comprising only *E. gomphocephala*, is also shown.

Table 2. Classification of part of *Eucalyptus* sect. *Bisectae* Maiden ex Brooker (Brooker 2000) and the re-assignment of *E. gomphocephala*. Series following *E. protensa* are listed for completion of *E.* subsect. *Glandulosae* although their constituent species are not given as they are not relevant to this paper.

Eucalyptus sect. *Bolites* Brooker
E. gomphocephala DC.
Eucalyptus sect. *Bisectae* Maiden ex Brooker
Eucalyptus subsect. *Hadrotes* Brooker
Eucalyptus ser. *Cornutae* (Benth.) Blakely
E. cornuta Labill.
E. macrandra F. Muell. ex Benth.
Eucalyptus ser. *Lehmannianae* D.J. Carr & S.G.M. Carr
Eucalyptus subser. *Conjunctae* Brooker
E. mcquoidii Brooker & Hopper,
E. lehmannii (Schauer) Benth.
E. arborella Brooker & Hopper
E. conferruminata D.J. Carr & S.G.M. Carr
Eucalyptus subser. *Liberae* Brooker
E. newbeyi D.J. Carr & S.G.M. Carr
E. talyuberlup D.J. Carr & S.G.M. Carr
E. burdettiana Blakely & Steedman
E. megacornuta C.A. Gardner
Eucalyptus subsect. *Glandulosae* Brooker
Eucalyptus ser. *Clinatae* Brooker
E. cernua Brooker & Hopper
E. vesiculosa Brooker & Hopper
E. vegrandis L.A.S. Johnson & K.D. Hill
Eucalyptus ser. *Erectae* Brooker
Eucalyptus subser. *Abundae* Brooker
Eucalyptus suprasp. *Angustae* Brooker
E. mimica Brooker & Hopper subsp. *mimica*
E. mimica subsp. *continens* Brooker & Hopper
E. steedmanii C.A. Gardner
E. spathulata Hook.
E. suggrandis L.A.S. Johnson & K.D. Hill subsp. *suggrandis*
E. suggrandis subsp. *alipes* L.A.S. Johnson & K.D. Hill
E. goniocarpa L.A.S. Johnson & K.D. Hill
Eucalyptus suprasp. *Longae* Brooker
E. incerata Brooker & Hopper.
E. tenera L.A.S. Johnson & K.D. Hill

E. depauperata L.A.S. Johnson & K.D. Hill
E. tephroclada L.A.S. Johnson & K.D. Hill
E. eremophila (Diels) Maiden
Eucalyptus suprasp. *Latae* Brooker
E. utilis Brooker & Hopper.
E. platypus Hook. subsp. *platypus*
E. platypus subsp. *congregata* Brooker & Hopper
Eucalyptus subser. *Pedicellatae* Blakely
E. sargentii Maiden subsp. *sargentii*
E. sargentii subsp. *fallens* K.D. Hill & L.A.S. Johnson
E. occidentalis Endl.
E. aspratilis L.A.S. Johnson & K.D. Hill
E. astringens (Maiden) Maiden subsp. *astringens*
E. astringens subsp. *redacta* Brooker & Hopper,
E. thamnoides Brooker & Hopper subsp. *thamnoides*
E. thamnoides subsp. *megista* Brooker & Hopper
E. stowardii Maiden
E. sporadica Brooker & Hopper
E. diminuta Brooker & Hopper
Eucalyptus subser. *Annulatae* L.A.S. Johnson & K.D. Hill ex Brooker
E. annulata Benth.
E. extensa L.A.S. Johnson & K.D. Hill
E. protensa L.A.S. Johnson & K.D. Hill
Eucalyptus ser. *Levispermae* Maiden
Eucalyptus ser. *Contortae* Blakely
Eucalyptus ser. *Stricklandiae* Brooker
Eucalyptus ser. *Accedentes* Chippend.
Eucalyptus ser. *Kruseanae* Chippend.
Eucalyptus ser. *Loxophlebae* Chippend.
Eucalyptus ser. *Obliquae* Blakely
Eucalyptus ser. *Dundasianae* Chippend.
Eucalyptus ser. *Elongatae* Blakely
Eucalyptus subsect. *Destitutae* Brooker

Descriptions

Eucalyptus sect. **Bolites** Brooker, *Aust. Syst. Bot.* 13: 94 (2000). *Type: Eucalyptus gomphocephala* DC.

Tree to 40 m tall with grey box-type rough bark to small limbs. *Branchlets* smooth, yellowish; pith glandular. *Cotyledons* more or less bilobed. *Juvenile leaves* petiolate, alternate, ovate or cordate, to 15 x 9.5 cm, thin, green. *Adult leaves* petiolate, alternate, lanceolate, to 16 x 2.5 cm, slightly discolorous, thin, green; reticulation dense and with very few, obscure oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncle erect, strongly flattened. *Buds* sessile to strongly and stoutly pedicellate, mushroom-shaped, to 2 x 1.2 cm; operculum hemispherical, rarely obtusely conical, wider than hypanthium. *Stamens* all fertile, outer ones oblique, inner flexed. *Ovules* in 4 vertical rows. *Fruit* sessile, more or less campanulate, to 2.2 x 1.7 cm, rim thick; disc level. *Seeds* black, flattish to saucer-shaped, often flanged, with distinct reticulum.

Notes. A section of one species occupying coastal dune and limestone habitats between Ludlow and Jurien, Western Australia. *E. gomphocephala* is widely planted as an ornamental in southern Australia. It is readily recognised by the robust tree habit, rough bark, yellowish branchlets, thin glossy adult leaves with dense reticulation, and mushroom-shaped buds.

Eucalyptus sect. **Bisectae** Maiden ex Brooker, *Aust. Syst. Bot.* 13: 98 (2000). *Type: Eucalyptus gracilis* F.Muell.

Cotyledons bisected.

Key to subsections of *Eucalyptus* sect. *Bisectae*

1. Buds to 7 cm long, much longer than wide; fruit large, thick-rimmed, held rigidly; stamens erect ..... subsect. **Hadrotes**
1. Buds smaller or slender, or if to 6 cm long, approximately as long as wide; fruit smaller and slender; stamens as given below
   2. Pith glandular; stamens erect or flexed ..... subsect. **Glandulosae**
   2. Pith not glandular; stamens never erect ..... subsect. **Destitutae**

Eucalyptus subsect. **Hadrotes** Brooker, *Aust. Syst. Bot.* 13: 98 (2000). *Type: Eucalyptus lehmannii* (Schauer) Benth.

Trees, *mallets* or *mallees* with rough or smooth bark. *Juvenile leaves* petiolate, elliptical to ovate or orbicular, to 10 x 7 cm. *Adult leaves* petiolate, lanceolate, narrowly lanceolate or elliptical, 4–14 x 1–3.5 cm, green to olive green, glazed, with intramarginal vein remote from leaf edge; reticulation often obscure with prominent irregular oil glands. *Inflorescences* axillary, unbranched, 7–50-flowered; peduncle flattened or terete. *Buds* sessile; operculum long, horn-shaped. *Disc* or *nectary* in form of convex mounds of tissue overlying valves; valves remaining united at their tip.

Key to the series of *Eucalyptus* subsect. *Hadrotes*

1. Seedling leaves smooth; pith of branchlets usually glandular ..... ser. **Cornutae**
1. Seedling leaves scabrid; pith of branchlets without glands ..... ser. **Lehmannianae**

Eucalyptus ser. **Cornutae** (Benth.) Blakely, *Key Eucalypts* 22, 106 (1934). *Type: Eucalyptus cornuta* Labill.

Mallee to tall *tree*, with decussate phyllotaxis. *Seedlings* (?not) scabrous. *Pith of branchlets* usually with glands. *Peduncles* terete or only slightly flattened.

Notes. A series of two species. Brooker & Kleinig (1990: 159) treated a proposed additional species as *Eucalyptus olivacea* Brooker & Hopper ined. Preliminary observations suggested that this taxon was a smooth-barked mallee with larger buds and fruit than *Eucalyptus macrandra,* and with a more northerly distribution. However, the distinctions do not hold, particularly the bud and fruit details, and both rough- and smooth-barked variants occur in the same locality, for instance, in the Stirling Range. Further field study may reveal bark differences to be associated with the age of the plant. On current evidence, we consider *E. olivacea* ined. to be conspecific with *E. macrandra*.

Eucalyptus cornuta has a fairly wide distribution in southern coastal Western Australia including islands off the south coast. It has been greatly depleted in numbers through the felling of the larger trees for construction purposes because of its excellent timber. In the poorer (particularly eastern) parts of its distribution it is reduced to a mallee. The species has been in cultivation in other parts of southern Australia for many years.

Carr & Carr (1980) referred to the pith glands of *E. cornuta* vis-à-vis *E.* ser. *Lehmannianae.* They stated that from an examination of specimens over 'most of its range', ...'the species always has glandular pith.' From an examination in CANB of about twenty specimens of *E. cornuta* over its range from west to east, we find that most specimens have pith glands. In a few others the glands were not evident and it may be that, if the character is diagnostic for the species as Carr & Carr imply, the glands in some specimens are minute, obscure or present at some nodes and not others.

The taxon described below the key is believed to be a hybrid of *Eucalyptus cornuta* and an entirely unrelated species, *E. angulosa* Schauer, of *E.* sect. *Dumaria.* We assign no further infra-generic status for it.

Key to species of *Eucalyptus* ser. *Cornutae*

1. Disc of fruit domed, extending over prominently exserted valves which remain coherent at the tips ..... **E. cornuta**
1. Disc of fruit flat; valves reaching to rim, not coherent ..... **E. macrandra**

1. Eucalyptus x missilis Brooker & Hopper, *nothosp. nov.*

Frutex "mallee" ad 3 m altus cortice laevi. Cotyledones bilobae. Folia adulta nitentia, viridia, ad 8 x 3 cm. Inflorescentiae 7 vel multiflorae; pedunculi erecti. Alabastra sessilia vel breviter pedicellata, lato-fusiformia, ad 1.8 x 0.7 cm operculo conico. Aliquot stamina exteriora erecta, cetera inflexa. Fructus sessiles, cupulati, ad 1.5 x 1.5 cm, laeves vel costati. Valvae 3 vel 4, exiles et aliquamdiu apicem versus connexae.

Typus: Cheyne Beach, 34°53'S, 118°23'E, Western Australia, 3 June 1983, *M.I.H. Brooker* 8155 & *S.D. Hopper* (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

Mallee to 3 m tall, with smooth bark. *Pith of branchlets* glandular. *Cotyledons* bilobed. *Seedling leaves* remaining opposite for 2 or 3 pairs, petiolate. *Adult leaves* alternate, petiolate, broadly lanceolate to elliptical, to 8 x 3 cm, glossy, green. *Inflorescences* axillary, unbranched, 7–many-flowered; peduncles erect, stout, flattened, to 2.5 cm long. *Buds* sessile or shortly pedicellate, broadly fusiform, to 1.8 x 0.7 cm; operculum conical. *Stamens:* some outer ones erect, others inflexed. *Anthers* versatile, dorsifixed, oblong, opening by longitudinal slits. *Ovary* 3- or 4-locular; ovules in 4 vertical rows on placenta. *Fruit* sessile, cupular, to 1.5 x 1.5 cm, smooth or ribbed; valves 3 or 4, not exceeding the thick rim, slender at the tips which are united for a time. *Seeds* black, flattened, shallowly ribbed on vertical side, smooth on dorsal side. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Thistle Cove, 18 Mar. 1972 *K.M. Allan* 847 (CANB, PERTH); Gully north of Mt Le Grand, 15 Sep. 1978, *D.F. Blaxell* (BRI, CANB, K, MEL, NSW); Cheyne Beach, 3 June 1983, *D.F. Blaxell* (CANB, NSW, PERTH); Esperance, 21 Jan. 1970,

Figure 1. Buds and fruits of *Eucalyptus* x *missilis* (*Brooker* 7171).

M.I.H. Brooker 2519 (CANB, NSW, PERTH); Coronet Creek, 4 Apr. 1977, *M.I.H. Brooker* 5645 (CANB, NSW, PERTH); W end of Thistle Cove, 4 Apr. 1977, *M.I.H. Brooker* 5651, 5653 (AD, CANB, MEL, NSW, PERTH); Cheyne Beach, Dec. 1979, *M.I.H. Brooker* 6686 (CANB, NSW, PERTH); Cheyne Beach to Mermaid Point, Nov. 1981, *M.I.H. Brooker* 7171, 7171a (CANB, NSW, PERTH); Hood Point, 9 Mar. 1988, *M.I.H. Brooker* 9919 (CANB, PERTH); Flinders Peninsula, 20 July 1988, *M.I.H. Brooker* 9994 (AD, CANB, MEL, NSW, PERTH); Sinker Reef area, Two Peoples Bay, E of Albany, 24 Jan. 1973, *N.T. Burbidge* 8105 (CANB, PERTH); Cheyne (Hassell) Beach, 1.3 km SW of caravan park along Mermaid Point track, 34°54'S, 118°23'E, 21 Nov. 1979, *S.D. Hopper* 1567 (PERTH); 3 km SE of Mt Le Grand, 2.4 km S of Lucky Bay Road on Hellfire Bay Road, 3 May 1982, *S.D. Hopper* 2275 (PERTH); West Cape Howe, 29 Oct. 1988, *L.A.S. Johnson* 9150 & *B. Briggs* (CANB, NSDW, PERTH); between Limestone Head and Bald Head, Flinders Peninsula, Torndirrup, S of Albany, 6 July 1986, *G.J. Keighery* 8164, 8165, (PERTH); 2.1 km NW of Mt Gardner, Two Peoples Bay Nature Reserve, 21 Apr. 1988, *N.K. McQuoid s.n.* (PERTH); West Cape Howe National Park, 27 Jan. 1996, *D. Nicolle* 1671 (CANB, PERTH).

Distribution and habitat. Western Australia: coastal, of scattered occurrence from West Cape Howe National Park east to Cape Le Grand, on sand over limestone or granite. (Figure 2A)

Flowering time. January to April.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. *Eucalyptus* x *missilis* is numerically rare but widely distributed and found on several conservation reserves including William Bay National Park, Two Peoples Bay Nature Reserve and Cape Le Grand National Park.

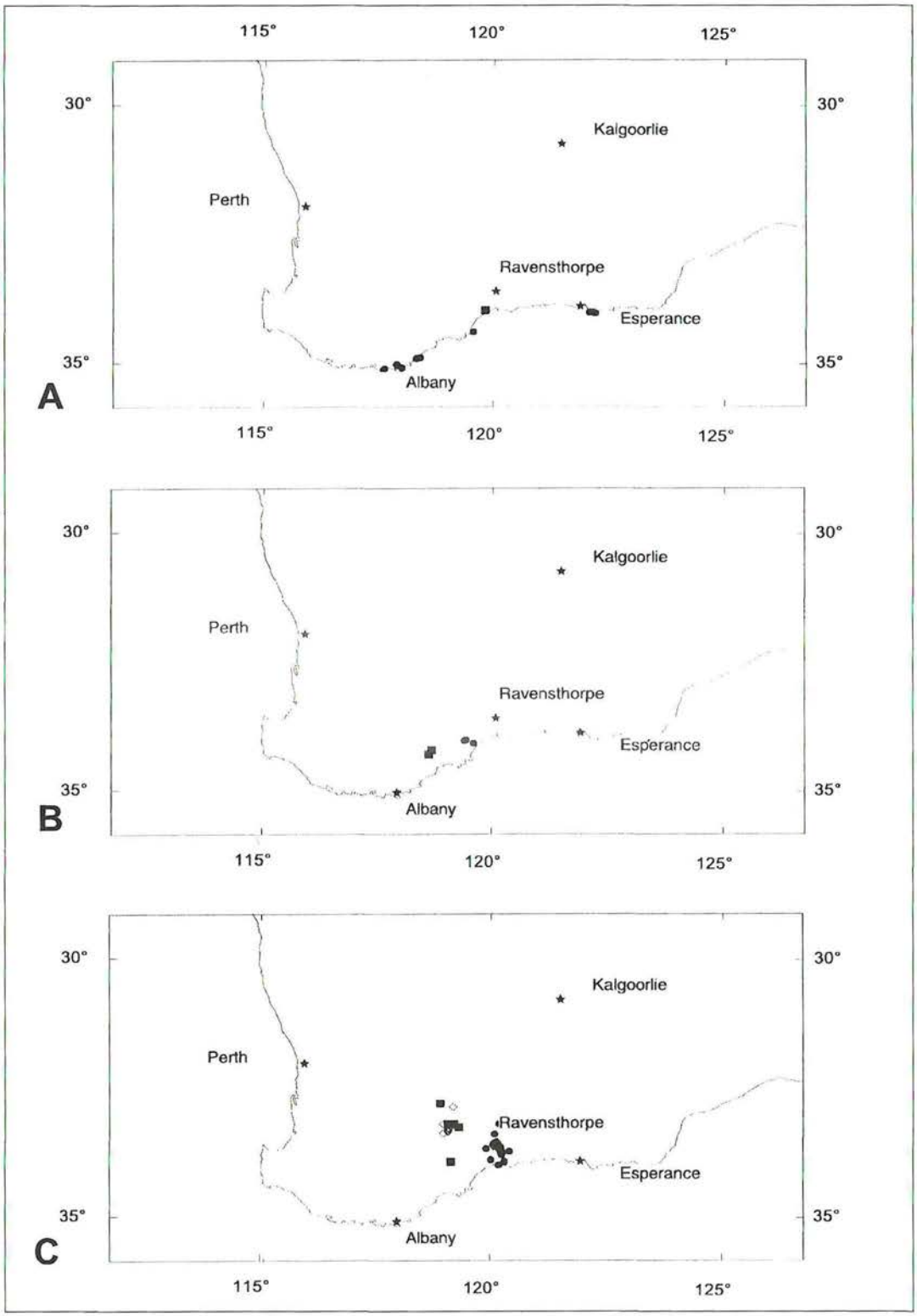

Figure 2. Distribution maps. A – *Eucalyptus mcquoidii* ■ and *E.* x *missilis* ●; B – *E. arborella* ● and *E. vesiculosa* ■; C – *E. cernua* ●, *E. mimica* subsp. *continens* ◇and *E. mimica* subsp. *mimica* ■.

Etymology. This species has been known to us for many years as "bullet bush" because of the bud shape and is given a name reflecting this, from the Latin *missilis* – that which may be thrown.

Notes. Flowers of this taxon have only been observed in bud. *Eucalyptus* x *missilis* has a very scattered distribution not unlike the hybrid species *E. erythrandra* Blakely & Steedman which was demonstrated to be a hybrid of *E. angulosa* and *E. tetraptera* Turcz. (Beard 1976). It does not occur in large populations and is usually found growing with both *E. angulosa* and *E. cornuta* in the vicinity. Recently the authors collected it at Cape Hood where *E. angulosa* occurred in abundance but no *E. cornuta* was seen in a brief search although this is a typical coastal site within the known distribution of the species.

Eucalyptus x missilis has characteristics consistently intermediate between *E. cornuta* and *E. angulosa*, the most contrasting diagnostic features of these species being the wholly erect stamens of the former and the inflexed stamens of the latter. In *E. x missilis*, some outer stamens are erect and the rest are inflexed. The new species is also intermediate in leaf, valve, seed and seedling characters.

In a glasshouse trial to test for comparative morphology, *Eucalyptus x missilis* progeny segregated for some seedling characters. This provides further evidence of a likely hybrid origin for the species. However, we consider that the morphological uniformity of mature individuals within and between all populations justifies taxonomic recognition of the species.

Eucalyptus ser. **Lehmannianae** D.J. Carr & S.G.M. Carr, *Austral. J. Bot.* 28: 523 (1980). *Type: Eucalyptus lehmannii* (Schauer) Benth.

Tree, shrub, mallee or *mallet*, with whorled phyllotaxis. *Seedlings* scabrous. *Pith of branchlets* without glands. *Peduncles* flattened or terete. *Staminal filaments* lemon-green.

Key to subseries of *Eucalyptus* ser. *Lehmannianae*

1. Hypanthia of most or all buds and fruits within an inflorescence fused ..... subser. **Conjunctae**
1. Hypanthia of all buds free ..... subser. **Liberae**

Eucalyptus subser. **Conjunctae** Brooker, *Aust. Syst. Bot.* 13: 99 (2000). *Type: Eucalyptus lehmannii* (Schauer) Benth.

Mallets, small *trees* or *mallees*. *Adult leaves* green, slightly glossy; intramarginal vein well removed from leaf edge in broader-leaved species. *Inflorescences* axillary, unbranched; peduncle long, stout, subtending more than 7 flowers fused by their hypanthia and remaining fused in fruit. *Buds* with operculum many times longer than wide. *Stamens* erect. *Filaments* pale lemon-green, massed in a ball when in full flower. *Fruit valves* exserted, remaining fused at their tips.

Notes. This subseries consists of four species, all of which have been referred to *Eucalyptus lehmannii* previously because of their fused hypanthia. Fused hypanthia are a unique feature of this subseries, distinguishing it from the remainder of thegenus. Other obvious characters of the subseries are the remote intramarginal vein of the adult leaves, the very numerous buds, long opercula and lemon-green stamens. The species occur in coastal and subcoastal areas from the Stirling Range eastwards to the Wittenoom Hills and also on many offshore inlands.

Key to species in *Eucalyptus* subser. *Conjunctae*

1. Peduncle terete ..... 2. **E. mcquoidii**
1. Peduncle flattened
2. Operculum < 5 times as long as wide, thick ..... **E. conferruminata**
2. Operculum > 5 times as long as wide, slender
3. Mallee ..... **E. lehmannii**
3. Small tree ..... 3. **E. arborella**

2. Eucalyptus mcquoidii Brooker & Hopper, *sp. nov.*

Eucalypto lehmannii (Schauer) Benth. affinis, a qua habitu arborescenti, foliis parvis angustioribusque (ad 1.5 cm latis), insignite pedunculis teretis et usque ad 50 alabastra in quoque inflorescentia differt.

Typus: west of estuary 200 m NW of Quoin Head campsite, Fitzgerald River National Park, Western Australia, 6 April 1995, *M.I.H. Brooker* 12198W (*holo:* CANB; *iso:* AD, NSW, PERTH).

With affinity to *Eucalyptus lehmannii* (Schauer) Benth. from which it differs in the tree habit (branching low on the trunk), small narrower juvenile leaves, to 6 x 1.5 cm, notably terete peduncles and up to 50 buds per inflorescence (to 21 in *E. lehmannii*). (Figure 3)

Other specimens examined. WESTERN AUSTRALIA: 7.7 km S of Telegraph Track on way to Quoin Head, Fitzgerald River National Park, 6 Apr. 1995, *M.I.H. Brooker* 12197W (CANB); 1 km W of Quoin Head, Fitzgerald River National Park, 6 Oct. *C.J. Robinson* 1183 (PERTH); 0.75 km NNW of Quoin Head, 25 Dec. 1988, *E.M. Sandiford* (PERTH).

Distribution and habitat. Known only from near Quoin Head, Fitzgerald River National Park, Western Australia, on cliff-top on a branch of creek. On a steep slope of skeletal soils deriving from shale and quartzite. (Figure 2A)

Flowering period. Unknown.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. *Eucalyptus mcquoidii* is numerically rare and highly localised. The future of this fire-sensitive obligate-seeder species in Fitzgerald River National Park is secure provided fire frequencies are managed to ensure adequate canopy-stored seed is present.

Etymology. Named after Nathan McQuoid, botanist and collector, formerly Head Ranger of Fitzgerald River National Park, who has assisted us in many ways with the taxonomy of the Western Australian eucalypts, and who is the discoverer of *Eucalyptus vesiculosa*, newly published below in this paper.

Notes. Although no flowering material has been collected in the field, the species is known to produce the lemon-green stamens typical of this subseries in cultivation. It is quite distinctive in its terete peduncles.

3. Eucalyptus arborella Brooker & Hopper, *sp. nov.*

A *Eucalypto lehmannii* habitu arborescenti, foliis plantularum deltoideis ad 4 cm latis et praesentibus in clivis petrosis differt.

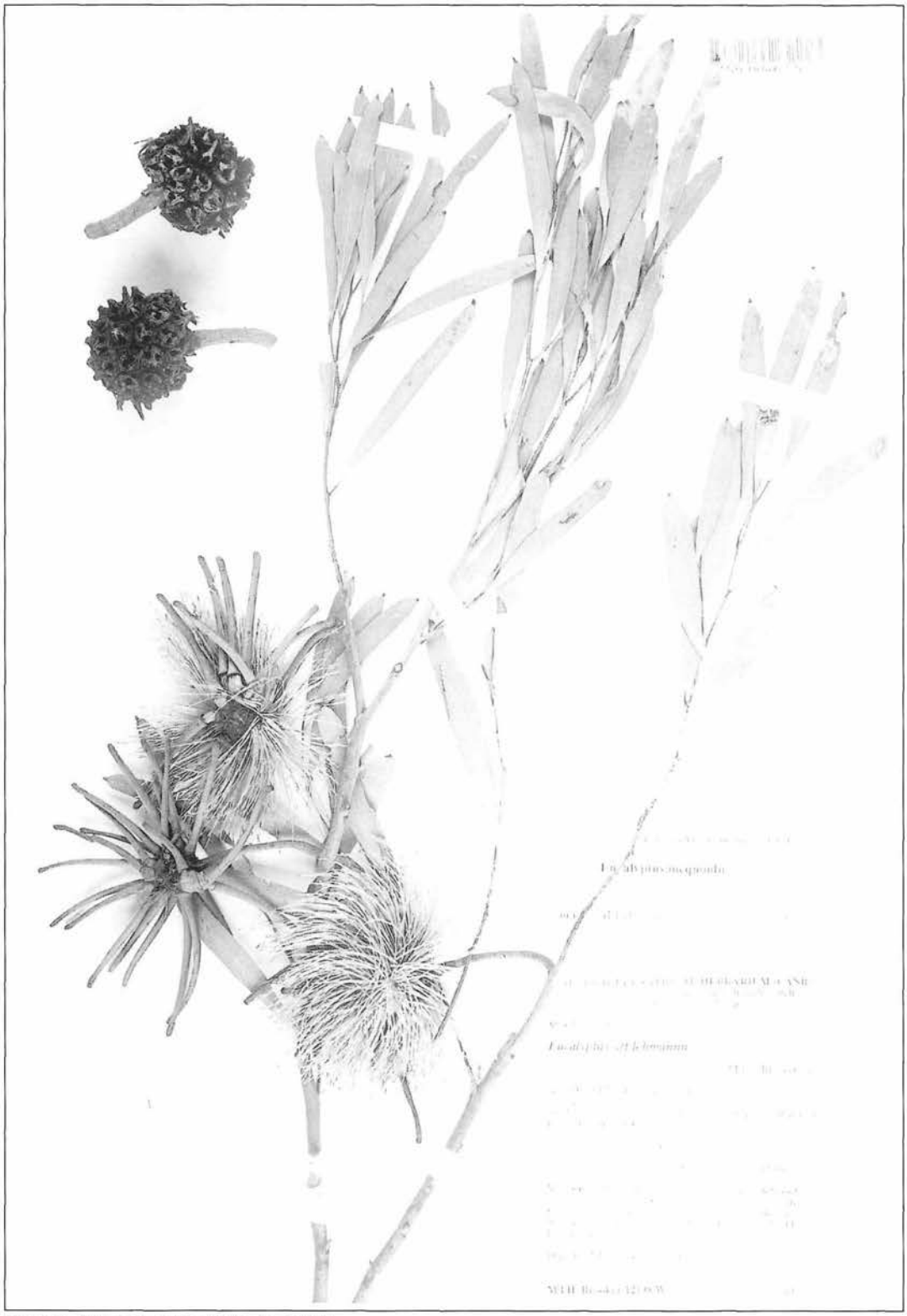

Figure 3. Holotype of *Eucalyptus mcquoidii*.

Typus: Fitzgerald River National Park, 1.5 km south-east of Twertup Field Studies Centre, Western Australia, 12 March 1989, *S.D. Hopper* 7131 (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

Differs from *E. lehmannii* by the tree habit (branching low on the trunk), juvenile leaves deltoid, broader, to 4 cm wide (in *E. lehmannii* ovate, to 3.5 cm wide), and the occurrence on stony sites (*E. lehmannii* occurs mostly on sandy plains). (Figure 4A)

Other specimens examined. WESTERN AUSTRALIA: Fitzgerald Inlet, Fitzgerald Reserve, 34°05'S, 119°34'E, 3 Aug. 1970, *M.I.H. Brooker* 2701 (PERTH, CANB); Harrie Hill, 1.5 km SE of Twertup Cottage, Fitzgerald National Park, 26 Nov. 1991, *M.I.H. Brooker* 10918 (AD, CANB, MEL, NSW, PERTH); Twertup Hill, E of cottage, Fitzgerald River National Park, 18 Aug. 1999, *M.I.H. Brooker* 13035 (CANB, PERTH); Fitzgerald River National Park, 6.2 km W of bed of Fitzgerald River on Fitzgerald Inlet Road, 12 Mar. 1989, *S.D. Hopper* 7132 (AD, CANB, MEL, NSW, PERTH); Fitzgerald River National Park, 5.5 km NNW of mouth of Fitzgerald River, on NE slopes above inlet, 12 Mar. 1989, *S.D. Hopper* 7133 (AD, CANB, MEL, NSW, PERTH); Fitzgerald River National Park, 500 m S of telegraph track on Quoin Head track, 13 Mar. 1989, *S.D. Hopper* 7134, 7135 (AD, CANB, MEL, NSW, PERTH); hill *c.* 1.5 km SE of Twertup Field Studies Centre, Fitzgerald River National Park, 7 Apr. 1995, *S.D. Hopper* 8325 (PERTH).

Distribution and habitat. Known only from the Fitzgerald River National Park, Western Australia, where it forms low woodlands on breakaways, rocky slopes and rocky creek lines with *E. astringens*, *E. clivicola* Brooker & Hopper, *E. falcata* Turcz., *E. uncinata* Turcz., *Banksia laevigata* and *B. media*. (Figure 2B)

Flowering time. March to May.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. *Eucalyptus arborella* is somewhat rare but secure in Fitzgerald River National Park provided fire frequencies are managed to ensure adequate canopy-stored seed is present in this fire-sensitive obligate-seeder species.

Etymology. From the Latin, *arbor* (tree), with the diminutive suffix, *ella*.

Notes. The species is closely related to *E. lehmannii*, differing principally in its tree habit.

Eucalyptus subser. **Liberae** Brooker, *Aust. Syst. Bot.* 13: 99 (2000). *Type: Eucalyptus burdettiana* Blakely & Steedman

Mallets or *mallees*. *Adult leaves* alternate, petiolate, narrowly lanceolate to lanceolate, to 9 x 1.7 cm green to blue-green, slightly glossy; intramarginal vein well removed from leaf edge. *Inflorescences* axillary, unbranched; peduncle long, flattened, subtending 3–13 free flowers. *Buds* sessile, elongated, to 5 x 1 cm; operculum many times longer than wide, smooth or warty. *Stamens* erect. *Filaments* pale lemon-green. *Fruit* sessile, campanulate, to 2 x 2.5 cm; valves exserted, remaining fused at their tips for a while.

Notes. This subseries comprises the remainder of *E.* series *Lehmannianae*, i.e. those species with free buds and fruits. Four species are recognised. For descriptions of these species see Carr & Carr (1980) and Brooker & Kleinig (1990).

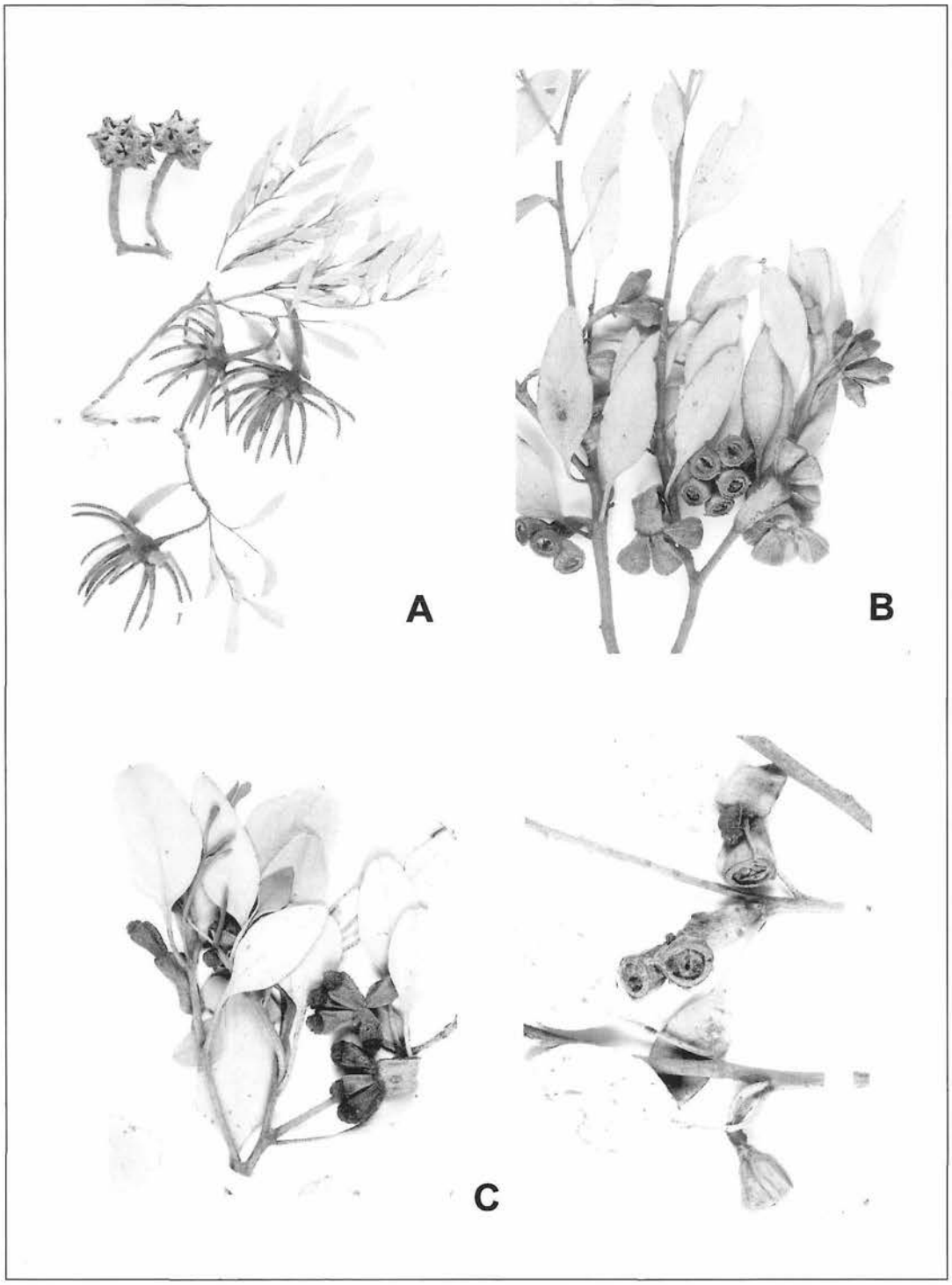

Figure 4. Buds and fruits. A – *E. arborella* (*Brooker* 10918); B – *E. cernua* (*Brooker* 12922); C – *E. vesiculosa* (*Brooker* 12213W).

Key to species of *Eucalyptus* subser. *Liberae*

1. Operculum smooth
 2. Fruit to 1.7 cm wide; buds 7–13; mallee or small tree ..... **E. talyuberlup**
 2. Fruit 2–3 cm wide; buds 3–7; mallet ..... **E. newbeyi**
1. Operculum warty
 3. Operculum warts few, small; mallee ..... **E. burdettiana**
 3. Operculum warts many, prominent; mallet ..... **E. megacornuta**

Eucalptus subsect. **Glandulosae** Brooker, *Aust. Syst. Bot.* 13: 99 (2000). *Type: Eucalyptus annulata* Benth.

Pith of branchlets glandular.

Note. With the subtraction of the *Eucalyptus* subsection *Hadrotes* above, the section *Bisectae* comprises a large number of series which divide into two large groups, one of which with pith glands we address in some detail below.

Key to series of *Eucalyptus* subsect. *Glandulosae*

1. Seed spherical to cuboid ..... ser. **Levispermae**
1. Seed compressed-ovoid to flattish
 2. All stamens erect in unopened bud ..... ser. **Erectae**
 2. Some or all stamens inflexed in unopened bud
  3. Seedcoat honey-combed on dorsal side ..... ser. **Contortae**
  3. Seedcoat not honey-combed
   4. Seed with terminal hilum ..... ser. **Stricklandiae**
   4. Seed with ventral hilum
    5. Crown comprising juvenile leaves ..... ser. **Kruseanae**
    5. Crown comprising adult leaves
     6. Adult leaves > 2.5 cm wide, very thick, not flexible ..... ser. **Obliquae**
     6. Leaves < 2.5 cm wide, flexible
      7. Style narrowed at base or articulate ..... ser. **Loxophlebae**
      7. Style widening at base
       8. Leaf oil glands minute or obscure; juvenile leaves glossy ..... ser. **Dundasianae**
       8. Leaf oil glands distinct; juvenile leaves dull
        9. Peduncles terete ..... ser. **Elongatae**
        9. Peduncles flattened
         10. Leaf reticulation distinct ..... ser. **Accedentes**
         10. Leaf reticulation obscured by very numerous oil glands ..... ser. **Clinatae**

Eucalyptus ser. **Clinatae** Brooker, *Aust. Syst. Bot.* 13: 99 (2000). *Type: Eucalyptus cernua* Brooker & Hopper

Some or all stamens inflexed in bud; leaf oil glands distinct and very numerous, obscuring the leaf reticulation.

Notes. A series of three species, which share the glazed leaf surfaces and great leaf oil gland density and lack of reticulation of *Eucalyptus* ser. *Erectae* subser. *Abundae*.

Key to species of *Eucalyptus* ser. *Clinatae*

1. Inflorescences erect; operculum smooth; flowers creamy white ..... **E. vegrandis**
1. Inflorescences down-turned; flowers red
2. Operculum warty; adult leaves to 7 x 4 cm; marlock ..... 4. **E. vesiculosa**
2. Operculum smooth; adult leaves to 10 x 2.5 cm; mallee or mallet ..... 5. **E. cernua**

Notes. According to the protologue of Hill & Johnson (1992), the stamens of *Eucalyptus vegrandis* are erect. Dissection of the isotype in CANB and of some other specimens cited by the authors shows that the stamens, arising from a narrow staminophore, are mostly if not all inflexed. Hence, our inclusion of the species in the *E.* ser. *Clinatae*.

Hill & Johnson include both *Eucalyptus vegrandis* and *E. spathulata* in their extra-codical series *Erythronemae* subseries *Platypodosae*. Among the characters they use to diagnose this subseries is that the filaments are erect "well before maturity", and it must be assumed from this that stamen disposition is maintained to bud maturity. Dissection of *E. spathulata* buds confirms, by contrast with *E. vegrandis*, that the stamens are all erect, arising from a broad staminophore in several whorls, thus placing it in *E.* ser. *Erectae* subser. *Abundae*.

From the study of numerous field collections, we had intended to recognise another taxon, *Eucalyptus recondita* Brooker & Hopper ined., also with inflexed stamens (see Brooker & Kleinig 1990). From the large number of specimens of this taxon and typical *E. vegrandis* in CANB, we recognise a more or less continuous gradient between the two. It became clear the two taxa were best treated as one. Typical *E. vegrandis* is at the narrow-leaved end of the gradient and *E. recondita* ined. at the broad-leaved end. The latter name should now be disregarded in favour of the former, unless other factors subsequently found lead to its recognition, possibly at the subspecies level.

4. Eucalyptus vesiculosa Brooker & Hopper, *sp. nov.*

A *Eucalypto cernuae* foliis adultis late ellipticis in petiolis longioribus, alabastris valde angulatis, operculis vesiculosis, floribus constanter rubris, et praesentia in societatibus plus minusve puris differt.

Typus: Boxwood Hill–Ongerup road, 4 km west of Norman Rd, east of Monjemup Rd, Western Australia, 8 April 1995, *M.I.H. Brooker* 12213 W *& S.D. Hopper* (*holo:* CANB; *iso:* AD, NSW, PERTH).

Differs from *Eucalyptus cernua* by the broadly elliptical adult leaves on longer petioles, strongly angled buds, prominently warty opercula, consistently red flowers, and occurrence in more or less pure stands. (Figure 4C)

Other specimens examined. WESTERN AUSTRALIA: Corackerup Nature Reserve, 19 Sep. 1999, *M.I.H. Brooker* 13043 (CANB, PERTH); about 40 km SW of Jerramungup on the Boxwood Hill–Ongerup road between Monjemup Rd and Norman Rd (1.3 km from Monjemup Rd), Oct. 1994, *N. McQuoid* 1, 2 (CANB, PERTH); Boxwood Hill–Ongerup road, between Norman Rd and Monjemup Rd at edge of Corackerup Nature Reserve, 5 May 1999, *A. Slee* 4133 (CANB, PERTH), 4134 (CANB).

Distribution and habitat. Ongerup area of Western Australia. Known only from two localities where it occurs in a more or less pure stand with some *E. annulata* and *E. neutra* on a reddish clay flat, on ground gently sloping northwards towards lateritic breakaways of the reserve. (Figure 2B)

Flowering time. September to October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. *Eucalyptus vesiculosa* is highly localised, locally abundant, and occurs in Corackerup Nature Reserve.

Etymology. From the Latin, *vesiculosus* (covered with blisters), in reference to the warty operculum.

Notes. Eucalyptus vesiculosa occurs in an extensive, more or less pure, erect marlock stand of similar height to *E. platypus*. It could be mistaken for this species from a distance, but differs clearly by the angled buds and prominently warty opercula. It has broader leaves, longer petioles, and more strongly angled buds and fruits than its close relative *E. cernua*, which does not occur in 'pure' stands.

5. Eucalyptus cernua Brooker & Hopper, *sp. nov.*

[*Eucalyptus nutans auct. mult. non* F. Muell. (see below).]

Frutex "mallee" vel "mallet" ad 4 m altus arbore summa dense rotundata. Folia adulta breviter petiolata, elliptica, ad 10 x 2.5 cm, nitentia, olivacea vel atroviridia, dense glandulifera. Inflorescentiae axillares, 7-florae, pedunculi deflexi. Alabastra ovoidea, ad 1.8 x 0.7 cm, operculo brevi rotundato. Aliqua vel omnia stamina inflexa. Flores rubra. Fructus cupulati vel obconici, ad 1.3 x 1.3 cm.

Typus: 4.6 km N of Ravensthorpe–Albany road on Lake Grace road, 34°33'S, 120°00'E, Western Australia, 4 September 1987, *M.I.H. Brooker* 8657 (*holo:* CANB; *iso:* AD, MEL, NSW, PERTH).

Mallee or *mallet* to 4 m tall, with smooth bark. *Pith of branchlets* glandular. *Cotyledons* bisected. *Seedling leaves* alternate, petiolate, ovate to deltoid, to 7 x 5 cm, green. *Adult leaves* alternate, shortly petiolate, elliptical to lanceolate, to 10 x 2.5 cm, concolorous, olive green to dark green, glossy; intramarginal vein well removed from leaf edge; side veins usually distinct but further reticulation not visible, with very numerous oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncle strongly flattened, rigidly down-turned, to 2.6 cm long. *Buds* sessile or on a short, stout, tapering pedicel, more or less ovoid or rhomboidal in outline, to 1.8 x 0.7 cm, with operculum narrower than the strongly ribbed hypanthium. *Stamens* either some outer ones erect with others inflexed, or all inflexed. *Anthers* versatile, oblong, opening by longitudinal slits. *Flowers* red or rarely creamy white. *Ovary* 3–5-locular; ovules in 4 vertical rows on placenta. *Fruit* sessile, cupular to obconical, ribbed, to 1.3 x 1.3 cm; rim thick; disc annular to descending; valves 3–5, scarcely exserted. *Seeds* grey-brown, shallowly reticulate on dorsal side. (Figure 4B)

Other specimens examined. WESTERN AUSTRALIA: N side of Mt MacMahon, NE of Ravensthorpe, 14 Sep. 1978, *D. Blaxell* 1737 (CANB, NSW, PERTH); 4.7 km NW of highway 1 on Ravensthorpe–Lake King road, 10 Oct. 1984, *B.Briggs* 7717 & *L. Johnson* (AD, CANB, MEL, NSW, PERTH); *c.* 3 miles [5 km] NE of Kundip, 7 Apr. 1974, *M.I.H. Brooker* 4462 (CANB, PERTH); 8.5 km N of Jerdacuttup road, t/o on Ravensthorpe–Hopetoun road, 26 Nov. 1985, *M.I.H. Brooker* 9115, (CANB); E of Mt MacMahon on fire trail along N side of range near bottom of slope, 7 Apr. 1995, *M.I.H. Brooker* 12205 W (AD, CANB, NSW, PERTH); 9 km from Ravensthorpe–Jerramungup road on Cocibarup Rd from east, 7 Apr. 1995, *M.I.H. Brooker* 12207 W (AD, CANB, NSW, PERTH); 100 m from highway 1 along Eldverdton Rd, E of Ravensthorpe, 31 Aug. 1998, *M.I.H. Brooker* 12922 (CANB, PERTH); 6.7 km SE of Ravensthorpe, 26 Mar. 1968, *G.M. Chippendale* 415 (CANB, MEL, NSW, PERTH); 17.5 km SE of Ravensthorpe, 9 Jan. 1979, *M.D. Crisp.* 4979 (CANB, NSW PERTH); 4 km W of Annie Peak,

Fitzgerald River National Park, 11 Jan. 1979, *M.D. Crisp* 5030 (CANB, PERTH); Ravensthorpe district, Nov. 1944, *C.A. Gardner s.n.* (CANB, PERTH); Kundip, 23 Oct. 1961, *C.A. Gardner* 13722 (CANB, PERTH); 20 km by road SSE of Ravensthorpe on Hopetoun road, 17 Sep. 1976, *L. Haegi* 1010 (AD, CANB); 8.4 km S of highway on Mason Bay Rd, 9 Nov. 1986, *K.D. Hill* 2364 (PERTH); 1 km SW of Bandalup Hill, 20 Jan. 1981, *G.J. Keighery* 3712 (PERTH); Hopetoun, Nov. 1909, *J.H. Maiden* (NSW H5615) (CANB, NSW): Ravensthorpe–Hopetoun road, 15 Jan. 1970, *S.L. Paul* 83, 85 (CANB, PERTH); 19 km N of Hopetoun, 13 Aug. 1951, *R.D. Royce* 3674 (PERTH); 5 km E of Ravensthorpe, 5 Oct. 1966, *P.G. Wilson* 5534 (CANB, PERTH); 1 km S of Ravensthorpe, 21 May 1967, *P.G. Wilson* 5877 (CANB, PERTH); 18 miles from Hopetoun towards Ravensthorpe, 27 Oct. 1968, *J. Wrigley* (CANB 036802).

Distribution. In and around the Ravensthorpe Range, Western Australia. (Figure 2C)

Flowering time. September to January.

Etymology. From the Latin, *cernuus* (nodding, towards the earth), referring to the down-turned inflorescences.

Notes. Eucalyptus cernua is the red-flowering (rarely creamy white) mallee known commonly until recently as *E. nutans*, the type of which is *E. platypus* and is from Bremer Bay, well to the south-west of the known occurrences of *E. cernua*. The relationship of *E. cernua* to *E. vesiculosa* is given above.

Eucalyptus ser. **Erectae** Brooker, *Aust. Syst. Bot.* 13: 100 (2000). *Type: Eucalyptus annulata* Benth.

Stamens erect in bud.

Notes. A series comprising three subseries, *Eucalyptus* subser. *Annulatae*, the three species of which were treated by Johnson & Hill (1991), and two other much larger subseries which include several of the new species treated in this paper.

Key to subseries in *Eucalyptus* ser. *Erectae*

1. Seedcoat deeply pitted ..... subser. **Annulatae**
1. Seedcoat shallowly reticulate
   2. Secondary veins of adult leaf obscure and further reticulation not seen; staminophore broad ..... subser. **Abundae**
   2. Secondary veins of adult leaf distinct; tertiary veining present; staminophore narrow ..... subser. **Pedicellatae**

Eucalyptus subser. **Abundae** Brooker, *Aust. Syst. Bot.* 13: 100 (2000). *Type: Eucalyptus platypus* Hook.

Mallees or *mallets*, with smooth bark. *Pith of branchlets* glandular. *Adult leaves* glossy, olive green, with obscure side veins and very numerous oil glands. *Stamens* erect, arising in several whorls from a broad, flat staminophore.

Notes. A subseries of 12 species, three of which each comprise two subspecies. It corresponds with part of *Eucalyptus* ser. *Elongatae* Blakely *sensu* Chippendale 218 (1988) and is equivalent to the informal *Eucalyptus* subser. *Platypodinae* Pryor & Johnson, "Class. Eucs" 44 (1971).

Key to *Eucalyptus* subser. *Abundae*

1. Buds in groups of 3
 2. Outer operculum held to bud maturity ..... 6b. **E. mimica** subsp. **continens**
 2. Outer operculum shed before bud maturity or split into sepals
  3. Outer operculum shed whole before bud maturity
   4. Fruit prominently 2-winged longitudinally ..... **E. goniocarpa**
   4. Fruit not winged
    5. Pedicels winged, > 4 mm long ..... **E. suggrandis** subsp. **alipes**
    5. Pedicels not winged, < 4 mm long ..... **E. suggrandis** subsp. **suggrandis**
  3. Outer operculum split into sepals
   6. Buds to 2.3 x 0.5 cm ..... 6a. **E. mimica** subsp. **mimica**
   6. Buds to 3.3 x 1.3 cm ..... **E. steedmanii**
1. Peduncles with 7 or more flowers
 7. Buds and fruit glaucous
  8. Whole aspect of plant strongly glaucous; peduncles 7-flowered; fruit to 1.4 x 1.3 cm ..... 7. **E. incerata**
  8. Branchlets, buds and fruit lightly glaucous; peduncles with more than 7 flowers; fruit to 1.1 x 1 cm ..... **E. tephroclada**
 7. Buds and fruit not glaucous
  9. Adult leaves > 2 cm wide
   10. Peduncles erect, up to 2.5 cm long ..... 8. **E. utilis**
   10. Peduncles down-curved, up to 4 cm long
    11. Adult leaves orbicular, to 3.5 cm wide ..... **E. platypus** subsp. **platypus**
    11. Adult leaves elliptical, to 2.5 cm wide ..... 9. **E. platypus** subsp. **congregata**
  9. Adult leaves < 2 cm wide
   12. Adult leaves to 0.4 cm wide ..... **E. spathulata**
   12. Adult leaves to > 0.4 cm wide
    13. Operculum warty ..... **E. suggrandis** subsp. **suggrandis**
    13. Operculum smooth
     14. Buds to 4 cm long
      15. Inflorescences in 7s; adult leaves to 12 cm long ..... **E. eremophila**
      15. Inflorescences in 7s to 11s; adult leaves to 8 cm long ..... **E. tenera**
     14. Buds to 2.5 cm long ..... **E. depauperata**

6. Eucalyptus mimica Brooker & Hopper, *sp. nov.*

Eucalypto steedmanii affinis; arbor "mallet" vel frutex "mallee" ad 5 m altus trunco exili cortice laevi. Folia adulta linearia, ad 8 x 0.7 cm, olivacea, dense glandulifera. Inflorescentiae axillares, 3-florae; pedunculi erecti. Alabastra pedicellis longis, ad 2.3 x 0.8 cm, longitudinaliter 3 vel 4-costis. Fructus pedicellati quadrati in sectione, ad 1.4 x 0.9 cm.

Typus: 11.3 km along Old Ravensthorpe Road from Newdegate–Lake King road, Western Australia, 24 November 1987, *M.I.H. Brooker* 9811 (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

Related to *E. steedmanii* but differing in the smaller buds to 1.8 x 0.8 cm and fruits to 1.3 x 0.9 cm.

Flowering period. Not known.

Etymology. The epithet alludes to the similarity of the new species to *Eucalyptus steedmanii*, from the Latin, *mimicus* (mimicking).

Notes. Eucalyptus mimica is related to *E. steedmanii*, which differs in its larger buds to 3.3 x 1.3 cm and fruit to 2.2 x 1.7 cm. *E. steedmanii* is commonly found on low ironstone hills whereas *E. mimica* occurs either in saline habitats or in sandy loam soils. Two subspecies are recognised for *E. mimica*.

6a. Eucalyptus mimica Brooker & Hopper subsp. **mimica**

Mallee with grey-green over coppery smooth bark. *Buds* with free sepals. (Figure 5A)

Other specimens examined. WESTERN AUSTRALIA: 11 km from Newdegate–Lake King road on Old Ravensthorpe Rd, 17 Dec. 1987, *M.I.H. Brooker* 9838 (AD, CANB, MEL, NSW, PERTH); between Lake Grace and Karlgarin, Feb. 1965, *C.A. Gardner s.n.* (PERTH); ± 7 miles [11 km] SE of Newdegate, 4 Nov. 1965, *A.S.George* 7299 (PERTH); 23 km E of Newdegate on Lake King road, 14 Sep. 1989, *A. Napier* 304 & *A. Kelly* (PERTH); 4 miles [6 km] S of Newdegate, 21 July 1970, *K.R. Newbey* 3217 (CANB, NSW, PERTH); 16 miles [26 km] E of Pingrup, 6 m W of Greenhills soak, Feb. 1953, *D. Serventy* 183 (CANB, MEL, PERTH); W edge of Lake King, 10 Nov. 1983, *P.S. Short* 2356 & *L. Haegi* (AD, MEL, PERTH); 17.8 km SE from Newdegate on Old Ravensthorpe Rd, 23 Oct. 1992, *P.J. White* 397 (PERTH).

Distribution and habitat. Western Australia: from east of Pingrup to south of Newdegate, occupying saline sites. (Figure 2C)

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. *Eucalyptus mimica* subsp. *mimica* is only known from road verges and private land in a small portion of the wheatbelt.

6b. Eucalyptus mimica subsp. **continens** Brooker & Hopper, *subsp. nov.*

A subspecie typica habitu "mallet", trunco exili, cortice atroschistacea, operculo exteriore persistenti et habitatione non salino differt.

Typus: 11 km south along Lockhardt Rd from Magenta Rd, Western Australia, 17 December 1987, *M.I.H. Brooker* 9841 (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

Mallet with dark grey bark. *Buds* with persistent outer operculum. (Figure 5B)

Other specimens examined. WESTERN AUSTRALIA: 8 miles [13 km] S of Newdegate, 1952, *G.E. Brockway* 4 (PERTH); 11 km S along Lockhart Rd from Magenta Rd, S of Newdegate, 27 Nov. 1991, *M.I.H. Brooker* 10925 (AD, CANB, NSW, PERTH); 12.1 km N of Ryans Rd on Lockhart Rd, 7 Sep. 1988, *K.D. Hill* 3138 (PERTH); 1/3 mile [0.5 km] SW of Sullivan Soak, Feb. 1953, *D.L. Serventy* 229 (PERTH).

Distribution and habitat. Known only from the type locality and nearby areas of Western Australia, occurring in non-saline, sandy loam soils. (Figure 2C)

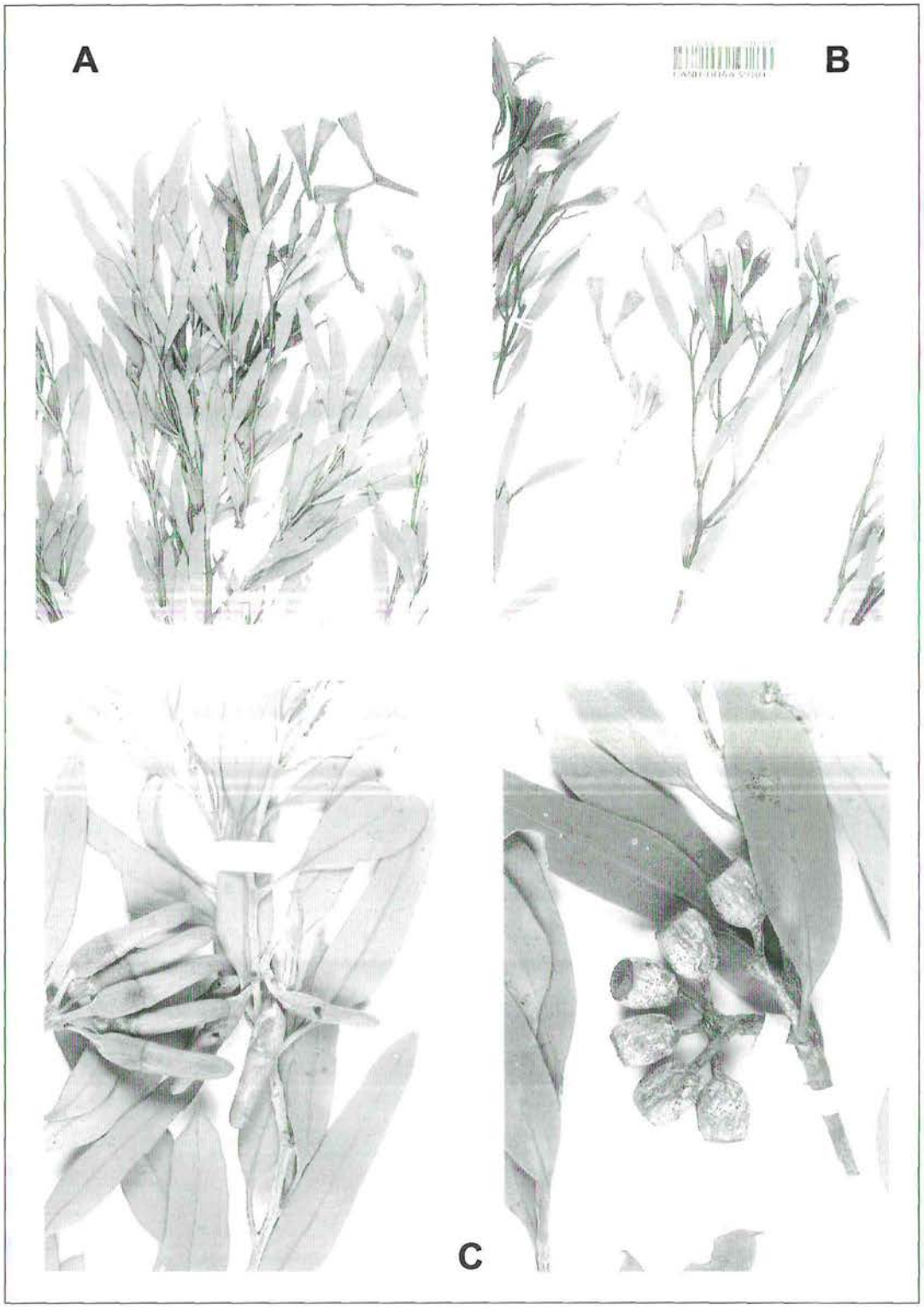

Figure 5. Buds and fruits. A – *E. mimica* subsp. *mimica* (*Brooker* 9811); B – *E. mimica* subsp. *continens* (*Brooker* 9841); C – *E. incerata* (*Hill* 627).

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. *Eucalyptus mimica* subsp. *continens* is somewhat rare but is probably secure provided fire frequencies are managed to ensure that adequate canopy-stored seed is present on this fire-sensitive obligate-seeder species.

Etymology. From the Latin, *continens* (retaining), alluding to the retention of the outer operculum until flowering.

Notes. Differs from the typical subspecies by the mallet habit, dark grey bark, persistent outer operculum and the habitat of non-saline, sandy loam soils.

The retention of the intact outer operculum until late in bud development is an attribute unique in Western Australian members of *E.* subgenus *Symphyomyrtus* except for the unrelated box species, *E. petraea* D.J. Carr & S.G.M. Carr.

7. Eucalyptus incerata Brooker & Hopper, *sp. nov.*

Frutex "mallee" *Eucalypto eremophilae* (Diels) Maiden affinis a qua ramulis alabastris fructibusque valde glaucis, alabastris robustioribus, et fructibus leviter costatis differt; a *E. tephroclada* glaucedine majore, alabastris minoribus in quoque inflorescentia, et alabastris fructibusque majoribus differt.

Typus: 16.1 km north of Hyden–Norseman track on Mt Day road, 32°04'S, 121°02'E, Western Australia, 7 November 1983, *M.I.H. Brooker* 8358, *S.D. Hopper, L.A.S. Johnson & D.F. Blaxell* (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

Mallee with affinity to *Eucalyptus eremophila* (Diels) Maiden but differing in the strongly glaucous branchlets, buds and fruit, more robust buds, and the slightly ribbed fruit; from *E. tephroclada* it differs by more glaucescence, usually fewer buds in the inflorescence, and larger buds and fruits. (Figure 5C).

Other specimens examined. WESTERN AUSTRALIA: 17 km E of grid in rabbit proof fence E of Hyden, 32°25'S, 119°22'E, 9 Aug. 1984, *M.I.H. Brooker* 8621 (AD, CANB, MEL, NSW, PERTH); 603 mile peg between Cross Roads and Marvel Loch, 8 Dec. 1968, *S. Chambers* 188 (PERTH); 16 km E of Rabbit Proof Fence, E of Hyden, 13 Aug. 1965, *C.A. Gardner* 16112 (PERTH); Bremer Range, *c.* 8.9 km SE of Hill 495, 22 Sep. 1994, *N. Gibson & M. Lyons* 1666 (PERTH); 15.8 km N of Hyden–Norseman track on Mt Day track turning off 123.0 km W of Norseman–Coolgardie road, 32°04'S 120°26'E, 7 Nov. 1983, *K. Hill* 627, *L. Johnson, D. Blaxell, I. Brooker & S. Hopper* (CANB, NSW, PERTH); 97.5 km E of Hyden on Hyden–Norseman track, 17 May 1988, *L.A.S. Johnson* 9104 & *M. Johnson* (CANB, NSW, PERTH); 6 km N of Mt Day, 122 km WNW of Norseman, 32°05'S, 120°30'E, 7 Nov. 1983, *S.D. Hopper* 3583 (PERTH); 5 miles [8 km] N on Mt Day Road, 27 Oct. 1966, *A. Kessell* 491 (CANB, PERTH); area S of Marvel Loch, 15 Sep. 1966, *A Kessell* 494 (PERTH); on the Mt Holland–Southern Cross road, Sep. 1967, *W. Rogerson* 345 (PERTH).

Distribution and habitat. Occurs in mallee scrub between Hyden, Norseman and Coolgardie, Western Australia. (Figure 6A)

Flowering period. October to December.

Etymology. The name refers to the white waxy deposit on the branchlets, buds and fruit (Latin, *inceratus* – covered with wax).

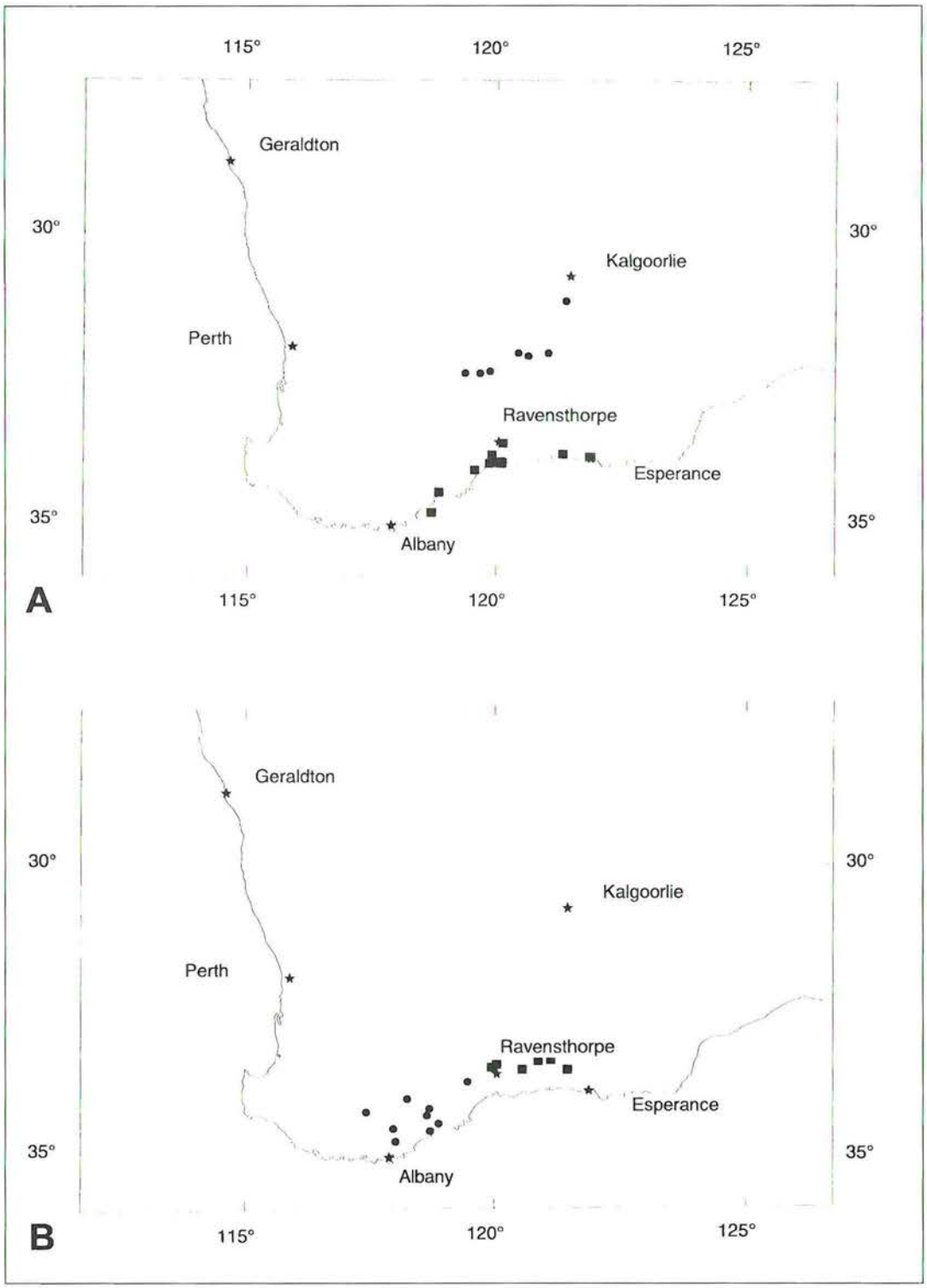

Figure 6. Distribution maps. A – *E. incerata* ● and *E. utilis* ■; B – *E. astringens* subsp. *redacta* ● and *E. platypus* subsp. *congregata* ■.

Notes. Eucalyptus incerata occurs within the range of the widely distributed *E. eremophila* which extends from the Lake Chinocup area to east of Esperance and inland to the Great Victoria Desert. Hill & Johnson (1992) published several other new taxa related to *E. eremophila* and showed the distributional relationships of these parapatric and allopatric taxa, including the then unpublished *E. incerata*. It is likely that clines or intergrades between all relevant taxa occur where the taxa are geographically close.

Eucalyptus incerata differs most noticeably from the related species in the whole glaucous aspect of the mallees, and particularly its glaucous branchlets, buds and/or fruits and its more robust buds and fruit. It is more strongly glaucous and has larger buds and fruits than *E. tephroclada*. *E. incerata* is consistently 7-budded while *E. tephroclada* consistently has more than 7 buds. Specimens of *E. incerata* with the largest fruits often have slight vertical ribbing on the walls of the hypanthium.

8. Eucalyptus utilis Brooker & Hopper, *sp. nov.*

[*Eucalyptus platypus* var. *heterophylla auct. mult. non* Blakely, e.g. Chippendale (1988).]

Arbor "mallet" vel frutex "mallee" cortice laevi cinereo vel cupreo. Folia adulta breviter petiolata, alternantia, elliptica vel late lanceolata, ad 9 x 3 cm concoloria, viridia vel olivacea, nitentia; nervus intramarginalis distincte separatus ab margine folii, reticulum sparsum et glandulae numerosissimae. Inflorescentiae axillares, non ramosae, 7-florae, pedunculi erecti, complanati, ad 2.5 cm longi. Alabastra breviter pedicellata, fusiformia, ad 2.6 x 0.6 cm. Fructus sessiles vel breviter pedicellati plus minusve obconici, ad 1 x 1 cm.

Typus: Hopetoun, Western Australia, 19 October 1964, *C.A. Gardner* 14888 (*holo:* PERTH).

Mallet or *mallee* to 7 m tall with grey over coppery smooth bark. *Seedling leaves* alternate, petiolate, ovate, to 5 x 4 cm, green, scabrid. *Adult leaves* alternate, shortly petiolate, elliptical to broadly lanceolate, to 9 x 3 cm, concolorous, green to olive-green, glossy; intramarginal vein well removed from leaf edge; reticulation sparse, with very numerous oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncle erect, flattened, to 2.5 cm long. *Buds* shortly pedicellate, fusiform, to 2.6 x 0.6 cm. *Fruit* sessile to shortly pedicellate, more or less obconical, to 1 x 1 cm. (Figure 7A)

Other specimens examined. WESTERN AUSTRALIA: Hopetoun, Mar. 1969, *L. Allan* 846 (PERTH); Esperance, 26 Oct. 1963, *T.E.H. Aplin* 2637 (PERTH); Hopetoun plains, 8 Nov. 1952, *P.H. Barrett* 5 (PERTH); 15 miles [24 km] N of Ravensthorpe, 6 Nov. 1952, *P.H. Barrett* 22 (PERTH); 4 mile beach, Hopetoun, 31 Oct. 1962, *J.S. Beard* 2223 (PERTH); Pallinup River, Jan. 1964, *G.E. Brockway* 7483/63 (PERTH); just E of Hopetoun, Feb. 1965, *G. Brockway* s.n. (PERTH); Beaufort Inlet, Millers Point Rd, 34°28'S, 118°51'E, 19 Feb. 1986, *M.I.H. Brooker* 9179 (AD, CANB, MEL, NSW, PERTH); 2 miles [3 km] W of Esperance, 25 Mar. 1968, *G.M. Chippendale* 410 (CANB, PERTH); Fitzgerald River National Park, Hamersley River estuary, NE corner, 33°37'S, 119°55'E, 11 Jan. 1979, *M.D. Crisp* 5039 (CBG, NSW, PERTH); East Mt Barren–Hopetoun, 10 Jan. 1969, *H. Demarz* D1075 (PERTH); Middle Island, 9 Jan. 1973, *M.C. Ellis* 9292 (PERTH); Hopetoun, 12 May 1924, *C.A. Gardner* 2159 (PERTH); S of Kundip, Jan. 1935, *C.A. Gardner s.n.* (PERTH); Hopetoun, 29 Aug. 1963, *C.A. Gardner* 14044 (PERTH); Culham Inlet, 18 Oct. 1964, *C.A. Gardner* 14863 (PERTH); Culham Inlet, 1 Feb. 1960, *A.S. George* 607 (PERTH); near Cape Irby, 29 Mar. 1964, *A.S. George* 6146 (PERTH); 3.2 km E of East Mt Barren, 29 Oct. 1975, *J.W. Green* 4576 (PERTH); end of Millers Point Rd, Beaufort Inlet, 13 May 1982, *G.J.Keighery* 4860 (PERTH); Bremer Bay area, Aug. 1971, *A. Kessell* 965 (PERTH); Barker

Inlet, between Hopetoun and Esperance, 3 Nov. 1962, *M.E. Phillips s.n.* (CBG 021859 in CANB); Mondrain Island, Recherche Archipelago, 9 Feb. 1960, *R.D. Royce* 6222 (PERTH); Hopetoun, 24 Oct. 1982, *A. Strid* 2126 (PERTH); near centre Middle Island, Recherche Archipelago, 34°06'S, 123°10'E, 21 Nov. 1973, *A.S. Weston* 8859 & *M.E. Trudgen* (PERTH); Middle Island, 7 Nov. 1978, *A.S. Weston* 10752 (PERTH); Dempster Head, Esperance, 21 Jan. 1944, *H.M. Wilson* 79 (PERTH).

Distribution and habitat. Occurs in Western Australia from Beaufort Inlet east to Esperance, particularly on coastal sands. (Figure 6A)

Flowering period. December to January.

Etymology. From the Latin, *utilis* (useful), alluding to its widespread cultivation in Perth.

Notes. Inspection of the holotype of *Eucalyptus platypus* var. *heterophylla* in NSW (near Ongerup, Western Australia, 30 May 1917, *F. Stoward s.n.*) by one of us (SDH) showed that this specimen was morphologically intermediate between the locally abundant *E. platypus* subsp. *platypus* and *E.spathulata* and therefore almost certainly a hybrid between those two taxa. Populations that have been attributed for many years to *E. platypus* var. *heterophylla* are not known to occur anywhere near where the type was collected. They constitute the distinct taxon treated here as *E. utilis*, which is particularly well known on the coastal dunes between East Mt Barren and Hopetoun. Robert Brown first collected *E. utilis* from Lucky Bay in January 1802, using the manuscript name *E. linopoda* on his specimen labels.

9. Eucalyptus platypus subsp. **congregata** Brooker & Hopper, *subsp. nov.*

A subspecie typica foliis ellipticis et pedunculo constanter elongato differt.

Typus: Neds Corner Rd, south of Grass Patch Rd intersection, Western Australia, 17 September 1999, *M.I.H. Brooker* 13029 & *A.V. Slee* (*holo:* CANB; *iso:* AD, PERTH)

Differs from the typical subspecies in the elliptical leaves and the consistently elongated peduncle. (Figure 7B)

Other specimens examined. WESTERN AUSTRALIA: 12.3 miles [20 km] S of Salmon Gums, 15 Feb. 1970, *M.I.H. Brooker* 2499 (CANB, MEL, NSW, PERTH); 6.4 km from highway W on Borden–Bremer Bay road, 25 Nov. 1989, *M.I.H. Brooker* 9820 (CANB, PERTH); corner of Robins and Speddingup West Rd, 7 Feb. 1989, *M.I.H. Brooker* 10164 (AD, CANB, MEL, NSW, PERTH); 477 mile peg on Norseman–Salmon Gums road, 29 Mar. 1968, *S.G.M. Carr* 617 (PERTH); near roadside N of Location 1153, *c.* 53 km NNW of the coast at Stokes Inlet, 15 Oct. 1968, *Hj. Eichler* 20247 (AD, CANB); 24 km NE of Fitzgerald on Fitzgerald Rd, 29 Nov. 1983, *D.B. Foreman* 1339 (CANB, MEL, NSW, PERTH); 600 m S of SW corner of Moolyall Rocks Nature Reserve, 11 Mar. 1988, *S.D. Hopper* 6340, (CANB, PERTH); Kundip, 22 Apr. 1953 *R.D. Royce* 4152 (PERTH); West Point Rd between Rawlinson Rd and Oldfield River, 13 Sep. 1999, *A.V. Slee* 4244 (CANB); 14 km from Ravensthorpe towards Lake King township, 10 km N of Lake King turn-off from Ravensthorpe–Albany road, 22 Oct. 1981, *J.G. West* 4600 (CANB, PERTH).

Distribution. Occurs in Western Australia, from the Lake King–Ravensthorpe road eastwards towards Salmon Gums. (Figure 6B)

Flowering period. January to March.

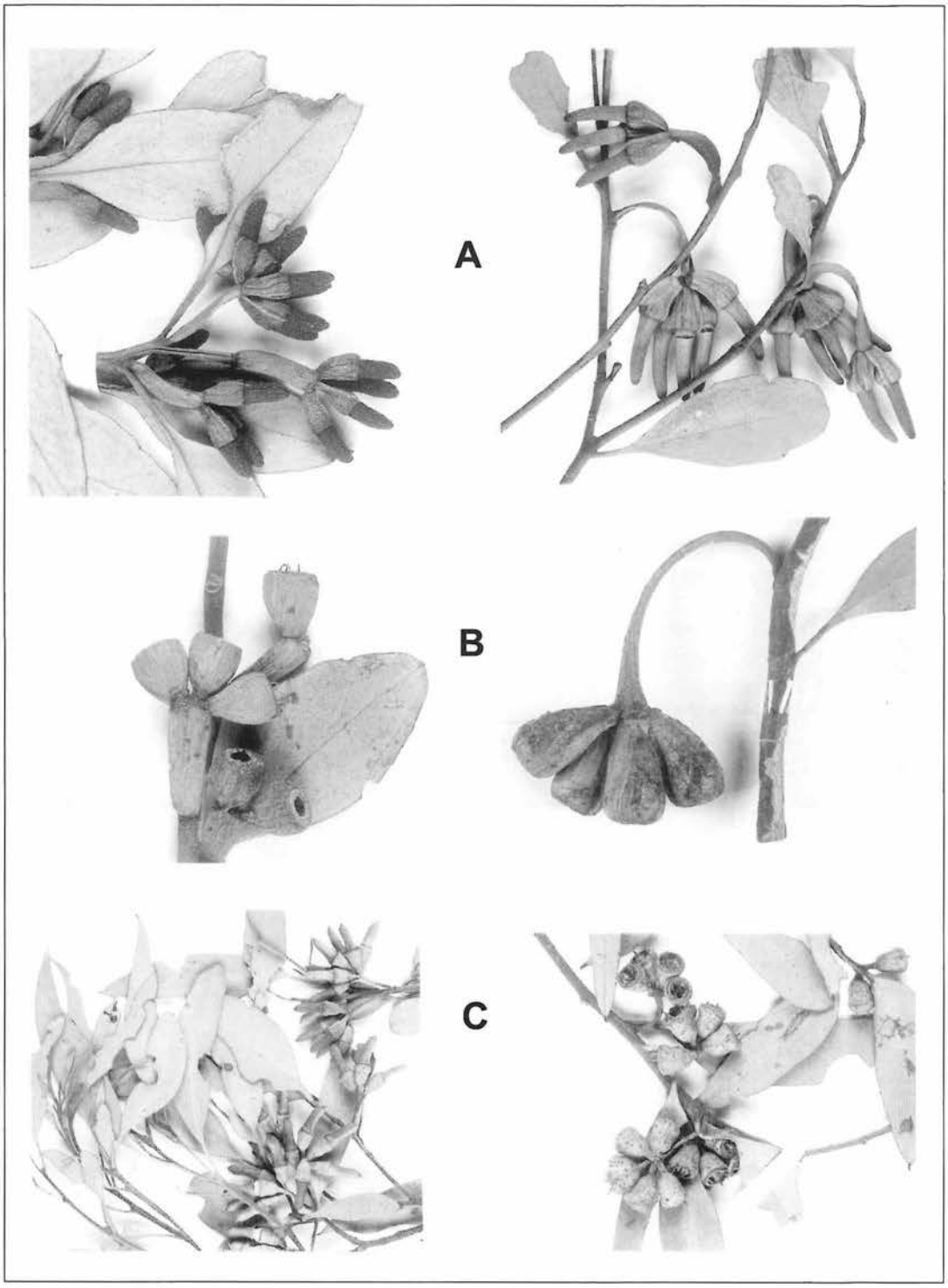

Figure 7. Buds and fruits. A – *E. utilis* (CBG 021859 in CANB); B – *E. platypus* subsp. *congregata* (*Brooker* 13029); C – *E. astringens* subsp. *redacta* (*Brooker* 13040).

Etymology. The name refers to the dense communities in which it occurs.

Notes. This subspecies occurs in more or less pure marlock stands, similar to the typical subspecies. Inspection of the foliage reveals the distinguishing leaf shape. The long peduncles are not so strongly diagnostic as they can occur in the typical subspecies.

There are stands of marlocks between the Lake King–Ravensthorpe road and Lake Magenta which have affinity with both *E. platypus* subsp. *congregata* and *E. goniocarpa* Johnson & Hill and should be regarded as intermediates.

Eucalyptus subser. **Pedicellatae** Blakely, "Key Eucalypts" 23, 108 (1934). *Type: Eucalyptus astringens* (Maiden) Maiden.

Mallees or *mallets*. *Pith of branchlets* glandular. *Adult leaves* glossy, green or olive-green, with numerous oil glands, not obscuring the side veins. *Stamens* erect, arising from a narrow staminophore.

Notes. A subseries of nine species, three of which comprise two subspecies. It is equivalent to the informal *Eucalyptus* subser. *Occidentalinae* Pryor & Johnson, "Class. Eucs" (1971).

Key to species and subspecies of *Eucalyptus* subser. *Pedicellatae*

1. Rough bark in mature plants present over part or most of trunk or stems
 2. Peduncles slender, not flattened
  3. Buds < 2.4 cm long; fruit < 0.9 cm long ..... **E. sargentii** subsp. **sargentii**
  3. Buds > 2.4 cm long; fruit > 0.7 cm long ..... **E. sargentii** subsp. **fallens**
 2. Peduncles widening towards top
  4. Fruit campanulate, valves prominent ..... **E. occidentalis**
  4. Fruit cupular, valves enclosed or to rim level ..... **E. aspratilis**
1. Bark smooth, or trunk with partly shed curls of dead bark, otherwise smooth
 5. Mallet
  6. Buds to 2 x 0.6 cm; fruit to 1.2 x 1 cm; trunk with partly shed curls of dead bark, otherwise smooth ..... **E. astringens** subsp. **astringens**
  6. Buds to 1.5 x 0.4 cm; fruit to 0.9 x 0.7 cm; bark smooth .... 10. **E. astringens** subsp. **redacta**
 5. Mallee
  7. Peduncles flattened and widening towards tip
   8. Fruit campanulate
    9. Fruit to 0.6 x 0.8 cm ..... 11a. **E .thamnoides** subsp. **thamnoides**
    9. Fruit to 1.2 x 1 cm ..... 11b. **E. thamnoides** subsp. **megista**
   8. Fruit cylindrical to obconical ..... 12. **E. sporadica**
  7. Peduncles slender, not or scarcely flattened
   10. Buds and fruit prominently ribbed; leaves very glossy, bright green ..... **E. stowardii**
   10. Buds and fruit not or scarcely ribbed; leaves slightly glossy, green, blue-green or olive green
    11. Opercula smooth, pointed at the tip; bark rough at base of larger specimens; on saline soils ..... **E. sargentii** subsp. **fallens**
    11. Opercula slightly ribbed, rounded at the tip; bark smooth; on sandstone, kaolinite or laterite ..... 13. **E. diminuta**

10. Eucalyptus astringens subsp. **redacta** Brooker & Hopper, *subsp. nov.*

A subspecie typica statura inferiore, cortice laevi, et alabastris fructibusque minoribus differt.

Typus: Wellstead Rd to Cape Riche at the Mt Maxwell (Konkoberup Hill) rubbish tip, Western Australia, *A.V. Slee* 4117 (*holo:* CANB; *iso:* PERTH).

Differs from the typical subspecies by the smaller stature, smooth bark, and smaller buds and fruits. (Figure 7C)

Other specimens examined. WESTERN AUSTRALIA: 1 km S of Pallinup River at Chillinup, 11 Oct. 1984, *B. Briggs* 7880 & *L.A.S. Johnson* (NSW, PERTH); 200 m from N side of Beaufort Inlet, on main road to water, 14 Nov. 1981, *M.I.H. Brooker* 7165 (CANB, PERTH); Beaufort Inlet, track to NW of camping site, 14 Nov. 1981, *M.I.H. Brooker* 7167 (CANB, PERTH); Konkoberup Hill, 34°36'S, 118°44'E, 29 Nov. 1984, *M.I.H. Brooker* 8741 (AD, CANB, MEL, NSW, PERTH); 0.7 km south along Norman Rd from Cowellup Rd, 34°12'S, 118°42'E, 21 Feb. 1985, *M.I.H. Brooker* 8864 (CANB, MEL, NSW, PERTH); Sandalwood Rd, 34°16'S, 118°16'E, 13 Apr. 1985, *M.I.H. Brooker* 8953 (CANB, MEL, NSW, PERTH); W edge of Swan Gully, 8.5 km NNW of Cape Riche, 6 Oct. 1987, *S.D. Hopper* 6192 (PERTH); 8.5 km S along Carlawillup Rd, 34°07'S, 119°03'E, 9 Mar. 1988, *M.I.H. Brooker* 9906 (AD, CANB, MEL, NSW, PERTH); Sandalwood Rd, E of Borden, before Gnowellen Rd, 8 Apr. 1995, *M.I.H. Brooker* 12215 (CANB, PERTH); between Yeriminup Rd and Albany Highway, 8 Apr. 1995, *M.I.H. Brooker* 12221 (CANB, PERTH); 41.6 km W of Ravensthorpe, 29 Aug. 1998, *M.I.H. Brooker* 12918 & *A.V. Slee* (CANB, PERTH); Borden–Bremer road, 9 km W from highway, 19 Aug. 1999, *M.I.H. Brooker* 13040 & *A.V. Slee* (CANB, PERTH); 1 km W of Kamballup, 30 km ENE of Mount Barker, 15 Sept. 1985, *G.J. Keighery & J.J. Alford* 1611 (CANB, PERTH); 2 km N of Borden on Borden road, 23 Oct. 1985, *N. Hoyle* 1126 (CANB, PERTH).

Distribution. Western Australia: from west of the Stirling Range, through the lower Pallinup River area, eastwards to Bremer Bay, including the Stirling Range National Park. (Figure 6B)

Flowering period. August to November.

Etymology. The name refers to the small buds and fruit compared with the typical subspecies (from the Latin, *redactus* – reduced).

Notes. This is one of several taxa that have been incorrectly ascribed to either *E. occidentalis* or typical *E. astringens,* which are distinguished in the subseries by the short, stubby buds and slightly flared fruits. *E. occidentalis* is a basally rough-barked species of seasonally waterlogged sites. By contrast both subspecies of *E. astringens* are confined to well-drained lateritic rises and slopes.

This small, erect mallet may be associated with other mallet species, e.g. *E. newbeyi* D.J. Carr & S.G.M. Carr and *E. melanophitra* Brooker & Hopper, and the mallee, *E. neutra* Nicolle.

11. Eucalyptus thamnoides Brooker & Hopper, *sp. nov.*

Eucalypto astringenti affinis a qua habitu fruticoso et habitatione non collinis differt.

Typus: Needilup Rd, 6.8 km south of East Rd, Western Australia, 21 July 1988, *M.I.H. Brooker* 10003 (*holo:* CANB; *iso:* PERTH).

With affinity to *Eucalyptus astringens*, differing by the mallee habit and non-breakaway habitat.

Etymology. From the Greek, *thamnos* (shrub or bush), in reference to the habit compared with the related mallet species, *E. astringens*.

11a. Eucalyptus thamnoides Brooker & Hopper **thamnoides**, *subsp. nov.*

Mallee with fruit to 0.6 x 0.8 cm. (Figure 8A)

Specimens examined. WESTERN AUSTRALIA: 8.4 km S by fire trail from Salt River Rd, SW of Donnelly Peak, Stirling Range, 9 Oct. 1982, *M.I.H. Brooker* 7721 (CANB, PERTH); 3.6 km W of Sanders Rd on Kendenup Rd, 9 June 1983, *M.I.H. Brooker* 8185 (CANB, PERTH); 2 km NW of Kambellup on Woogenillup Rd, 13 Apr. 1985, *M.I.H. Brooker* 8950 (CANB, PERTH); 10–20 km E of Jerramungup, 25 Nov. 1987, *M.I.H. Brooker* 9818 (CANB, PERTH); 8.4 km S along Carlawillup Rd, 9 Mar. 1988, *M.I.H. Brooker* 9906 (CANB, PERTH); 8.2 km WNW of Nyabing, 19 July 1988, *M.I.H. Brooker* 9988 (CANB, PERTH); 1 km from Kambellup (highway) on Woogenillup Rd., 8 Apr. 1995, *M.I.H. Brooker* 12216 (CANB, PERTH); 3 km from Kambellup (highway) on Woogenillup Rd, 8 Apr. 1995, *M.I.H. Brooker* 12217 (CANB, PERTH); 3.7 km W of Sanders Rd on road to Kendenup, 8 Apr. 1995, *M.I.H. Brooker* 12218 (CANB, PERTH); 9.5 km N of Formby South Rd on Chester Pass Rd, Stirling Range National Park, 21 Aug. 1999, *M.I.H. Brooker* 13046 & *A.V. Slee* (CANB, PERTH); 15 km S of Ongerup, Peenebup Creek, 22 Jan. 1980, *M.D. Crisp* 6141, *J. Taylor* and *R. Jackson* (CANB); Gnowangerup at 0.6 km on Tambellup Rd from Jerramungup Rd, 31 Oct. 1988, *L.A.S. Johnson* 9164 & *B.A. Briggs* (CANB, NSW); 1 km E of Warrungup, Stirling Range, 10 May 1982, *G.J. Keighery* 4833 (CANB, PERTH); Kamballup Reserve, SE corner, 27 Feb. 1988, *A. Napier* & *A. Taylor* 208, (CANB, PERTH); Pallinup River area, 20 Apr. 1996, *D. Nicolle* 2243 (AD, CANB, PERTH); 12 miles [19 km] from Gnowangerup, 10 Oct. 1962, *M.E. Phillips* (CBG 021940); *c.* 20 miles [32 km] from Gnowangerup, towards Albany, 10 Oct. 1962, *M.E. Phillips* (CBG 021942) (CANB); 23 miles [37 km] from Gnowangerup, 10 Oct. 1962, *M.E. Phillips s.n.* (CBG 021949) (CANB); 5 miles [8 km] N of Stirling Range, 21 May 1964, *R.D. Royce* 8156 (CANB, PERTH); 20 km [32 km] W of Bremer Bay township, 1 Oct. 1966, *P.G. Wilson* 4332 (CANB, PERTH).

Distribution. Western Australia: from Gnowangerup area to south of the Stirling Range and north-east towards Jerramungup, including the Stirling Range National Park. (Figure 9A)

Flowering period. Not known.

Notes. It is distinguished from the following subspecies by the smaller buds and fruits (to 0.6 x 0.8 cm). The two subspecies bear a parallel relationship in fruit size to the subspecies of *Eucalyptus astringens*. Associated species include several mallees, e.g. *E. falcata* Turcz., *E. phaenophylla* Brooker & Hopper, *E. pluricaulis* Brooker & Hopper subsp. *porphyrea* Brooker & Hopper, *E. uncinata* Turcz., and *E. preissiana* Schauer subsp. *preissiana*.

11b. Eucalyptus thamnoides subsp. **megista** Brooker & Hopper, *subsp. nov.*

A subspecie typica alabastris fructibusque majoribus differt.

Typus: Norman Rd, Corackerup Creek Nature Reserve, east side of road, Western Australia, 8 April 1995, *M.I.H. Brooker* 12212 (*holo:* CANB; *iso:* AD, NSW, PERTH).

Differs from the typical subspecies by the larger buds and fruit (to 1.2 x 1 cm). (Figure 8B)

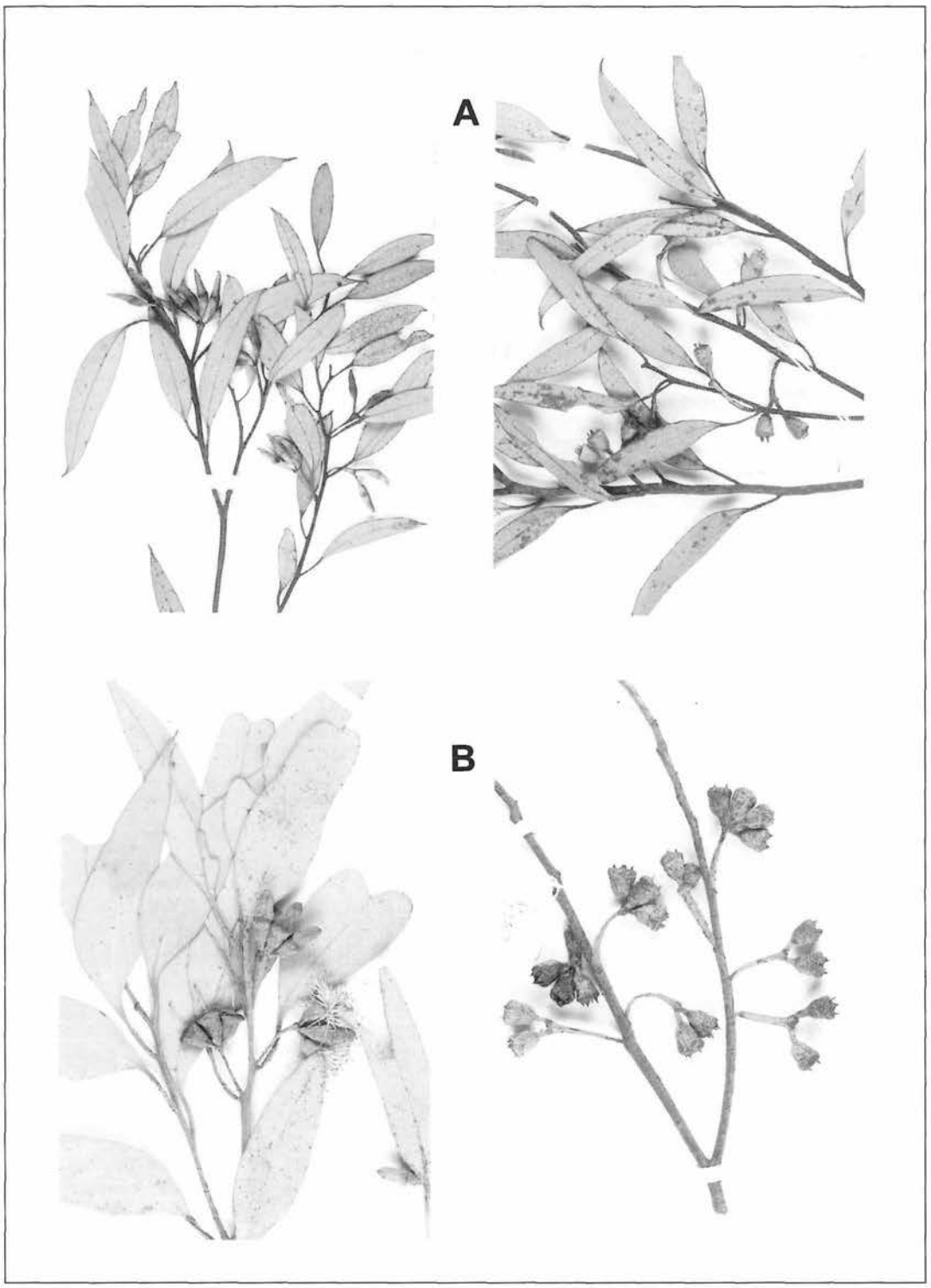

Figure 8. Buds and fruits. A – *E. thamnoides* subsp. *thamnoides* (*Brooker* 13046); B – *E. thamnoides* subsp. *megista* (*Brooker* 12912).

Specimens examined. WESTERN AUSTRALIA: 5.8 km S of Ongerup, 21 Feb. 1985, *M.I.H. Brooker* 8862 (CANB, PERTH); Narrakine State Forest, O'Neill's Rd, 19 Jun. 1986, *M.I.H. Brooker* 9357 (CANB, PERTH); Newman Block, Chomley Rd, breakaway on S side, 19 Jun. 1986, *M.I.H. Brooker* 9360 (CANB, PERTH); 15.6 km along Brook Rd from highway 1, 18 May 1987, *M.I.H. Brooker* 9641 (CANB, PERTH); 14.8 miles [23.8 km] SSE of Ravensthorpe, 23 Mar. 1968, Ranger's House, Quiss Rd., Fitzgerald River National Park, 25 Nov. 1991, *M.I.H. Brooker* 10921 (AD, CANB, NSW, PERTH); 0.5 km W of Highbury Tavern, 5 Apr. 1995, *M.I.H. Brooker* 12185 (AD, CANB, NSW, PERTH); 110 km from Albany towards Jerramungup, 4.2 km S of Pallinup River, 28 Aug. 1998, *M.I.H. Brooker* 12912 & *A.V. Slee* (CANB,PERTH); 3 miles [6.8 km] N from Cranbrook, 11 Sep. 1947, *N.T. Burbidge* 2468 (CANB); Mt Merrivale (near Esperance), low down mount on W side, around base of rock, 4 Nov. 1968, *E.M. Canning* (CBG 068524) (CANB); *G.M. Chippendale* 417 (CANB, MEL, NSW, PERTH); 2.9 miles [4.7 km] W of Needilup, 27 Mar. 1968, *G.M. Chippendale* 424 (CANB, PERTH); Ravensthorpe Range, 23 Nov. 1994, *D. Nicolle* 1122 (AD, CANB); *c.* 20 miles [32 km] from Gnowangerup, 10 Oct 1962, *M.E. Phillips* (CBG 021942) (CANB); Nature Reserve, Jaloran–Piesseville road, 3.5 km E of junction with Edwards Rd, 3 July 1992, *P. White* 314 (CANB, PERTH); 7 miles [11 km] from Ravensthorpe towards Hopetoun, at junction of minor road near copper mine, 27 Oct. 1968, *J. Wrigley* (CBG 028793) (CANB).

Distribution. Western Australia: from Williams and Cranbrook districts in the west, eastwards to the western end of the Fitzgerald River National Park. (Figure 9A)

Flowering period. Unknown, maybe variable throughout the year.

Etymology. From the Greek, *megistos* (largest), alluding to the size of the fruits compared with the typical subspecies.

Notes. This subspecies occurs on plains and low rises, not lateritic breakaways. The soils may be red-brown sandy clays or sandy gravel. There is a great variety of associated species, including, *Eucalyptus incrassata* Labill., *E. pluricaulis* Brooker & Hopper subsp. *pluricaulis*, *E. falcata*, *E. wandoo* Blakely, *E. redunca* Schauer, *E. phaenophylla* Brooker & Hopper and *E. uncinata*.

12. Eucalyptus sporadica Brooker & Hopper, *sp. nov.*

Frutex "mallee" cortice laevi. Folia plantularum petiolata, alternantia, ovata vel lanceolata, ad 9 x 3 cm. Folia adulta petiolata, alternantia, lanceolata vel falcata, 5–9 x 1–1.8 cm, concoloria, nitentia, viridia. Inflorescentiae axillares, non ramosae, 7-florae; pedunculi deflexi, complanati, 0.8–2 cm longi. Alabastra pedicellata, elongata, 1.7–2.5 x 0.4–0.5 cm, operculo cornuto. Fructus pedicellati cylindrici vel leviter campanulati, 0.8–1.5 x 0.7–1.2 cm, disco descendenti et valvis exsertis.

Typus: 3.6 km N of Burngup, Western Australia, 8 September 1984, *M.I.H. Brooker* 8684 (*holo:* CANB; *iso:* AD, MEL, NSW, PERTH).

Mallee to 4 m tall with red-brown, greenish grey, grey, or silvery white smooth bark. *Juvenile leaves* alternate, petiolate, ovate to lanceolate, to 9 x 3 cm, light green to blue-green. *Adult leaves* alternate, petiolate, lanceolate or falcate, 5–9 x 1–1.8 cm concolorous, glossy, green; reticulation moderately dense, with numerous large island and intersectional oil glands. *Inflorescences* axillary, unbranched, 7-flowered; peduncle down-turned, flattened, 0.8–2 cm long. *Buds* pedicellate, elongated, 1.7–2.5 x 0.4–0.5 cm, scar obscure; operculum horn-shaped. *Fruit* pedicellate, cylindrical to slightly campanulate, 0.8–1.5 x 0.7–1.2 cm; rim thin; disc descending; valves 3 or 4, exserted. (Figure 10A)

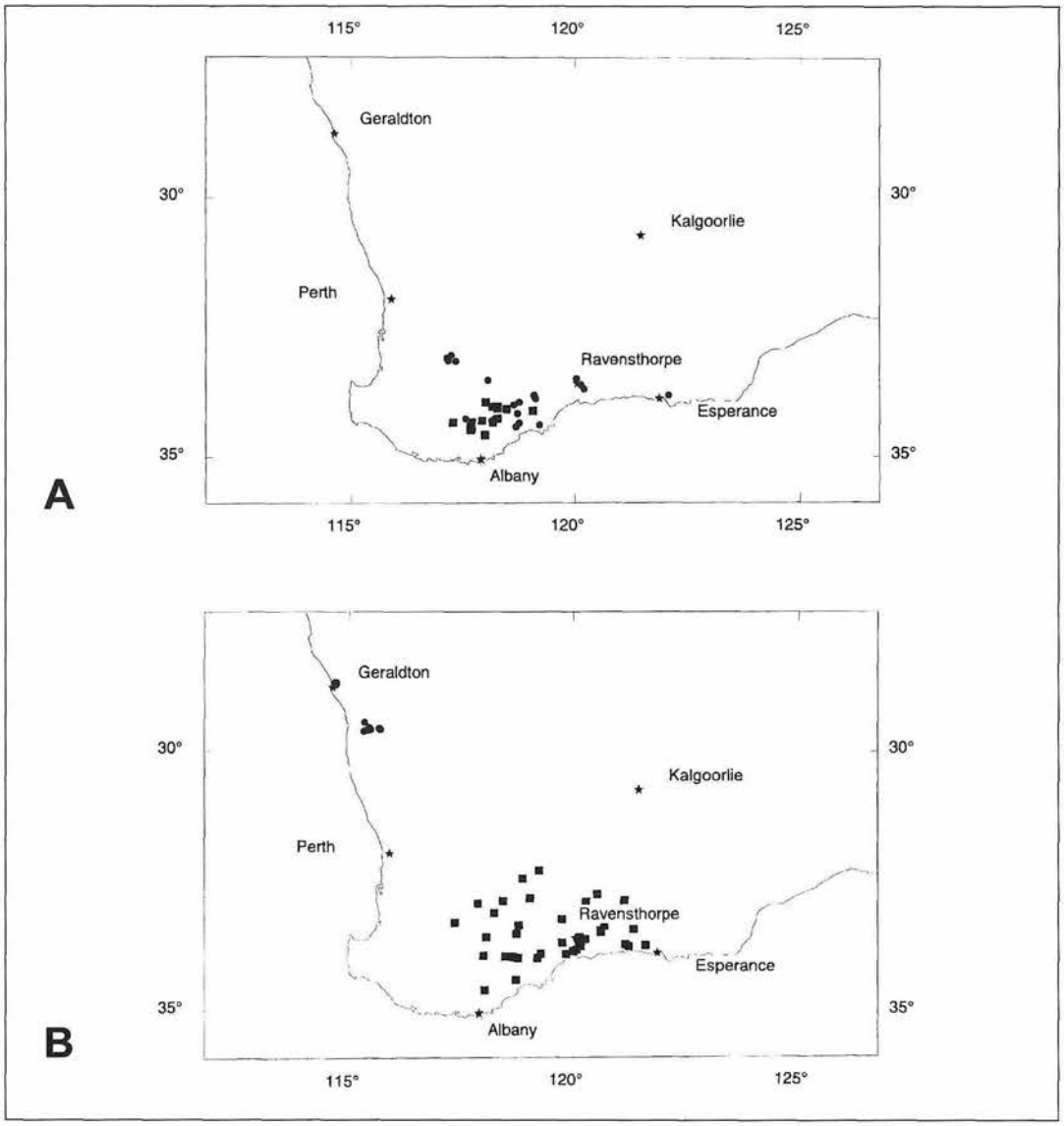

Figure 9. Distribution maps. A – *E. thamnoides* subsp. *megista* ● and *E. thamnoides* subsp. *thamnoides* ■; B – *E. diminuta* ● and *E. sporadica* ■.

Other specimens examined. WESTERN AUSTRALIA: Tarin Rock, opposite siding, 24 Sep. 1974, *T.E.H. Aplin* 6021 (CANB, PERTH); 20.6 km E of Ravensthorpe on Hwy 1, 26 Oct. 1985, *D.J. Bedford* 566 (CANB, NSW, PERTH); *c.* 5 miles [8 km] S of Kundip, towards Hopetoun, 7 Apr. 1974, *M.I.H. Brooker* 4458 (CANB,PERTH); Peak Charles, 2 May 1982, *M.I.H. Brooker* 7505 (CANB, PERTH); Ravensthorpe Range, NW of Mt Desmond, 13 Nov. 1981, *M.I.H. Brooker* 7143 (CANB, NSW, PERTH); Hamersley River crossing, Fitzgerald River National Park, 18 Dec. 1984, *M.I.H. Brooker* 8759 (CANB, PERTH); Frank Hann National Park, 8 Aug. 1978, *D. Butcher* 327 (CANB, PERTH); 20 miles [32 km] W from Esperance–Norseman road towards Lake King, 23 Sep. 1978, *R.J. Cranfield* 761 (CANB, PERTH); Frank Hann National Park, 8 Aug. 1978, *D. Monk* 337 (CANB, PERTH); NW base of Annie Peak, 30 May 1970, *K. Newbey* 3168 (CANB, PERTH); 3 km along Northern Fireline from Quiss Rd, Fitzgerald River National Park, 4 May 1999, *A. Slee* 4124 (CANB, PERTH).

Distribution. Widespread in the south-eastern part of the southern wheatbelt of Western Australia, from Lake Grace and the Fitzgerald River National Park east towards Peak Charles. (Figure 9B)

Flowering period. Variable, maybe throughout the year.

Etymology. From the Latin, *sporadicus* (sporadic) in reference to its widespread and scattered distribution.

Notes. Eucalyptus sporadica has been collected widely in the area of occurrence. It has been confused with *E. eremophila* of *E.* subser. *Abundae* but it is readily distinguished by the non-glazed leaf surfaces and the narrow staminophore. It is probably closest to *E. aspratilis* which is distinguished by rough bark and the somewhat larger, straight-sided fruit.

13. Eucalyptus diminuta Brooker & Hopper, *sp. nov.*

Frutex "mallee" *Eucalypto stowardii* Maiden affinis a qua cortice interdum cupreo, foliis adultis parvioribus (6–8 x 0.7–1.5 cm) minus nitentibusque, alabastris (1.8–2.5 x 0.5–0.7 cm) fructibusque (1–1.4 x 0.8–1.1 cm) parvioribus minus costatibusque differt.

Typus: Yuna road, 28°42S, 114°40'E, Western Australia, 4 November 1985, *M.I.H. Brooker* 9061 (*holo:* PERTH; *iso*: CANB, NSW).

Mallee with affinity to *Eucalyptus stowardii*, from which it differs in the bark being at times coppery, the smaller, less glossy adult leaves, and smaller, less ribbed buds and fruit. (Figure 10B)

Other specimens examined. WESTERN AUSTRALIA: 1 km E of Mindaloo Beacon, 24°34'S, 115°25'E, 27 May 1983, *M.I.H. Brooker* 8141 (CANB, PERTH); 7.7 km from Geraldton–Northampton road on Yuna road, 28°42'S, 114°42'E, 30 Oct. 1984, *M.I.H. Brooker* 8721 (CANB, PERTH); pass NE of Geraldton on Yuna road, 28°42'S, 114°40'E, 11 June 1985, *M.I.H. Brooker* 9038 (CANB, PERTH); Yandanooka Nature Reserve, 13 Mar. 1986, *M.I.H. Brooker* 9204 *& S.D. Hopper* (CANB, PERTH, NSW, MEL); 13.1 km SW of Three Springs on Eneabba road, 29°34'S, 115°39'E, 21 Nov. 1986, *M.I.H. Brooker* 9554 (AD, CANB, MEL, NSW, PERTH); W side of Mindaloo Beacon Hill, 21 Apr. 1998, *M.I.H. Brooker* 9938 (CANB); 9 miles [14.5 km] NE of Geraldton on Yuna road, 16 Mar. 1968, *G.M. Chippendale* 321 (CANB, PERTH).

Distribution. Occurs in Western Australia, recorded from Moresby Range, north-east of Geraldton along road to Yuna, near Mindaloo Beacon and in the Yandanooka Nature Reserve. (Figure 9B)

Flowering period. October to December.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. *Eucalyptus diminuta* is numerically rare and known from only two localities, but is secure in at least one nature reserve.

Etymology. The name alludes to the smaller leaves and less ribbed buds and fruit than those of *Eucalyptus stowardii* (Latin, *diminutus* – diminished).

Figure 10. Buds and fruits. A – *E. sporadica* (*Brooker* 4458); B – *E. diminuta* (*Brooker* 9938).

Notes. Eucalyptus diminuta has been confused with *E. stowardii* but differs notably in its habitat of sandstone, laterite or kaolinite rubble associated with hills and breakaways. *E. stowardii* occurs mainly on sands, although it occurs on decomposing stony granite rises north-west of Merredin. *E. stowardii* differs markedly from *E. diminuta* in its larger, very glossy leaves, and the much more strongly ribbed buds. The two species, with *E. sargentii*, are notable among *E.* ser. *Erectae* by the slender, non-flattened peduncles.

Eucalyptus diminuta differs from *E. sporadica* by the terete peduncles, shorter, slightly ribbed, obtuse opercula and smaller, usually obconic fruit. It differs from *E. sargentii* subsp. *fallens* by the consistently smooth bark, slightly ribbed obtuse operculum, and occurrence on hills and breakaways.

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Korthalsella arthroclada (Viscaceae), a new species from south-west Western Australia

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Abstract

Cranfield, R.J. *Korthalsella arthroclada* (Viscaceae), a new species from south-west Western Australia. *Nuytsia* 14(3): 361–364 (2002). A new parasitic species from the south-west of Western Australia, *Korthalsella arthroclada* Cranfield, is described, illustrated and mapped. The key to the species of *Korthalsella* Tieghem (Viscaceae) in "Flora of Australia" Volume 22 is updated.

Introduction

The new taxon described here is known only from a small population of plants parasitic on several tall *Melaleuca* shrubs fringing a lake south of Geraldton, Western Australia. It was known to be a probable new species for some years prior to its first collection (N.G. Marchant pers. comm.) but its identity could not be determined because it had never been seen in flower or fruit. In December 1992 flowering material was finally observed and material collected. It was subsequently identified as a species of *Korthalsella* Tieghem (Viscaceae).

Korthalsella has been revised relatively recently (Barlow 1983) and also covered in "Flora of Australia" (Barlow 1984). The new species is very different from the only named Western Australian representative of the genus, *Korthalsella leucothrix* Barlow, which is parasitic on *Acacia* shrubs. Its closest relative is possibly *Korthalsella grayi* Barlow, which is endemic to the Queensland rainforest.

Taxonomy

Diagnostic characters for the two known Western Australian species of *Korthalsella* along with the Queensland species *K. grayi* are given in Table 1. The three species can be distinguished by both vegetative and floral characters. *K. arthroclada* differs from the other two species in having more numerous shorter basal internodes and an acute apex to the rudimentary leaves. It also differs from *K. grayi* in its shorter flowers and from *K. leucothrix* in its more terete stems and fewer flowers per node.

The different hosts and the geographical distributions of these three species are further evidence of their distinctiveness. *Korthalsella arthroclada* is a parasite known only on *Melaleuca lanceolata* Otto (Myrtaceae) and occurs in a shrubland area that is virtually at sea level. *K. grayi* occurs at altitudes in

excess of 1000 m and is a parasite on the following Queensland rainforest genera: *Elaeocarpus* L. (Elaeocarpaceae), *Symplocos* Jacq. (Symplocaceae) and *Rhodamnia* Jack (Myrtaceae). *Korthalsella leucothrix* is recorded mainly from South Australia but is also known from a few localities in Western Australia where it has been recorded on two host species, *Acacia acuminata* Benth. and *A. craspedocarpa* F. Muell. (Mimosaceae). Its known distribution is further inland than that of *K. arthroclada*.

Table 1. Characters distinguishing *Korthalsella arthroclada* from two similar species.

Character	***K. arthroclada***	***K. grayi***	***K. leucothrix***
stem	terete or slightly compressed	terete or slightly compressed	compressed
number of basal internodes per stem	10–13	7–10	9 or 10
internode length (mm)	5–7	10–20	10–20
rudimentary leaf apex	acute	obtuse	obtuse
number of flowers per node	usually 6	usually 8	*c.* 20
flower length (mm)	1–1.5	1.5–2	1–1.5

Amendment to key to *Korthalsella* species in "Flora of Australia"

For the addition of the new species to the key to *Korthalsella* species given in "Flora of Australia" Volume 22 (Barlow 1984: 141), the last part of the key needs to altered to read:

5 Stems compressed-flattened but rounded at edges, widest at apex, up to 3 mm wide; flowers *c.* 20 in 3 or 4 rows at each node ..... **K. leucothrix**
5: Stems terete or slightly compressed, 1–2 mm diam.; flowers usually 6 or 8 per node in 1 row (rarely 2 rows present).
6 Flowers 1–1.5 mm long; leaf apex acute ..... **K. arthroclada**
6: Flowers 1.5–2 mm long; leaf apex obtuse ..... **K. grayi**

Korthalsella arthroclada Cranfield, *sp. nov.*

Korthalsellae grayi affinis sed internodiis brevioribus, floribus parvioribus differt.

Typus: south-west of Eneabba [precise locality withheld], Western Australia, 9 December 1992, *R.J. Cranfield & P. Spencer* 8700 (*holo:* PERTH 02931990).

Aerial parasitic *shrub* to 7 cm high, much branched with 1 or 2 stems arising from a haustorium attached to a host plants upper branches. *Stems* greenish yellow, erect, with numerous internodes; basal internodes terete or slightly compressed, linear, 5–7 x 1–2 mm and succeeded by shorter nodes 1–5 x 1–1.5 mm, venation obscure. *Rudimentary leaves* opposite, distichous, each pair united and encircling the

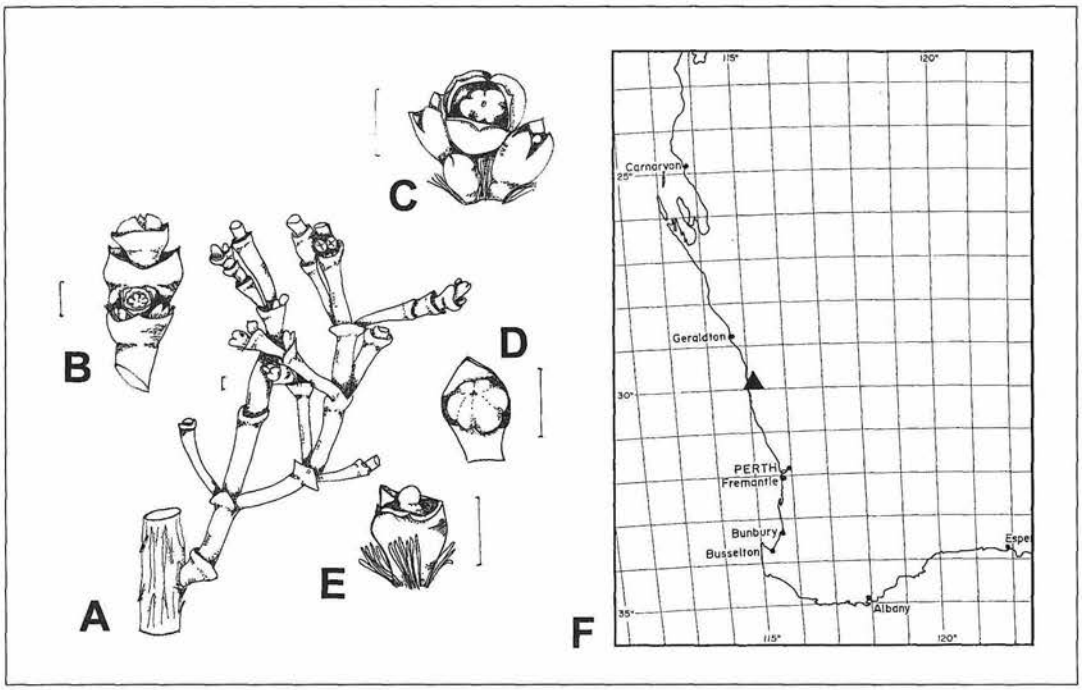

Figure 1. *Korthalsella arthroclada*, all scale bars = 1 mm. A – plant on host stem; B – flowering branch; C – flower cluster; D – male flower dissected; E – female flower dissected; F – distribution map.

node, 0.5–1 mm long, much broader than long, shortly ciliate; apex acute. *Hairs of floral cushion* few, *c.* 0.5 mm long, white to brown, multicellular, visible at flowering time. *Flowers* produced at every actively growing node, mostly in a single row, sometimes with a second row below the first, each row with a triad in the axil of each leaf, a male flower in centre of triad and a female flower on each side. *Male flower* globose, *c.* 0.5 mm diam., with a short stipe; tepals 3, triangular, *c.* 0.5 mm long; anthers 3, 2-locular, united into a synandrium with a common apical pore. *Female flowers* ellipsoid, 1–1.5 x *c.* 0.5 mm; tepals 3, *c.* 0.5 mm long, persistent at the top of the ovary; style short *c.* 0.25 mm long. *Fruit* not seen. (Figure 1A–E)

Distribution. Known only from one locality near Eneabba, Western Australia (Figure 1F). This locality is in the South West Botanical Province and is within the Geraldton Sandplains biogeographic region (Thackway & Cresswell 1995).

Habitat. Parasitic on *Melaleuca lanceolata*, which forms an open tall shrubland fringing a brackish lake. The soil is white sandy clay.

Flowering time. December.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. This species is known only from the type area and restricted to a few tall host shrubs. Additional surveys are required to determine whether this species warrants endangered status or is indeed more common than presently thought.

Etymology. From the Greek words *arthro* (jointed) and *clados* (branch).

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Three new early-flowering species of *Petrophile* (Proteaceae) from south-western Australia

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Abstract

M. Hislop & B.L. Rye. Three new early-flowering species of *Petrophile* (Proteaceae) from south-western Australia. *Nuytsia* 14(3): 365–374 (2002). Three new south-western Australian species, *Petrophile antecedens* Hislop & Rye, *P. clavata* Hislop & Rye and *P. nivea* Hislop & Rye, are described and illustrated. All of these species show similarities to, and one of them has been included under, *P. brevifolia* Lindl. The relevant part of the key to *Petrophile* in "Flora of Australia" Volume 16 is updated to include the new species and other new information. All of the new species have an early flowering time and two of them have conservation priority.

Introduction

Petrophile R. Br. ex Knight (Proteaceae) is a genus of at least 57 species, with one species endemic to Kangaroo Island in South Australia, five species endemic to eastern Australia, and the remainder endemic to south-western Australia. The genus was treated for "Flora of Australia" by Foreman (1995), who has named 11 new species.

An additional three new species of *Petrophile*, including one not discovered until 1999 when it was collected for the first time south of Eneabba, are described in this paper. A common factor that appears to have hindered the discovery of each of these species is their early flowering period. All three could be confused with *P. brevifolia* Lindl., as they key out more closely to that species than to any other in Blackall & Grieve (1988) and in Foreman (1995), but are readily distinguished by a number of morphological differences. A portion of the key to *Petrophile* in "Flora of Australia" key is revised to incorporate the new taxa.

Methods

All measurements were taken from dry pressed material. Measurements of the tepal limb were taken from the point of insertion of the very short filament of the stamen to the apex of the tepal and did not include the hairs extending beyond the apex. Anther length was taken from newly dehisced anthers and included the length of the sterile tip, i.e. the terminal extension of the connective. The pollen presenter was measured from the point near the end of the style where the thickening begins to the apex of the small terminal stigma. The hairy portion of the presenter is referred to here as the 'brush'.

Distribution maps were obtained from the Western Australian Herbarium's Florabase data. Biogeographic regions are as defined in Thackway & Cresswell (1995). The conservation codes given in this paper are those used by the Western Australian Department of Conservation and Land Management. An explanation of these codes is given at the end of this *Nuytsia* issue.

Update to "Flora of Australia" treatment of *Petrophile*

Circumscription of *Petrophile brevifolia* Lindl.

The description of *Petrophile brevifolia* given by Foreman (1995) in "Flora of Australia" Volume 16 agrees fairly well with our circumscription of the species. Both the branchlets and cone scales are described as glabrous, excluding two of the new species. The third new species, *P. nivea*, is excluded by the description of the cones as being 10–20 mm long. However, the description of the flower colour as "yellow or cream or white" should be amended to "pale yellow or cream" as the tepals of *P. brevifolia* are not pure white as in *P. nivea*.

Petrophile brevifolia is a very variable taxon in need of further study. Although most of its variants flower from August to December, there is at least one early-flowering variant that may begin flowering in June and therefore overlap in flowering time with the new species described below.

Revision of key

To bring it up to date with this study, the key to species of *Petrophile* given in Volume 16 of "Flora of Australia" needs to be amended after the second lead of the fifth couplet on page 150. A revision of that portion of the key is given below. Addition of the new taxa requires four new couplets, A–D, to be used. Some characters used in the original key that give an incomplete separation of the taxa have been deleted. New characters have been added in places, for example to couplet 8, and distribution data have also been added.

Note that in couplet 14 of the original key *Petrophile teretifolia* R. Br. was incorrectly given instead of *P. brevifolia*, which should key out for the second time at that point. *P. teretifolia* always has leaves much longer than 15 mm and is correctly keyed earlier in the original key.

Another species for which significant changes have been incorporated into the key below is *Petrophile longifolia* R. Br. The circumscription of *P. longifolia* in "Flora of Australia" encompasses two main taxa, one with prostrate stems as illustrated by a photograph (Figure 29), and the other with stems more erect as illustrated in Figure 94H. The prostrate taxon is probably a new species and is currently known in PERTH by the informal name *Petrophile* sp. prostrate (*J.W. Horn & R. Butcher* 2649). It extends from the Stirling Range area to the south coast, extending east to Hopetoun, and its pollen presenter has the base somewhat compressed and a very dense brush with clubbed hairs. The taxon assumed to be true *P. longifolia* is more widespread; its pollen presenter has a base that is not compressed and a dense brush with acute hairs. Type material of *P. longifolia* has been requested to resolve this uncertainty as to the true identity of the taxon.

Petrophile longifolia also needs to key out under the second lead of couplet 3, as it sometimes has the leaves minutely scabrous. It would key out there with *P. aspera* C.A. Gardner ex Foreman, from which it can be distinguished by its less prominently scabrous leaves and its longer pollen presenter with the swollen base distinctly wider than the bottom of the brush.

5: Cones and inflorescence sessile
7 Most leaves more than 15 mm long
8 Leaves terminating in a pungent point 1–2.5 mm long; brush of pollen presenter not very dense, the axis clearly visible
A Involucral bracts densely hairy on base, the glabrous portion brown outside; pollen presenter with clubbed hairs
B Pollen presenter 1.5–2.2 mm long, the swollen portion more or less fusiform and partially hairy, the glabrous base about as long as the brush; involucral bracts prominent, conspicuously brown above the grey-hairy base. (York area to Darkan area and Harrismith.) ..... **P. antecedens**
B: Pollen presenter 3–4 mm long, the swollen portion very narrowly turbinate, glabrous and much longer than the cylindrical brush above; involucral bracts not prominent, with the brown apex more slender than in B above and not conspicuous above the grey-hairy base. (Coorow to Calingiri.) ..... **P. clavata**
A: Involucral bracts glabrous, grey throughout or with grey margins; pollen presenter with acute hairs
9 Involucral bracts very narrowly ovate; tepals 12–20 mm long. (Shark Bay to Perth to near Ravensthorpe.) ..... **P. brevifolia**
9: Involucral bracts ovate or almost elliptic; tepals *c.* 30 mm long. (Mullewa to near Watheroo.) ..... **P. megalostegia**
8: Leaves blunt or acute, but without a prominent pungent point; brush of pollen presenter dense or very dense (with the axis hidden) in all species except *P. media*
10 Tepals mauve or pink turning whitish; brush of pollen presenter *c.* 3 mm long, with clavate hairs. (Stirling Range to Israelite Bay.) ..... **P. teretifolia**
10: Tepals cream or yellow; brush of pollen presenter *c.* 2 mm long, with acute or clavate hairs.
11 Cone scales very prominently striate; tepals *c.* 10 mm long; brush hairs (except for the basal ones) with a recurved apex. (Scott River to Two Peoples Bay.) ..... **P. acicularis**
11: Cone scales not very prominently striate; tepals 15–25 mm long; brush hairs with apex patent or incurved.
12 Involucral bracts usually 20–40, grey throughout or brown with grey margins; cone scales narrowly ovate or ovate; pollen presenter brush moderately dense, with portions of the axis visible, the upper hairs antrorse and straight. (Darling Range to Scott River to Ravensthorpe.) ..... **P. media**
12: Involucral bracts usually 8–20, brown; cone scales ovate to broadly rhomboid; pollen presenter brush dense or very dense, the axis largely or fully hidden, the upper hairs either ascending and incurved or patent.
C Stems prostrate on mature plants; pollen presenter with no indentation at summit of swollen base, the basal hairs patent, all hairs obtuse to distinctly clubbed. (Stirling Range area to Manypeaks to Hopetoun.) ..... **P.** sp. **prostrate**

C: Stems more erect; pollen presenter with the basal hairs usually strongly antrorse so as to give the appearance of a constriction between the base and the brush, all hairs acute or rarely basal ones obtuse. (Wandering to Perup River to Albany and Stirling Range area.) ..... **P. longifolia**

7 Most leaves 6–15 mm long

13 Tepals glabrous. (Hyden to Stirling Range to Israelite Bay.) ..... **P. phylicoides**

13: Tepals villous

14 Leaves with a pungent point 0.5–2.5 mm long; pollen presenter with a truncate to narrowly obovoid glabrous base and terete upper axis, with hairs restricted to the terete portion.

D Leaves sufficiently distant not to conceal the branchlets and involucral bracts; involucral bracts grey throughout or brown with grey margins; tepals cream or pale yellow, the limb with hairs 0.5–0.8 mm long; cones 10–20 mm diam. (Shark Bay to Perth to near Ravensthorpe.) ..... **P. brevifolia**

D: Leaves very crowded, concealing the branchlets and involucral bracts; involucral bracts brown throughout; tepals white, the limb with hairs 1–1.5 mm long; cones 6–8 mm diam. (Near Eneabba.) ..... **P. nivea**

14: Leaves with a broad mucro at apex, not pungent; pollen presenter largely fusiform, with hairs on all but the base of the fusiform swelling. (Southern Cross to Coolgardie to Peak Charles.) ..... **P. arcuata**

Descriptions of new species

Petrophile antecedens Hislop & Rye, *sp. nov.*

Frutex ramulis pilosis. Folia teretia, pungentia. Inflorescentia sessilis, globosa; bracteae involucrales manifestae, peranguste ovatae, fusae, basi pilosae. Tepala pallido-cremea, dense pilosa. Pollinis praebitor tumore plus minusve fusiformi praeditus, cujus pars superior pilis manifeste clavatis.

Typus: 3.5 km east of Metro Rd then north on the track for 1.65 km, Gibbs State Forest, Wandering, Western Australia, 1 June 2000, *F. Hort* 1037 (*holo:* PERTH 05570530; *iso:* CANB).

Shrub erect, often widely spreading, 0.3–0.5 m high, up to 0.5 m wide, without a lignotuber. *Branchlets* hairy, conspicuously so on young growth. *Leaves* antrorse, almost straight to distinctly recurved, those directly below the inflorescences mostly distinctly recurved, simple, terete, 20–40 x 1–2 mm, with a pungent apical point; point straight or very slightly recurved, 1–2 mm long. *Inflorescence* terminal, sessile, globose, 20–30 mm diam. *Involucral bracts* numerous, conspicuous, often recurved, very narrowly ovate, 14–25 mm long, acuminate, densely hairy and appearing greyish towards base, glabrous and brown above. *Cone scales* narrowly ovate or ovate, 7–12 mm long, densely hairy outside throughout or at least on distal half. *Tepals* 10–15 mm long, pale cream, with a very dense indumentum of patent to antrorse hairs; limb 1.6–2 mm long, lacking a pronounced apical point, the largest hairs 1–2 mm long. *Anthers c.* 1.3 mm long; sterile apex *c.* 0.25 mm long. *Pollen presenter* 1.5–2.2 mm long, yellow turning reddish brown, the swollen portion very narrowly obovoid, almost fusiform, i.e. the apex tapering to the brush axis, which is broader at the base than at the apex, the glabrous tip 0.2–0.4 mm long;

brush 0.8–1.2 mm long, 0.5–0.7 mm diam., the axis moderately densely covered by clavate hairs 0.2–0.3 mm long but still visible between the hairs. *Cones* very broadly ovoid or globose, 12–15 x 10–13 mm. *Nuts* very broadly or depressed obovate in outline, with a slightly indented base, beaked, *c.* 3 x 3–3.5 mm not including the beak or hairs; adaxial surface densely covered by dark purplish hairs *c.* 0.3 mm long and with scattered long golden hairs on the surface, very densely hairy on the margin with golden brown (sometimes also some white) hairs, the larger ones 4–4.5 mm long; abaxial surface largely glabrous apart from a central band of white appressed hairs or sometimes completely glabrous. (Figure 1 A–C)

Other specimens examined. WESTERN AUSTRALIA: off Dardadine Rd South, NE of Stricklands Rd, SE of Dardadine, 18 May 1992, *V. Crowley* DKN 128 (PERTH); Harrismith, 15 July 1993, *D. Greeve* (ALB); along a track off Deefor Rd, *c.* 2.5 km S of Pine Plot 6, Flynn State Forest, W of York, 8 June 2000, *F. Hort* 1043 (PERTH); *c.* 0.8 km NE of Deefor Rd on a track originating 5.9 km E of Yarra Rd and 1.4 km W of Bumper Rd, Flynn State Forest, W of York, 8 June 2000, *F. Hort* 1044 (PERTH); along a track off Deefor Rd, *c.* 2.5 km S of Pine Plot 6, Flynn State Forest, 31 July 2000, *F. Hort* 1094 (PERTH); Deefor Rd, 0.6 km W of Nuytsia Rd then *c.* 200 m NW, Flynn State Forest, 13 Sep. 2000, *F. Hort* 1125 (PERTH); Narrakine Rd, S of gravel reserve, 29 May 1999, *C. Taylor, P. Rose & G. Warren* 214 (PERTH); Narrakine Block State Forest 52, S side, 20 May 1999, *G. Warren* 233 (PERTH).

Distribution and habitat. Distributed in the Avon Wheatbelt and Jarrah Forest regions of the South West Botanical Province, occurring in an area about midway between Canning Dam and York and extending south to Dardadine (which is near Darkan) and south-east to Harrismith. The species occurs mainly in open woodlands of Jarrah, Marri, Wandoo or other eucalypts, but one population is known from dense heathland surrounded by woodland. The soil has been recorded as white or yellowish sandy clay soils, sometimes mixed with gravel, and overlying laterite. (Figure 2)

Phenology. Flowers May to early June. This species has a particularly brief and early flowering period in comparison with other members of the genus.

Conservation status. Although only recently discovered, with the first known collection made in 1992, this taxon is not considered to be at risk. Several new large populations were located in surveys by Fred Hort in 2000. The known range of the species is *c.* 170 km long and 100 km wide.

Etymology. From the Latin *antecedens* – preceding, as this species flowers ahead of nearly all other members of the genus *Petrophile*.

Notes. See notes under its closest relative *Petrophile clavata*. Four other species that are similar in having clavate hairs on the pollen presenter are *P. aspera*, *P. helicophylla* Foreman, *P.* sp. prostrate (*J.W. Horn & R. Butcher* 2649) and *P. teretifolia*, but in these species the hairs are less prominently clavate and are more densely arranged. These four species all appear to be more closely related to one another than to *P. antecedens* and *P. clavata*.

Petrophile clavata Hislop & Rye, *sp. nov.*

Petrophile antecedens affinis sed pollinis praebitore grandiore basi glabro anguste turbinato, longitudine penicillum cylindraceum multo superante, bracteis involucralibus magis pilosis, minus conspicuis et acumine graciliore differt.

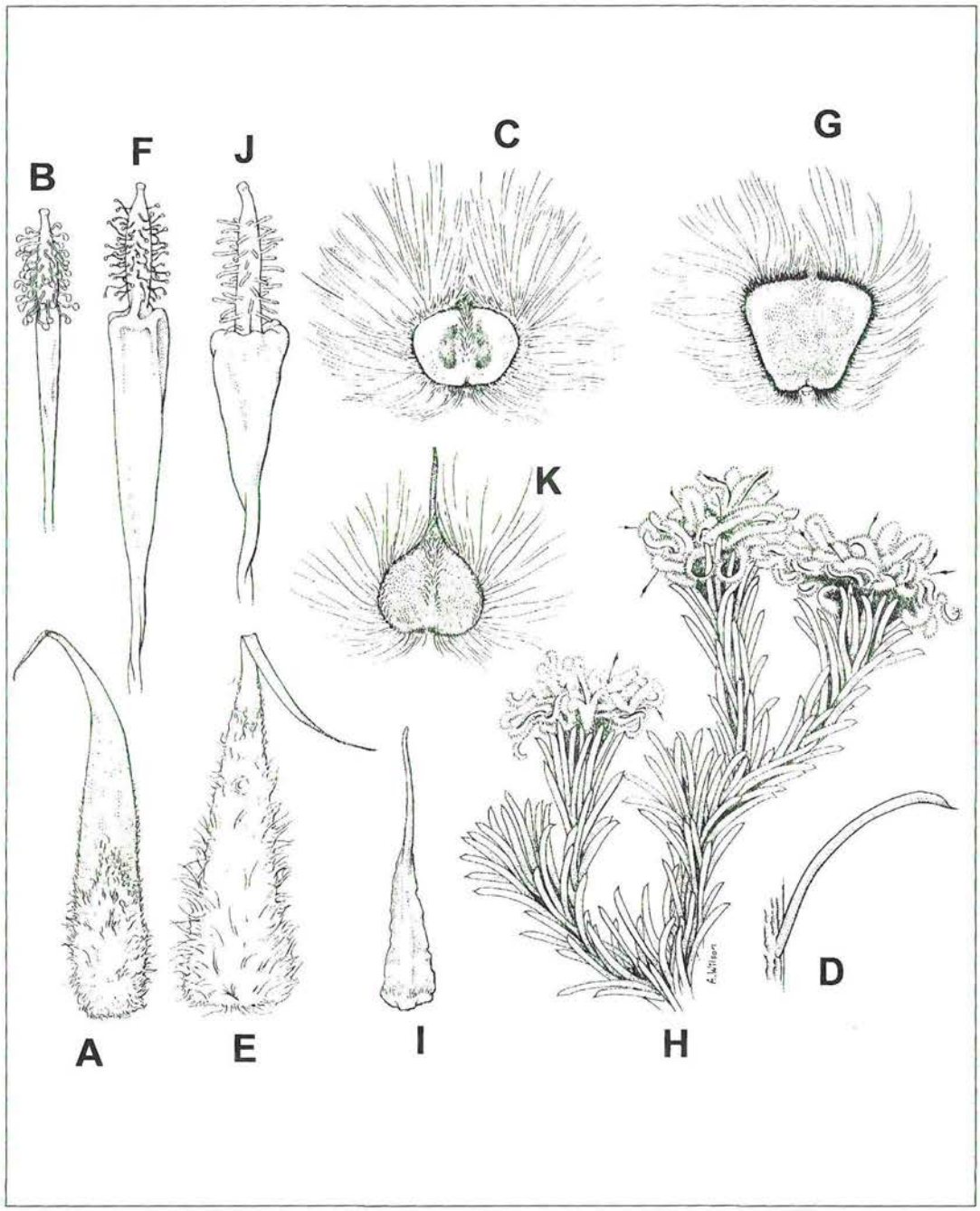

Figure 1. A–C. *Petrophile antecedens*. A – involucral bract (x4), B – pollen presenter (x15), C – abaxial surface of nut (x4.5); D–G. *Petrophile clavata*. D – leaf (x2), E – involucral bract (x4), F – pollen presenter (x15), G – abaxial surface of nut (x6); H–K. *Petrophile nivea*. H – flowering branch (x1), I – involucral bract (x4), J – pollen presenter (x15), K – abaxial surface of nut (x6). Drawn by Annemarie Wilson from *F. Hort* 1037 (A–C), *A.S. George* 16303 (C–F), *C. Chapman s.n.* (G) and *M. Hislop* 1341 (H–K).

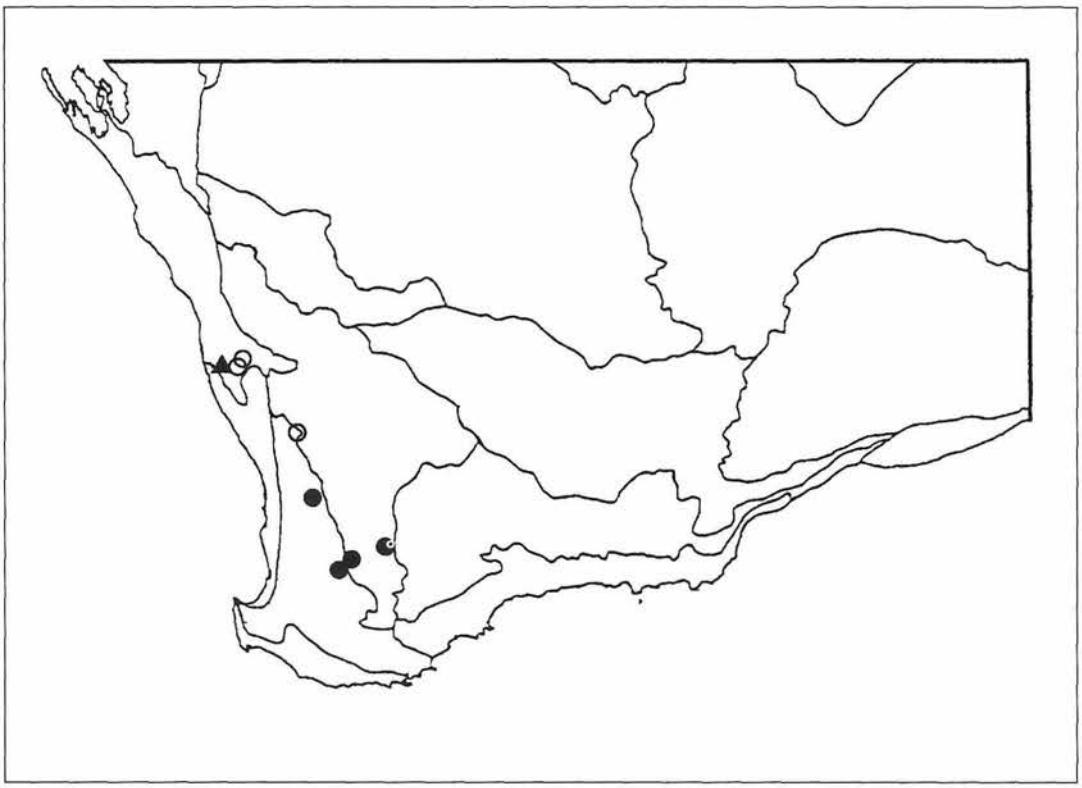

Figure 2. Distributions of *Petrophile antecedens* ●, *P. clavata* ○ and *P. nivea* ▲ in south-western Australia.

Typus: 9 km south-west of Calingiri, 1 June 1984, Western Australia, *A.S. George* 16303 (*holo:* PERTH 03422712; *iso:* MEL *n.v.*).

Shrub erect or spreading, 0.25–0.7 m high. *Branchlets* hairy, conspicuously so on young growth. *Leaves* antrorse, sometimes mostly almost straight to incurved or s-shaped but usually mostly distinctly recurved, simple, terete, 20–50 x 1–2 mm, with a pungent apical point; point straight or very slightly recurved, 1–2 mm long. *Inflorescence* terminal, sessile, globose, 30–45 mm diam. *Involucral bracts* numerous, often recurved, very narrowly ovate, 10–20 mm long, narrowly acuminate, densely hairy and grey on base, somewhat hairy above then glabrous and brown distally. *Cone scales* narrowly ovate or ovate, 7–12 mm long, densely hairy outside throughout or at least on distal half. *Tepals* 15–20 mm long, cream or very pale yellow, with a very dense indumentum of patent to antrorse hairs; limb 2.2–2.5 mm long, lacking a pronounced apical point, the largest hairs usually 1.5–2 mm long. *Anthers* at least 1.5 mm long (only old ones seen). *Pollen presenter* 3–4 mm long, colour not clear but probably yellow turning red-brown, the glabrous base very narrowly obconic (i.e. the apex truncate), the brush axis uniform in diameter, the glabrous tip *c.* 0.2 mm long; brush 1–1.2 mm long, 0.5–0.7 mm diam., the axis fairly densely covered by clavate hairs 0.2–0.3 mm long but still visible between the hairs. *Cones* globose or depressed globose, 10–12 x 10–15 mm. *Nuts* broadly or very broadly obovate in outline, with a slightly indented base, shortly beaked, *c.* 3.3 x 3.5 mm not including the beak or hairs; adaxial surface densely covered by dark purplish hairs *c.* 0.15 mm long and with a few long golden hairs on the surface, very densely hairy on the margin with golden brown hairs, the larger ones 3–3.5 mm long; abaxial surface glabrous apart from a central band of white appressed hairs. (Figure 1 D–G)

Other specimens examined. WESTERN AUSTRALIA: Coorow Reserve, W of Coorow, 30 June 1967, *C. Chapman* (PERTH); 9 km SW of Calingiri, 1 June 1984, *A.S. George* 16302 (MEL *n.v.*, PERTH); vacant crown land immediately S of Alexander Morrison National Park, 7 Sep. 1979, *E.A. Griffin* 2199 (PERTH).

Distribution and habitat. Collected in Coorow Reserve, adjacent to Alexander Morrison National Park and near Calingiri. Two of these localities are in the Geraldton Sandplains region not far from the border of the Swan Coastal Plain region, while the third locality is more or less on the border between the Avon Wheatbelt and Jarrah Forest regions. *Petrophile clavata* may well occur in all four of these biogeographic regions. It is recorded in heathland vegetation, in sandy soils on laterite hilltops. (Figure 2)

Phenology. Flowers: probably May to July or August. No young inflorescences have been seen, the specimens collected at the beginning of June having all flowers fully opened and the other specimens having only old inflorescences with flowering completed.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. Currently known from three localities extending over a distance of *c.* 140 km and including at least one reserve. This species is in need of further survey to determine its conservation status more accurately. It is probably poorly collected partly because of its early flowering time.

Etymology. From the Latin *clavatus* – clubbed, referring to the clavate hairs on the pollen presenter. The clubs on the pollen presenter are more obvious in this species (Figure 1B) than any of the other five species of *Petrophile* known to have clavate hairs, including its very close relative *P. antecedens* (Figure 1F).

Notes. There are no records as to whether or not this taxon has a lignotuber.

Petrophile clavata occurs within the geographic range of the much more common and variable species *P. brevifolia* and was previously included under that species. It is not known whether the two species coexist at any localities, but even if they do coexist they may still be completely reproductively isolated, as they would be unlikely to flower simultaneously. *P. clavata* can be readily distinguished from *P. brevifolia* by the presence of a conspicuous indumentum on the branchlets, involucral bracts and cone scales. Other differences include the longer hairs on the tepals, the longer base to its pollen presenter (always considerably longer than the brush) and the clubbed hairs on the brush.

The closest relative of *Petrophile clavata* is one of the other new species, *P. antecedens*. In addition to the differences given in the key, *P. clavata* has larger inflorescences than *P. antecedens*. Floral measurements such as tepal and anther length appear to be greater in *P. clavata* but cannot be accurately measured in this species since there are no young flowers on the specimens. The two taxa appear to be geographically separated, although further survey is needed to determine their full ranges. They also appear to show significant habitat differences, with *P. clavata* recorded from more open, exposed locations in heathlands on lateritic hills and certainly occurring in a less humid environment than that of *P. antecedens*, which occurs in woodlands (or less commonly in dense heathlands) and not on the highest ground.

Petrophile nivea Hislop & Rye, *sp. nov.*

Frutex erectus, ramulis glabris. Folia congesta, teretia, pungentia. Inflorescentia sessilis, globosa;

bracteae involucrales a foliis occultae, peranguste ovatae, fuscae, glabrae. Tepala nivea, dense pilosa. Pollinis praebitor basi peranguste turbinatus, glaber, supra pilis brevibus acutis sparse obtectus.

Typus: in the locality of Warradarge, south of Eneabba [precise locality withheld], Western Australia, 9 July 1999, *M. Hislop* 1341 (*holo:* PERTH 05372682; *iso:* CANB, K, MEL).

Shrub 0.4–0.6 m high, commonly 0.3–0.4 m wide, without a lignotuber. *Branchlets* glabrous. *Leaves* widely to shallowly antrorse, crowded, largely concealing the surfaces of the branchlets and involucral bracts, simple, gently s-shaped, incurved or recurved, terete, 10–15 x 1–1.5 mm, with a slightly recurved apex including a point, glabrous; point pungent, 0.5–1 mm long, brown. *Inflorescence* terminal, sessile, globose, 20–25 mm diam. *Involucral bracts* few, erect, very narrowly ovate, 8–12 mm long, acuminate, brown throughout, glabrous. *Cone scales* narrowly ovate, 5–7 mm long, glabrous apart from a few marginal hairs. *Tepals c.* 15 mm long, white, with a very dense indumentum of patent to antrorse hairs; limb 3–4 mm long including a pronounced apical point 0.6–1 mm long, the largest hairs 1–1.5 mm long. *Anthers c.* 1.7 mm long; sterile apex *c.* 0.2 mm long. *Pollen presenter* 2–3 mm long, yellow turning reddish brown, glabrous on the narrowly obconic basal swelling 0.8–1.2 mm long and on the apical tip 0.3–0.4 mm long; brush 1–1.4 mm long, *c.* 0.5 mm diam., the axis rather sparsely covered by acute hairs *c.* 0.2 mm long. *Cones* globose, 6–8 x 6–8 mm. *Nuts* broadly ovate-cordate in outline, prominently beaked, *c.* 3 x 2.5 mm not including the beak; adaxial surface with a dense indumentum of minute dark hairs and with scattered long white hairs on the surface, very densely hairy on the margin with white hairs, the largest ones 3–4 mm long; abaxial surface with a prominent central band of white appressed hairs and similar hairs scattered elsewhere. (Figure 1 H–K)

Other specimen examined. WESTERN AUSTRALIA: type locality, 29 May 1999, *M. Hislop* 1308 (PERTH).

Distribution and habitat. Known from a single locality to the south of Eneabba, in the Geraldton Sandplains region. The species grows on white sand over laterite in a heathland that is very rich in Proteaceae, including ten other species of *Petrophile*. The associated *Petrophile* species are *P. aculeata* Foreman, *P. brevifolia*, *P. chrysantha* Meisn., *P. linearis* R. Br., *P. macrostachya* R. Br., *P. megastegia* F. Muell., *P. scabriuscula* Meisn., *P. serruriae* R. Br., *P. shuttleworthiana* Meisn. and *P. striata* R. Br. (Figure 2)

Phenology. Flowers: May to August.

Conservation status. Conservation Codes for Western Australian flora: Priority One. Currently known only from the type locality on private property, where it is locally common.

Etymology. From the Latin *niveus* – snow-white, referring to the flower colour.

Notes. A distinctive species characterised by its pure white flowers, crowded leaves largely concealing the surfaces of the branchlets and involucral bracts, long perianth hairs and small cones. Also notable is its dense zigzag growth pattern, with seasonal growth increments short and produced at a wide angle (*c.* 45 degrees) from the terminal point of the previous season's growth. These characters readily distinguish *P. nivea* from the ten other *Petrophile* species with which it coexists at the type locality. The coexisting species include *P. brevifolia*, which appears to be its closest relative, but the earlier flowering time of *P. nivea* apparently prevents any possiblity of hybridisation.

Acknowledgements

We would like to thank Fred Hort for collecting specimens of one of the new species, Paul Wilson for translating the diagnoses into Latin and Annemarie Wilson for the excellent line illustration.

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A new species of *Laxmannia* (Anthericaceae) from Tasmania and a new subspecies from Western Australia

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Abstract

Keighery,G.J. A new species of *Laxmannia* (Anthericaceae) from Tasmania and a new subspecies from Western Australia. *Nuytsia* 14(3): 375–380 (2002). Two new members of the genus *Laxmannia* R. Br. (Anthericaceae) are described as *L. morrisonii* Keighery and *L. grandiflora* subsp. *brendae* Keighery. The new species is a Tasmanian endemic known only from the type collection made in 1960. It is poorly known and urgently needs relocating to assess its conservation status. It could possibly be a member of the *Laxmannia squarrosa* group and, if so, would be the only representative of this group in eastern Australia. The new subspecies is one of the western representatives of the *L. squarrosa* group. It is confined to a small area north-west of Denmark and has conservation priority.

Introduction

Laxmannia R. Br. is an endemic Australian genus of Anthericaceae. The genus was treated for "Flora of Australia" by Keighery (1987), who recognised three species endemic to eastern Australia and a further 10 species and 7 subspecies occurring in Western Australia. Two new taxa of *Laxmannia*, one a new eastern species from Tasmania and the other a newly discovered subspecies from the south-west of Western Australia, are described here. They increase the total number of taxa recognised in the genus to 14 species and eight subspecies.

Of the three eastern Australian endemics recorded by Keighery (1987), only *L. orientalis* Keighery was known from Tasmania. In 1999 the author was shown a collection of an unidentified *Laxmannia* from Tasmania that had terminal erect inflorescences and appeared to be morphologically close to the *L. squarrosa* group of Western Australia or possibly intermediate between this group and the *L. gracilis* group. Determining the correct placement of this species would have been easier if other aspects of its biology, such as its flower colour and chromosome number, were known.

The *Laxmannia gracilis* species group occurs on both sides of Australia, represented in the west by *L. arida* Keighery and *L. minor* R. Br. and in the east by *L. compacta* Conran & P. Forster and *L. gracilis* R. Br. This group has small inflorescences on long erect peduncles, usually coloured flowers that open narrowly and are nocturnal or open over several days, and petals similar to the sepals. Polyploidy is common in *Laxmannia gracilis*, with populations in the southern parts of its range being hexaploid.

The *Laxmannia squarrosa* group comprises five species, all Western Australian, with large erect inflorescences on short or long peduncles, enclosed by numerous usually brown-coloured imbricate bracts, white flowers with a diurnal life and the sepals dry at flowering, and cupular petals much shorter than the sepals. Polyploidy is uncommon in members of this group.

In 1996 Brenda Hammersley collected an unusual *Laxmannia* from north-east of Denmark that was referable to the *Laxmannia squarrosa* group. Within this group the collection keys to *Laxmannia grandiflora* Lindl., but is disjunct and differs in having an extremely compact habit with few-flowered inflorescences on very short peduncles usually not exceeding the leaves. The disjunct location and morphological distinctiveness of this population merits its recognition as a separate subspecies. This new subspecies is described here together with the new species from Tasmania.

Taxonomy

Laxmannia grandiflora subsp. **brendae** Keighery, *subsp. nov.*

Differt a subspecies aliis *Laxmanniea grandiflorea* planta 2–6 cm alta, inflorescentia erecta, normaliter foliis brevioribus.

Typus: north-east of Denmark [precise locality withheld], Western Australia, 30 August 1996, *B.G. Hammersley* 1615 (*holo:* PERTH 04432177).

Erect compact stilted *herb* 2–6 cm tall, including the stilt roots which are 10–15 mm long and the inflorescences. *Leaves* straight with a recurved apex, linear, 10–15 mm long, apex acute; sheath scarious, *c.* 2 mm long, margins entire, the apex extended into 3 long cilia to 3 mm long. *Inflorescence* erect, generally not exceeding the leaves, 4–12-flowered; peduncle 10–30 mm long. *Outer bracts* scarious, keeled at base, translucent to fawn, oblong-ovate, 4–5 mm long, apex acute, margins entire. *Inner bracts* white, margins very divided. *Flowers* white. *Sepals* 4–5 mm long. *Petals c.* 3 mm long. *Outer anthers* free, *c.* 2 mm long. *Inner anthers* attached to petals *c.* 2 mm from base. *Ovary c.* 1 mm long. *Style c.* 1 mm long. *Fruit* not seen.

Other specimens examined. WESTERN AUSTRALIA: S of type locality, 1 Sep. 1997, *B.G. Hammersley* 1757 (PERTH); type locality, 30 Aug. 1996, *B.G. Hammersley* 1619 (PERTH).

Distribution and habitat. Known from two monadnocks north of Denmark, growing in shallow siliceous sands over granite in a mixed low heath of *Grevillea fuscolutea*, *Cryptandra congesta*, *Andersonia sprengelioides* and *Grevillea cirsiifolia*. (Figure 1)

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. The small area in which this taxon occurs is an area of State Forest that is proposed as a National Park. Although restricted in occurrence (B. Hammersley, pers. comm.) it does not appear to be under any immediate threat.

Etymology. This subspecies is named after the collector of the type, Brenda Hammersley in recognition of the considerable work she has undertaken in documenting the flora of the Denmark area.

Notes. Two subspecies have previously been described in *Laxmannia grandiflora*. Their distributions are included in Figure 1 for comparison with the new subspecies. Subsp. *grandiflora* is a densely tufted

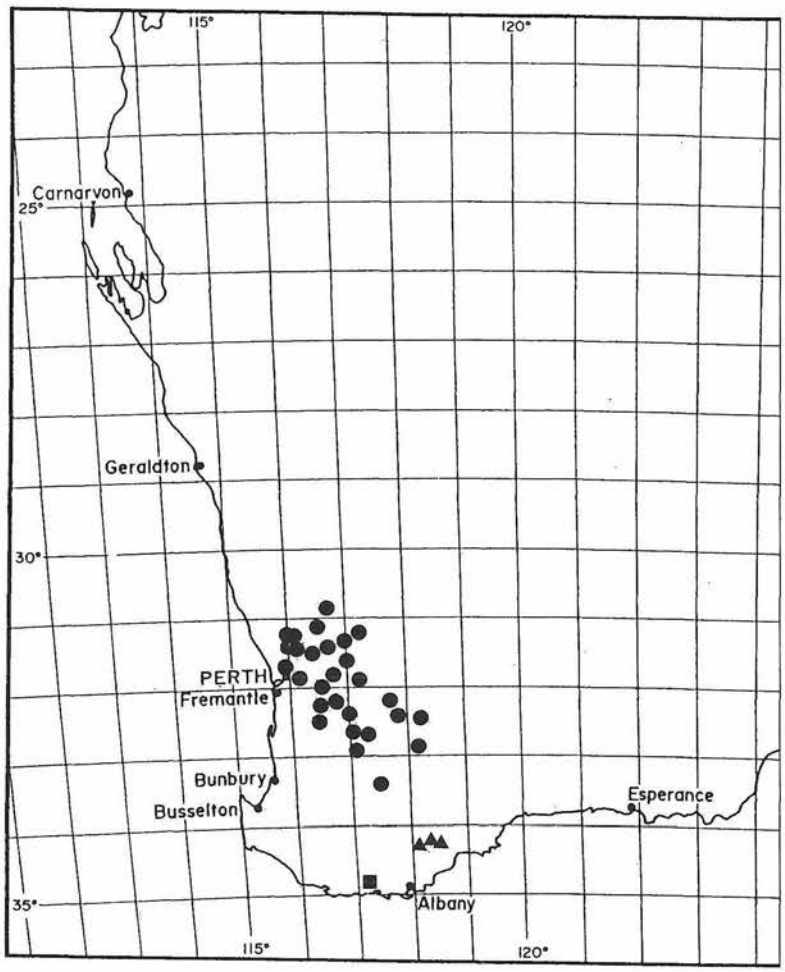

Figure 1. Distribution of *Laxmannia grandiflora* subsp. *brendae* ■, *L. grandiflora* subsp. *grandiflora* ● and *L. grandiflora* subsp. *stirlingensis* ▲.

perennial, normally with the stem bases on or near the soil surface, and with peduncles 7–14 cm long. It occurs between Mogumber, Perth inland to Quairading and south to Narrogin on duplex soils in Wandoo woodland. *Laxmannia grandiflora* subsp. *stirlingensis* is disjunct to the south of the nominate subspecies, occurring on winter-wet clay soils in heath around South Stirlings, and is a tall slender rambling perennial on stilt roots 10–22 cm tall and with peduncles 12–22 cm long.

The new subspecies from the Denmark area differs from both of the named subspecies in having an extremely compact habit with few-flowered inflorescences on very short peduncles usually not exceeding the leaves. Subsp. *brendae* is separated by a disjunction of some 60 km from the closest populations of subsp. *stirlingensis* and over 200 km from the closest populations of subsp. *grandiflora*.

Laxmannia grandiflora subsp. *brandae* joins a series of narrow endemics confined to a few isolated granite monadnocks north of Denmark. These are the recently described species *Borya longiscapa*, *Cryptandra congesta*, *Grevillea fuscolutea* and two currently unnamed species of *Andersonia*. Future study will probably add more to this list.

Laxmannia morrisii Keighery, *sp. nov.*

Differt a *Laxmannia gracili* habitu compacto vel 50 mm alto, internodis brevissimi, pedunculo brevi, petalis sepalis multo brevioribus.

Typus: Snug Plains, near Grey Mountain, Tasmania, January 1960, *W.D. Jackson s.n.* (*holo:* HO 446141).

Erect compact stilted *herb* to 50 mm tall, including the stilt roots (to 15 mm long) and the inflorescences. *Leaves* straight, linear, pungent, 8–15 mm long; sheath scarious, *c.* 2 mm long, margins entire, the apex extended into 3 long cilia to 3 mm long. *Inflorescence* erect, 4–12-flowered; peduncle 10–30 mm long. *Outer bracts* scarious, keeled at base, oblong-ovate, 4–5 mm long, apex acute, margins entire. *Inner bracts* white, margins very divided. *Flowers* ?white. *Sepals* 4–5 mm long. *Petals c.* 3 mm long. *Outer anthers* free, *c.* 2 mm long. *Inner anthers* attached to petals *c.* 2 mm from base. *Ovary c.* 1 mm long. *Style c.* 1 mm long. *Fruit* not seen. (Figure 2)

Distribution and habitat. The locality given on the type specimen is uncertain according to the collector; there is a possibility the type could have been collected on the Middlesex Plains (D.S. Morrison pers. comm.). However, Middlesex Plains is a lowland area which has been intensively collected and it is unlikely that the species was collected there.

Snug Plains is an area of subalpine undulating plateau at an altitude of *c.* 600 m, south-west of Hobart. The vegetation is a complex of wet and dry sclerophyll forest, and mallee woodlands (Jackson 1973). The area receives winter snowfalls and temperatures below freezing, including a record of –22 degrees in 1983 (Davidson & Read 1985). This is a remarkable site for a species of *Laxmannia*, as no other species reaches the subalpine.

Conservation status. Snug Plains, an area of State Forest, is a proposed conservation park under the Tasmanian Regional agreement (A. Blanks pers. comm.). However, the species has not been collected since the type in 1960 and urgently needs recollecting to assess its true conservation status. It should be listed as 1K (known only from the type, conservation status cannot be determined) under the national ROTAP system (Briggs & Leigh 1996).

Etymology. I have great pleasure in naming this species after Desmond Morris F.L.S., who has a unique knowledge of the native and naturalized flora of Tasmania and who, in publications and in herbarium curation, has spread this knowledge to many people. Dennis recognized the unusual nature of this collection during routine curatorial activities at Hobart.

Notes. Laxmannia morrisii is a very distinctive species that has small inflorescences subtended by numerous bracts almost as long as the flowers, probably white flowers, with the petals shorter than the sepals but not cupular, and a short vegetative axis densely covered by leaf bases. The plant is superficially very similar in appearance to some forest populations of *Laxmannia squarrosa*, probably because of its compact habit and short inflorescences. This is no doubt owing to the locality where the species occurs, as the compact vegetative axis covered by the overlapping leaf sheaths would provide some cold protection. The sole population is in flower in summer and is the only summer-flowering species known in the genus. All western species, including *L. squarrosa*, are in mature seed in January.

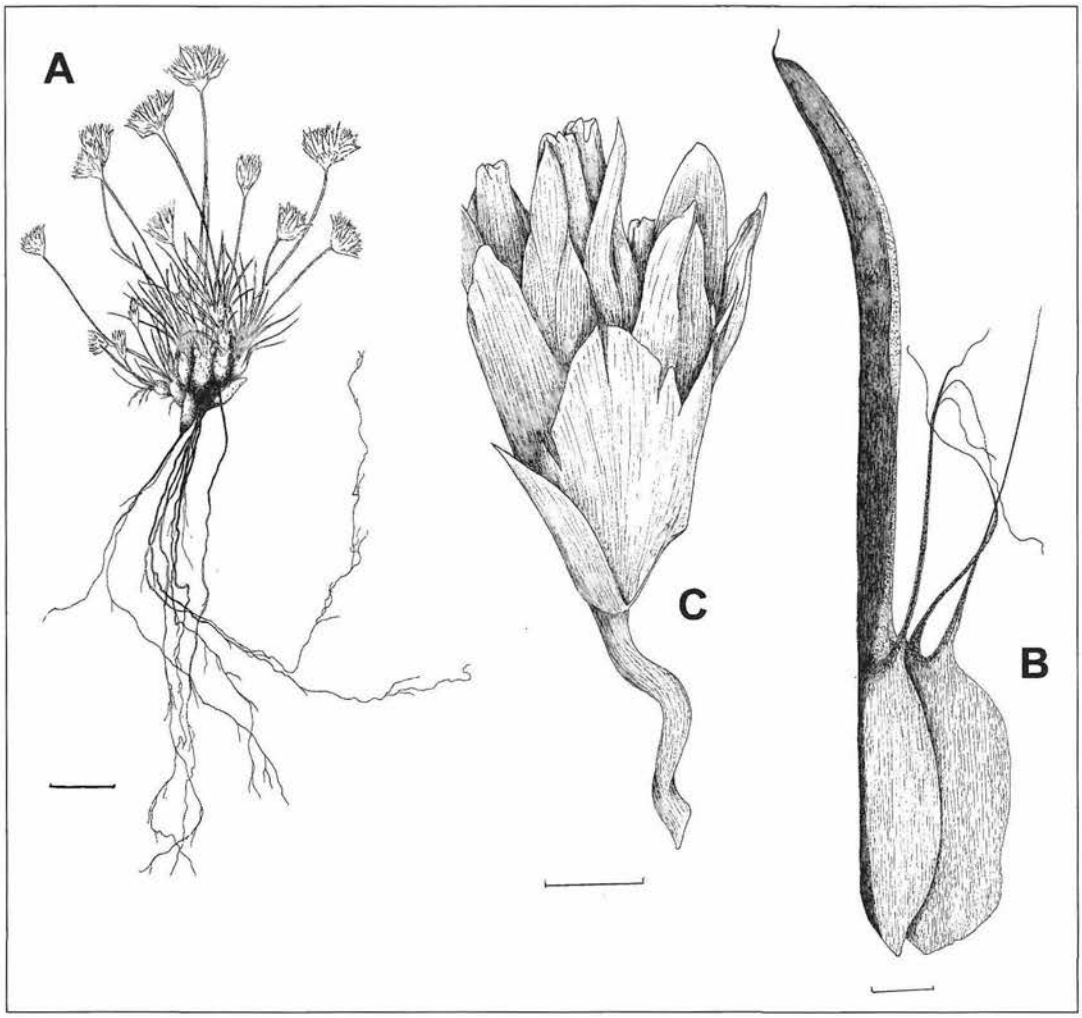

Figure 2. Type of *Laxmannia morrisii*. A – whole plant, scale bar = 1 cm; B – leaf with leaf sheath, scale bar = 1 mm; C – inflorescence, scale bar = 1 mm.

While its distribution suggests that it is part of the *Laxmannia gracilis* group, *L. morrisii* differs in having the petals much shorter than the sepals and a very compact habit. The densely overlapping leaf bases with long terminal cilia are unique in the *L. gracilis* group. Living plants are necessary to place this unique collection since flower colour, flower longevity, petal shape, bract colour and ploidy levels are all diagnostic for the species groups.

Acknowledgements

The type collection of the new species was borrowed from HO. The author was able to view type material and other collections at SYD, MEL and AD with the assistance of these organisations, and an ABRS grant. Neil Gibson and Tony Blanks provided details about the habitat of the species. Nadine Guthrie drew the illustrations. Brenda Hammersley first recorded the new Western Australian taxon and has surveyed its known populations.

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A new subspecies of *Cleome uncifera* (Capparaceae) from Western Australia

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Abstract

Keighery, G.J. A new subspecies of *Cleome uncifera* (Capparaceae) from Western Australia. *Nuytsia* 14(3): 381–384 (2002). *Cleome uncifera* subsp. *microphylla* Keighery is described to provide a name for a small-leaved variant of *Cleome uncifera* Kers. from the Great Sandy and Tanami deserts of north-western, Western Australia. The distinction of the new subspecies is discussed, the ranges of variation in the leaves of the new and typical subspecies are illustrated and a map of the distribution of the two subspecies is provided.

Introduction

The Australian members of the Capparaceae are not well known taxonomically, especially the genera *Capparis* L. and *Cleome* L., both of which need detailed study to resolve species limits. This is largely because the family occurs predominantly in the less densely populated, and botanically poorly known, northern parts of Australia.

The Australian members of the genus *Cleome* were last reviewed by Hewson (1982) as a contribution to the "Flora of Australia" project. One of the species accepted by Hewson was *Cleome uncifera* Kers. This apparently short-lived soft-wooded perennial occurs in the Pilbara, Carnarvon, Great Sandy Desert, Tanami and Dampier Land Biogeographic Regions of Western Australia (Thackway & Creswell 1995). Specimens from the eastern populations of *Cleome uncifera* differ quantitatively from typical material in a number of morphological characters. On the basis of these differences, especially the small leaves, this variant is described here as a separate subspecies.

Taxonomic treatment

Cleome uncifera subsp. **microphylla** Keighery, *subsp. nov.*

Differt a subsp. *uncifera* foliolis obovatus-ellipticus, 3–4 mm longis; et siliqua cum stylis peristens, 20–40 mm longa.

Typus: 1 km south-west of Well 42, near Lake Guli, Great Sandy Desert, 21°19'S, 125°53'E, 3 May 1979, Western Australia, *A.S. George* 15578 (*holo:* PERTH 03236307; *iso:* NT, CANB).

A low spreading densely branched soft-wooded *shrub* from a corky woody base to 50 cm tall and 40 cm wide. *Leaf* (from basal non-flowering branch) with petiole 2–4(10) mm long; leaflets obovate-elliptic, 3–5 mm long. *Petals* 12–16 mm long; claw 4–5 mm long. *Inner petals* with a central red marking. *Siliqua* (including persistent style) 20–40 mm long, pedicel 4–6 mm long. (Figure 1A–D)

Specimens examined. WESTERN AUSTRALIA: McLarty Hills, Great Sandy Desert, 7 Aug. 1977, *A.S. George* 14711 (PERTH); Tobin Lake (21°41'S, 125°45'E), 5 May 1979, *A.S. George* 15621 (PERTH, DNA, CANB); near Well 24, Canning Stock Route, 11 Aug. 1992, *A.E. de Jong s.n.* (PERTH); 47 km S of Sturt Creek Homestead, 11 Nov. 1995, *P.K. Latz* 14685 (PERTH, DNA, CANB, MEL); Well 40, Canning Stock Route, Aug. 1973, *M. House & P. Smith* 92 (PERTH); Rudall River (23°S, 122°45'E), *P.G. Wilson* 10480 (PERTH).

Distribution and habitat. Occurs on red sand dunes, often in greatest numbers after fires, in the Great Sandy and Tanami Deserts, Western Australia. (Figure 2)

Conservation status. This taxon has a fairly wide distribution in a region that is not subject to large-scale habitat destruction, so is not considered to be at risk.

Phenology. Recorded in flower from May to November, with flowering time probably depending on rainfall. The arid areas of occurrence of this taxon have both summer and bixeric rainfall patterns, however, rainfall is low and erratic.

Notes. Both subspecies of *Cleome uncifera* appear to have the same habit and plant size. Subsp. *uncifera* prefers sandy soils, but not necessarily dunes. While information relating to fires is lacking on most collections, personal observations suggest the occurrence of this subspecies is linked to rainfall events rather than fire, although it can be common after fires also. Although occasionally recorded (on a few herbarium specimens) as being annual, this taxon perenneates from the corky rootstock. It appears to be a relatively short-lived perennial, but further field observations are needed to assess its longevity.

There are consistent differences in the size of the leaves, flowers and fruits between the two subspecies, as shown in Table 1. Petal length might show a slight overlap but there is no overlap in the vegetative and fruiting characters listed. Figure 1 illustrates the range of variation in leaves of the two subspecies, with the obovate-elliptic leaflets of subsp. *microphylla* (A–D) clearly smaller than the linear to narrowly obovate-elliptic leaflets of subsp. *uncinata* (E–H).

Table 1. Comparison of five quantitative character states for the two subspecies of *Cleome uncifera*. All measurements are in millimetres.

Character	**Subsp. *microphylla***	**Subsp. *uncifera***
petiole length	2–4(5)	15–20
leaflet length	3–5	15–24
petal length	12–16	16–20
fruit pedicel length	4–6	10–15
fruit plus style length	20–40	55–75

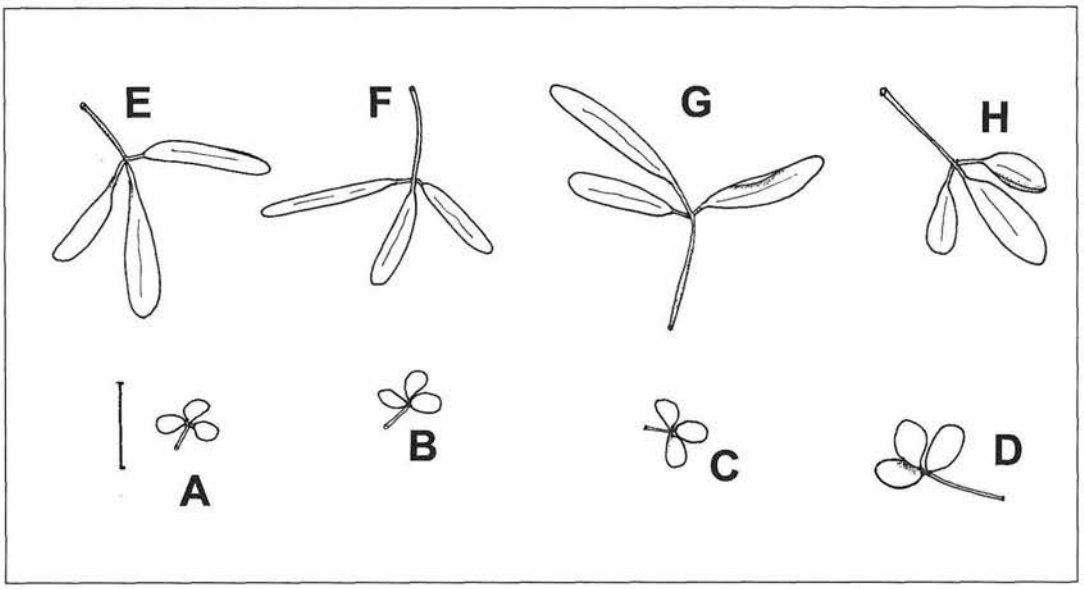

Figure 1. Tracings of a selection of mature vegetative leaves of the two subspecies of *Cleome uncifera*. A–D. *C. uncifera* subsp. *microphylla*; E–H. *C. uncifera* subsp. *uncifera*. Scale bar = 10 mm. Drawn from *P.K. Latz* 14685 (A), *A.S. George* 14711 (B), *A.S. George* 15621 (C) and *P.G. Wilson* 10480 (D), *A.A. Mitchell* 921 (E), *K.R. Newbey* 10567 (F), *N.T. Burbidge* 5854 (G), *P.G. Wilson* 893 (H).

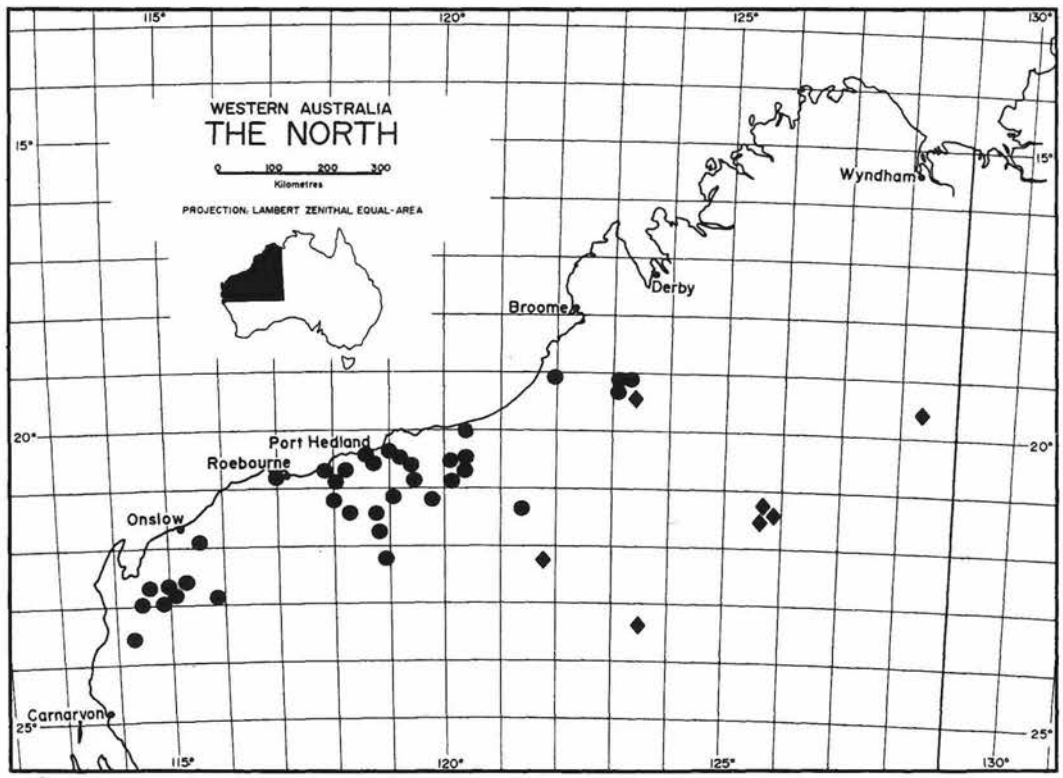

Figure 2. Geographic distribution of *Cleome uncifera* subsp. *microphylla* ◆ and *C. uncifera* subsp. *uncifera* ●.

No consistent qualitative differences are known between the two taxa. Populations of susp. *uncifera* in the Pilbara usually have pure yellow flowers, but plants on the northern and eastern margins often have the central two petals with a red stripe as is found in subsp. *microphylla*.

Distribution data show the two subspecies are disjunct (Figure 1). They only approach each other in the McLarty Hills region, south-east of Broome. In this area there are no records of sympatry, or signs of intergradation between the two subspecies, with one growing on sandplain in the hills and the other on dunes east of the hills. This geographical separation combined with the quantitative nature of the differences between the taxa suggests that subspecies rank is the preferred option.

Acknowledgements

The author would like to acknowledge the support and assistance of the staff at CANB, MEL, SYD and AD which enabled him to examine material of *Cleome* held at their respective institutions. Malcolm Trudgen provided observations on the biology of the nominate subspecies.

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Psammomoya (Celastraceae), a taxonomic review

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Abstract

Keighery, G.J., *Psammomoya* (Celastraceae), a taxonomic review. *Nuytsia* 14(3): 385–392 (2002). The south-western Australian genus *Psammomoya* Diels & Loes. is reviewed and shown to consist of four species, two of them previously named as *P. choretroides* (F. Muell.) Diels & Loes. and *P. ephedroides* Diels & Loes. Two new species, *Psammomoya grandiflora* Keighery and *P. implexa* Keighery, are described. All species are illustrated and a key is provided.

Introduction

Psammomoya is the sole genus of the Celastraceae occurring in temperate Western Australia and is endemic to this region. The genus is closely related to *Apatophyllum* McGillivray (McGillivray 1971), one species of which occurs in the arid zone of Western Australia (Cranfield & Lander 1992). *Apatophyllum* can be distinguished in having leafy stems, the leaves spirally arranged and well developed (opposite-decussate and reduced to cataphylls in *Psammomoya*), bracteoles triangular (ovate in *Psammomoya*), and the floral disc erect and free (broad and fused in *Psammomoya*).

Only two species of *Psammomoya* were recognised when the genus was treated by Jessup (1984) in the "Flora of Australia". The current study was commenced after sorting the contents of a folder for unnamed *Macarthuria* Huegel ex Endl. (Molluginaceae) collections showed that several of them were *Psammomoya* specimens that did not easily fit the accepted taxonomy of the genus. Additional collections of the new taxa recognised here were found among the specimens determined as *Psammomoya choretroides* and *P. ephedroides*.

Methods

All herbarium collections of *Psammomoya* at PERTH, MEL, SYD, and AD have been examined for this study. Populations of three of the four taxa have been examined in the wild.

Taxonomy

Psammomoya Diels & Loes. *in* L. Diels & E. Pritzel, *Bot. Jahrb. Syst.* 35 : 339 (1904). *Type: Psammomoya choretroides* (F. Muell.) Diels & Loes.

Shrubs usually from a corky-barked woody rootstock. *Leaves* opposite-decussate, reduced to dark brown cataphylls. *Inflorescence* of solitary flowers or 2–4-flowered fascicles in axils of cataphylls. *Flowers* hermaphrodite, actinomorphic, on a short pedicel with persistent scarious bracteoles at base. *Sepals* 5, imbricate, broadly ovate to deltate; apex thickened, acute, brown or black. *Petals* 5, imbricate, white, apex acute. *Stamens* 5, opposite sepals and inserted on or below the rim of the disc. *Anthers* cordate, longitudinally dehiscent, introrse, yellow. *Disc* flat, pentagonal. *Ovary* scarcely or partially immersed in disc, 2- or 3-locular, each locule with 2 basal anatropous ovules. *Fruit* a loculicidal capsule, erect or decurved. *Seeds* 1–3, usually 1, erect, ellipsoid or narrowly ellipsoid, with a white fleshy aril at base; seed coat ribbed, crustaceous, brown or black; endosperm copious.

A genus of four species endemic in the south-west of Western Australia.

Key to *Psammomoya* species

1. Ovary 2-locular. Pedicels 0.5–1.2 mm long.
   2. Branchlets 4-angled and 4-sulcate, usually viscid; apex obtuse, hidden by numerous bracts ..... **1. P. choretroides**
   2. Branchlets 6-ribbed, not viscid; apex pungent, exposed ..... **2. P implexa**
1. Ovary 3-locular. Pedicels 1.5–5 mm long.
   3. Branchlets with a pungent apex. Flowers small, the petals 2.5–3.5 mm long ..... **3. P. ephedroides**
   3. Branchlets with a soft acute apex. Flowers large, the petals 6–7 mm long ..... **4. P. grandiflora**

1. Psammomoya choretroides (F. Muell.) Diels & Loes., *in* L. Diels & E. Pritzel, *Bot. Jahbr. Syst.* 35: 340, fig. 1 (1904). – *Logania choretroides* F. Muell., *Victorian Naturalist* 6: 118 (1889). *Type:* eastern sources of the Swan River, Western Australia, *Mrs Heal* (*holo:* MEL 100676; *iso:* MEL 100675).

Illustrations. Diels & Pritzel (1904: fig. 41A–H); Morley & Toelken (1983: fig. 132D–F); Jessup (1984: fig. 42G,H); McGillivray (1971: 404, fig. 3).

Rigid erect *shrub*, to 45 cm tall, with 2–5 erect branches from a corky rootstock. *Branchlets* erect, many, 4-angled and 4-sulcate, usually viscid along the angles; apex short, obtuse, black, covered by cataphylls. *Cataphylls* 1–3 mm long, dark brown or black, the pairs of cataphylls separated by 7–11 mm internodes on main branches below branchlets. *Flowers* single or in fascicles of 2–4, often appearing sessile, the pedicel 0.5–1.2 mm long. *Sepals* deltate, 0.9–1.6 mm long. *Petals* ovate-deltate, 2.0–2.4 mm long. *Stamens* inserted below margin of disc; filament 0.4–0.7 mm long; anther *c.* 0.5 mm long. *Disc* fleshy, 1.5–2.0 mm diam. *Ovary* half immersed in disc, 2-locular. *Style c.* 0.2 mm long; stigma obscurely 2-lobed. *Capsule* 2-lobed, broadest above middle, 2-valved, 5–9 mm long, 5–8 mm wide, 1- or 2-seeded. *Seeds* narrowly ellipsoid, 3.8–4.3 mm long; aril 3–4 mm long. (Figure 1A–C)

Selected specimens examined (57 examined). WESTERN AUSTRALIA: Boorabbin, *T.E.H. Aplin* 1936 (PERTH); Dowering, *C.A. Gardner* 667 (PERTH); Lake King, *A.S. George* 329 (PERTH); 13 miles [21 km] E of Lake Grace, 27 Sep. 1975, *J.W. Green* 4445 (PERTH); Quairading, *G.J. Keighery* 2260 (PERTH); Mt Glasse, Bremer Range, *K.R. Newbey* 5593 (PERTH).

Distribution. Endemic to Western Australia, from Galena south-east to the Bremer Range and south to Lake King. (Figure 2A)

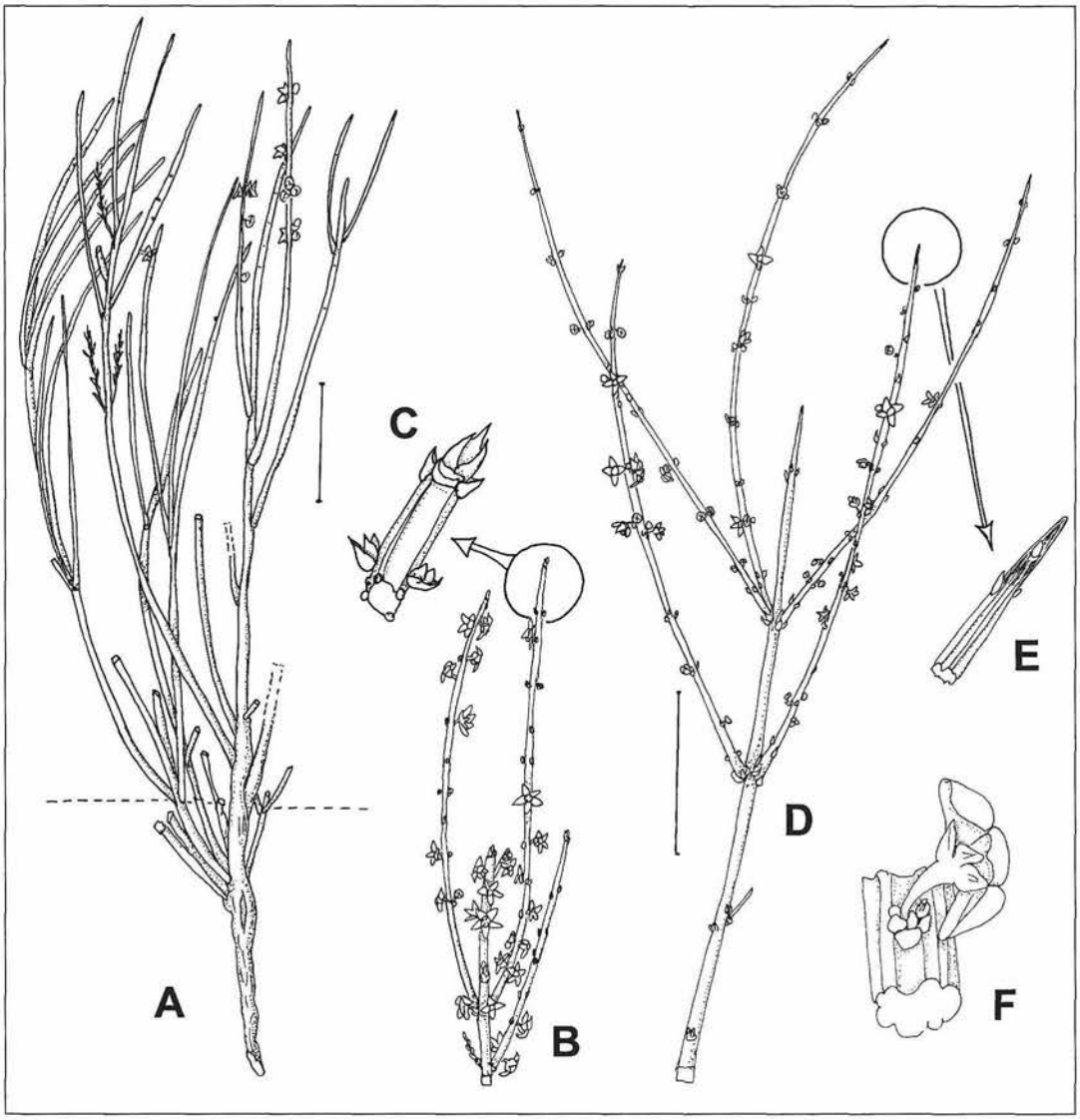

Figure 1. A–C. *Psammomoya choretroides*. A – whole plant (scale bar = 20 mm), B – flowering branch, C – apex of branchlet. D–F. *Psammomoya implexa*. D – flowering branch (scale bar = 25 mm), E – apex of branchlet, F – flower. Drawn from *J.W. Green* 4445 (A–C) and *C.A. Gardner* 12031 (D–F).

Habitat. Known from various vegetation types including *Eucalyptus salmonophloia* woodland, *Allocasuarina* spp. shrubland, heath with emergent mallees or low heath. Soils where this species grows include grey sand, yellow sandy clay, lateritic sand or brown clayey sand.

Flowering time. August to October.

Conservation status. Widespread and well conserved.

Notes. Psammomoya choretroides is closely related to *P. implexa*. See notes under the latter species.

2. Psammomoya implexa Keighery, *sp. nov.*

Frutex usque ad 1 m altus, ramis principalibus intricate ramosis, 6-costatis, non viscidis; apex atrobrunneus vel niger, pungens, 5–7 mm longus.

Typus: near Wilroy, Western Australia, 29 August 1945, *C.A. Gardner* 7547 (*holo:* PERTH 02791501; *iso:* PERTH 02792532, 02793415, 02793423, 02793431).

Shrub to 1 m tall, intricately branched; main branches 6-ribbed, not viscid. *Branchlets* 6-ribbed, not viscid; apex pungent, 5–7 mm long, dark brown or black. *Cataphylls c.* 1 mm long, dark brown or black, the pairs of cataphylls separated by 17–22 mm internodes on main branches. *Flowers* single or in fascicles of 2–4, often appearing sessile but on a pedicel 0.5–1.1 mm long. *Sepals* broadly triangular, 0.6–0.9 mm. *Petals* ovate-deltate, 1.8–2.2 mm long. *Stamens* inserted below margin of disc; filament less than 0.6 mm long; anther *c.* 0.5 mm long. *Disc* fleshy, 1.5–2.0 mm diam. *Ovary* half immersed in disc, 2-locular. *Style c.* 0.2 mm long; stigma obscurely 2-lobed. *Capsule n.v.* (Figure 1D–F)

Other specimens examined. WESTERN AUSTRALIA: 36.8 km N of Wubin, 25 Aug. 1998, *R. Davis* 6480 (PERTH); near Wilroy, 29 Aug. 1945, *C.A. Gardner* 7547 (PERTH); Ningham to Whitewells, *C.A. Gardner* 12031 (PERTH); 0.4 km S of Morris Rd on McWhirter Rd, c. 35 km N of Morawa, 27 July 1996, *B.J. Lepschi* 2738 & *T.R. Lally* (PERTH); 1 km W of Littles Bore, Gabyon Station, 15 Aug. 1993, *S. Van Vreeswyk* 3766 (PERTH); Wilroy, *J.Z. Weber* 5140 (AD, PERTH).

Distribution. Endemic to Western Australia, recorded from Wilroy and Gabyon Station south-east to near Wubin and near Ningham Station. (Figure 2B)

Habitat. This species is recorded as occurring on stony ridges.

Flowering time. August to October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Probably present in Wilroy Nature Reserve and in unallocated Crown land.

Etymology. The epithet is from the Greek word for intricately branched, referring to the much branched habit of the species.

Notes. A poorly known species previously housed at PERTH as *Psammomoya petraea* Keighery ms. Collections of this species in fruit are needed.

Psammomoya implexa was previously confused with *P. choretroides*. However, the two species are disjunct in distribution and there are constant differences in habitat, morphology and habitat preference. *Psammomoya choretroides* is a small compact erect shrub which has 4-angled, usually viscid, stems and erect branchlets with an obtuse apex covered by cataphylls. *Psammomoya implexa* is a large spreading much-branched shrub, which has rigid non-viscid 6-ribbed stems and numerous spreading branchlets ending in a long black pungent point.

3. Psammomoya ephedroides Diels & Loes. *in* L. Diels & E. Pritzel, *Bot. Jahbr. Syst.* 35 : 340 (1904). *Type:* ?toward King George Sound, Western Australia, 1892, collector unknown, (*holo:* B *n.v.*, ?destroyed; *iso:* MEL 100678).

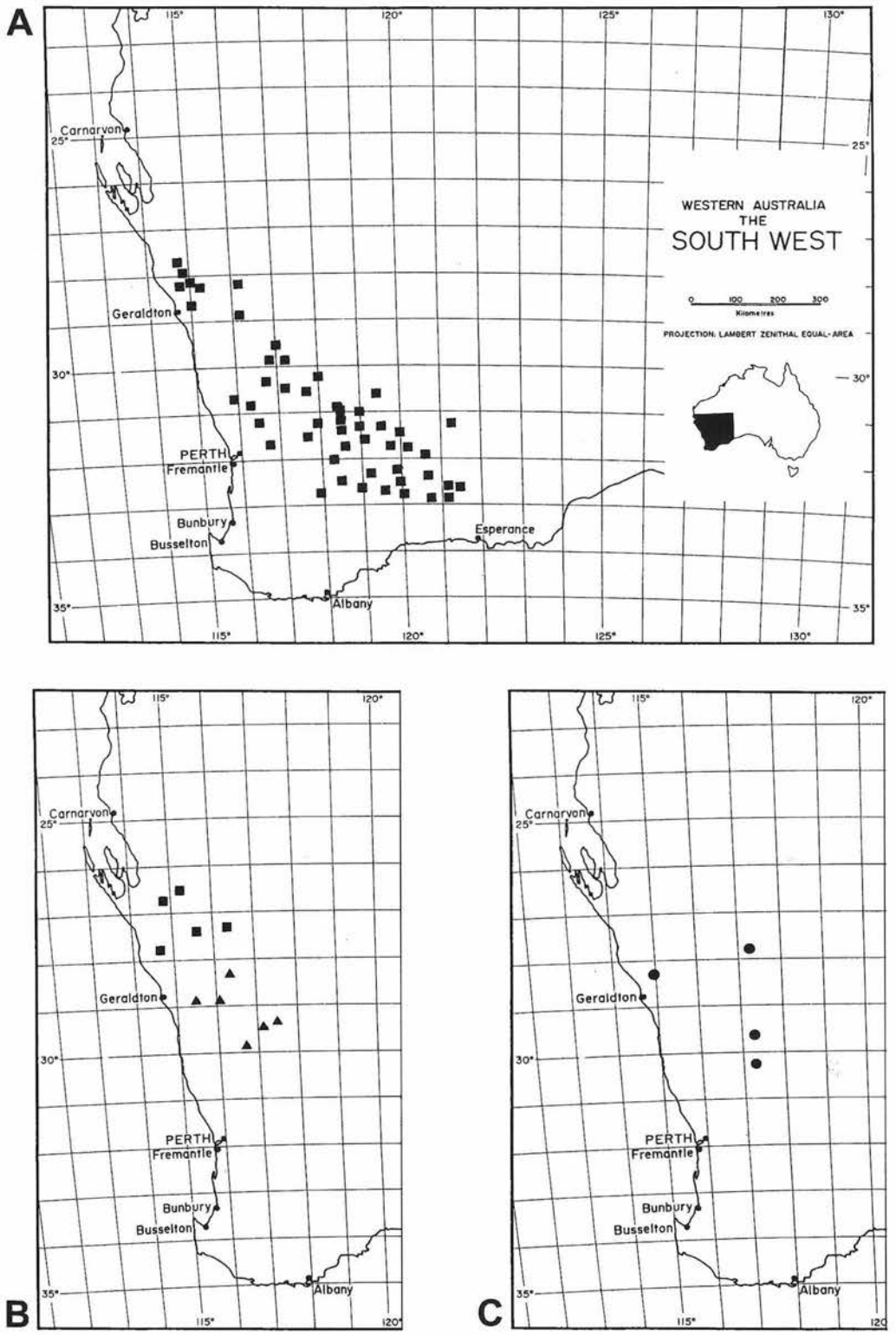

Figure 2. Distribution maps. A – *Psammomoya choretroides*; B – *P. ephedroides* ■ and *P. implexa* ▲; C – *P. grandiflora*.

Illustrations. Diels & Pritzel (1904: fig. 41J–L); Jessup (1984: fig. 42H,J).

Much-branched tangled spreading *shrub*, to 1.5 m x 1.5 m; main stems spreading to erect, with numerous short side branchlets. *Branchlets* rigid, 15–35 mm long, 4-angled and 4-sulcate; apex pungent, 2–5 mm long, black. *Cataphylls* linear, 0.5–0.7 mm long, dark brown or black. *Flowers* mostly solitary; pedicel 1.5–2.0 mm long. *Sepals* broadly ovate, 0.8–1.0 mm long. *Petals* ovate-oblong, 2.7–3.5 mm long. *Stamens* inserted on margin of disc; filament *c.* 1.5 mm long; anther *c.* 0.7 mm long. *Disc* thin, 1.0–1.5 mm diam. *Ovary* scarcely immersed, 3-locular. *Style* 1.3–1.5 mm long; stigma obscurely 3-lobed. *Capsule* without persistent corolla, 3-valved, ellipsoid, 5–6 mm long. *Seeds* narrowly ellipsoid, 3.5–4.5 mm long, *c.* 2.5 mm wide, nearly half immersed in the aril. (Figure 3A,B)

Other specimens examined. WESTERN AUSTRALIA: Murgoo Station, *A.M. Ashby* 3298B (AD, PERTH); Toolonga, *A.A. Burbidge* 33 (PERTH); N of Murchison River Bridge, *C.A. Gardner* 2539 (PERTH); Murchison River, *C.A. Gardner* 13199 (PERTH); Murchison River, Aug. 1931, *C.A. Gardner & W.E. Blackall s.n.* (PERTH); Galena, *Gittens* 1579 (PERTH); 35 km N of Murchison River Bridge, *R.V. Smith* 66/307 (PERTH, MEL).

Distribution. Endemic to Western Australia, extending from Toolonga Station east to Murgoo Station. (Figure 2B)

Habitat. Psammomoya ephedroides occurs in heaths and shrublands on deep yellow or red sandy loams.

Flowering time. July to September.

Conservation status. Not considered to be at risk. *Psammomoya ephedroides* is present in Kalbarri National Park and Toolonga Nature Reserve. It is also known from several stations and is probably present on unallocated Crown land between these areas.

Notes. Previously confused with *P. grandiflora* (see notes under that species).

The type collection could not have been made close to King George Sound or the Stirling Range as suggested tentatively by Diels and Loesener (*in* Diels & Pritzel 1904), as this species is known only from north of Geraldton.

4. Psammomoya grandiflora Keighery, *sp. nov.*

Frutex erectus. Ramuli non spinescentes, apicibus acutis. Cataphylla circa 2 mm longa. Pedicelli 3–5 mm longi. Petala ovato-oblonga ad triangulares, 6–7 mm longa. Filamenta 2.5–3.5 mm longa. Capsula in corolla persistenti circumdata, 3 valvata, 6–8 mm longa.

Typus: Mt Gibson, 29°36' S, 117°11' E, Western Australia, 3 October 1984, *B.H. Smith* 454 (*holo:* PERTH 02791498; *iso:* MEL, CANB, AD, HO, MO).

Illustration. Jessup (1984: fig. 42I).

Spreading erect *shrub* to 80 cm high and 1 m wide; branches erect or spreading, more or less terete. *Branchlets* erect, 4-angled and 4-sulcate; apex very short, soft, acute, covered by cataphylls. *Cataphylls*

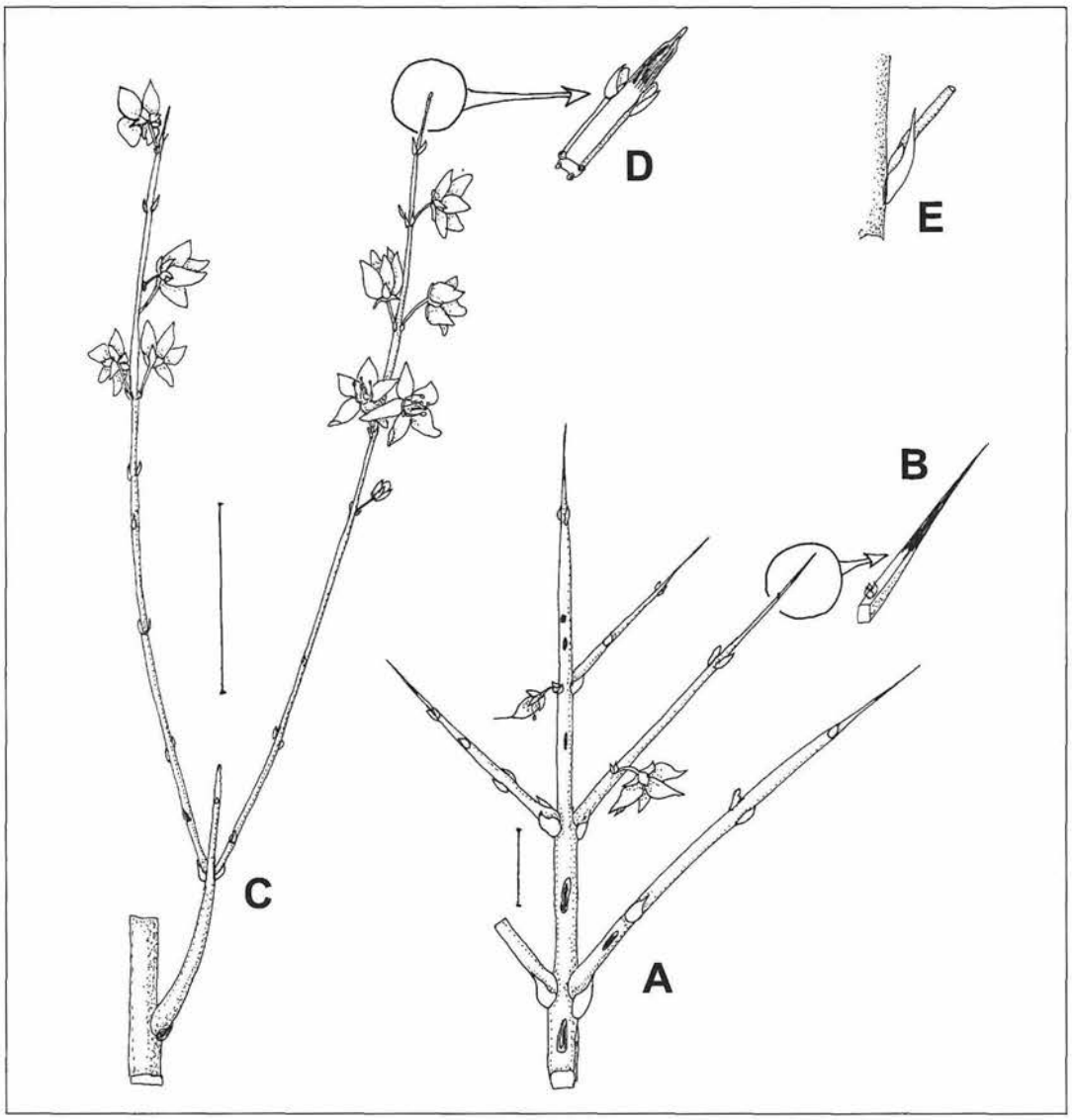

Figure 3. A,B. *Psammomoya ephedroides*. A – flowering branch (scale bar = 5 mm), B – apex of branchlet. C–E. *Psammomoya grandiflora*. C – flowering branch (scale bar = 30 mm), D – apex of branchlet, E – bracts. Drawn from *A.M. Ashby* 32986 (A,B) and from *B.H. Smith* 2085 (C–E).

linear-lanceolate, *c.* 2 mm long, dark brown or black, the pairs of cataphylls separated by 17–24 mm internodes on the main branches. *Flowers* mostly solitary; pedicel 3–5 mm long. *Sepals* broadly ovate, 1.5–2.0 mm long. *Petals* ovate-oblong to triangular, 6–7 mm long, white. *Stamens* inserted below margins of disc; filament 2.5–3.5 mm long; anther *c.* 0.7 mm long. *Disc* thin, 2.5–3.2 mm diam. *Ovary* scarcely immersed in disc, 3-celled. *Style c.* 2 mm long; stigma obscurely 3-lobed. *Capsule* enclosed by a persistent corolla, 3-valved (or rarely 2-valved by abortion), ellipsoid, 6–8 mm long, 1–3-seeded. *Seeds* ellipsoid, *c.* 3 mm long, black, half immersed in the aril. (Figure 3C–E)

Other specimens examined. WESTERN AUSTRALIA: between Dalgaranga and Mt Farmer, 27°44' S, 117°13' E, *J.S. Beard* 7184 (PERTH); East Yuna Reserve, *A.C. Burns* 1 (PERTH); East Yuna

Reserve, *A.C. Burns* 3 (PERTH); East Yuna Reserve, *A.C. Burns* 22 (PERTH); Mt Gibson, Nov. 1968, *C.A. Gardner s.n.* (PERTH); No. 2 Rabbit Proof Fence, 30°13' S, 117°12' E, *B.H. Smith* 2085 (PERTH).

Distribution. Endemic to Western Australia, known only from scattered localities from East Yuna east to Mt Farmer and south-east to the Mt Gibson area. (Figure 2C)

Habitat. On Mt Gibson *Psammomoya grandiflora* occurs in *Allocasuarina/Grevillea* and *Melaleuca* thicket on red loam over jasperlite. At East Yuna the recorded habitat is "rocky", and near Mt Farmer the species occurs in sandplain with bowgada and spinifex.

Flowering time. August to October.

Conservation status. Not considered to be at risk. *Psammomoya grandiflora*, while poorly known, occurs in nature reserves at East Yuna and Mt Gibson. There is considerable uncleared land between these two locations that could include additional populations.

Etymology. The specific name denotes the large flowers of this species.

Notes. *Psammomoya grandiflora* is related to *P. ephedroides* and was previously included in this species, but differs in having non-pungent branchlets, larger cataphylls, longer pedicels, larger flowers and the capsule enclosed by a persistent corolla.

Discussion

The genus has diversified on the northern and north-eastern margins of the South West Botanical Province of Western Australia. The four species fall into two groups of closely related species, one comprised of *Psammomoya choretroides* and *P. implexa*, and the other of *P. ephedroides* and *P. grandiflora*. In both cases, these groups have one species occurring on deep sandy soils and the second on rocky outcrops.

Acknowledgements

A grant from the Australian Biological Resources Study enabled the author to check type collections held in the National Herbarium of Victoria, Melbourne. Access to the collections was provided by the curator and staff of MEL.

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Taxonomic notes on the genus *Stenopetalum* (Brassicaceae)

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Abstract

Keighery, G.J., Taxonomic notes on the genus *Stenopetalum* (Brassicaceae). *Nuytsia* 14(3): 393–403 (2002). The name *Stenopetalum gracile* Bunge is reinstated for part of the northern and eastern populations previously included under *S. robustum* Endl. *Stenopetalum robustum s. str.* is a decumbent white-flowered species occurring between Albany and Bunbury. A new species, *Stenopetalum salicola* Keighery, is described to cover populations previously ascribed to *S. robustum* occurring around inland salt lakes. Two coastal perennial taxa are segregated from *Stenopetalum lineare* R. Br. ex DC. *s. lat.*, with those from temperate eastern Australia reinstated as *S. lineare* var. *canescens* Benth. and the more distinctive ones from the southern Nullarbor Cliffs described as the new species *S. saxatile* Keighery. *Stenopetalum lineare* var. *lineare* comprises annual populations occurring inland. A new key is provided for the 12 species and two varieties currently recognised in *Stenopetalum*.

Introduction

The genus *Stenopetalum* R. Br. ex DC. (Brassicaceae) was revised by Shaw (1972), but as noted by Hewson (1982), many taxonomic problems remain. Members of this widespread Australian genus can be placed in a number of groups of related species and two of these species complexes are treated here. These are the *Stenopetalum robustum* complex, which has traditionally been regarded as monotypic, and the *S. lineare* species complex, which includes *S. decipiens* E. Shaw and *S. velutinum* F. Muell.

In the first complex, *Stenopetalum robustum* as treated here is restricted to populations occurring between Busselton and Albany. There are two species within the remainder of the previously broadly defined species. *Stenopetalum gracile* is reinstated to cover populations on the Swan Coastal Plain north of Busselton extending north to Kalbarri and into the western Wheatbelt. Another distinctive taxon is found around saline lakes in the interior and is here described as a new species, *S. salicola*.

The second complex includes the most widespread and variable species of the genus, *S. lineare* R. Br. ex DC. *s. lat.*, which has two distinctive perennial coastal variants. One occurring on the Nullarbor Cliffs is segregated as a new species, *S. saxatile*. The other occurring usually in near-coastal situations in Eastern Australia is reinstated as *S. lineare* var. *canescens*.

A third complex, comprising *Stenopetalum filifolium* Benth. and *S. pedicellare* F. Muell. ex Benth., is closely related to *S. robustum s. lat.* and is currently being investigated.

Taxonomy

Key to species and varieties of *Stenopetalum*

The key *to Stenopetalum* in the "Flora of Australia" (Hewson 1982: 300) can be amended as follows to include all 12 species and the two varieties currently recognised. Note that the previous key gives the first measurements of couplet 12 as fruiting pedicels, however, there is considerable elongation in the pedicel between flowering and fruiting and the two species overlap in fruit.

1. Plant with branched hairs
 2. Hairs sessile, bifid ..... **S. nutans**
 2: Hairs irregularly branched or stellate
  3. All parts of plant densely hairy
   4. Plants slender annuals; silicula 4–7 mm long; ovules 10–20 per locule; seeds tuberculate ..... **S. velutinum**
   4: Plants perennial with a corky rootstock, silicula 7–11 mm long; ovules 3–10 per locule; seeds smooth ..... **S. decipiens**
  3: Upper parts of plant glabrous to sparsely hairy
   5. Plants slender annuals; leaves of lower stem pinnatisect to trisect ..... **S. lineare** var. **lineare**
   5: Plants slender perennials, rootstock not corky; leaves entire, remotely dentate or rarely trisect
    6. Upper parts of plant glabrous ..... **S. lineare** var. **canescens**
    6: Upper parts of plant sparsely hairy, chiefly at nodes ..... **S. saxatile**
1: Plant glabrous, or with papillae or simple hairs
 7. Fruiting pedicels erect to spreading
  8. Leaves entire to dentate; ovules 6–10 per locule ..... **S. filifolium**
  8: Leaves pinnasect basally, reducing to entire; ovules 8–15 per locule ..... **S. anfractum**
 7: Fruiting pedicels pendulous, rarely horizontal
  9. Plants covered in simple hairs, petals short and broad ..... **S. robustum**
  9: Plants glabrous, petals fine and tapering
   10. Fruiting pedicel swollen adjacent to fruit ..... **S. salicola**
   10: Fruiting pedicel not swollen adjacent to fruit
    11. Petals 3–6 mm long, often cleistogamous ..... **S. sphaerocarpum**
    11: Petals 6–25 mm long
     12. Flowering pedicels robust, 2–3 mm long, silicula 5–9 mm long, seeds *c.* 2 mm long ..... **S. gracile**
     12: Flowering pedicels slender, 7–20 mm long, silicula 4–5 mm long, seeds *c.* 1 mm long ..... **S. pedicellare**

A. The *Stenopetalum robustum* species complex

True *Stenopetalum robustum* is a decumbent, shortly hairy, annual herb, bearing pure white flowers, which have a sickly sweet fetid odour typical of many fly-pollinated flowers (e.g. *Laxmannia* in the Anthericaceae). The corolla lobes are very short and broad (*c.* 2 mm wide and up to 6 mm long, a ratio of 3 or less), compared to other members of this complex (1–2 mm wide and up to 10 mm long, a ratio of 4–8). The key characters separating this species from other members of the genus are the presence

of short hairs on the stem, inflorescence axis and peduncle, and the white flowers with short broad corolla lobes.

Stenopetalum gracile Bunge, A.A. von *in* Lehmann, Pl. Preiss. 1: 257 (Feb. 1845). – *Stenopetalum robustum* var. *gracile* (Bunge) Ostenf., *Kongl. Danske Vidensk. Selsk. Biol. Med.* 3(2): 65 (1921). *Type:* "In arenosis umbrosis vallis haud longae ab ora maritima Perth" [near Perth, Western Australia], 24 June 1839, *L. Preiss* 1938 (*iso:* W!, MEL!).

Stenopetalum croceum Bunge, A.A. von *in* Lehmann, Pl. Preiss. 1: 258 (Feb. 1845). *Type:* "In arenosis sylvae haud longae ab oppidulo Perth" [near Perth, Western Australia], 13 December 1838, *L. Preiss* 1939 (*iso:* W!, MEL!).

Erect annual *herb* up to 20 cm, normally less, generally glabrous but some plants have a few scattered simple hairs on the basal 10 mm of the stem, with the inflorescence axis glabrous, hairs lost on all plants as the fruits mature. *Basal leaves* once divided, 20–40 mm long, *c.* 2 mm wide, glabrous or with a few scattered simple hairs, lobes 4–8 mm long, usually lost after flowering finishes. *Stem leaves* pinnatifid, 2–15 mm long. *Floral leaves* often linear, entire, 5–8 mm long. *Flowers* usually slightly decurved or at right angles to stem at anthesis, sweetly scented. *Pedicels* up to 3 mm long in flower, prominently decurved (45° to stem) and 7–10 mm long in fruit, glabrous. *Sepals c.* 3 mm long, white to pale orange. *Petals* 15–25 mm long, less than 1 mm wide, white or orange-brown. *Capsule* obovoid, *c.* 4 mm long. (Figure 1A–C)

Selected specimens examined. WESTERN AUSTRALIA (43 seen): Moora, Sep.1946, *A.M. Ashby* 159 (PERTH); Valentine Rd, S of Yuna, 30 Aug. 1967, *A.M. Ashby* 2276 (PERTH, AD); 6 miles [10 km] WNW of Murchison House Station Homestead, 28 Aug. 1969, *A.S. George* 9612 (PERTH); Lake Clifton, 17 Oct. 1992, *G.J. Keighery* 13804 (PERTH); Claremont, 10 Nov. 1900, *A. Morrison s.n.* (PERTH).

Distribution. The species occurs between Capel and Toolonga inland to Yuna and Moora. (Figure 2A)

Habitat. Usually on calcareous sandy soils and limestone ridges near the coast but also recorded from white, yellow and red sands further inland. Grows under coastal heath, limestone shrublands, Tuart (*Eucalyptus gomphocephala*) and *Banksia* woodlands.

Flowering period. Late August to early November.

Conservation status. Widespread and well conserved.

Notes. This species was named twice, as *Stenopetalum gracile* Bunge and *S. croceum* Bunge, on successive pages of "Plantae Preissianae", from specimens collected near Perth. The name appearing first, *S. gracile*, is here selected.

Stenopetalum gracile is an erect annual herb that is generally glabrous, although some plants have a few scattered simple hairs on the basal 10 mm of the stem. Its basal leaves are once divided and its pale orange or white flowers have a sweet honey scent and very long narrow petals. The species is found naturally in openings in the coastal communities of the Swan Coastal plain and does not appear to be dependent on fire to occur in large numbers.

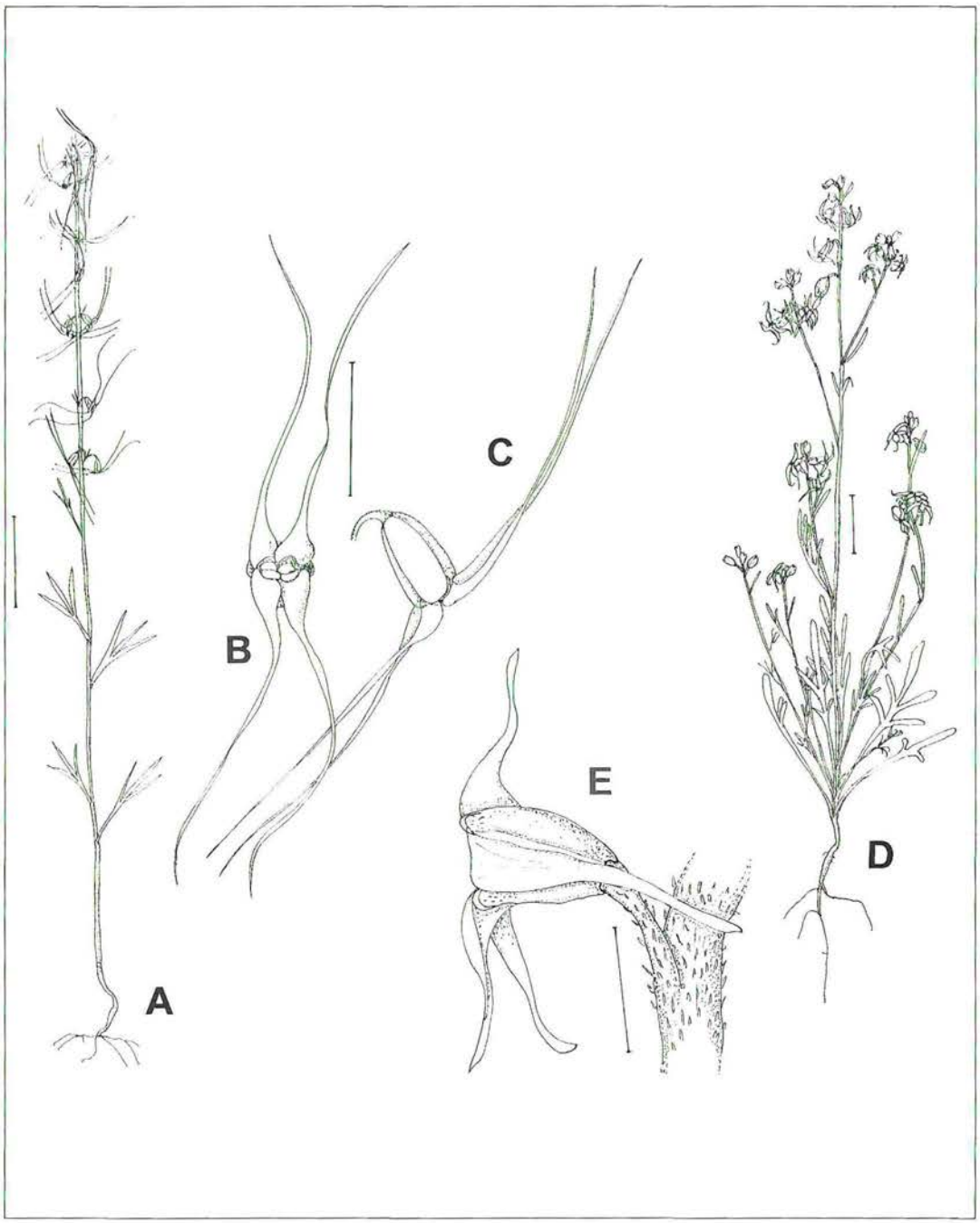

Figure 1. A–C. *Stenopetalum gracile*. A – whole plant, scale bar = 20 mm; B,C – front and side views of flower, scale bar = 10 mm. D,E. *Stenopetalum robustum*. D – whole plant, scale bar = 20 mm; E – flower, scale bar = 5 mm. Drawn from PERTH specimens *G.J. Keighery* 13804 (A–C) and *G.J. Keighery* 9789 (D,E).

There are two anomalous PERTH collections from inland Western Australia (Wanjarri Nature Reserve, 4 Aug. 1988, *G.J. Keighery s.n.*; 30 km N of Mt Beaumont, *M.A. Burgman & C. Layman* 3102) that key to *Stenopetalum gracile*. These are indicated by stars on Figure 2A. These collections may be better placed in *S. salicola* (in part) or in the closely related species complex involving *S. filifolium*. The *S. filifolium* complex will be the subject of a separate study.

Stenopetalum robustum Endl., Enum. Pl. 4 (1837). *Type:* King George Sound, Western Australia, *Hügel* (*holo:* W!).

Stenopetalum minus Bunge, Pl. Preiss. 1: 258 (1845). *Type:* Princess Royal Harbour, Western Australia, December 1840, *L. Preiss* 1936 (*iso:* MEL!).

Stenopetalum brachypetalum F. Muell. and *Stenopetalum robustum* var. *brachypetalum* F. Muell. *nom. alt.*, Fragm. 11: 60 (1879). *Type:* "legi in vicinia sinus regis Georgii" [vicinity of King George Sound, Western Australia] (*iso:* MEL!).

Stenopetalum album E. Pritz., *Repert. Spec. Nov. Regni. Veg.* 10: 133 (1911). *Type:* "In partibus australibus prope oppidulum Busselton haud procul ab ora marina" [near Busselton], Western Australia, October 1909, *M. Koch* 1969 (*iso:* MEL!, PERTH!).

A decumbent or rarely erect *herb*, up to 20 cm tall and 30 cm wide but normally much less, with scattered to dense simple hairs on all vegetative parts. *Basal leaves* usually divided, up to 70 x 5 mm. *Inflorescence axis* covered with short simple appressed hairs. *Floral leaves* usually simple, linear to linear-obovate, 5–25 mm long, apex acute, with scattered short simple appressed hairs. *Flowers* usually slightly decurved or at right angles to stem at anthesis, with a sweet fetid scent. *Pedicels* up to 3 mm long in flower, prominently decurved (45° to stem) and 4–6 mm long in fruit, with short appressed hairs that are scattered at base and becoming denser at summit. *Sepals* up to 3 mm long, greenish white. *Petals* up to 6 mm long, *c.* 2 mm wide, white. *Fruit* obovoid, 3–4 mm long, *c.* 3 mm wide. (Figure 1D,E)

Selected specimens examined. WESTERN AUSTRALIA (31 seen): Lake William, West Cape Howe National Park, 9 Nov. 1987, *G.J. Keighery* 9789 (PERTH); 3.5 miles [6 km] down track to Boat Harbour, W of Denmark, 10 Sep. 1971, *K.F. Kenneally* 71/72 (PERTH); Nornalup Inlet, 12 Oct.1968, *R.D. Royce* 8486 (PERTH); intersection of Hooley Rd and Georgette Rd, Leeuwin–Naturaliste National Park, 28 Nov. 1989, *N. Gibson & M. Lyons* 422 (PERTH); Symmonds Block, Tuart Forest, W of Ludlow, 12 Sep. 1994, *G.J. Keighery* 13579 (PERTH).

Distribution. Coastal sites between Busselton and Albany. (Figure 2B)

Habitat. On sandy soils under coastal shrublands and woodlands. The species behaves as a post fire ephemeral occurring in very large populations in many conservation reserves after fire.

Flowering period. September to October.

Conservation status. Widespread and well conserved. Recorded for most major national parks (Torndirrup, West Cape Howe, William Bay, Walpole–Nornalup, Scott, Leeuwin–Naturaliste) along the southern coast and from the Tuart National Park on the Swan Coastal Plain.

Notes. See notes under part A. The *Stenopetalum robustum* species complex.

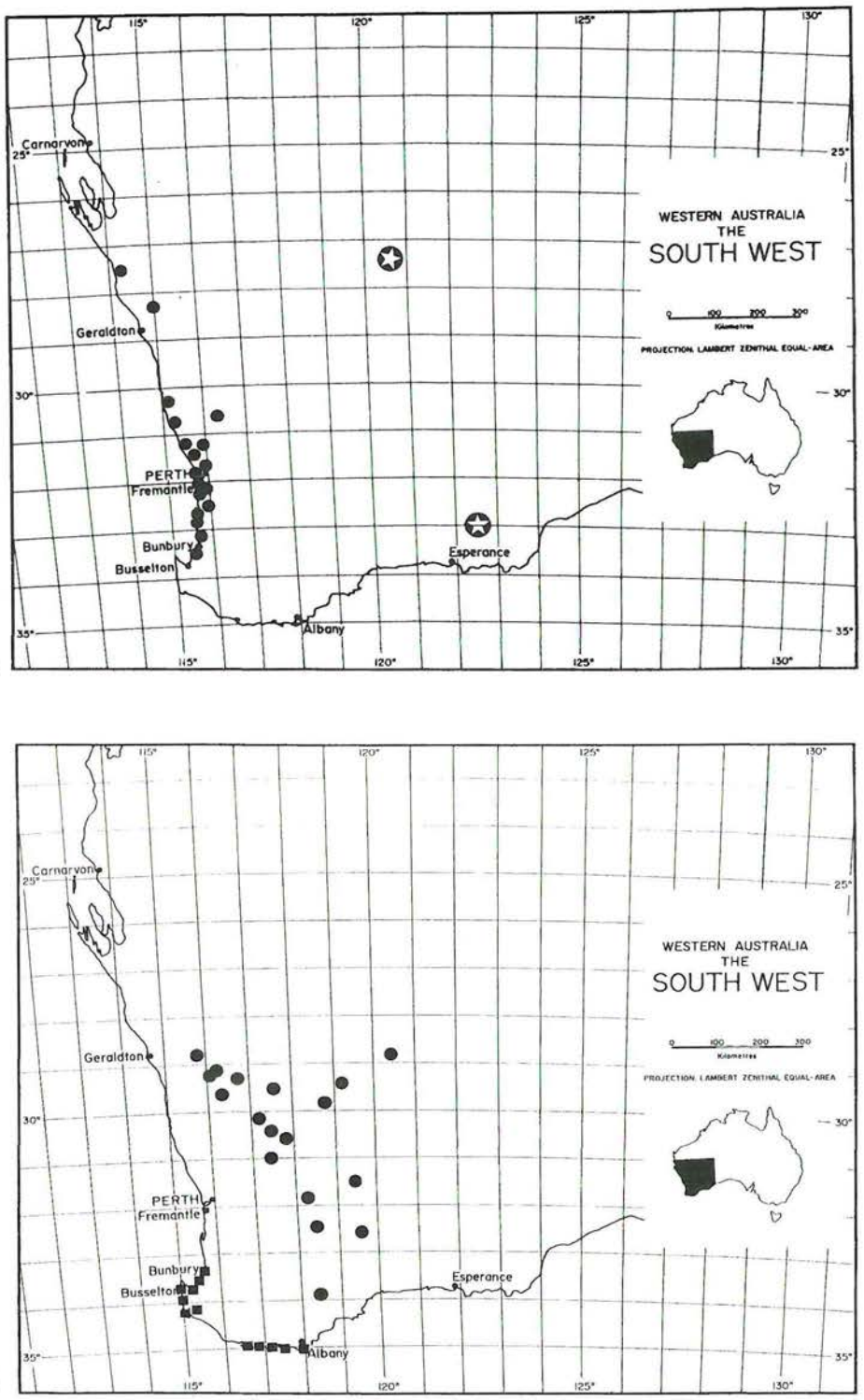

Figure 2. Distribution maps. A – *Stenopetalum gracile* ● and atypical populations ✪; B – *Stenopetalum robustum* ■ and *S. salicola* ●.

Stenopetalum salicola Keighery, *sp. nov.*

Species haec ab *Stenopetalum gracile* Bunge, differt fructiferii pedicellis tumidulus supra basin.

Typus: 33.4 km S of Perenjori on road to Wubin, Western Australia, 27 July 1996, *B.J. Lepschi* 2724 & *T.R. Lally* (*holo:* PERTH 04585232).

Erect annual *herb*, up to 20 cm but normally less, generally glabrous but some plants with a few scattered simple hairs on the basal 10 mm of the stem, with the infloresence axis glabrous, the hairs lost on all plants as the fruits mature. *Basal leaves* once divided, 20–40 mm long, *c.* 2 mm wide, glabrous, lobes 4–8 mm long, usually lost after flowering finishes. *Stem leaves* pinnatifid, 2–15 mm long. *Floral leaves* often linear, entire, 5–8 mm long. *Flowers* usually slightly decurved or at right angles to stem at anthesis, sweetly scented. *Pedicels* 4–5 mm long in flower, becoming swollen adjacent to the fruit and prominently decurved, 7–10 mm long in fruit, glabrous. *Sepals* 2–3 mm long, white to pale orange. *Petals* orange-brown, 15–25 mm long, less than 1 mm wide. *Capsule* obovoid, *c.* 4 mm long. (Figure 3A–C)

Selected specimens examined. WESTERN AUSTRALIA (23 seen): 3 km SE of Morawa, 10 Aug. 1973, *A. Kanis* 1625 (PERTH); Cowcowing, *M. Koch* 1072 (PERTH); Lake Harvey, 14 Aug. 1999, *M.N. Lyons* 2621 (PERTH); Lake Raeside, 1 Sep. 1968, *P.G. Wilson* 7556 (PERTH).

Distribution. Recorded from the edges of most saline (usually gypsum rich) lakes and braided drainage lines in the Avon wheatbelt region. (Figure 2B)

Habitat. Recorded from low dunes, claypans and dune slopes in *Halosarcia* shrubland, *Eucalyptus spathulata* mallee and *Melaleuca* shrubland (M.N. Lyons, pers. comm.).

Flowering period. July to September. Fruits are recorded from September to November.

Conservation status. Widespread and well conserved, but under long term threat by rising saline ground-waters and locally by gypsum mining.

Notes. This taxon is probably the cause of the confusion previous authors (e.g. Shaw 1972; Hewson 1982) have noted in separating *Stenoptalum robustum* and *S. filifolium*. It is readily distinguished from both by its swollen pedicel when in fruit. As previously noted the latter species will be the subject of a separate study.

Being a small slender annual, *Stenopetalum salicola* is also superficially similar to *S. sphaerocarpum* F. Muell., an inbreeding and often cleistogamous herb that occurs around saline lakes in the arid zone of Western Australia. The latter species is readily distinguished by its smaller flowers with slender petals 3–6 mm long, and its spreading or erect globose fruits.

B. The *Stenopetalum lineare* complex

The *Stenopetalum lineare* species complex is widespread and variable, comprising four closely related species, including both annual and perennial outbreeding taxa as well as one inbreeding, often cleistogamous, taxon. The inbreeding taxon is a common variant of *S. lineare* (illustrated in Keighery *et al.* 1986) that is found throughout the range of the species.

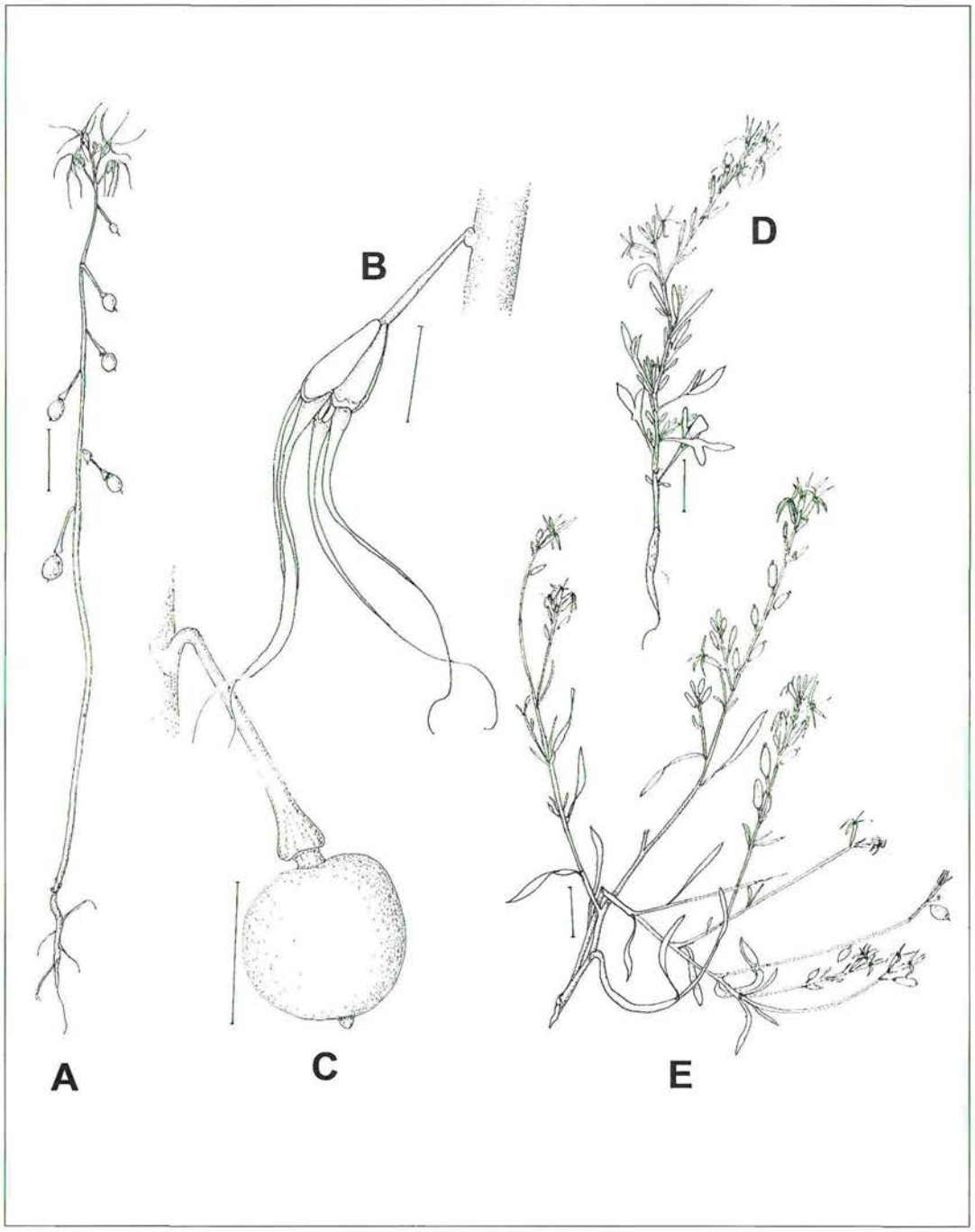

Figure 3. A–C. *Stenopetalum salicola*. A – whole plant, scale bar = 10 mm; B – flower, scale bar = 2 mm; C – fruit, scale bar = 4 mm. D,E. *Stenopetalum saxatile*. D – young plant, scale bar = 20 mm; E – flowering branch, scale bar = 20 mm. Drawn from PERTH specimens *M. Lyons* 2621 (A–C) and *G.J. Keighery & J. Alford* 920 (D,E).

During a survey of the flora of the Nullarbor region (Keighery *et al.* 1986), a distinctive new member of the widespread *Stenopetalum lineare* complex was located along the Nullarbor Cliffs. This was a shrubby perennial with sweetly scented open flowers, which is described below as *S. saxatile*. The adjacent Nullarbor variant of *S. lineare* is annual, and most specimens have insignificant flowers that are only partially opened or are cleistogamous. The new perennial taxon, which is confined to coastal cliffs, is the only member of the *S. lineare* complex present through most of its range. However, the two species co-occur in the Eucla area and, although they are not known to co-occur elsewhere, they do overlap in distribution near Eyre. The only known location where the annual *S. lineare* (*G.J. Keighery & J. Alford* 1431) and perennial *S. saxatile* (*G.J. Keighery & J. Alford* 920) occur together is in Eucla National Park, 1 km west of the State border. In both the Eucla and Eyre areas, there is no sign of any overlap in characters or evidence of hybridisation between the two species.

Black (1963), in his discussion of *Stenopetalum lineare*, had also recognised that an undescribed species of *Stenopetalum* was present in the Tate Herbarium represented by a collection from Fowlers Bay. This taxon corresponds to the new species discussed above.

Black also recognised var. *canescens* as distinct, but misapplied this name to the then undescribed *S. decipiens*. *Stenopetalum lineare* var. *canescens* applies to a glabrous perennial variant of the complex found chiefly in coastal sites in south-eastern Australia. This variant is reinstated below.

Stenopetalum lineare var. **canescens** Benth., Fl. Austral. 1: 78 (1863). *Type:* Port Phillip, Victoria, *F. Mueller* (*holo:* K; *iso:* MEL 10745).

Slender spreading *shrub*, with several soft-wooded stems arising from a woody rootstock, to 20 cm tall and 2 m wide, normally much less. *Stems* green aging brown, glabrous. *Leaves* linear-spathulate to obovate, tapering to a slender petiole 3–10 mm long; lamina 50–100 mm long, generally entire but occasionally with short lobes, glabrous, succulent. *Floral leaves* usually simple, linear to linear-obovate, 5–25 mm long, apex acute. *Pedicels* erect and *c.* 2 mm long in fruit. *Sepals* strongly saccate and enclosing ovary, 3–4 mm long, green to colourless; upper portion (above saccate base) *c.* 1 mm long, acute, with a scarious margin. *Petals* spreading, linear, 10–13 mm long, *c.* 2 mm wide, orange-brown. *Fruit* obovoid, 5–8 mm long.

Other specimens examined. SOUTH AUSTRALIA: Dark Island Soak, Keith, Oct. 1954, *R.L. Specht s.n.* (AD 9651431).
VICTORIA: mouth of Darby River, Wilsons Promontory, 7 Nov. 1908, *Audas & St John s.n.* (MEL); mouth of Aire River, 7 Oct. 1979, *G.W. Carr* 7783 (MEL); near Brighton, Nov. 1852, *F. Mueller* (MEL 10753 & 10780, labelled as *S. gratulatorium* in Mueller's handwriting); Wilsons Promontory, *s. d., s. coll.* (MEL 10735, labelled as *S. gratulatorium* in Mueller's handwriting); Wilsons Promontory, 12 May 1853, ?*F. Mueller* (MEL 10733, labelled as *S. lineare* var *latifolium* in Mueller's handwriting).

Distribution and habitat. Collections that are referable to this variety are known from coastal sand dunes in Victoria and from the Dark Island Heath in South Australia. The taxon ranges from Keith in South Australia to Wilsons Promontory in Victoria.

Flowering period. October to November.

Conservation status. The taxon is poorly collected. The most recent collections seen are over 20 years old but var. *canesens* is probably widespread in South Australia and southern Victoria.

Notes. Specimens of this taxon at MEL have been variously labelled by Mueller as *Stenopetalum gratulatorium* F. Muell. ms. or *S. lineare* var. *latifolium* F. Muell. ms. The taxon was formally named by Bentham (1863) in "Flora Australiense" as *Stenopetalum lineare* var. *canescens*.

This variety is restricted to mainly coastal areas in south-eastern Australia, occurring on sands not limestone, and resprouting after fires, with individual plants occupying an area 1–2 m wide (AD 9651431).

The author has not been able to study populations of this taxon in the field. These populations may prove to be better placed under *S. saxatile*, to which they key. The eastern taxon differs from *S. saxatile* in being completely glabrous, with entire often succulent leaves and slender fruits. There is also a considerable disjunction in the ranges of these two taxa and they have very different habitats. Until further studies can be undertaken, it seems best to retain the coastal eastern taxon in *S. lineare* and and reinstate it as variety *canescens*.

This taxon is poorly represented in herbaria, the most recent collection sighted dating from 1979. Further collections of coastal *Stenopetalum* populations are needed from South Australia and Victoria.

Stenopetalum saxatile Keighery, *sp. nov.*

Fruticulus gracilis erectus ad 50 cm altus vel raro decumbens, caudex lignosus. Folia simplicia raro trilobus, linearis-sphathulatus ad obovatus. Petala croceus-fuscus, lineare, 4–5 mm longa.

Typus: 10 km north of Eyre (32°10'S, 126°18'E), Western Australia, 1 October 1984, *G.J. Keighery* 7556 (*holo:* PERTH 03289907; *iso:* CANB).

Slender erect or rarely decumbent *shrub*, with several short-lived soft-wooded stems arising from a woody rootstock, up to 50 cm tall; young shoots and plants often covered with white branched hairs, which become scattered on the leaves. *Stems* green aging brown, becoming sparsely hairy chiefly around the nodes. *Leaves* linear-spathulate to obovate tapering to a slender petiole 3–10 mm long; lamina 5–15 mm long, generally entire but occasionally trifid, sparsely hairy. *Pedicels* erect and *c.* 2 mm long in fruit. *Sepals* strongly saccate and enclosing ovary, 3–4 mm long, green to colourless; upper portion (above saccate base) *c.* 1 mm long, acute, with a scarious margin. *Petals* spreading, linear, 4–5 mm long, *c.* 1 mm wide, orange-brown. *Fruit* obovoid, 4–6 mm long. (Figure 3D,E)

Selected specimens examined. WESTERN AUSTRALIA and SOUTH AUSTRALIA: 20 km E of Eucla, 3 Sep.1981, *R. Bates* 986 (AD); Eucla, *H.H. Carey s.n.* (MEL); 9 km WSW of Eucla,15 Sep.1971, *H.J.Eichler* 21325 (AD); Eucla National Park, on the border between Western Australia and South Australia, 13 Oct. 1986, *G.J. Keighery & J. Alford* 920 (PERTH); Wilsons Bluff, 3 km E of Eucla, 12 Oct. 1986, *G.J. Keighery & J. Alford* 1078 (PERTH); 3 km E of Eucla, 16 Oct. 1986, *G.J. Keighery & J. Alford* 1567 (PERTH); Fowlers Bay, summer 1879, *Mrs Richards* (AD 96115075 & 96115078); Eucla, 1896, *C. Ryan s.n.* (MEL 11006); towards Spencers Gulf, *Maj. Warburton* (MEL); Madura, 5 Sep. 1963, *J.H. Willis s.n.* (PERTH, MEL); 3 km N of old Eucla, *P.G. Wilson* 1647 (AD).

Distribution and habitat. Occurs on the Nullarbor Cliffs in near coastal sites between Eyre in Western Australia and Fowlers Bay in South Australia.

Flowering period. August to October.

Conservation status. The western populations are in Nuytsland Nature Reserve and Eucla National Park. The species is not considered as endangered.

Notes. This species is one of three perennial members of the *S. lineare* complex. Plants of *Stenopetalum saxatile* are finer in all aspects of morphology than one of these taxa, *S. lineare* var. *canescens*, which is described above. The other perennial member of the group is *S. decipiens*, which occurs on the inland ranges of Western Australia, Northern Territory and Queensland. It differs from *S. saxatile* in having an enlarged corky stem base, densely hairy stems and leaves, larger ovate-oblong fruits and larger seeds.

Acknowledgements

Type collections were borrowed from W. The author was able to view type material, and other collections at SYD, MEL and AD with the assistance of these organisations, and an ABRS grant. Thanks are also due to the other bodies who funded the many biological surveys noted herein, and especially to my co-workers who made these expeditions productive and enjoyable.

Michael Lyons provided access to his records and numerous collections of *Stenopetalum salicola* gathered during the Salinity Action Plan Survey.

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Utricularia petertaylorii (Lentibulariaceae), a new species from the south-west of Western Australia

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Abstract

Lowrie, A. *Utricularia petertaylorii* (Lentibulariaceae), a new species from the south-west of Western Australia. *Nuytsia* 14(3): 405–410 (2002). A new species, *Utricularia petertaylorii* Lowrie, is described and illustrated. A key is provided to all the known *Utricularia* species occurring in the south-west of Western Australia.

Introduction

In Peter Taylor's excellent taxonomic monograph of *Utricularia* (Lentibulariaceae) he recorded (Taylor 1989: 104) in detail his field examination of an unusual *Utricularia* population on North East Rd, 80 km south-east of Perth. He found the plants in this population not only varied in size, but had a corolla suggestive of *U. inaequalis* A. DC. and leaves and traps suggestive of *U. violacea* R. Br. He concluded that this population might represent a hybrid swarm and recommended further study of it in comparison with uniform populations of *U. inaequalis* and *U. violacea*.

Extensive study in the field of this population and of other similar populations discovered during the current study has established that these populations represent a distinct new species rather than a hybrid. It has a number of disjunct but morphologically similar populations in the south-west of Western Australia. The earliest known collection of it was made by Charles Gardner in 1920. The new species is here described as *Utricularia petertaylorii*.

Taxonomy

Key to the *Utricularia* species of south-west Western Australia

1 Calyx lobes 4 (subgenus *Polypompholyx*) 2
1: Calyx lobes 2 (subgenus *Utricularia*) 4
2 Corolla pale pink to white; trap dorsal appendages deeply tridentate ..... **U. westonii**
2: Corolla pale pink to bright pink; trap dorsal appendages shortly bifid 3
3 Corolla *c.* 4 mm wide, spur glandular ..... **U. tenella**
3: Corolla *c.* 12 mm wide; spur glabrous ..... **U. multifida**
4 Plants with tubers; corolla red ..... **U. menziesii**

4: Plants without tubers; corolla yellow, violet or pale lilac 5
5 Plants free-floating; corolla yellow 6
5: Plants affixed aquatics; corolla violet or pale lilac 7
6 Ultimate segments of the leaves many; inflorescence 4–8-flowered; pedicels pendulous in fruit ..... **U. australis**
6: Ultimate segments of the leaves very few; inflorescence 1–3-flowered; pedicels semi-erect in fruit ..... **U. gibba**
7 Inflorescence peduncle twining around nearby herbs for support 8
7: Inflorescence peduncle erect 9
8 Corolla *c.* 20 mm wide; palate bearing 2 raised yellow ridges ..... **U. volubilis**
8: Corolla *c.* 5 mm wide; palate bearing 3 raised yellow ridges ..... **U. helix**
9 Inflorescence peduncle bearing 2–4 scales; corolla pale lilac on both lips ..... **U. simplex**
9: Inflorescence peduncle without scales; corolla lower lip violet, upper lip violet or pale lemon 10
10 Corolla upper lip pale lemon 11
10: Corolla upper lip violet 12
11 Corolla lower lip reniform; spur longer than the lower corolla lip ... **U. paulineae**
11: Corolla lower lip semi-circular in outline with the apex 3-lobed; spur shorter than the lower corolla lip ..... **U. benthamii**
12 Leaves linear-cuneate, apex rounded; bracts and/or bracteoles 2 13
12: Leaves narrowly linear, apex acute; bracts and bracteoles 3 or more 14
13 Corolla lower lip depressed obovate in outline, apex ± 3-lobed; bracts similar ..... **U. violacea**
13: Corolla lower lip reniform, apex ± entire; bracts dissimilar... **U. petertaylorii**
14 Corolla upper lip divided v-shaped into 2 oblong lobes, apex rounded; palate bearing *c.* 8 prominent yellow slightly raised ridges and streaks ..... **U. inaequalis**
14: Corolla upper lip obovate, apex truncate and slightly emarginate; palate bearing 2 prominent yellow ridges mostly with a smaller ridge between ..... **U. dichotoma**
(Western Australian variant)

Utricularia petertaylorii A. Lowrie, *sp. nov.*

Differt a *Utricularia inaequali* A. DC. lamina folii lineari-cuneata, apice rotundato, bracteis et/vel bracteolis 2, lobo superiori calycis ovato, lobo inferiori lato elliptico vel suborbiculari; a *U. violacea* R. Br. labio inferiori corollae reniformi et margine apicali undulato, lobo superiori calycis late obovato, lobo inferiori late ovato, appendice dorsali utriculi brevissimi applanato ad apicem truncato integro, appendicibus lateralibus brevis remote dentatis, alis ventralibus margine serratis.

Typus: North East Rd, *c.* 3 km south of Albany Highway, upper Serpentine River, 32°29'S, 116°18'E, Western Australia, 10 November 1990, *A. Lowrie* 184 *(holo:* PERTH 05849500; *iso:* MEL, K).

Annual *herb,* terrestrial, with a compact basal rosette of leaves 14–20 mm diam., anchored to the soil by rhizoids, stolons absent, with traps located above soil level among the leaves; traps and leaves generally covered with a film of water at flowering. *Leaves* linear-cuneate, apex rounded, 7–10 mm long (including translucent white petiole); lamina green, 0.4–0.7 mm wide. *Traps* on a long slender stalk,

laterally compressed, *c.* 1.5 mm long, *c.* 1.3 mm wide in side view, to *c.* 0.8 mm wide in dorsal view; dorsal appendage above the mouth very short, flat, apex truncate, entire, curving downwards; lateral appendages short, wide, wing-like, distally dentate; ventral wings along the base marginally serrate. *Inflorescences* 1 or 2, erect, arising from basal rosette of leaves, 2.5–10 cm long (including peduncle); peduncle terete, 0.3–0.5 mm diam., glabrous, without scales. *Bracts* 2, opposite, basisolute (attached near the middle), dissimilar; one bract ovate, 1.5–1.7 mm long, 0.6–0.7 mm wide, apex acute, base ± square, narrower and truncate; other bract obovate, 1.5–1.7 mm long, 0.6–1.0 mm wide, apex variable from emarginate to irregularly dentate, base ± square, narrower but truncate at an angle. *Flowers* 1 per peduncle; pedicel 5–7.5 mm long. *Calyx lobes* 2, unequal; upper lobe ovate, 2–3 mm long, 2–3 mm wide; lower lobe broadly elliptic to suborbicular, 1.8–2.5mm long, 1.5–2.7 mm wide. *Corolla* 7–13 mm long (not including the nectary spur), 10–20 mm wide; lower lip violet, reniform, 5–10.5 mm long, 10–20 mm wide, apical margin undulate; upper lip violet, broadly obovate in outline, with apex so deeply emarginated as to now appear ± v-shaped, both lobes apically rounded, the upper outer lobe margins commonly rolled inwards a little, 3–5 mm long, 5–9 mm wide at the apex, 1.5–2.5 mm wide at the base. *Palate region* yellow bordered by a few radiating purple lines, bearing 4 raised yellow ridges, the central 2 ± entire, the outer 2 ± v-shaped. *Spur* in very small specimens longer, in larger specimens shorter than the lower corolla lip, positioned ± 45° to the lower corolla lip, yellowish, with faint purple lines near the base, ± obpyriform, 5–6.5 mm long, 2–3.5 mm wide at the base, 1–1.2 mm wide near the apex, 1.2–1.5 mm wide at the apex, apex entire or emarginate. *Capsule* globose, 3–3.5 mm long, dehiscing by a longitudinal slit. *Seeds c.* 0.2 mm long; testa dark brown, reticulate. (Figure 1)

Selected specimens examined. WESTERN AUSTRALIA: Drakesbrook, Waroona, 32°51'S, 115°57'E, 17 Oct. 1920, *C.A. Gardner* 243 (PERTH); Metro Rd, 32°17'S, 116°26'E, 12 Nov. 1999, *F. Hort s.n.* (PERTH); Palgarup, 34°10'S, 116°12'E, 6 Oct. 1985, *A. Lowrie s.n.* (PERTH); North East Rd, upper Serpentine River, 32°29'S, 116°18'E, 19 Nov. 1996, *A. Lowrie* 1617 (PERTH); Talbot West Rd, Helena River East Branch, 31°57'S, 116°30'E, 24 Oct. 1999, *A. Lowrie* 2392 & *F. & J. Hort* (PERTH); Little Darkin Swamp, Warragel Rd, 32°04'S, 116°31'E, 3 Nov. 1999, *A. Lowrie* 2418 & *F. & J. Hort* (PERTH); Leona Rd, 32°14'S, 116°19'E, 17 Nov. 1999, *A. Lowrie* 2420 & *F. & J. Hort* (PERTH); Leona Rd, 32°15'S, 116°19'E, 17 Nov. 1999, *A. Lowrie* 2425 & *F & J. Hort* (PERTH); Metro Rd, 32°18'S, 116°26' E, 17 Nov. 1999, *A. Lowrie* 2428 & *F. & J. Hort* (PERTH); Big Brook crossing, North East Rd, 32°34'S, 116°14'E, 2 Nov. 2000, *A. Lowrie* 2535 (PERTH).

Distribution. Recorded from the Helena River East Branch *c.* 60 east of Perth, upper Darkin River, Upper Serpentine River, Waroona and Palgarup (near Manjimup) Western Australia.

Habitat. Utricularia petertaylorii grows in yellowish brown granitic soils along winter-wet drainage lines of granite outcrops; in red loam soils in winter wet creek watersheds; and in black sandy soil or brown clayey loam on the margins of winter wet swamps, creeks, swampland flats and watersheds.

The population of *Utricularia petertaylorii* near Metro Rd (*A. Lowrie* 2428 & *F. & J.* Hort) was the largest encountered in this study. In mid November the species was flowering en masse at this large, south-sloping, almost flat granite 'outcrop' that is scarcely raised above the level of the surrounding ground. Here the species occurs as small crowded colonies, in patches commonly only a few square metres in size, with scattered individuals between, along the main winter-wet drainage lines on the aprons of the granite outcrop. Plant height and flower size are variable. Small specimens commonly grow alongside larger specimens, both sharing the same soil and moisture availability. Field surveys since 1990 have established that in good rainfall years the population is large. In drought years the population is notably reduced in overall numbers.

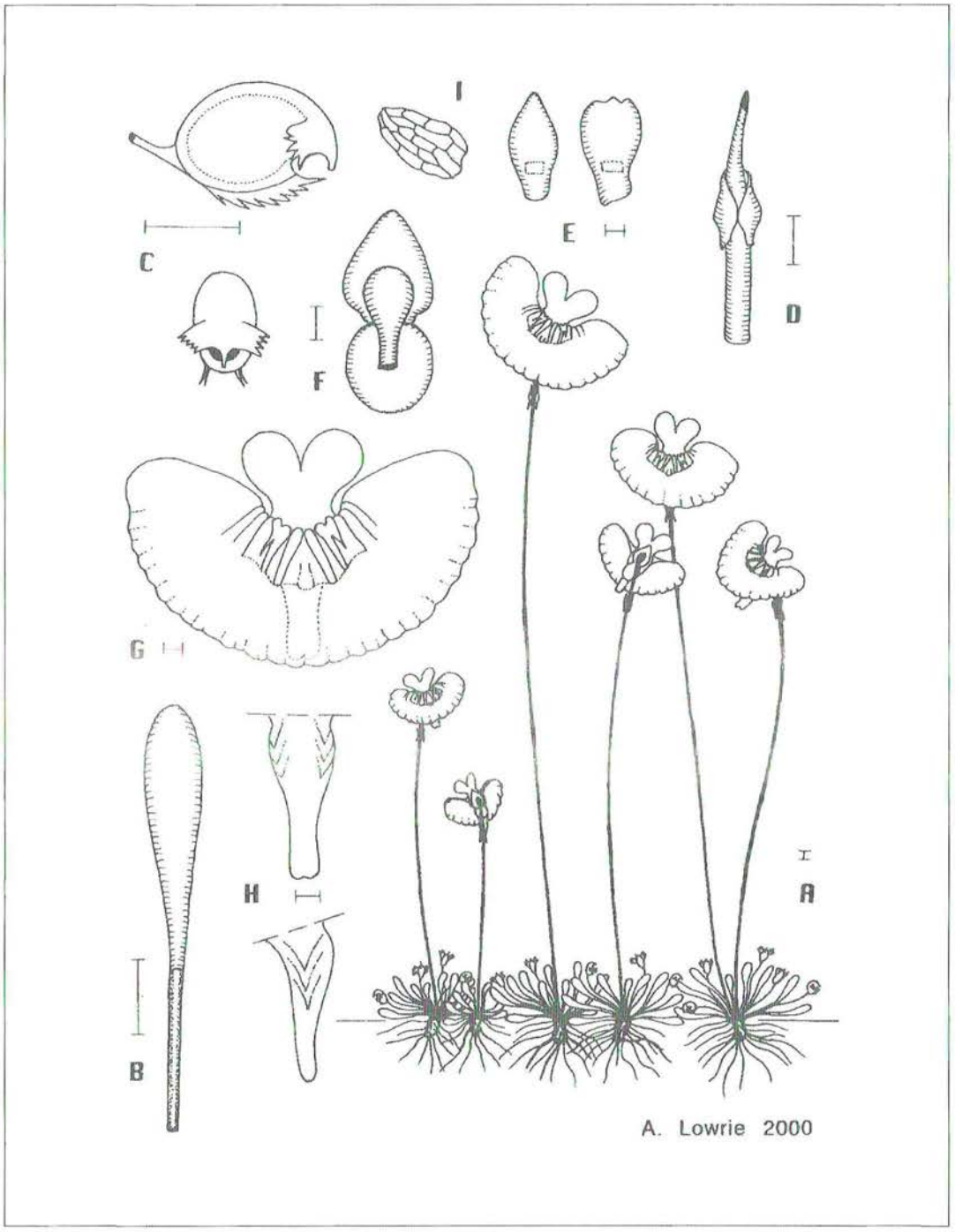

Figure 1. Live material of *Utricularia petertaylorii* from the type location, drawn by Allen Lowrie. A – colony of mature plants; B – leaf; C – trap, side view above, dorsal view below; D – peduncle and pedicel with bracts or bracteoles; E – bracts or bracteoles; F – calyx lobes, rear view; G – corolla; H – spur, front view above, side view below; I – seed, enlarged. Scale bars all = 1 mm.

Phenology. Flowering observed October to November, also some fruiting capsules with mature seed at this time. Most capsules were bearing mature seed by the end of November and early December.

Conservation status. Utricularia petertaylorii is currently not under threat. It is locally abundant at its known localities.

Etymology. This species is named in honour of Peter Taylor, professional botanist, world authority on *Utricularia* and author of a taxonomic monograph on the genus, which he began in 1948 (the year of my birth) and published in 1989.

Notes. The closest relatives to *Utricularia petertaylorii* in south-west Western Australia are *U. inaequalis* A.DC. and *U. violacea* R. Br. While *Utricularia petertaylorii* does share a number of morphological similarities with both *U. inaequalis* and *U. violacea*, each of the three species has a unique combination of these characters. *U. petertaylorii* also has unique characters, such as the much shorter dorsal appendage to its traps.

Utricularia inaequalis differs from *U. petertaylorii* by having a corolla lower lip depressed obovate in outline with an obscurely 3-lobed apex; leaf lamina narrowly lanceolate, apex acute; bracts and bracteoles 4; trap dorsal appendage very long, pointed and entire, lateral appendages long, narrow, distally fimbriate, ventral wings narrow and distally fimbriate, positioned at the dorsal end of the base only. *U. violacea* differs from *U. petertaylorii* by having a corolla lower lip depressed obovate in outline with a markedly 3-lobed apex; spur in both large and small specimens longer than the lower lip; calyx upper lobe broadly obovate, lower lobe broadly ovate; trap dorsal appendage longer, pointed and serrate on the inside margin, lateral appendages slightly longer, distally fimbriate, and ventral wings marginally fimbriate.

Utricularia inaequalis is a coastal species extending along the coastal plain from just north of Perth to Busselton. *U. inaequalis* and *U. violacea* grow together at Armadale, Pinjarra and Busselton. Notably each of these populations is at the same distance, *c.* 20 km, from the west coast. At each of the three sites no intermediates or hybrids have been found after very extensive searches over a number of seasons. These observations suggest that *U. inaequalis* and *U. violacea* are genetically isolated from each other. Certainly there is no evidence that *U. petertaylorii* is a hybrid between these two taxa.

Utricularia inaequalis does not occur anywhere in the vicinity of *U. petertaylorii* and the typical *U. violacea* is also notably absent from this and all the other known locations of *U. petertaylorii.* However, typical *U. violacea* has been found on a few granite outcrops in the region but always by itself or in association with *U. tenella* R. Br.

The atypical white-flowered variant of *U. violacea* (see photograph, plate 30 E in Lowrie 1998: 115) was found growing in association with *U. petertaylorii* at only one location (*A. Lowrie* 2425 & *F & J Hort*). No intermediates or possible hybrids were found between these two taxa suggesting that they are genetically isolated from each other. A very thorough search in and for some distance beyond this site failed to find any of the typical violet-flowered *U. violacea*.

Another possibility examined during the present study was of *Utricularia petertaylorii* being a hybrid between *U. benthamii* P. Taylor and the widespread *U. violacea*. No evidence was found to support this. At Palgarup *Utricularia petertaylorii* was discovered growing with *U. benthamii* but without the presence of *U. violacea*.

Acknowledgements

I would like to thank Paul Wilson for his assistance with the Latin diagnosis; the referee Peter Taylor for his suggestions and comments; Barbara Rye for her comments, and the staff of the Western Australian Herbarium.

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A review of *Hibbertia glomerosa sens. lat.* (Dilleniaceae)

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Abstract

Wheeler, J.R. A review of *Hibbertia glomerosa sens. lat.* (Dilleniaceae). *Nuytsia* 14(3): 411–418 (2002). A lectotype is chosen for the south-western Australian species *Hibbertia glomerosa* (Benth.) F. Muell. and two new taxa are distinguished amongst the material previously placed under that name. The new taxa, *Hibbertia glabrisepala* J.R. Wheeler from the Kalbarri–Geraldton area and *H. glomerosa* var. *bistrata* J.R. Wheeler, from the Mullewa area, are described and illustrated.

Introduction

Examination of the collections housed as *Hibbertia glomerosa* (Dilleniaceae) in the Western Australian Herbarium (PERTH) has revealed the presence of three taxa. Two of these differ from one another only in indumentum characters and are regarded as varieties. The third shows significant differences from the other two taxa, including its almost glabrous calyx and smaller stamen number, and is regarded as a separate species. This species group belongs to *Hibbertia* sect. *Candollea* Gilg.

When Bentham (1863: 43) originally described *Hibbertia glomerosa* [as *Candollea glomerosa*], he took a broad view of the taxon, apparently encompassing both of the above species as indicated by his statement "Calyx clothed with long, silky, or woolly hairs, or sometimes quite glabrous". However, his description of the stamens "in 5 bundles of 4–6 each" matches the species with the larger number of stamens. A lectotype is chosen here accordingly and the taxon with fewer stamens is described below as the new species *H. glabrisepala*.

Also mentioned under Bentham's original description of *Candollea glomerosa* is var. *subsericea* Benth., a taxon with only three carpels, fewer stamens and very shortly pedunculate flowers. The type of this, "Swan River, Drummond" at Kew, does not appear to be closely related to *Hibbertia glomerosa* and probably has more affinity with *Hibbertia racemosa* (Endl.) Gilg.

Taxonomy

Key to taxa of the *Hibbertia glomerosa* group

1. Sepals more or less glabrous. Stamens 15, in 5 fascicles each with 3 anthers ..... **H. glabrisepala**

1. Sepals with conspicuous pilose hairs. Stamens (20)25–38, in 5 fascicles each with 4–8 anthers.
   2. Leaves with a short felted indumentum. Sepals with short hairs underlying pilose hairs ..... **H. glomerosa** var. **bistrata**
   2. Leaves more or less glabrous. Sepal indumentum of pilose hairs only ..... **H. glomerosa** var. **glomerosa**

Hibbertia glabrisepala J.R. Wheeler, *sp. nov.*

[*Candollea glomerosa* Benth., Fl. Austral. 1: 43 (1863) *p.p.* as to the excluded syntype, *Oldfield*, Port Gregory (MEL 666853), not as to lectotype.]

Hibbertiae glomerosae affinis sed sepalis fere glabris et staminibus paucioribus differt.

Typus: Red Bluff, Junction of road to Red Bluff and Airport road, 27°43'S, 114°09'E, Western Australia, 6 September 1984, *J.R. Wheeler* 2376 (*holo:* PERTH 04395387; *iso:* K, AD, CANB, MEL, NSW).

Shrub to 1 m high; branchlets glabrous apart from the tips of young shoots, usually scarred by fallen leaves. *Leaves* linear to narrowly oblong, 9–20(40) mm long and (0.8)1–3 mm wide, flat but with recurved margins, glabrous; base dilated and stem-clasping, the margin ciliolate; apex more or less obtuse, often with a minute blunt point from the extending midrib. *Flowers* terminating short shoots, single or in small clusters, sessile, 15–20 mm across; bracts 2 or 3, brownish, circular to very broadly obovate, fairly rigid, 3–5 mm long with a tiny to elongated leaf-like tip up to an additional 5 mm long, glabrous apart from a ciliolate margin. *Sepals* connate basally, elliptic, 6–10.5 mm long, glabrous or almost so apart from occasional minute appressed hairs and a ciliolate margin; outer sepals shortly acute; inner sepals broader, more obtuse, the margins membranous and more distinctly ciliolate. *Petals* bright yellow, obovate, 6–11 mm long, apically notched. *Stamens* 15, in 5 fascicles each of 3 stamens, two of the anthers held side by side and one held in front of the other two; filaments fused in the lower half; anthers narrowly oblong and dehiscing by longitudinal slits. *Carpels* 5, globular, glabrous, each with a radiating style; ovule 1 per carpel. *Fruiting carpels* obovoid, *c.* 3.5 mm long and 2 mm wide; seed brown, ellipsoid, *c.* 2 mm long and 1.5 mm wide, with a small translucent waxy aril. (Figure 1)

Selected specimens examined (all PERTH) WESTERN AUSTRALIA: Kalbarri, 29 June 1978, *D. & B. Bellairs* 1300; W of Mullewa, 23 Aug. 1964, *J. Galbraith* 446A; AMG-Zone 50 375426 m E 6705439 m N; Brand Mudge Rd, W of Winchester, 7 Oct. 1992, *E.A. Griffin* 7080; *c.* 2 miles [3 km] E of Kalbarri, along road to Ajana, 20 Sep. 1971, *R.D. Hoogland* 11991 (duplicates CANB, K, L, US, BRI, HBG, A, TNS all *n.v.*); *c.* 8 miles [13 km] due SE of Yuna, 9 Nov. 1974, *R.D. Hoogland & G.L. Stebbins* 12483 (duplicates CANB, UC, L, HBG, US all *n.v.*); east-west track S of central southern boundary of Cooloomia Nature Reserve, 5.35 km E of cross-roads (E track to Nerren Nerren), 3 Aug. 1996, *G.J. Keighery & N. Gibson* 2042; Port Gregory, *Oldfield*; 26.3 km from Port Gregory along Yerina Springs road, 15 Aug. 1985, *N. Sammy s.n.*; 25 km E of Naraling, along road from Yuna to Eradu, 30 Aug. 1974, *G.L. Stebbins & G. Keighery* A17; Red Bluff, junction of road to Red Bluff and Airport road, 6 Sep. 1984, *J.R. Wheeler* 2378 (duplicates MEL, AD); Hutt River Crossing with Northampton–Port Gregory road, 7 Sep. 1984, *J.R. Wheeler* 2382 (duplicates AD, K, CANB); Kalbarri township, *c.* 500 km N of Perth, 10 May 1968, *P.G. Wilson* 6647.

Distribution. Western Australia, South West Botanical Province, IBRA region (Thackway & Cresswell 1995) of Geraldton Sandplain, extending from Cooloomia Nature Reserve south to west of Winchester and inland to near Yuna. (Figure 2A)

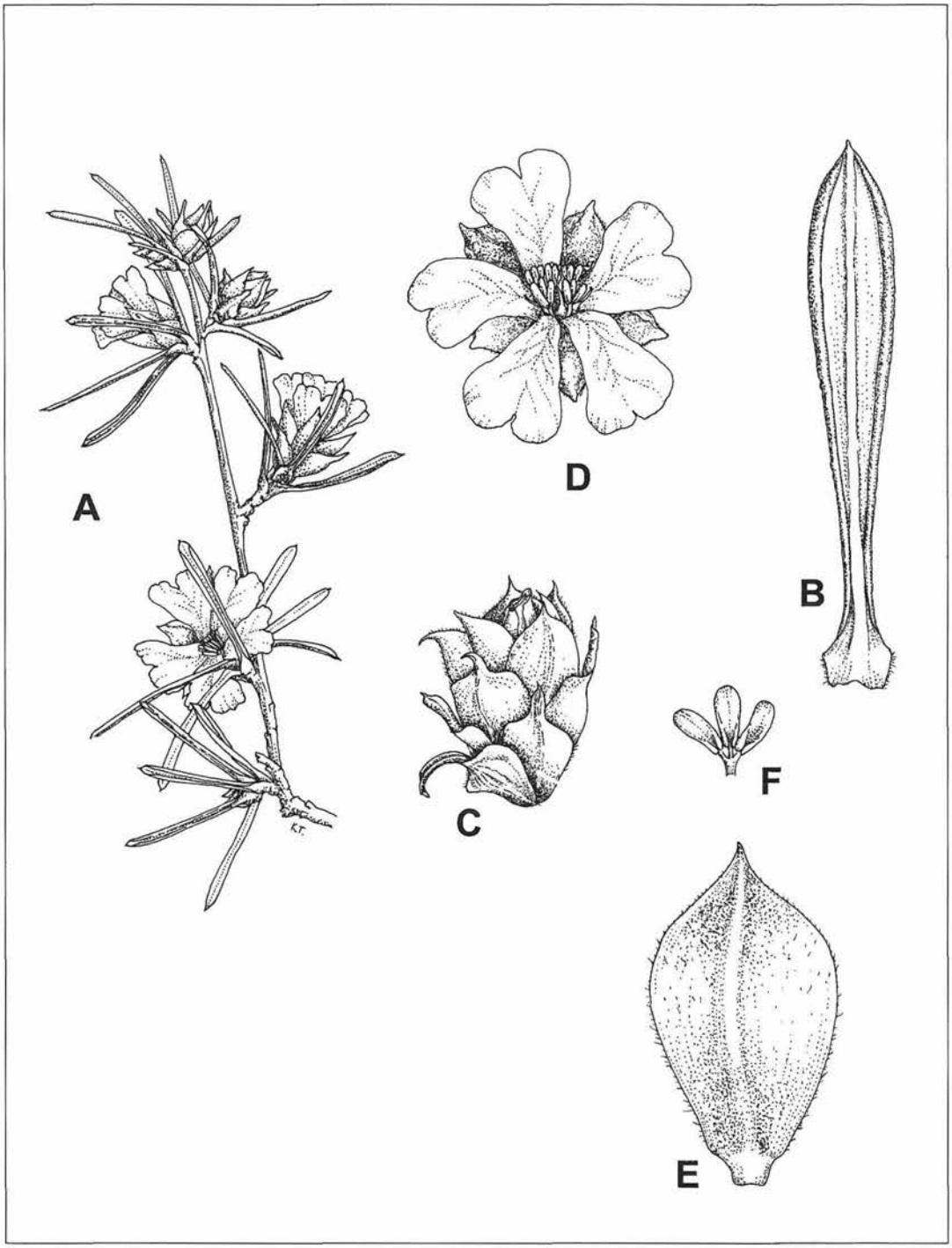

Figure 1. *Hibbertia glabrisepala*, drawn from *A. & B. Bellairs* 1300 and *J.R. Wheeler* 2378. A – flowering branch (x2); B – lower surface of leaf (x8); C – bracts surrounding immature flower (x4); D – flower (x4); E – inner sepal (x8); F – staminal bundle (x8).

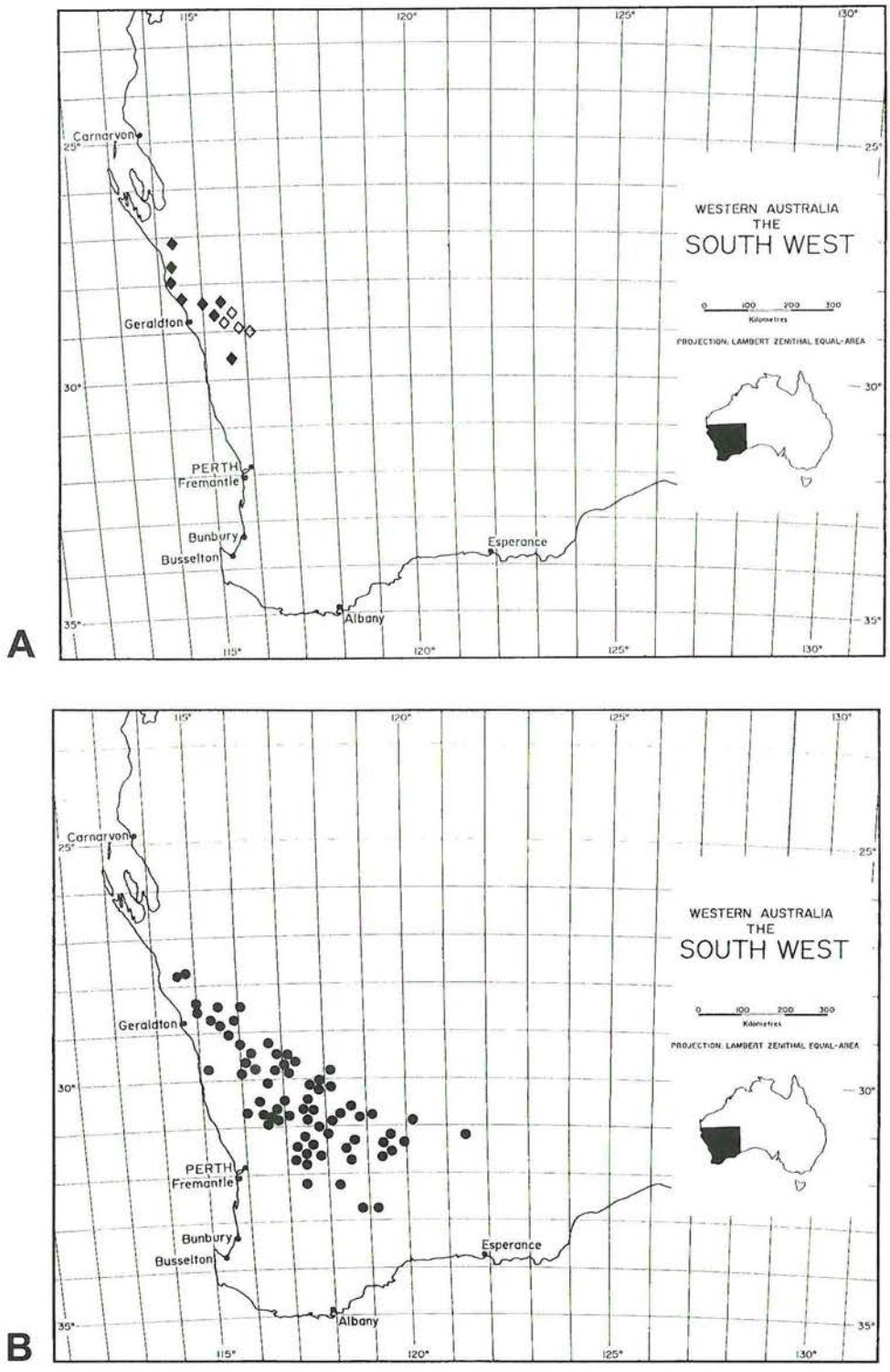

Figure 2. Distribution maps. A – *Hibbertia glabrisepala* ◆ and *H. glomerosa* var. *bistrata*◇; B – *H. glomerosa* var. *glomerosa*.

Habitat. Occurs on sandy soils, recorded from heath or mallee vegetation.

Phenology. Flowering is recorded from May to October. Fruits have been recorded for September and October.

Conservation status. The species appears to be fairly widespread and is not believed to be under threat.

Etymology. The specific epithet refers to the almost glabrous sepals.

Affinities. Differs from its close relative *Hibbertia glomerosa* in the absence of the long coarse hairs on its calyx, its more conspicuous broad bracts surrounding the flower and in its reduced stamen number. Each of the five stamen fascicles always has 3 anthers only, making a total of 15 stamens per flower, whereas there are (20)25–38 stamens with 4–8 anthers per fascicle in *H. glomerosa*.

Note. Previously known in PERTH by the phrase name *Hibbertia* sp. Red Bluff (*J.R. Wheeler* 2376).

Hibbertia glomerosa (Benth.) F. Muell., Syst. Census Austral. Pl. 2 (1882). – *Candollea glomerosa* Benth., Fl. Austral, 1: 43 (1863). *Type*: Swan River [Western Australia], *Drummond p.p.* (*lecto:* K, here designated).

Hibbertia polyclada Diels *in* L. Diels & E. Pritzel, *Bot. Jahrb. Syst.* 35: 385 (1904). *Type:* Avon District, near Wyola, Western Australia, 24 October 1901, *L. Diels* 5035 (*iso:* PERTH 04430603).

Shrub, mostly to 0.6 m, rarely to 1 m high; young branchlets of flowering shoots sericeous, otherwise glabrous, usually scarred by fallen leaves. *Leaves* linear to narrowly oblong, 7–25(35) mm long and 1–3(4.5) mm wide, glabrous to hairy; base usually dilated and slightly stem-clasping, the margin ciliolate; apex more or less obtuse, often with a minute blunt point extending from the midrib. *Flowers* terminating short shoots, single or in few-flowered clusters, sessile, 10–25 mm across; bracts few, usually 1–3, 4–12 mm long, either ovate to elliptic and bract-like or leaf-like and scarcely differing from the uppermost leaves, often ciliolate towards the base. *Sepals* connate basally, ovate to elliptic, 6–12 mm long; with conspicuous coarse white pilose hairs particularly in the mid-section, the tips and base often glabrous, sometimes with an underlying indumentum of shorter hairs; outer sepals tapered upwards and acute; inner sepals broader and more obtuse but apiculate, with membranous margins, often appearing almost glabrous but usually minutely ciliolate. *Petals* bright yellow, obovate, 7–14 mm long, emarginate. *Stamens* (20)25–38, in 5 fascicles each of 4–8 stamens in an irregular cluster; filaments fused in the lower half; anthers narrowly oblong and dehiscing by longitudinal slits. *Carpels* 5, globular, glabrous, each with an erect to radiating style; ovule 1 per carpel. *Fruiting carpels* obovoid, 2.5–3 mm long, *c.* 2 mm wide; seed brown, globular, 1–2 mm diam., with a small white waxy aril.

Typification. Bentham (1863) cited two syntypes, Swan River, *Drummond* and Port Gregory, *Oldfield*, which are morphologically quite distinct, belonging to different species. The *Drummond* specimen is lectotypified because it agrees best with Bentham's original description in having four or more stamens in each staminal bundle. It also agrees best with current concepts of *Hibbertia glomerosa*, which is a taxon with a conspicuously pilose calyx. The excluded syntype has fewer stamens and is almost devoid of calyx hairs. It belongs to the new species described above.

Notes. Hibbertia polyclada was described by Diels (Diels & Pritzel 1904) from material he collected at Wyola, a railway siding between Northam and Merredin in the Avon district. It has slightly shorter leaves

than the type of *Hibbertia glomerosa*, but not unusually short when seen in the light of the material now available. It is here considered to be a synonym of *Hibbertia glomerosa*.

Two varieties are recognised in *Hibbertia glomerosa*. The new variety, var. *bistrata*, is confined to a small area within the range of the much more widespread typical variety, but there are no records of the two taxa coexisting at any localities.

a. Hibbertia glomerosa var. **bistrata** J.R. Wheeler, *var. nov.*

Hibbertiae glomerosae var. *glomerosae* affinis sed foliis bracteisque pubescentibus, indumento sepalorum brevi aliquantum coacto pilos albos conspicuos subjecti differt.

Typus: c. 10 miles [16 km] SE of Mullewa along road to Morowa, 28°37'S, 115°38'E, Western Australia, 21 September 1971, *R.D. Hoogland* 11999 (*holo:* PERTH 03073688; *iso:* A, CANB, L, NSW all *n.v.*).

Leaves with a somewhat felted indumentum of sparse to dense hairs which are appressed and usually curled or tangled, densest on the lower surface, ciliolate towards base. *Bracts* densely shortly hairy with curled or tangled hairs, ciliolate towards base. *Sepals* with a short somewhat felted indumentum which is often ferruginous, underlying conspicuous white pilose hairs. (Figure 3A–C)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: between Mullewa and Morawa, 22 Sep. 1931, *W.E. Blackall* 729; between Mullewa and Morawa, 24 Sep. 1932, *W.E. Blackall* 2789; between Mullewa and Morawa, 22 Sep. 1931, *C.A. Gardner & W.E. Blackall* 729; 45 miles [72 km] along Mullewa–Morawa road, 6 Oct. 1984, *A.C. Burns* 9; Canna, 18 Sep. 1931, *C.A. Gardner* 2663; Wilroy Reserve 26196, 16 km SSE of Mullewa, 25 Sep. 1976, *B.G. Muir* 287(3.53).

Distribution. Western Australia, South West Botanical Province, IBRA region (Thackway & Cresswell 1995) of Avon Wheatbelt, apparently restricted to between Mullewa and Morawa. (Figure 2A)

Habitat. Recorded from sand, sandy loam and granitic soils in shrubland or heath.

Phenology. Flowers recorded for September and October; immature fruits for October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Apparently restricted to a few populations, although one collection indicates that the taxon is locally common and one is included in a reserve.

Etymology. The name refers to the 2-layered effect of sepal indumentum.

Affinities. *Hibbertia glomerosa* var. *bistrata* differs from var. *glomerosa* in having short curled hairs on its leaves and bracts, and also in having similar short hairs on its sepals underlying the long strong pilose hairs which are characteristic of the sepals of both varieties of *H. glomerosa*.

b. Hibbertia glomerosa (Benth.) Muell. var. **glomerosa**

Leaves glabrous apart from very sparse and very minute straight appressed hairs on the upper surface near the base and a minutely ciliolate margin towards the base. *Bracts* glabrous apart from a ciliolate

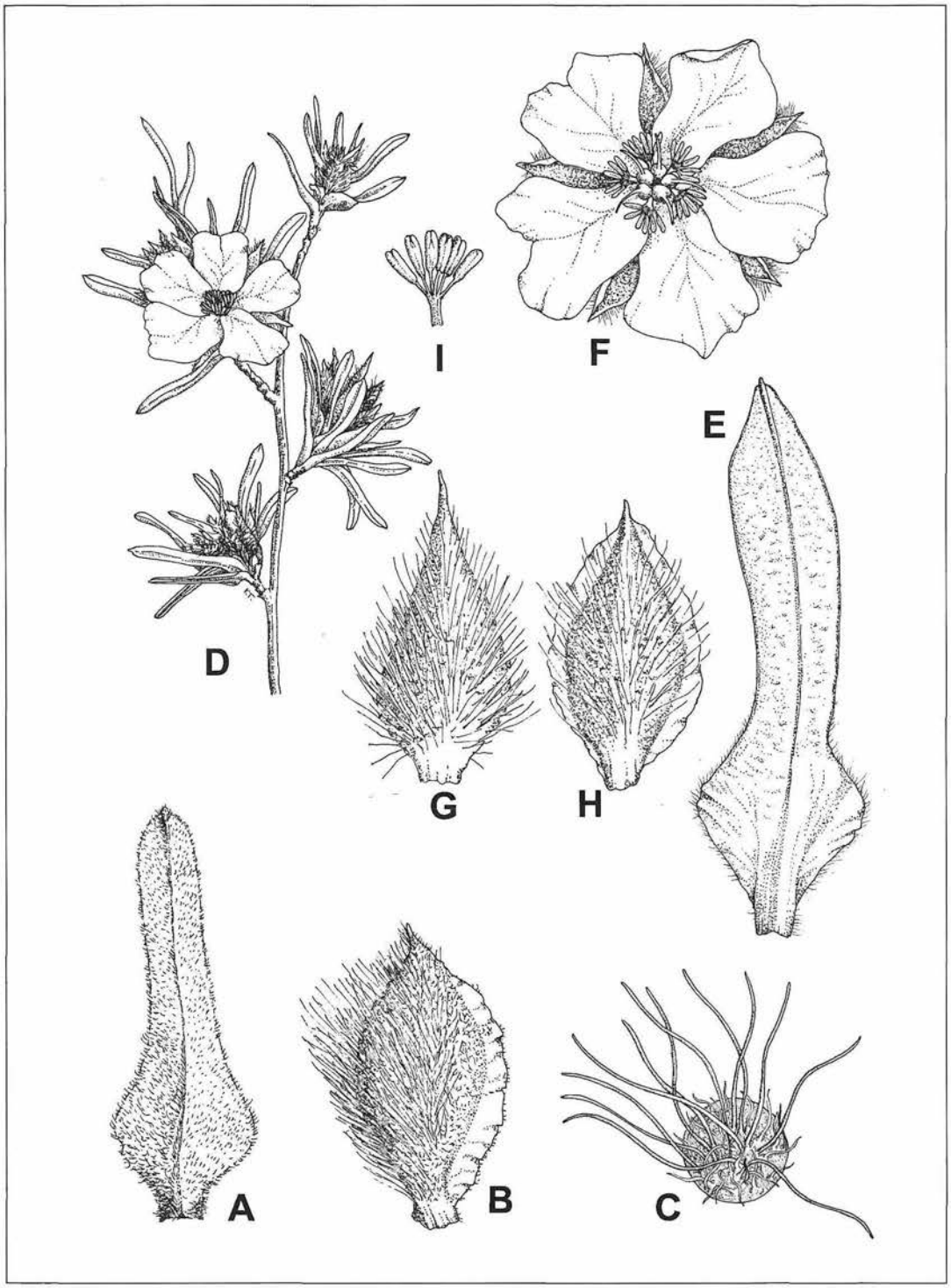

Figure 3. A–C. *Hibbertia glomerosa* var. *bistrata*, drawn from *A.C. Burns* 9. A – leaf (x8); B – inner sepal (x8); C – sepal hairs (x20); D–I. *Hibbertia glomerosa* var. *glomerosa*, drawn from *P.S. Short* 3852 and *J.R. Wheeler* 2587. D – flowering branch (x2); E – lower surface of leaf (x8); F – flower (x4); G – outer sepal (x8); H – inner sepal (x8); I – staminal bundle (x8).

margin. *Sepals* with conspicuous pilose hairs particularly in the mid-section, the tips and base usually glabrous or sometimes also with very sparse minute appressed straight hairs. (Figure 3D–I)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Great Northern Highway at roadside, 70.0 km *c.* NE of Wubin, 22 Sep. 1985, *J. D'Alonzo* 494; near Narembeen, Sep. 1929, *W.E. Blackall s.n.*; Caroling Rocks, 4 km W of Karalee homestead on water pipeline, 141 km W of Coolgardie and 57 km E of Southern Cross, 6 Oct. 1983, *S.J. Forbes* 1487 (duplicates MEL, AD all *n.v.*); 25.26 km E of Mullewa, near Pindar, 6 June 1991, *W. Greuter* 22589; *c.* 9 miles [14.5 km] N of Campion, near vermin proof fence, 30 Sep. 1971, *R.D. Hoogland* 12044 (duplicates CANB, E, L, MEL all *n.v.*); rubbish tip area 7 km W of Perenjori on S side of road, 18 Aug. 1994, *E.D. Kabay* 351; 13 miles [21 km] N of Lake Biddy, 12 Oct. 1963, *K.R. Newbey 1043*; Mt Walter, *c.* 90 km NE of Southern Cross, 16 Sep. 1981, *K.R. Newbey* 8924; *c.* 10 km NW of Pintharuka, 20 Sep. 1990, *P. S. Short* 3852 (duplicate MEL *n.v.*); 14 km E of Piawaning on road to Wongan Hills, 16 Sep. 1988, *J.R. Wheeler* 2530; N of Beacon, 16 km along Bimbijy Rd towards Mt Churchman, 20 Sep. 1988, *J.R. Wheeler* 2587; Avon district, *c.* 35 km N of Merredin, 31 Oct. 1974, *D.J.E. Whibley* 4724 (duplicate AD *n.v.*).

Distribution. South-west Australia, IBRA regions (Thackway & Cresswell 1995) of Geraldton Sandplains, Avon Wheatbelt and Mallee from the South West Botanical Province and Murchison and Coolgardie from the Eremaean Botanical Province, extending from the Murchison River south to near Newdegate and inland towards Mt Jackson and south of Coolgardie. (Figure 2B)

Habitat. Found in sand, loam or clay soils over laterite or granite in shrubland, heath or mallee vegetation.

Phenology. Flowers recorded from July to November; fruits recorded from September to November.

Conservation status. Widespread, not believed to be currently under threat.

Note. The leaves are usually up to 25 mm long, but a collection (*B.H. Smith* 1331) from Tampu Well in the Avon District has leaves to 35 mm long.

Acknowledgements

I should like to thank the Director and staff of the Western Australian Herbarium for access to the State collection. Thanks also to Kathleen Trafalski for preparing the fine illustrations and Paul Wilson for the Latin diagnoses.

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Two new species of *Hibbertia* section *Candollea* (Dilleniaceae) from the south-west of Western Australia

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Abstract

Wheeler, J.R. Two new species of *Hibbertia* section *Candollea* (Dilleniaceae) from the south-west of Western Australia. *Nuytsia* 14(3): 419–426 (2002). Descriptions and illustrations of the new species *Hibbertia notibractea* J.R. Wheeler and *H. trichocalyx* J.R. Wheeler, are presented. Both species are closely related to *Hibbertia ferruginea* J.R. Wheeler, and a key to these three species is given. They belong to *Hibbertia* sect. *Candollea* Gilg.

Introduction

During the preparation of a treatment of the family Dilleniaceae for the "Flora of the Perth Region" (Wheeler 1987), studies commenced on a species aggregate belonging to *Hibbertia* section *Candollea* Gilg. A new species, *Hibbertia ferruginea* J.R. Wheeler was described (Wheeler 1984), and its relationship to closely related taxa, as it was then understood, was detailed. Further studies, during the preparation of the "Flora of the South West (Bunbury–Augusta–Denmark)" (Wheeler *et al.* in press), have enabled the discrimination of further taxa in this group. Two new species, which extend from Margaret River to Two Peoples Bay just east of Albany, are described and illustrated here.

Taxonomy

Key to species of the *Hibbertia ferruginea* complex

1. Carpels 5. Stamens 15. Sepals with dense brownish appressed hairs. Leaves bluntly mucronate, margins revolute ..... **H. ferruginea**
1. Carpels 3. Stamens 11. Sepals glabrous or with occasional white or brown hairs. Leaves obtuse, flat or margins slightly to prominently recurved.
   2. Outer sepals (5)6–8 mm long, glabrous or almost so apart from the ciliolate margin. Bracts usually glabrous or almost so ..... **H. notibractea**
   2. Outer sepals (3)4.5–6(6.5) mm long, white-hairy. Bracts hairy in their upper half ..... **H. trichocalyx**

Hibbertia notibractea J.R. Wheeler, *sp. nov.*

Species insignis bracteis conspicuis fere glabris, cremeis vel pallido bruneis; differt a *Hibbertiae ferruginea* et *H. trichocalyx* sepalis fere glabris.

Typus: Blackwood River, Fisher Road near Molloy Caravan Park, Western Australia, 5 September 1983, *J.R. Wheeler* 2122 B (*holo:* PERTH 03076466; *iso:* AD, CANB, K).

Shrub to 0.6 m high, multistemmed, erect, sprawling or prostrate; branchlets with sparse appressed hairs, glabrescent. *Leaves* alternate or in alternate clusters, sessile, spreading and occasionally recurved towards their tip, linear to very narrowly oblong-obovate, 6–25(40) mm long, 0.8–3 mm wide, glabrous, glabrescent or sparsely hairy with long pilose hairs, upper surface smooth or somewhat tuberculate, entire, flat or margins slightly to prominently recurved, apex obtuse. *Flowers* axillary or terminating axillary shoots, solitary, sessile, 10–15 mm diam. *Bracts* 3–6, conspicuous, cream to pale brown, broadly elliptic and somewhat concavo-convex, varying in size with the largest 4–7.5 mm long, 3–4 mm wide, usually fairly rigid in the centre but becoming thinner towards the margin, glabrous apart from occasional woolly apical hairs and a ciliolate to ciliate margin (cilia white or red-brown), apex obtuse but frequently abruptly acuminate or with the midrib continued as a soft and often curved awn; outermost bracts shortest, often with a darker midrib and sometimes with a minute leaf-like tip. *Sepals* 5, basally connate, narrowly ovate, glabrous or sometimes with occasional red-brown or white appressed apical hairs and a ciliolate margin; outer sepals (5)6–8 mm long, 1.5–2.5 mm wide, long-acute; inner sepals slightly shorter and broader, (4.5)5.5–7 mm long, 2.5–3.5 mm wide, obtusely acuminate and sometimes softly awned. *Petals* 5, yellow, obovate, (5)7–8 mm long, emarginate. *Stamens* 11 all around the carpels, 9 of them with their filaments fused into 3 fascicles each of 3 stamens, the remaining 2 stamens free; filament 1–1.5 mm long; anther elliptic, 1–1.8 mm long. *Carpels* 3, glabrous; style 1.5–3 mm long; ovule 1 per carpel. *Fruitlets* obovoid, 1.5–2.5 mm long; seed light brown, ellipsoid, *c.* 1.3 mm long, *c.* 1 mm wide, with a waxy basal aril. (Figure 1)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Meelup Springs Reserve, Cape Naturaliste Rd, Eagle Bay, 29 Sep. 1999, *D. Carter* 148; Boat Harbour Road, 2.9 km by road SW of South Coast Highway junction, 25 Nov. 1990, *N. Gibson & M. Lyons* 884; Denmark Shire, Denbarker State Forest, track S from Blue Lake Road to Possum Trapper's Cave, 21 Oct. 1993, *B.G. Hammersley* 987; Denmark Shire, Old Railway Reserve *c.* 1 km W from Happy Valley Rd, 13 Oct. 1999, *B.G. Hammersley* 2274; *c.* 5 miles [8 km] E of Alexandra Bridge along Brockman Highway, 18 Oct. 1971, *R.D. Hoogland* 12152 (duplicates CANB, B, G, K, L, UC, US all *n.v.*); Rainbow Caves Rd, 0.9–1.2 km W of junction with Caves Rd, Shire of Augusta–Margaret River, 6 Oct. 1999, *J.W. Horn* 2765 (duplicate DUKE *n.v.*); Scott River National Park, 26 Sep. 1990, *C.J. Robinson* 189; Calgardup, track along N boundary of Leeuwin–Naturaliste National Park, 500 m W of Caves Rd, 27 Oct. 1999, *J. Scott* 132; Peaceful Bay, *c.* 4.5 km W along Ficifolia Rd, 26 Sep. 1986, *J.R. Wheeler* 2467 (duplicate CANB); Walpole–Nornalup National Park, junction of Nut and Ficifolia Rds on Nut Rd, 21 Sep. 1992, *J.R. Wheeler* 3220.

Distribution. Western Australia, South West Botanical Province, IBRA regions (Thackway & Cresswell, 1995) of Warren and Jarrah Forest. Recorded from Leeuwin National Park to near Denmark. (Figure 2A)

Habitat. Recorded on sandy soils from slight rises around swamps or seasonally inundated areas, occasionally from sand in sheoak woodland, *Corymbia ficifolia* woodland or banksia woodland, less often from Jarrah forest.

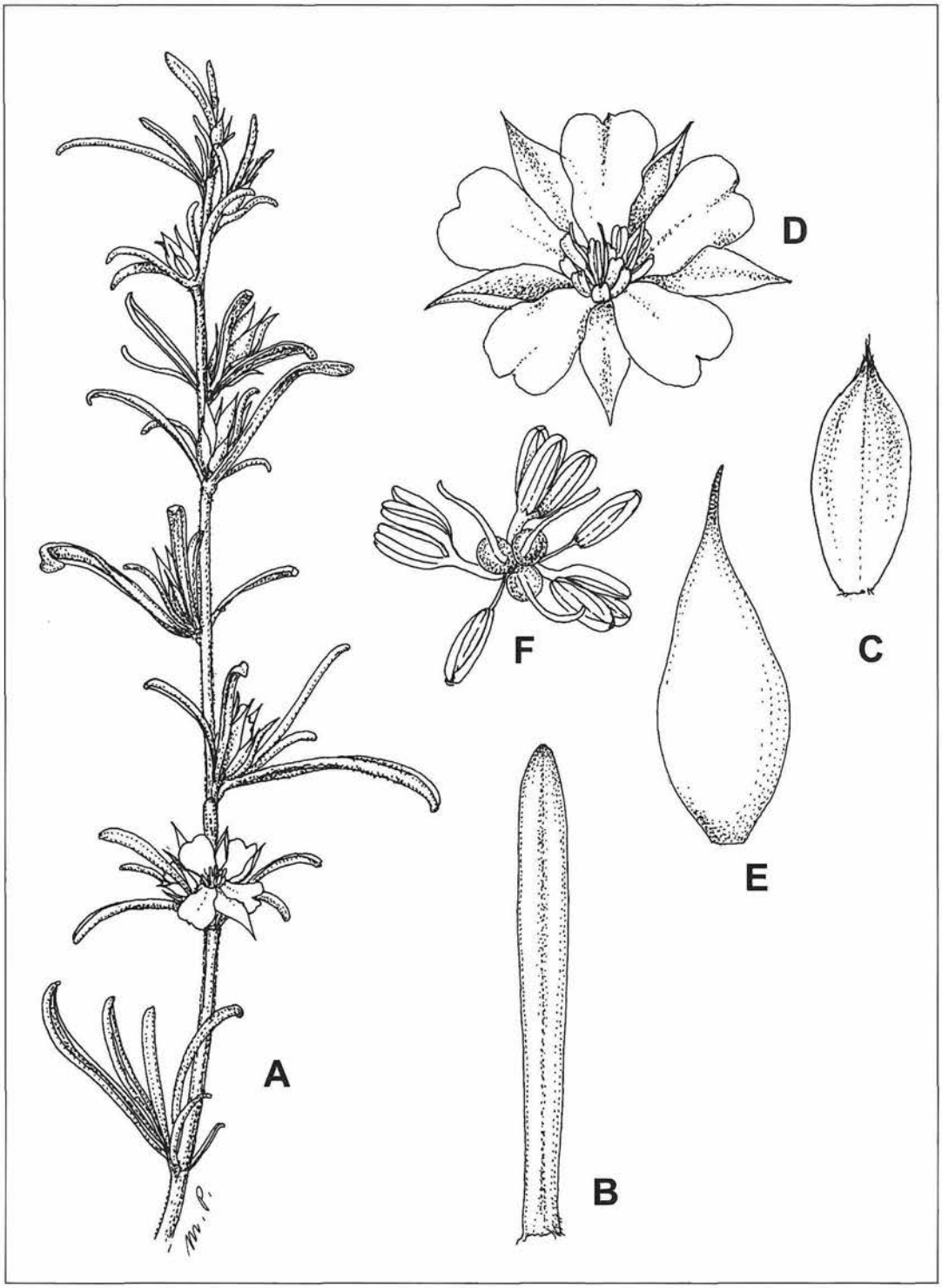

Figure 1. *Hibbertia notibractea*. A – flowering branch (x2), B – leaf (x4), C – bract (x8), D – flower (x4), E – outer sepal (x8), F – stamens and carpels (x8). Drawn from *N. Gibson & M. Lyons* 884.

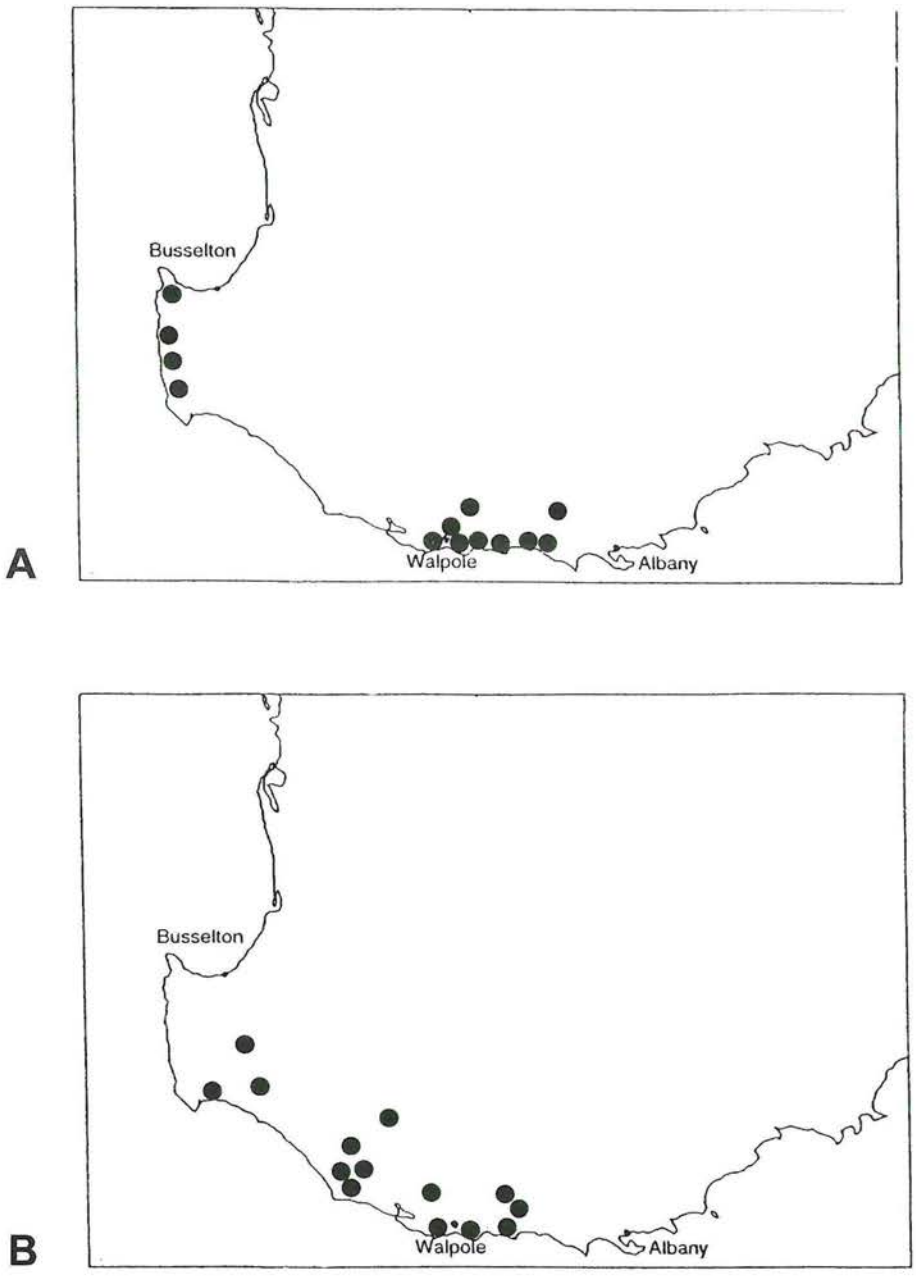

Figure 2. Distribution maps. A – *Hibbertia notibractea*; B – *Hibbertia trichocalyx*.

Phenology. Flowers recorded August to December; fruits recorded September to December.

Conservation status. Widespread along the south coast and apparently not endangered, being recorded from three national parks, although its response to attack by *Phytophthora* has not been documented.

Etymology. The name from the Latin, *nota* – distinguishing mark or feature and *bractea* – bract, referring to the large conspicuous bracts surrounding the flowers.

Affinities. Closely related to both *Hibbertia ferruginea* and *H. trichocalyx*. *Hibbertia ferruginea* differs in having somewhat longer and narrower leaves which are more tightly recurved to the midrib and which have a distinct but blunt apical point, its bracts are similar in shape but more hairy, its sepals are acute with appressed brown hairs and it has 15 stamens in 5 fascicles each with 3 anthers arranged around 5 glabrous carpels. *Hibbertia notibractea* differs from *H. trichocalyx* in leaf, bract and sepal characteristics (see affinities section under that species).

Notes. Collections from the Peaceful Bay area often have leaves which are somewhat tuberculate and with prominently recurved margins. A collection (*R.D. Hoogland* 12139) from west of Forest Grove has short flat leaves 6–10 mm long and unusually small flowers, its sepals only 4.5–6 mm long. This collection resembles *H. trichocalyx* but with glabrous sepals and almost glabrous bracts; it appears to be an intermediate. Another apparent intermediate specimen collected from Yelverton (*G.J. Keighery* 10849) resembles *H. notibractea* but approaches *H. trichocalyx* in its distinctly hairy sepals. Some of the hairs of the calyx of this specimen are quite rusty brown in colour and are reminiscent of *H. ferruginea*.

Hibbertia trichocalyx J.R. Wheeler, *sp. nov.*

Hibbertiae notibractea similis sed sepalis brevioribus pilosis et bracteis leviter pilosis.

Typus: Northcliffe–Windy Harbour, 5 km north of Windy Harbour, Western Australia, 27 September 1986, *J.R. Wheeler* 2472 (*holo:* PERTH 03076741; *iso:* AD, CANB, K).

Shrub to 0.6 m high, prostrate or sprawling, usually multistemmed, the young shoots often softly and densely hairy; branchlets hairy with somewhat curled hairs. *Leaves* alternate or in alternate clusters, sessile, somewhat spreading, oblong, elliptic or obovate, (3.5)5–12(20) mm long, 1.5–4.5(6) mm wide, moderately to densely softly hairy with long, fine and somewhat curled or tangled hairs, entire, flat or with very slightly recurved margins, apex obtuse. *Flowers* axillary or terminating short axillary shoots, solitary, sessile, 8–12(15) mm diam. *Bracts* 2 or 3, usually quite conspicuous, cream to pale brown, elliptic to broadly elliptic, flat to concavo-convex, 2.5–5 mm long, 1.5–3.5(4) mm wide, with white hairs towards the apex, margin usually ciliolate to ciliate (cilia white to red-brown), apex obtuse, abruptly acute or acuminate, rarely the outermost with a leaf-like tip. *Sepals* 5, basally connate, ovate-elliptic, with long tangled hairs at least in the upper half, hairs mostly white but occasionally with a few red-brown hairs towards the apex and margins; outer sepals (3)4.5–6(6.5) mm long, 1.5–2 mm wide, acute to long-acute or the midrib extended as a soft awn; inner sepals slightly shorter and broader, (3)4–5.5 mm long, *c.* 2.5 mm wide including a thin glabrous margin, subacute to obtusely acuminate with the midrib extended as a soft awn. *Petals* 5, yellow, obovate, 4–7 mm long, emarginate. *Stamens* 11 all around the carpels, 9 of them with their filaments fused into 3 fascicles each of 3 stamens, the remaining 2 stamens free; filament *c.* 1 mm long; anther oblong-elliptic, 1–1.5 mm long. *Carpels* 3, glabrous; style *c.* 1.5 mm long; ovule 1 per carpel. *Fruitlets* obovoid, 2–2.5 mm long; seed light brown, ellipsoid, 1.5–2 mm long, *c.* 1 mm wide, with a waxy basal aril. (Figure 3)

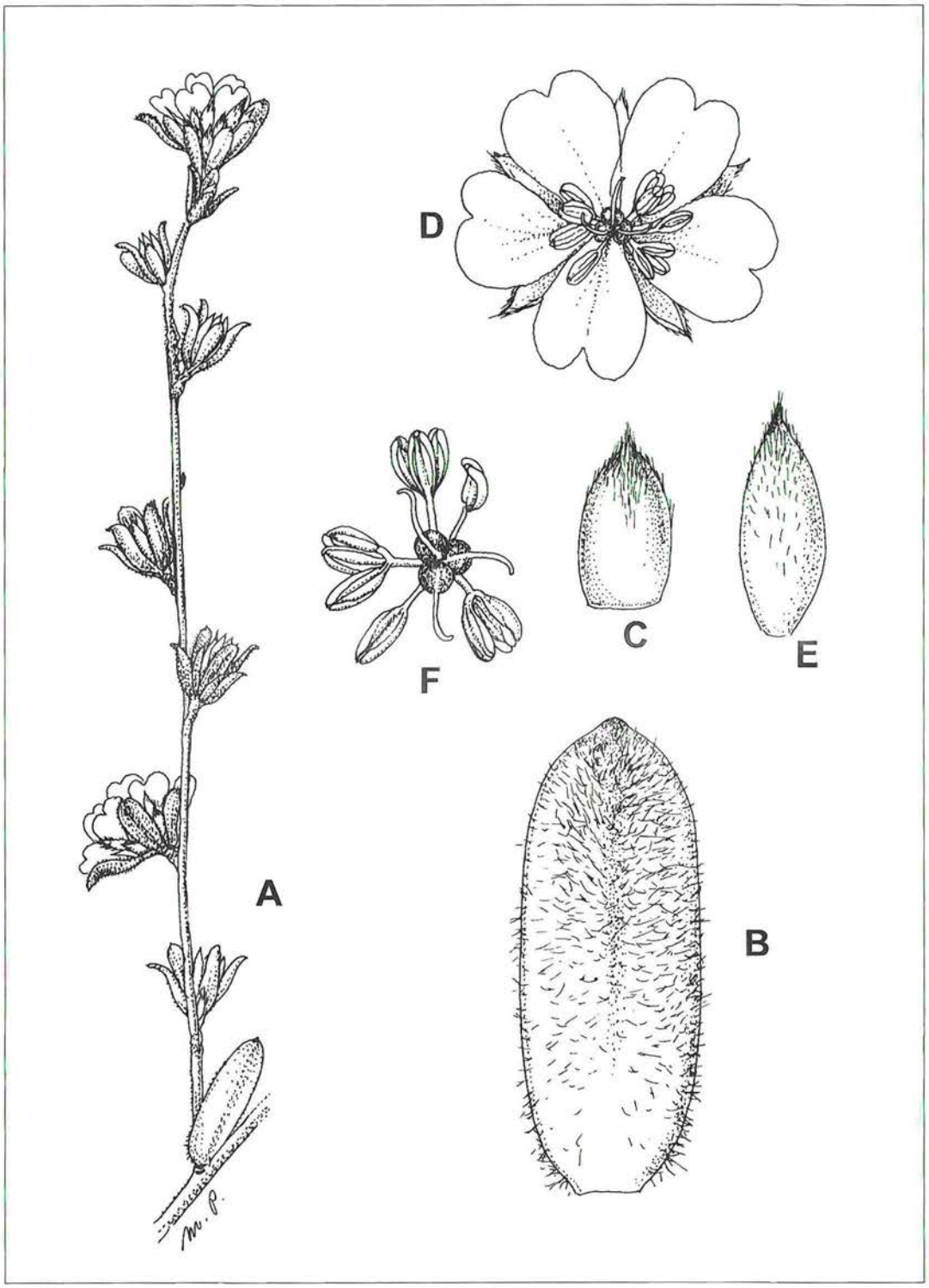

Figure 3. *Hibbertia trichocalyx*. A – flowering branch (x2), B – leaf (x8), C – bract (x8), D – flower (x4), E – outer sepal (x8), F – stamens and carpels (x8). Drawn from *J.R. Wheeler* 2472.

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Boggy Lake, Walpole, Nov. 1958, *D. Churchill s.n.*; Quinninup tip, 2 Nov. 1997, *R.J. Cranfield* 11609; Cell 5, Site 165, Four Acres Rd, 2.4 km W of Tom Brittan Road bearing W, 20 Oct. 1998, *R. Davis* 7477; Peaceful Bay, 1.3 km W along Ficifolia Rd from Peaceful Bay, S side, 2 Oct. 1995, *B.G. Hammersley* 1463; along Wheatley Coast Rd, *c.* 2 miles [3 km] N of Windy Harbour, 25 Oct. 1971, *R.D. Hoogland* 12194 (duplicates CANB, HBG, K, L, NSW, TNS, US all *n.v.*); Site 130, S of Beardmore Rd, E of South Western Highway, 25 Aug. 1997, *K.A. Redwood* 443; Rosa Brook, Margaret River District, 15 Oct. 1954, *R.D. Royce* 4898; Stewart Rd, 13.1 km from Vasse Highway (*c.* 35 km SSW of Nannup), 4 Sep. 1983, *J.R. Wheeler* 2110 (duplicates CANB, K); 1.1 km W along Ficifolia Rd, Peaceful Bay, 26 Sep. 1986, *J.R. Wheeler* 2464; Northcliffe–Windy Harbour, 5 km N of Windy Harbour, 27 Sep. 1986, *J.R. Wheeler* 2474 (duplicates AD, DUKE).

Distribution. Western Australia, South West Botanical Province, IBRA regions (Thackway & Cresswell, 1995) of Warren and Jarrah Forest. Recorded from Margaret River to Peaceful Bay. (Figure 2B)

Habitat. Sandy soil, often on well-drained rises, in heath, mallee-heath, eucalypt and banksia woodland. Occasionally recorded from swampy sites.

Phenology. Flowers September to November; fruits recorded for November.

Conservation status. Widespread along the south coast and not believed to be under threat, although its response to attack by *Phytophthora* has not been documented.

Etymology. From the Greek *trich* – hair, *calyx* – covering of a flower or fruit, the name referring to the hairy nature of the calyx.

Affinities. Closely related to *Hibbertia notibractea* and with a similar distribution pattern but apparently occupying slightly drier sites. The leaves of *Hibbertia trichocalyx* are flat and more densely hairy than those of *H. notibractea*; its bracts are not usually as conspicuous nor as large, are somewhat hairy and sometimes fewer in number. The sepals of *Hibbertia trichocalyx* are usually smaller than those of *H. notibractea* and distinctly hairy. *Hibbertia trichocalyx* differs from its other close relative, *H. ferruginea*, in its broader and shorter flat leaves, fewer and less conspicuous smaller bracts, smaller sepals and a reduced stamen and carpel number. The sepal indumentum of *Hibbertia ferruginea* is also denser and distinctly brownish in colour.

Discussion

Both the new species are closely related to *Hibbertia ferruginea* and together form a distinct subgroup within section *Candollea*. The differences between the three of them are detailed under each of the two new species. It is interesting that the Yelverton and Forest Grove collections seem to indicate a small degree of overlap in the Margaret River area where all three species occur. *Hibbertia ferruginea* occurs from Busselton and Collie south to the Scott River National Park, with an outlying record from 18 km south-south-west of Rocky Gully.

The three species are also relatively closely related to the *Hibbertia depressa* complex. They differ from *H. depressa* Steud. and *H. helianthemoides* (Turcz.) F. Muell. in their broad prominent bracts and in their more narrowly acute sepals, with the outer sepals slightly longer than the innermost. *Hibbertia*

depressa and *H. helianthemoides* have leaves that are narrow and more densely clustered, the clusters separated by longer internodes, a different indumentum in which the hairs of the lower leaf surface often form an apical tuft. They also have bracts which are less prominent and sepals which are more obtuse, subequal or the outer sepals slightly shorter than the innermost. The *Hibbertia depressa* complex will be the subject of a separate paper.

Sometimes *Hibbertia pulchra* Ostenf. may be superficially similar to *H. notibractea*, but what appear to be large bracts in the buds of *H. pulchra* are actually the broad outer sepals which are slightly shorter than the inner sepals. *Hibbertia pulchra* has bracts which are shorter, circular to broadly elliptic with a distinctly ciliolate margin, glabrous sepals which are obtuse to obtusely apiculate and thick but flat leaves. *Hibbertia pulchra* occurs in the Manjimup area extending east towards Mount Barker and possibly further east.

Acknowledgements

I would like to thank the Director and staff of the Western Australian Herbarium for access to the state collection. Thanks also to both Margaret Pieroni for the fine illustrations and to Paul Wilson for translating the brief Latin diagnoses.

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Wheeler, J.R. (in press). Dilleniaceae. *In:* Wheeler, J.R., Marchant, N.G., & Lewington, M. "Flora of the South West (Bunbury–Augusta–Denmark)." pp. 570–579.

Three new subspecies of *Hibbertia glomerata* (Dilleniaceae) from the Darling Range, Western Australia

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Abstract

Wheeler, J.R. Three new subspecies of *Hibbertia glomerata* (Dilleniaceae) from the Darling Range, Western Australia. *Nuytsia* 14(3): 427–435 (2002). A lectotype is selected for the south-western Australian species *Hibbertia glomerata* Benth. Three new subspecies, *Hibbertia glomerata* subsp. *darlingensis* J.R. Wheeler from the Darling Scarp, *H. glomerata* subsp. *ginginensis* J.R. Wheeler from the Gingin area and *H. glomerata* subsp. *wandoo* J.R. Wheeler from the eastern Darling Range, are described and illustrated. A key is provided to the subspecies.

Introduction

Hibbertia glomerata was first described by George Bentham (Bentham 1863) from material collected by James Drummond in 1843 from the somewhat broad locality "Swan River". Lectotypification is needed as the type material from Kew is a mixed collection of several taxa.

Examination of the PERTH collections of Dilleniaceae during the preparation of a treatment of the family for the "Flora of the Perth Region" (Wheeler 1987), showed considerable variation within *Hibbertia glomerata* and allusions were made there to the presence of further taxa. Additional collections over the past few years have enabled the recognition of four infra-specific taxa, two with mostly free stamens and the other two with stamens in fascicles.

The original description of *Hibbertia glomerata* does not state whether the stamens are free or fused into fascicles. However as Bentham has placed the species into the genus *Hibbertia* Andrews, in which the stamens are free or almost so, and not into the genus *Candollea* Labill. *nom. illeg.*, in which the stamens are united into fascicles, it is assumed that he perceived *H. glomerata* to be a taxon with free stamens.

Taxa with stamens fused into fascicles are normally placed in *Hibbertia* section *Candollea* Gilg. However, in this case the staminal differences between the taxa housed under *H. glomerata* are considered insufficient to warrant distinction even at the species level. This case illustrates the need for a review of the sectional boundaries of the genus *Hibbertia*. There is thought to be a similar breakdown of this traditional sectional boundary in the *Hibbertia exasperata* (Steud.) Briq. complex.

Taxonomy

Hibbertia glomerata Benth., Fl. Austral. 1: 34 (1863). *Type:* Swan River, [Western Australia], 1843, *J. Drummond*, 1st coll. no. 8 (*lecto:* K sheet stamped "Herbarium Hookerianum" and also annotated "stam. 8–10 libera, staminodia 0, ov. 3 glabra 1-ovulate", here designated; *isolecto:* K, LD, MEL 612823).

Shrub much-branched, usually to 0.5 m high but sometimes to 1 m; branchlets with prominent leaf scars, the young branchlets glabrous or minutely and sparsely puberulous. *Leaves* spirally arranged, sessile, sometimes dimorphic; floral leaves or all leaves oblong, narrowly obovate, or ovate to elliptic, 3–12 mm long, 1.5–7 mm wide, glabrous or with sparse hairs, base rounded to cordate or gradually tapered, margin entire and smooth or very slightly undulate and irregularly minutely crenulate, rarely sparsely ciliolate, apex obtuse or shallowly emarginate to subacute (rarely acute), the midrib often extended in a minute blunt apiculum which is often somewhat recurved; sometimes longer narrowly oblong leaves are present on the lower part of the plant and also basal to each of the short flowering shoots. *Flowers* solitary, sessile, (8)10–15 mm diam., terminating short axillary shoots. *Bracts* at base of flower usually 3, ovate, 0.5–1.5 mm long, inconspicuous, entire or sparsely minutely ciliolate, the outer bract usually acute and the others more or less obtuse. *Sepals* 5, connate basally, elliptic, (3)4–7 mm long, either all more or less equal in length or the outer two smaller, glabrous, obtuse to subacute or apiculate, rarely acute. *Petals* 5, yellow, obovate, (3.5)5–10 mm long, emarginate. *Stamens* 10–12, either all free and grouped between the carpels, or 9 of them distinctly fused into 3 fascicles and the remaining 2 free, rarely fusion of filaments irregular or very short; anthers narrowly oblong to narrowly elliptic, (1)1.2–2 mm long; staminodes absent. *Carpels* 3, glabrous; ovule 1 per carpel; style spreading, 1.5–2.5 mm long. *Fruitlets* obovoid, 2–3 mm high. *Seeds* brown, globular, *c.* 1.5 mm diam., with a white greatly divided aril.

Typification. The mixed type material from Kew comprises three sheets which Bentham apparently used for his description of *H. glomerata*.

One of the sheets has two pieces of plant material and is stamped "Herbarium Benthamianum 1854". The left piece is labelled "Swan River, Drummond 1839" and this is now recognised as *Hibbertia glomerata* subsp. *darlingensis*. The right hand piece, with a label "Swan River Drummond 8 1843" and "*Pleurandra* ?" in pencil, is here regarded as an isolectotype of *Hibbertia glomerata*.

The other two sheets, each with four pieces, are both stamped "Herbarium Hookerianum 1867" and bear the label "*Candollea* Swan River Drummond 8". One of these two sheets is annotated "stam. 8–10 libera, staminodia 0, ov. 3 glabra 1-ovulate", and it is this sheet which is here designated the lectotype of *Hibbertia glomerata*, being a complete sheet of uniform material and appearing to be from the same gathering as the right hand piece on the previous sheet.

The remaining sheet, again with the label "*Candollea* Swan River Drummond 8", is annotated "stam. circa 20–25, staminodia 0, ovaria 3 glabra 2-ovulate". This third sheet is material matching *Hibbertia commutata* Steud. and is not considered part of the type material, although it appears that Bentham did also use this material in drawing up his original description. Bentham (1863) mentions "stamens 10 to 15, or rarely above 20" and it is only the material on this latter sheet which has more than 12 stamens; Bentham also states "carpels 3, glabrous, 1- or 2-ovulate" and it is only the *Hibbertia commutata* material which has 2-ovulate carpels.

Notes. Bentham (1863) also tentatively named a new variety of *Hibbertia glomerata* as var. ? *canescens* Benth. and cited two syntypes: Gordon River, *Oldfield* and "rock at Oolingarran, Herb. *Mueller*". Neither of these syntypes belongs to *H. glomerata*. Material from the National Herbarium of Victoria of the first of these syntypes, labelled "Oldfield, Gordon River, WA" with the number 523 (MEL 666852), is a collection of *Hibbertia commutata* Steud. Material of the other syntype labelled "rock at Oolingarran, Herb. *Mueller*" (MEL 612824) is a collection of *Hibbertia potentilliflora* Benth.

Key to subspecies of *Hibbertia glomerata*

1. Stamens 10–12, all free or some with very short or irregular fusion.
   2. Leaves all similar, narrowly obovate or oblong to oblong-elliptic.
      3. Leaves narrowly obovate. Sepals apiculate, the outer sepals shorter than the inner sepals. ..... subsp. **wandoo**
      3. Leaves narrowly oblong. Sepals obtuse, all less more or equal in length ..... subsp. **darlingensis** (intermediate variant)
   2. Leaves usually dimorphic: floral leaves ovate to elliptic, usually somewhat undulate and very minutely crenulate; leaves basal to the flowering shoots much longer and narrowly oblong ..... subsp. **glomerata**
1. Stamens 11, 9 of them distinctly fused into 3 fascicles and 2 of them single.
   4. Leaves all similar, oblong to oblong-elliptic, glabrous, 1.5–4 mm wide ..... subsp. **darlingensis**
   4. Floral leaves ovate to elliptic, sometimes minutely ciliolate, 2.5–6.5 mm wide, sometimes also with elongated leaves basal to the flowering shoots ..... subsp. **ginginensis**

Hibbertia glomerata Benth. subsp. **glomerata**

Shrub erect, much-branched, to 1 m high. *Leaves* usually green, usually dimorphic but the basal ones sometimes caducous or apparently absent; floral leaves on the short axillary shoots ovate to elliptic, rarely obovate, (3.5)4–11 mm long, (2)3–7 mm wide, usually glabrous, the margin usually very slightly undulate and minutely crenulate, apex often recurved with a tiny blunt apiculum; leaves basal to the axillary flowering shoots often elongated, narrowly oblong, narrowly ovate or narrowly obovate, up to 25 mm long. *Bracts* glabrous or ciliolate. *Sepals* (3)4–7 mm long, all more or less equal in length; outer sepals obtuse to subacute, rarely acute; inner sepals obtuse to subacute. *Petals* (3.5)5–10 mm long. *Stamens* 10–12, all free; filament 1–1.5(2) mm long; anther (1)1.2–1.5 mm long. (Figure 1A–D)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: 600 m down walk trail from summit of Mt Lindesay, 25 Sep. 1991, *A.R. Annels* 1738; 7.6 km from highway on Sunny Glen Rd, 1.6 km along track to left, Denmark, 15 Sep. 1991, *A.R. Annels* 1745; Coalfields Rd, 5 km W of Bowelling, 13 Sep. 1998, *V. Crowley* 911; Mt Lindesay, N of Denmark, Oct. 1989, *B.G. Hammersley* 230; along Stewart Rd, *c.* 1 mile [1.6 km] from Brockman Highway, 26 Oct. 1971, *R.D. Hoogland* 12209 (duplicates CANB, BM, L, A, BISH, B all *n.v.*); Smith Rd, 20 km NE of Cowaramup (plot Smith 03), 11 Nov. 1993, *B.J. Keighery & N. Gibson* 638; 23.2 km, 5 deg. W of South of Capel and 32 km NW of Nannup, 27 Sep. 1993, *F.H. & M.P. Mollemans* 4440-2; Metricup, S of Busselton, 9 Oct. 1957, *R.D. Royce* 5771; Whicher Range, Sabina Rd, 2.7 km by road NE from junction with Jalbarragup Rd (S of Busselton), 9 Sep. 1983, *J.R. Wheeler* 2173; Stewart Rd, 1.5 km from Nannup–Augusta road, Canebrake Picnic Area, 7 Sep. 1985, *J.R. Wheeler* 2399; Denmark–Mount Barker road, *c.* 8 km N of intersection with South Coast Highway, 26 Sep. 1986, *J.R. Wheeler* 2461.

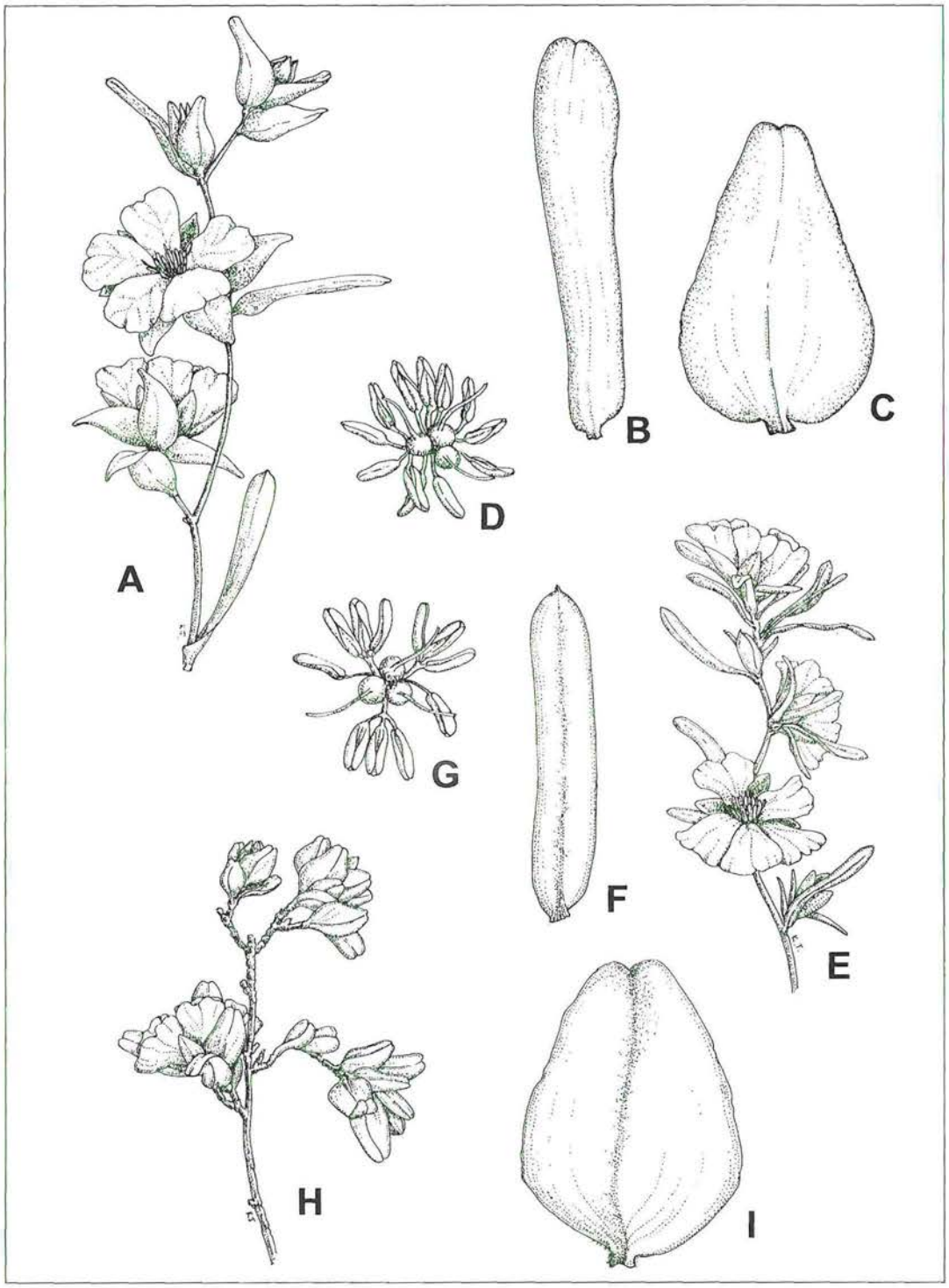

Figure 1. A–D. *Hibbertia glomerata* subsp. *glomerata*, drawn from *J.R. Wheeler* 2399 and *R.D. Hoogland* 12208. A – flowering branch (x2); B – basal leaf (x8); C – floral leaf (x8); D – stamens and carpels (x8). E–G. *Hibbertia glomerata* subsp. *darlingensis*, drawn from PERTH 03098087. E – flowering branch (x2); F – leaf (x8); G – stamens and carpels (x8). H, I. *Hibbertia glomerata* subsp. *ginginensis*, drawn from *E.M. Canning* 3575. H – flowering branch (x2); I – floral leaf (x8).

Distribution. Western Australia, IBRA regions (Thackway & Cresswell 1995) of Jarrah Forest and Warren. Recorded from Collie to the south-west corner of the state, with a disjunct occurrence in the east at Mt Lindesay and a northern outlier recorded near Nanga. (Figure 2)

Habitat. Recorded from a variety of habitats, most commonly forest or woodland but also from heath and in one case from a swamp. Found most commonly on sand, sandy loam, clay or granitic soils.

Flowering period. Flowers mostly September to November, but recorded as early as July.

Conservation status. Widely distributed in the south-west of the state and not apparently under threat.

Notes. Hibbertia glomerata subsp. *glomerata* is distinguished by its dimorphic leaves, the floral leaves usually ovate to elliptic in shape and with a very slightly undulate and minutely crenulate margin, whereas the lower leaves or those basal to the flowering shoots are much longer and narrowly oblong in shape. Subsp. *glomerata* occurs to the south of the other subspecies and usually on more sandy soils.

There is some geographical variation in this subspecies but the variants are not considered sufficiently distinct to warrant formal taxonomic recognition. Northern outliers from near Bowelling have more acute floral leaves, as do some specimens from near Nannup.

In the disjunct south eastern area, the specimens from Mt Lindesay itself are somewhat stunted in appearance, possibly somewhat windswept due to their location towards the summit of the mountain. They have small, fairly uniform, ovate leaves 3.5–6 mm long, occasionally sparsely hairy particularly towards the apex and with a sparsely and minutely ciliolate margin. Their smaller sepals are 3–4 mm long. Specimens from lower areas surrounding Mt Lindesay have slightly larger leaves with the occasional narrowly oblong leaves to 20 mm long and more closely resemble specimens from further west.

Hibbertia glomerata subsp. **darlingensis** J.R. Wheeler, *subsp. nov.*

Hibbertiae glomeratae subsp. *glomeratae* similis sed foliis floralis oblongis usque oblongo-ellipticis, 9 staminum in fasciculos 3 separatos conjunctis differt.

Typus: Jarrahdale scenic road, 8 km by road from South West Highway, 32°16'S, 116°04'E, Western Australia, 5 October 1983, *J.R. Wheeler* 2234 (*holo:* PERTH 03072703; *iso:* AD, CANB, K).

Shrub floriferous, compact and often tortuous, to 0.3 m high. *Leaves* often grey or glaucous, mostly all similar; floral leaves oblong or oblong-elliptic, 4–10 mm long and 1.5–4 mm wide, the apex often recurved with a tiny blunt apiculum, the margin usually entire, very occasionally with minute sparse cilia towards the base; leaves basal to the axillary flowering shoots, not or only very slightly larger up to 15 mm long. *Bracts* usually glabrous. *Sepals* 5–7 mm long, all more or less equal in length; outer sepals obtuse or less often subacute; inner sepals obtuse. *Petals* 6–9 mm long. *Stamens* 11, 9 of them distinctly fused for more than half their length into 3 fascicles each of 3 stamens, the remaining 2 single stamens free; filament (1.2)1.5–2 mm long; anther usually 1.5–2 mm long. (Figure 1E–G)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Kalamunda, Aug. 1919, *Miss E. Allum s.n.*; rubbish tip track off Cheverin Rd, Roleystone, 2 Oct. 1981, *R.J. Cranfield s.n.*; Camp Gully Rd, 1.4 km W of Capel–Donnybrook road, 21 Oct. 1997, *R. Davis* 4354; Swan River, *J. Drummond* 1st coll. n. 8 (not as to lectotype of *H. glomerata*); AMG-Zone 50 392368m E 6549266m

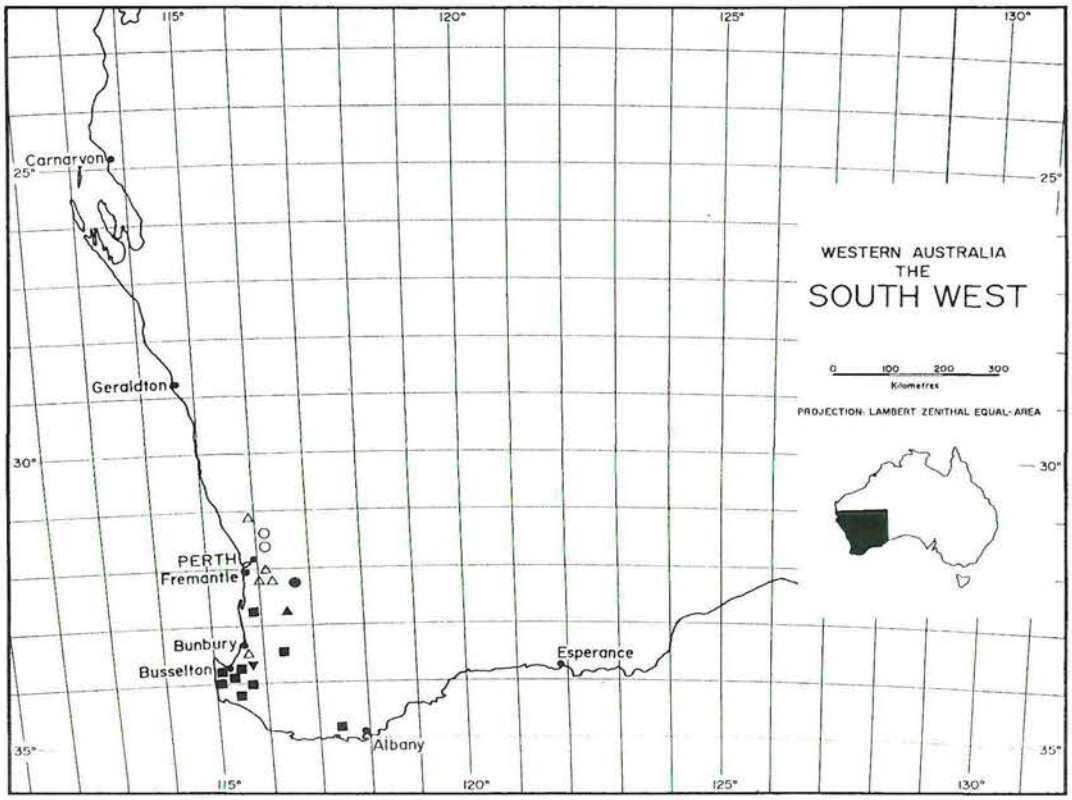

Figure 2. Distribution of *Hibbertia glomerata* subsp. *glomerata* ■; *Hibbertia glomerata* subsp. *darlingensis* △; *Hibbertia glomerata* subsp. *gingincusis* + ; *Hibbertia glomerata* subsp. *wandoo* ● ; intermediate variant with stamen bundles fused only basally ▼ and intermediate variant with free stamens ▲.

N, E of Brand Highway, S of Wannamal West Rd, N of Gingin, 16 Dec. 1992, *E.A. Griffin* 8482; Kalamunda, 19 km E of Perth, 7 Aug. 1985, *R. & M. Hamilton* 144 (duplicate MEL *n.v.*); Armadale Settlers Common, off Carradine Rd, to E of 4WD track (Plot -ARSC03), 14 Oct. 1996, *A. Markey* 359; 24 miles [39 km] from Perth along Albany Highway, 30 Sep. 1968, *M.E. Phillips* WA/68 1900 (duplicate CBG *n.v.*); Mills Rd, Gosnells (top of scarp), Sep. 1971, *B.A. Rockel* 10; Gooseberry Hill, 8 Sep. 1957, *R.D. Royce* 5741; 5 km NE of Armadale on Churchman Brook Rd, 1 Sep. 1974, *G.L. Stebbins & A. Weston* A 36; Albany Highway, *c.* 8 km from junction with South West Highway, near road train assembly area, 26 Sep. 1983, *J.R. Wheeler* 2195.

Distribution. Western Australia, IBRA regions (Thackway & Cresswell 1995) of Swan Coastal Plain and Jarrah Forest. Recorded from the Darling Scarp mainly near Perth but extending south to Jarrahdale, with a disjunct population between Capel and Donnybrook and a single collection north of Gingin. (Figure 2)

Habitat. Recorded from forest, woodland or roadside verges on lateritic soils.

Flowering period. Flowers mostly August to October, but recorded as early as June.

Conservation status. Not believed to be under any threat.

Etymology. Named after the Darling Range where this subspecies occurs.

Notes. Previously known by the informal name *Hibbertia* sp. Darling Range (*R.D. Royce* 5741). *Hibbertia glomerata* subsp. *darlingensis* differs from subsp. *glomerata* and subsp. *wandoo* in having the constant number of 11 stamens, 9 of which are fused into 3 fascicles. Its slightly longer anthers and the uniformity of its leaves which are all oblong to oblong-elliptic, separate it from subsp. *glomerata*. Apart from the northern outlier (*E.A. Griffin* 8482) which occurs on an upland plain on sandy gravel, this subspecies is restricted to lateritic soils of the Darling Scarp and western part of the Darling Range and is not known to occur in association with either of the other subspecies. It differs from *H. glomerata* subsp. *ginginensis* in its uniform oblong to oblong-elliptic leaves and from subsp. *wandoo* in leaf shape and sepals.

Two specimens (*R. Davis* 131, *R. Davis* 4354) from the southern limits of the Darling Range between Capel and Donnybrook, with narrowly oblong to obcuneate leaves and small flowers, may be a southern extension of subsp. *darlingensis*, but with their stamens fused only basally into fascicles. Three collections (*D. Halford* 80724, *J.R. Wheeler* 2206, *J.R. Wheeler* 2208) from near Boddington have foliage similar to this subspecies but apparently have free stamens. The status of these latter three specimens, which are probably all from a single population, is uncertain. (Figure 2)

Hibbertia glomerata subsp. **ginginensis** J.R. Wheeler, *subsp. nov.*

Hibbertiae glomeratae subsp. *glomeratae* similis sed 9 staminum in fasciculos 3 separatos conjunctis differt; a subsp. *darlingensi* foliis floralis latioribus, ovatis usque ellipticis differt.

Typus: Mooliabeenee Rd, 14.9 km from Gingin towards Bindoon, 31°21'S, 116°05'E, Western Australia, 5 September 1982, *J.R. Wheeler* 2035 (*holo:* PERTH 03072959; *iso:* AD, CANB, K).

Shrub erect, to 0.5 m high. *Leaves* often grey or glaucous, sometimes dimorphic; floral leaves ovate to elliptic, 3.5–10 mm long, 2.5–6.5 mm wide, occasionally with a few hairs towards the base of the upper surface, the apex often somewhat recurved with a minute blunt apiculum, the margin usually entire or sometimes very slightly undulate and minutely crenulate, sometimes minutely ciliolate towards the base; leaves basal to the flowering shoots sometimes longer, up to 22 mm long, often caducous or apparently absent. *Bracts* often minutely ciliolate. *Sepals* 4–6 mm long, all more or less equal in length, all obtuse. *Petals* 5–8 mm long. *Stamens* 11, 9 of them distinctly fused for more than half their length into 3 fascicles each of 3 stamens, the remaining 2 single stamens free; filament 1.5–2 mm long; anther usually 1.5–2 mm long. (Figure 1H,I)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: E side of Great Northern Highway at 36 mile peg [23 km S of Bindoon], *Anon*; 15.6 km from Gingin towards Bindoon (at Moora–Mogumber turnoff), 28 Sep. 1968, *E.M. Canning* WA/68 3571 (duplicates CBG *n.v.*); 15.6 km from Gingin towards Bindoon (at Moora–Mogumber turnoff), 28 Sep. 1968, *E.M. Canning* WA/68 3575 (duplicates CANB, CBG *n.v.*); 15 km E of Gingin, 14 Sep. 1995, *R. Davis* 90; Chittering–Muchea road, 14 Aug. 1983, *F.W. Phillips s.n.*; 16 km E of Gingin along Mooliabeenee Rd, 28 July 1983, *J.R. Wheeler* 2047.

Distribution. Western Australia, IBRA region (Thackway & Cresswell 1995) of Swan Coastal Plain. Recorded only from the Gingin area north of Perth. (Figure 2)

Habitat. Recorded from forest and woodland on laterite, clay-lateritic soil and sandy soil.

Flowering period. Flowers recorded July to September.

Conservation status. Conservation Codes for Western Australia Flora: Priority One. Fairly restricted, recorded mainly along roadsides north and east of Gingin.

Etymology. The name *ginginensis* refers to the Gingin area in which this subspecies occurs.

Notes. *Hibbertia glomerata* subsp. *ginginensis* differs from subsp. *glomerata* in staminal characters, from subsp. *darlingensis* in its leaf shape and from subsp. *wandoo* in both leaf shape and staminal characters (see key). It is well separated geographically from subsp. *glomerata* and subsp. *wandoo* and occurs north of the main range of subsp. *darlingensis* and to the south-east of the single northern outlier of the latter.

Hibbertia glomerata subsp. **wandoo** J.R. Wheeler, *subsp. nov.*

Hibbertiae glomeratae subsp. *glomeratae* affinis sed foliis aequabiliter, anguste obovatis, et sepalis apiculatis inaequalibus extimis brevioribus differt.

Typus: Wandoo Conservation Park, 5.9 km east of Dobaderry Rd on Dale West Rd and 3 km south-south-west on track along eastern boundary of forest block, Beverley, Western Australia, 32°16'S, 116°40E, 22 February 2000, *F. Hort* 944 (*holo:* PERTH 05604591; *iso:* AD, CANB, K, MEL, NSW).

Shrub erect, much-branched, to 0.6 m high. *Leaves* somewhat glaucous, narrowly obovate and very gradually tapered to the base, 4–11 mm long, 1–2 mm wide, flat, glabrous; apex obtuse, sometimes minutely apiculate, rarely slightly emarginate. *Bracts* often very inconspicuous, ciliolate. *Sepals* unequal in length, obtuse and shortly but distinctly apiculate; outer sepals 3–4 mm long, *c.* 1.5 mm wide; inner sepals 4–6 mm long, 2.5–3.5 mm wide. *Stamens* 10–12 in 3 groups, the filaments free or less commonly irregularly fused or very shortly fused basally; filament 1–2 mm long; anther 1–2 mm long.

Other specimens examined (all PERTH). WESTERN AUSTRALIA: Dobaderry Rd, 1.7 km N of Dale West Rd intersection, 8 Oct. 1997, *R. Davis* 4245; Wandoo Conservation Park, Dale West Rd, Beverley, 5 Aug. 1999, *F. Hort* 530; Wandoo Conservation Park, Dale West Rd, Beverley, 28 Apr. 1999, *J.& F. Hort* 455; Wandoo Conservation Park, Dale West Rd, Beverley, 28 Apr. 1999, *J.& F. Hort* 456; Boyagarring Nature Reserve, 0.7 km S of NW corner on Pike Rd, 9 Jan. 1999, *L. Sage, F. Hort & J. Hort* LWS 1461; Edge of Wandoo Conservation Park, Dale West Rd, 6.6 km W of Beverley–Westdale road, Shire of Beverley, 9 Oct. 2001, *J.R. Wheeler* 4126; Dobaderry Rd, 1.5 km N of Dale West Rd, Shire of Beverley, 9 Oct. 2001, *J.R. Wheeler* 4127; Dobaderry Rd, 1.5 km N of Dale West Rd, Shire of Beverley, 9 Oct. 2001, *J.R. Wheeler* 4128.

Distribution. Western Australia, IBRA region (Thackway & Cresswell 1995) of Jarrah Forest, restricted to an area south west of Beverley to Boyagarring Hill. (Figure 2)

Habitat. Recorded from lateritic soils in Wandoo woodland and from pockets of Jarrah-Marri within Wandoo woodland.

Phenology. Flowers recorded February, April, August and October; fruits recorded for January.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Restricted in distribution but not considered to be under immediate threat as it has been recorded as "plentiful" in a conservation park, although its response to attack by *Phytophthora* has not been documented.

Etymology. Named after the habitat in which this subspecies is commonly found, Wandoo woodland.

Notes. Previously known by the informal name *Hibbertia* sp. Wandoo (*J. & F. Hort* 456). This subspecies differs from all other subspecies of *H. glomerata* in its narrowly obovate leaves, which are more conspicuously rounded at the apex and gradually tapered to the base. It differs also in its shortly but distinctly apiculate sepals, of which the outermost sepals are the shortest. Subsp. *wandoo* shares with subsp. *glomerata* the character of mostly free stamens, although some filaments are occasionally irregularly fused or fused very shortly into fascicles. However it differs from subsp. *glomerata* in the uniformity of its leaves (absence of different basal leaves) as well as in its leaf shape and sepal characters. Although like subsp. *darlingensis*, this subspecies occurs in the Darling Range, its occurrence is much further east than is known for subsp. *darlingensis*.

Discussion

The differences between these taxa are insufficient for separation at the species level, particularly with the presence of intermediate collections which remain of uncertain status (see notes under subsp. *darlingensis*). Despite some overlap in the overall geographic ranges of the taxa, there are no records of any pair of them occurring together. There may be some edaphic differences between subspecies. Both subsp. *darlingensis* and subsp. *wandoo* occur on lateritic soils whereas subsp. *glomerata* usually is found on sandy soils. Subsp. *ginginensis* is known from both lateritic and sandy soils but appears to be geographically separated from the other two subspecies. In view of the degree of the differences between the taxa and the complex inter-relationship between them it is considered best to differentiate them at the subspecific level.

Acknowledgements

I should like to thank the Director and staff of the Western Australian Herbarium for access to the state collection and also the directors and staff of K, LD and MEL for allowing me to borrow the type material of *Hibbertia glomerata*. Thanks to Kath Trafalski for the fine illustration and to Paul Wilson for translating the brief Latin diagnoses. Thanks also to Leigh Sage who first brought subsp. *wandoo* to my attention.

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Notes and new taxa in the Australian genus *Myriocephalus* (Asteraceae: Gnaphalieae)

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Abstract

Wilson, Paul G. Notes and new taxa in the Australian genus *Myriocephalus* (Asteraceae: Gnaphalieae). *Nuytsia* 14(3): 437–444 (2002). Three new species of *Myriocephalus* Benth. are described: *M. biflorus* Paul G. Wilson, *M. scalpellus* Paul G. Wilson and *M. squamatus* Paul G. Wilson. One new combination, *Myriocephalus oldfieldii* (F. Muell.) Paul G. Wilson, is made and the name lectotypified, while the difference between this taxon and the superficially similar *M. nudus* A. Gray is clarified. A description and illustration are provided for *M. nudus*, which may be extinct as it has not been collected since the mid 19th century.

Introduction

The genus *Myriocephalus* Benth. (Asteraceae: Gnaphalieae), erected by Bentham (1837), was based solely on a collection of *M. appendiculatus* Benth., a species in which a dense compound head is surrounded by a general involucre made up of prominent bracts. Bentham (1867) later expanded his concept of the genus to include other species of the subtribe Angianthinae Benth., in which this general form of the inflorescence is apparent. However, as has been shown by Short *et al.* (1989) and Short (1993, 2000), the circumscription adopted by Bentham is too simplistic and produces an unnatural assemblage of taxa, for which reason Short proposed the transfer of several species to other genera. His circumscription of *Myriocephalus* is accepted in this paper.

During the preparation of a treatment of the genus for the "Flora of Australia" it became evident that the current delineation of some species of *Myriocephalus* was too broad and that this had obscured the presence of other taxa. Three of these taxa are here recognised as new species while a fourth corresponds to the taxon described by Mueller (1863) under the name *Lamprochlaena oldfieldii*.

Taxonomy

Size and distribution of *Myriocephalus*

Of the 14 species currently recognised in *Myriocephalus*, ten are endemic to Western Australia, one is common to Western Australia, South Australia and the Northern Territory, while the other three

are entirely extra-Western Australian. Species occurring only in eastern Australia are *M. pluriflorus* (J. Black) D. Cooke, *M. rhizocephalus* (DC.) Benth. and *M. squamatus*. Western Australian species that are not mentioned except for their inclusion in the key are *M. gascoynensis* P.S. Short, *M. helichrysoides* A. Gray, *M. occidentalis* (F. Muell.) P.S. Short, *M. pygmaeus* (A. Gray) P.S. Short, *M. rudallii* (F. Muell.) Benth. and *M. walcottii* P.S. Short.

Key to species of *Myriocephalus*

Notes. Abbreviations used in this key for the States and Territories of Australia are: NSW – New South Wales, NT – Northern Territory, Qld – Queensland, SA – South Australia, Vic. – Victoria and WA – Western Australia.

1. Corolla 5-lobed
 2. Bracts of general involucre with milk-white tips
  3. Plant glabrous; leaves linear, 2–4 cm long, with rounded apex. (South-west WA) ..... **M. helichrysoides**
  3: Plant variably woolly; leaves linear, 1–3 cm long, acute to acuminate
   4. Cypsela narrowly cylindrical, without a narrow sterile base; pappus absent. (South-west WA) ..... **M. appendiculatus**
   4: Cypsela narrowly top-shaped at base; pappus absent, or a scale, or of 1–3 bristles.
    5. Pappus of 1–3 bristles or absent. (Inland WA & SA, southern NT) ..... **M. rudallii**
    5: Pappus a broad scale. (Central and north-west SA) ..... **M. squamatus**
 2: Bracts of general involucre with hyaline, pale fawn, straw-coloured, or dirty white tips
  6. Stem simple, erect, not branched; plant glandular puberulous and cottony; pappus absent. (South-west WA) ..... **M. nudus**
  6: Plant branched, usually spreading from base, cottony or woolly but without glandular hairs; pappus absent or present.
   7. Cypsela narrowly cylindrical or narrowly ellipsoid (sometimes with a very short turbinate base)
    8. Bracts of general involucre with a pale fawn, or straw-coloured, or very pale dirty white hyaline apex; pappus absent or of 1(2) slender bristles
     9. Capitula with 4 florets. (Widespread in eastern WA) ..... **M. oldfieldii**
     9: Capitula with 2 florets. (South-east WA) ..... **M. biflorus**
    8: Bracts of general involucre with a glossy transparent hyalineapex; pappus a single firm bristle
     10. Florets 5 per capitulum; twin-hairs on cypsela minutely bidentate. (Carnarvon district, WA) ..... **M. gascoynensis**
     10: Florets 4 per capitulum; twin-hairs on cypsela with an anchor-shaped tip. (Pilbara region, WA) ..... **M. scapellus**
   7: Cypsela narrowly top-shaped with a narrow sterile base
    11. Pappus absent. (Murchison district, WA) ..... **M. walcottii**
    11: Pappus a short erose scale. (North-western SA) ..... **M. squamatus**
1: Corolla 3- or 4-lobed
 12. Capitular bracts noticeably cartilaginous towards base
  13. Capitula mostly 1-flowered; achenial hairs slender and minutely bidentate. (SA, NSW, & Vic.) ..... **M. rhizocephalus**

13: Capitula mostly 2- or 3-flowered; achenial hairs sub-clavate or rounded. (Southern WA) ..... **M. occidentalis**
12: Capitular bracts not cartilaginous towards base
14. Pappus bristle absent or solitary and less than half length of corolla. (Central and southern WA) ..... **M. pygmaeus**
14: Pappus bristles 1 or 2, ± equal to corolla. (SA, NSW, & Qld) ..... **M. pluriflorus**

Myriocephalus biflorus Paul G. Wilson, *sp. nov.*

Herba glabrescentes multicaulis ad 15 cm alta. Folia glanduloso punctata, inferiora linearia vel anguste oblonga ad 3 cm longa, superiora anguste oblonga, 5–10 mm longa, basi auriculata vel semi-amplexicaulia. Capitula-composita hemisphaerica, 10–15 diam. Involucrum-generale multiseriatum; bracteae numerosae anguste oblongae, c. 3 mm longae, hyalinae, sparse gossypinae. Capitula numerosa; bracteae capituli 3, anguste oblongo-obovatae, apicibus rotundatis, hyalinis. Flosculi 2; corolla anguste turbinata, c. 1.2 mm longa, breviter 5-lobata. Achenium cylindricum basi rotundatum, modice hirsutum pilis minute bidentatis c. 0.1 mm longis. Pappus absens.

Typus: south of Mt Ragged, Cape Arid National Park, Western Australia, 5 December 1971, *R.D. Royce* 10159 (*holo:* PERTH 00528242).

Multistemmed *herb* to 15 cm high; stems slender, glabrous or with a few cotton-like hairs. *Leaves* glabrous or with a few cotton-like hairs, somewhat glandular punctate; lower leaves linear, to 3 cm long; upper leaves narrowly oblong, 5–10 mm long, sometimes broadened and auriculate or semi-amplexicaul at base, obtuse to rounded at apex. *Compound head* hemispherical, 10–15 mm diam. *General involucre* multiseriate; bracts numerous, narrowly oblong to obovate, obtuse, *c.* 3 mm long, hyaline, sparsely cottony, with linear stereome and colourless hyaline lamina. *Capitula* numerous; capitular bracts 3, narrowly oblong-obovate with rounded hyaline tips. *Florets* 2. *Corolla* turbinate above, *c.* 1.2 mm long, shortly 5-lobed, yellow. *Achene* cylindrical, rounded at base, truncate at apex, 1 mm long, moderately hirsute with slender straight very minutely bidentate twin hairs *c.* 0.1 mm long. *Pappus* absent.

Other specimen examined. WESTERN AUSTRALIA: 20 km W of Mt Ragged, *E. Wittwer* 1902 (PERTH).

Distribution and habitat. Only recorded from the Cape Arid National Park in the Roe and Eyre botanical Districts (Beard 1980), south-eastern Western Australia. Growing in red silty loam around granite rocks (*fide* Royce *in sched.*).

Flowering period. The two specimens examined were collected in flower in either November or December.

Etymology. The specific epithet is Latin for "two-flowered".

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. The two known collections were gathered in a large national park and it is therefore unlikely that the species is under threat.

Affinities. This species is clearly similar to *Myriocephalus oldfieldii, q.v.,* and differs most noticeably in having only two florets and three capitular bracts in each capitulum; in *M. oldfieldii* there are four florets and four bracts per capitulum.

Myriocephalus nudus A. Gray, *J. Bot. Kew Gard. Misc.* 3: 174 (1851). – *Hirnellia nuda* (A. Gray) Kuntze, Rev. Gen. Pl. 1: 346 (1891). *Type:* Swan River, Western Australia, *J. Drummond s.n.* (*syn:* K photograph seen); same locality, *J. Drummond* 53 (*syn*: K photograph seen).

Erect *herb*, minutely glandular-puberulous and sparsely cottony; stem simple, to 20 cm high. *Leaves* linear, broadened at base, 5–15 mm long; uppermost smaller with hyaline margins and tips. *Compound head* depressed globose, to 15 mm diam. *General involucre* multiseriate; bracts numerous, with narrowly oblong sparsely cottony claw and short pale brown rounded lamina, in all *c.* 3 mm long. *Capitula* numerous; capitular bracts 4, narrowly oblong-obovate with rounded hyaline tips and green linear stereome. *Florets* 4. *Corolla* tubular below, narrow-turbinate above, *c.* 2 mm long, shortly 5-lobed. *Achene* narrowly cylindrical, *c.* 1 mm long, very sparsely hirsute with slender anchor-tipped twin hairs, these absent from apex. *Pappus* absent. (Figure 1A–C)

Other specimens examined. WESTERN AUSTRALIA: Nov. Holl. aust. occ., [*c.* 1844], *J. Drummond* 388 (W); Swan River, *J. Drummond* 283 (W).

Distribution and habitat. Evidently once found in the Perth district of Western Australia, but not collected since about 1850. The few collections seen lack precise locality data and field notes but they appear to have been gathered from muddy situations and were presumably growing in winter wetlands.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. This species may be extinct, and urgent survey is required.

Affinities. Myriocephalus nudus has not been collected since the middle of the 19th century and no specimens are present in the Western Australian Herbarium. Because of this its identity has been misunderstood and the name has been applied to a plant here recognised as *M. oldfieldii*. *Myriocephalus nudus* differs most noticeably from the latter in having a glandular puberulous simple stem and in having achenes with anchor-tipped twin-hairs.

Myriocephalus oldfieldii (F. Muell.) Paul G. Wilson, *comb. nov.*

Lamprochlaena oldfieldii F. Muell., Fragm. 3: 157 (1863). – *Myriocephalus nudus* var. *oldfieldii* (F. Muell.) Benth., Fl. Austral. 3: 558 (1867). *Type citation:* "Ad flumen Murchison et sinum Champion Bay. Walcott et Oldfield". *Type:* Murchison River, Western Australia, *A. Oldfield* (*lecto:* MEL 542208, here designated). *Excluded syntypes:* Oolinyarra, Murchison River, Western Australia, *A. Oldfield* (K, photo seen); Champion Bay, Western Australia, *A. Oldfield* (K, photo seen).

Herb to 15 cm high, branching usually near base. *Leaves* linear below to oblong acuminate above, somewhat auriculate at base, often crinkled, 5–20 mm long, cottony. *Compound head* depressed globose, 6–20 mm diam. *General involucre* multiseriate; bracts narrowly oblong, *c.* 3 mm long, hyaline, cottony, with linear stereome and pale fawn hyaline lamina. *Capitula* numerous; capitular bracts 4, narrowly oblong-obovate with rounded hyaline tips. *Florets* 4. *Corolla* turbinate above, 1.5–2 mm long, shortly 5-lobed, yellow. *Achene* cylindrical, rounded or shortly turbinate at base, *c.* 1 mm long, glabrous or sparsely to densely hirsute with slender bidentate twin hairs to 0.2 mm long these longer and erect around apex of achene. *Pappus* absent or of 1 (rarely 2) slender scabrid or smooth bristle(s) ± equal to corolla. (Figure 1D–F)

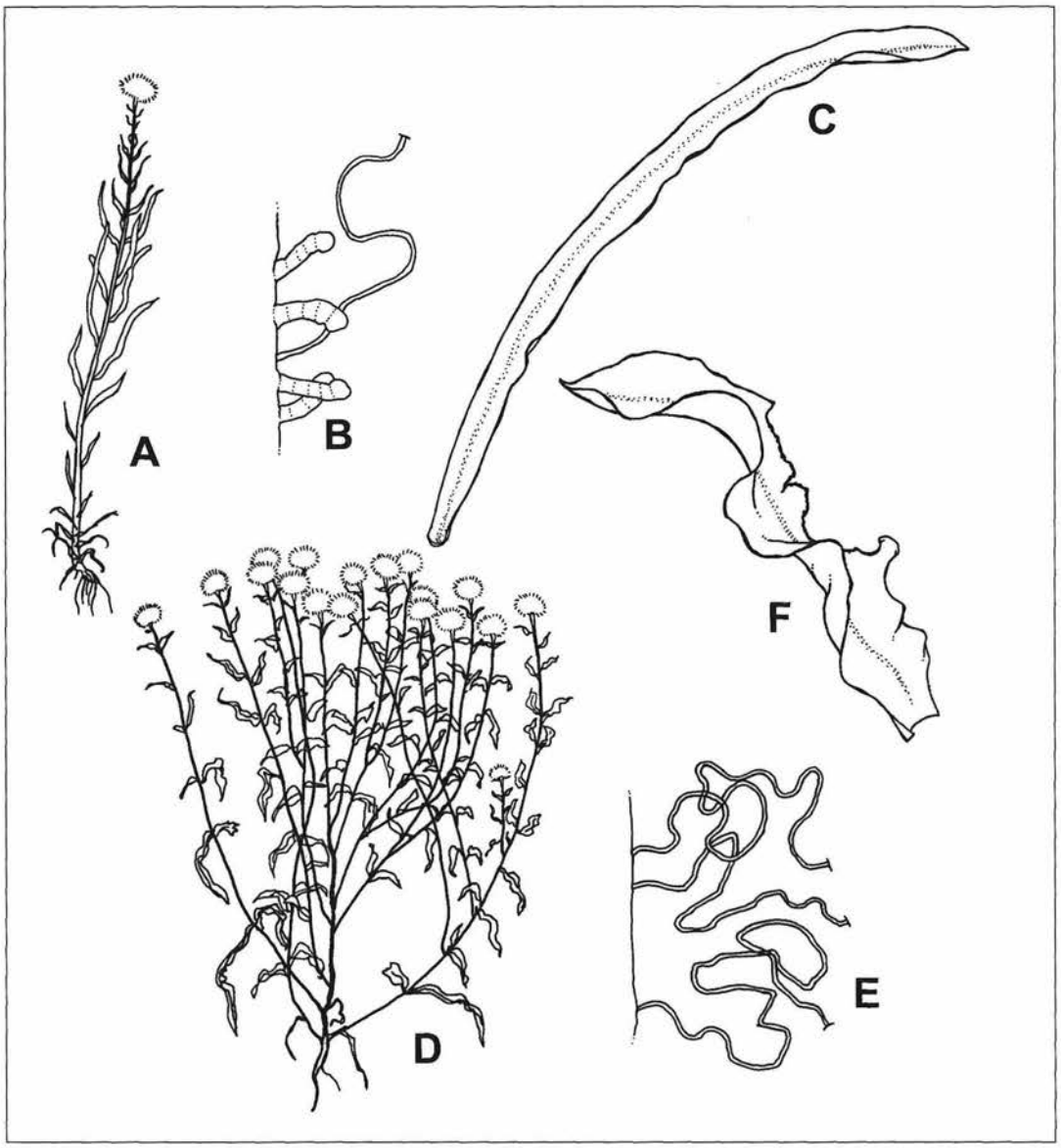

Figure 1. A–C. *Myriocephalus nudus*. A – habit (x0.35), B – hairs on stem (x200), C – leaf (x5); D–F. *Myriocephalus oldfieldii*. D – habit (x0.35), E – hairs on stem (x200), F – leaf (x5). Drawn by Annemarie Wilson from *J. Drummond* 388 (A–C) and *D. & B. Bellairs* 1118B (D–F).

Selected specimens examined. WESTERN AUSTRALIA: Galena Bridge, North West Coastal Highway, *D. & B. Bellairs* 1118B (PERTH); Jingemarra Station, *R.J. Cranfield* 6129 (PERTH); Rocky Pool, Gascoyne River, *K.F. Kenneally* 4658 (PERTH); 20 km W of Mt Ragged, *E. Wittwer* 1902 (PERTH).

Distribution and habitat. Widespread in Western Australia from the Moore River north to Onslow, east to Leonora, and south to Norseman. Usually found along creek beds or in seasonally wet clay pans.

Flowering period. This species has been collected in flower in all months except for March and presumably responds to local rainfall.

Conservation status. This species is widespread and is neither rare nor threatened.

Affinities. For comparison with *M. nudus* see under that species.

Notes. The name *M. oldfieldii*, as used here, includes a number of variants that differ in leaf morphology, in degree and type of achene pubescence, and in the presence or absence of a pappus. However, these morphological characters appear to be rather randomly distributed which creates difficulties when attempting to circumscribe infraspecific taxa. The lectotype is a variant with a glabrous epappose achene.

Myriocephalus scalpellus Paul G. Wilson, *sp. nov.*

Herba multicaulis ad 10 cm alta. Rami dense gossypini. Folia inferiora linearia, superiora oblonga 5–20 mm longa, modice gossypina. Capitula-composita depresso-globosa, ad 20 mm diam. Involucrum-generale multiseriatum; bracteae oblongae ad obovatae, *c.* 3 mm longae, hyalinae, sparse gossypinae. Capitula numerosa; bracteae capituli 4, anguste oblongo-obovatae, apicibus rotundatis, hyalinis. Flosculi 4; corolla anguste turbinata, 1.5–2 mm longa, breviter 5-lobata. Achenium anguste cylindricum, basi brevi sterili turbinata, ad 1.8 mm longum, sparse hirsutum, pilis firmis 0.3 mm longis apice ancora-morphis. Pappi setae 1 (vel 2 ad basim conjunctae) lineari-lanceolatae, solidae, basi latiores, cartilaginei.

Typus: east of Roy Hill [precise locality withheld], Western Australia, 4 September 1977, *P.S. Short* 499 (*holo:* AD 97743151; *iso:* PERTH 05496683).

Herb to 10 cm high, branching near base; branches densely cottony. *Leaves* linear below to oblong above, somewhat auriculate at base and crinkled, 5–20 mm long, moderately cottony. *Compound head* depressed globose, to 20 mm diam. *General involucre* multiseriate; bracts oblong to obovate, *c.* 3 mm long, hyaline, sparsely cottony, with linear stereome and hyaline obtuse to rounded tip. *Capitula* numerous; capitular bracts 4, narrowly oblong-obovate with rounded hyaline tips. *Florets* 4. *Corolla* turbinate above, 1.5–2 mm long, shortly 5-lobed, yellow. *Achene* narrowly cylindrical, shortly turbinate at base, to 1.8 mm long, sparsely hirsute with slender firm twin hairs *c.* 0.3 mm long that have anchor-shaped tips. *Pappus* of 1 firm bristle (or 2 united at base), linear-lanceolate, sparsely scabrid, slightly clawed at apex and broadening at base, ± equal to corolla.

Distribution and habitat. Only known from the type locality, which is east of Roy Hill in the Pilbara region of Western Australia, growing in a clay depression on a flood plain.

Flowering period. The only collection seen was collected in flower in early September.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Although this species is only known from one locality, the area involved is not under threat.

Etymology. The specific epithet *scalpellus* is Latin for lancet and refers to the appearance of the pappus bristle.

Notes. Evidently closely related to *M. oldfieldii* but differs from that species in having a firm lanceolate pappus bristle and long rigid achenial twin-hairs that are anchor-shaped at their tip.

Myriocephalus squamatus Paul G. Wilson, *sp. nov.*

Herba gossypina multicaulis ad 10 cm alta. Folia integra linearia vel anguste oblonga 10–20 mm longa, glanduloso punctata. Capitula-composita depresso-globosa, 10–15 diam. Involucrum-generale multiseriatum; bracteae anguste oblongae, c. 3 mm longae, hyalinae, gossypinae, lamina pallide fusca vel sordide alba. Capitula numerosa; bracteae capituli 4, anguste oblongae, apicibus rotundatis, hyalinis. Flosculi 4; corolla anguste turbinata, c. 2 mm longa, breviter 5-lobata. Achenium anguste cylindricum basi brevi sterili turbinata. Pappus squamam crustaceam erosam 0.1–0.2 mm longam.

Typus: between Oodnadatta and William Creek, on the Oodnadatta track, South Australia, 1 November 1989, *B. Nordenstam & A. Anderberg* 976 (*holo:* AD 99149270; *iso:* MEL 1593939, S *n.v.*).

Sparsely cottony *herb* to 10 cm high, branching at base. *Leaves* alternate, entire, linear to narrowly oblong or narrowly obovate, narrowed at base, 10–20 mm long, gland-dotted. *Compound heads* depressed globose, 10–15 mm diam., subtended by several leaves. *General involucre* equal to head, multiseriate; bracts narrowly oblong, *c.* 3 mm long, hyaline, cottony, with pale brown or dirty white rounded lamina *c.* 0.5 mm long. *Capitula* numerous; capitular bracts 4, narrowly oblong-cuneate, *c.* 3 mm long, with rounded hyaline tips. *Florets* 4. *Corolla* narrowly cylindrical below, narrowly turbinate above, *c.* 2 mm long, shortly 5-lobed, yellow. *Achene* narrowly cylindrical with short sterile turbinate base, 1–1.5 mm long, very sparsely hirsute with slender bidentate twin hairs. *Pappus* a broad erose scale 0.1–0.2 mm long. (Figure 2)

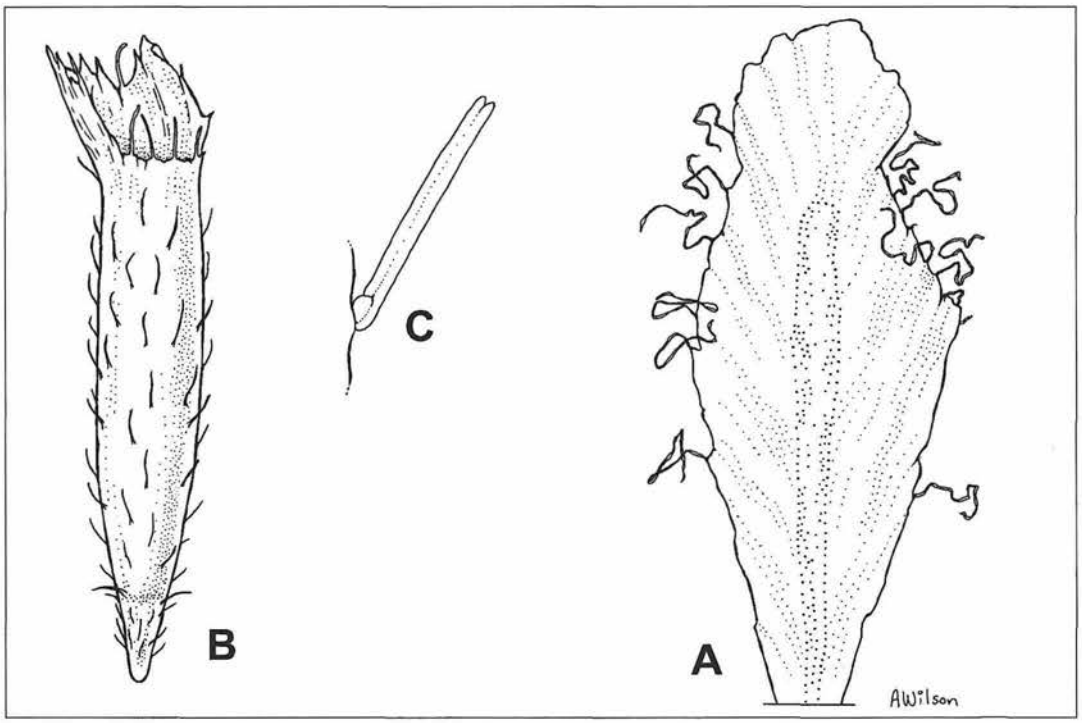

Figure 2. *Myriocephalus squamatus.* A – involucral bract (x30), B – achene (x70), C – achenial hair (x350). Drawn by Annemarie Wilson from *B. Nordenstam & A. Anderberg* 976.

Other specimens examined. SOUTH AUSTRALIA: 30 km S of Mt Willoughby homestead, *F.J. Badman* 1075 (AD); 30 km W of William Creek, *F.J. Badman* 1280 (AD); Stuart Range, *C. French* (MEL); Evelyn Downs Station, 25 Oct. 1955, *E.H. Ising* (AD): 5 km S of Cadney homestead, *B. Nordenstam & A. Anderberg* 881 (AD); Lagoon Waterhole, *A.C. Robinson* 886 (AD); Commonwealth Hill Station, *D.E. Symon* 3381A (AD); Durkin Out Station, *J.Z. Weber* 2828 (AD).

Distribution and habitat. Found in north-western South Australia, growing on clay pans and mulga flats.

Flowering period. Material in flower has been collected from September to November.

Conservation status. Evidently a common and widespread species that is not endangered.

Etymology. The specific epithet *squamatus* refers to the pappus which takes the form of a *squama* or scale.

Affinities. Myriocephalus squamatus is most similar to *M. rudallii* Benth., with which it has been confused; it differs from the latter in having a pale brown or dirty white (not milky white) apex to the bracts of the general involucre and in having a short scale-like pappus.

Acknowledgements

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Notes on the genus *Cratystylis* (Asteraceae), including one new species

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Abstract

Wilson, Paul G. & Albrecht, D.E. Notes on the genus *Cratystylis* (Asteraceae), including one new species. *Nuytsia* 14(3): 445–452 (2002). A review of the genus *Cratystylis* S. Moore is presented. One new species, *C. centralis* Albr. & Paul G. Wilson, from the Northern Territory is described, a putative hybrid, *C. conocephala* x *C. microphylla*, is noted, and a key to all taxa is provided. The results of an examination of the type material associated with the names *Cratystylis microphylla* S. Moore and *Stera microphylla* Ewart & B. Rees are detailed, and the former name lectotypified. A lectotype is also chosen for *C. conocephala* (F. Muell.) S. Moore.

Introduction

The tribal position of the Australian genus *Cratystylis* S. Moore within the Asteraceae is unclear but a placement in the subfamily Cichorioideae was suggested by Anderberg *et al.* (1992), who provided a detailed description of its morphology. They indicated that the apparent absence of a close affinity with any of the recognized tribes of Asteraceae suggests that it is a very isolated member of the subfamily.

Cratystylis is a small genus of shrubby dioecious plants, with three named species in Western Australia, one of which extends eastwards across southern Australia. The preparation of an account for the "Flora of Australia" has led us to examine the material in Australian herbaria and in particular to study and re-collect a *Cratystylis* plant that is found in the Northern Territory. The presence in the Northern Territory of a species of *Cratystylis* has been recognised for some years; it was mentioned by Jessop (1981) who suggested that it was an undescribed species closely related to *C. conocephala*, and listed by Dunlop *et al.* (1995) and by Albrecht *et al.* (1997) who referred to it as *Cratystylis* A36062 Glen Helen. A number of collections of this taxon from several localities in the Northern Territory have now been made and it is clear that it differs from the three named species of *Cratystylis*.

In the process of examining herbarium material of the genus it became apparent that specimens identified as *C. microphylla* could be separated into two groups, each with a different type of foliage and capitulum. This observation led to an investigation into the applications of the names *C. microphylla* S. Moore and *Stera microphylla* Ewart & B. Rees, the epithets of both being derived from the same manuscript name of F. Mueller & R. Tate.

The names *Cratystylis microphylla* and *Stera microphylla*

In November (and possibly December) 1891 Richard Helms, the botanist on the Elder Exploring Expedition 1891–1892, made collections of a plant at Lake Lefroy, Western Australia, that was subsequently given the name *Pluchea conocephala* var. *microphylla* by Mueller & Tate (1896), but it was not then formally described. The collections bearing this manuscript name found their way to a number of herbaria including the Royal Botanic Gardens, Kew (K) and the National Herbarium of Victoria (MEL). The specimens at Kew were described by Spencer Moore (1905) under the name *Cratystylis microphylla*, while those in the National Herbarium of Victoria were described by Ewart & Rees (1912) under the name *Stera microphylla*. According to collections seen in BM, K, MEL and PERTH, Richard Helms collected *C. microphylla* at Lake Lefroy on 7 November 1891 and "Near Lake Lefroy" on "12. 91" The latter date, which is written on a printed label attached to a PERTH specimen in pencil, has been interpreted as being December 1891. However, according to a map which accompanied the expedition (Lindsay 1893) and according to a résumé of the itinerary of the expedition by C.M. Eardley (Anon. 1950), all the relevant collections must have been made in November since by December the party was west of Southern Cross which is over 180 km west of Lake Lefroy and well beyond the otherwise recorded distribution of *C. microphylla*.

The description of *C. microphylla* by Spencer Moore refers to the leaves as oblong, obtuse, with a prominent dorsal rib, 1.5–2.5 mm long, appressed to the stem, and refers to the number of florets as 1 or 2. This description agrees with specimens collected by Helms 'near Lake Lefroy' which are mounted on sheet PERTH 01044044, and agrees with one of the two specimens mounted on sheet MEL 249444 that were collected by Helms at Lake Lefroy on 7 November 1891, and with one specimen (the lectotype, see below) of the two mounted on the type sheet, herb. K, except that the number of florets per capitulum appears to be strictly 1 and the leaves are only 1–1.5 mm long. These specimens match those of other collections that come from an area which stretches from near Comet Vale (about 100 km north of Kalgoorlie) south to Norseman. The pappus bristles of these specimens are minutely denticulate or smooth towards the apex.

The description and accompanying illustration of *Stera microphylla* by Ewart & Rees (1912) indicate that the leaves of this taxon are slightly spreading, 2–3 mm long, obovate and obtuse, covered with woolly hairs, and that the capitula are two-flowered. This description agrees with the specimen on sheet MEL 249445 collected by Helms at Lake Lefroy on 7 November 1891, with a duplicate of this collection at BM, with one of the two specimens on sheet MEL 249444, and with the left-hand specimen (excluded syntype) on the type sheet of *Cratystylis microphylla* S. Moore in herb. K. The first of these sheets has been labelled (? by Ewart) '*Stera microphylla* Ewart & Rees' and is accepted as being the holotype of that name.

These specimens that agree with the description and presumed holotype of *Stera microphylla* are intermediate in morphology between the lectotype of *Cratystylis microphylla* and the variant of *C. conocephala* found in the Lake Lefroy–Kalgoorlie area. It is assumed to be a hybrid between these two species. One collector (Arthur Weston, pers. comm.) indicated that the intermediate plant and the putative parents were found growing in the same locality.

It is probable that Moore derived his description of *Cratystylis microphylla* principally from the right-hand specimen on the type sheet in herb. K, which matches the sheet PERTH 01044044 cited above, but he also saw a specimen that matched the material on MEL 249225 (the type of *Stera microphylla*) which is 2-flowered and for this reason described the number of florets as one or two and the leaf size as 1.5–2.5 mm long. *Cratystylis microphylla*, as lectotypified below, corresponds to the plant with 1-flowered capitula and with smaller oblong resinous leaves that are appressed to the stem.

Key to species of *Cratystylis*

1 Plant appressed-villous with medifixed hairs; branchlets spinescent; anthers with long (c. 0.5 mm) tails ..... **C. subspinescens**
1: Plant tomentose, hairs basifixed; branchlets not spinescent; anthers with very short tails to 0.05 mm, or these absent
2 Glandular hairs absent; leaves obovate, spreading, 5–10 mm long; florets (4)5(6) ..... **C. conocephala**
2: Globular sessile glandular hairs obvious; leaves from subterete and appressed to spathulate and spreading; florets 1–4
3 Leaves 1–1.5 mm long, oblong, closely appressed to branch, resinous; capitula 1-flowered ..... **C. microphylla**
3: Leaves 2–6 mm long, elliptic to obovate, not closely appressed to branch, tomentose; capitula 2–4-flowered
4 Capitula 2-flowered; occurring in Western Australia .. ?**C. conocephala** × **C. microphylla**
4: Capitula 3- or 4-flowered; occurring in Northern Territory ..... **C. centralis**

Descriptions

Cratystylis centralis Albr. & Paul G. Wilson, *sp. nov.*

Folia anguste obovata vel spathulata, 3–6 mm longa, patentia, cineraceo lanata et glandibus minutis globulosis ornata. Capitulum anguste turbinatum, c. 10 mm altum, 3 vel 4 florum. Anthera calcarata perbrevibus caudata.

Typus: 2 km west-north-west of Glen Helen, West MacDonnell National Park, Northern Territory, 16 October 1997, *M.J.A. Barritt* 3000 (*holo:* DNA (A95428); *iso:* PERTH 05538882).

Much branched, brittle, greyish *shrub* to 1 m high. *Leaves* spreading, fleshy, narrowly obovate to spathulate, 3–6 mm long, covered with small globular glands and a thin greyish woolly tomentum. *Capitula* solitary, terminal on branchlets, 3- or 4-flowered. *Involucre* narrowly turbinate, 7–10 mm long; involucral bracts cartilaginous, woolly ciliate, resinous and shortly tomentose towards the apex, outer ones ovate, *c.* 2 mm long, inner ones narrowly oblong, *c.* 8 mm long, eventually spreading. *Corolla* glabrous, white, tube narrowly cylindrical, *c.* 4.5 mm long; lobes erect, narrowly triangular, *c.* 2 mm long. *Anthers* calcarate and very shortly tailed. *Style arms* in male flower appressed, in female flower spreading, linear, 1–2 mm long, obtuse to acute. *Cypsela* narrowly cylindrical, *c.* 3 mm long, finely ribbed. *Pappus bristles* shortly plumose below, densely barbellate towards apex, *c.* 3/4 length of corolla. (Figure 1A–C)

Other specimens examined. NORTHERN TERRITORY: 4 km WSW of Mt Sonder, *D.E. Albrecht* 8845 (DNA, PERTH); Tylers Pass, 23°39'S, 132°40'E, *G. Griffin* 108 (DNA); Mt Peachy, 24°18'S, 133°52'E, *G. Griffin s.n.* (DNA); Mt Laughlan foothills, North Garden Station, 23°20'S, 134°25'E, *G. Griffin s.n.* (DNA); Waterhouse Range, 24°02'S, 133°28'E, *G. Griffin s.n.* (DNA); 8.4 km from Arltunga on Paddy's Plain, 23°28'S, 134°36'E, *M. Heywood* 1 (DNA); 4.25 km SSE of Top Well near Garden Homestead, 23°00'S, 134°08'E, *M. Heywood* 199 (DNA); Tylers Pass, *P.K. Latz* 10263 (DNA, MEL); Mt Riddock Station, 23°01'S, 134°32'E, *P.K. Latz* 3156 (DNA); Hermannsburg Station, 23°42'S, 132°21'E, *P.K. Latz* 6740 (DNA, AD, NSW, K); *c.* 4 km S of Alkara Bore, Mt Riddock Station, 22°35'S, 135°26'E, *B.W. Strong* 779 (DNA); 2 km W of Glen Helen, 23°40'S, 132°38'E, *B.G. Thomson* 3566 (DNA).

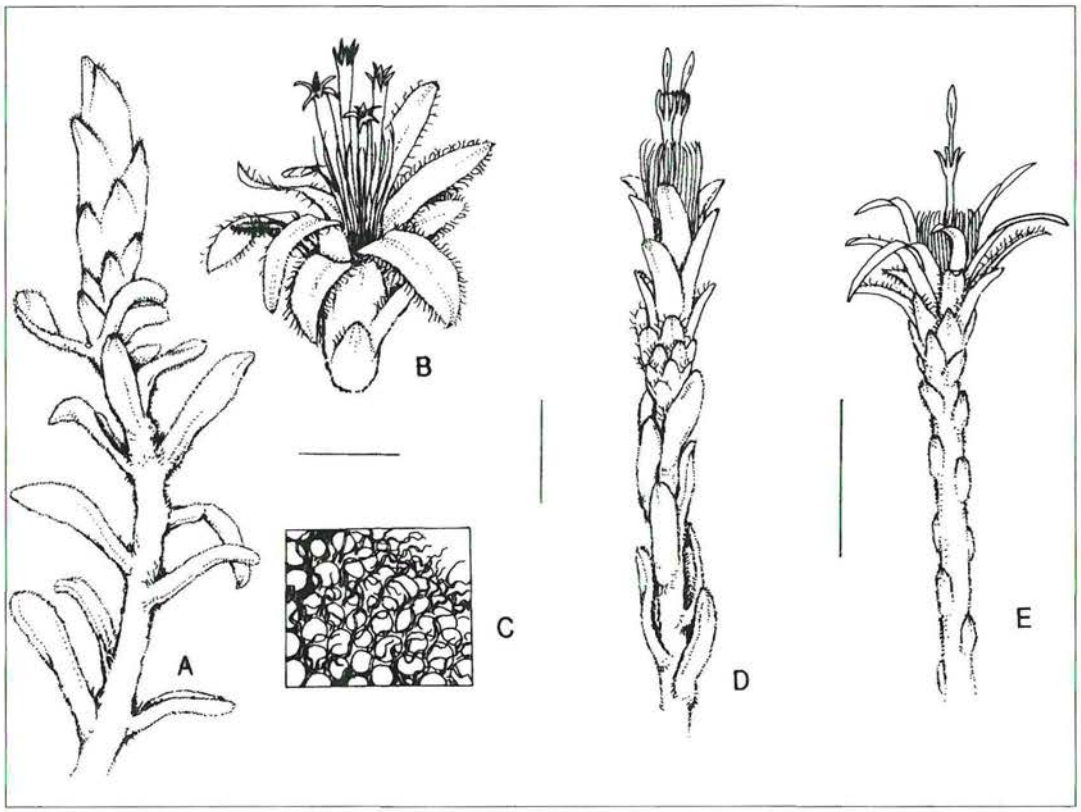

Figure 1. A–C. *Cratystylis centralis*, drawn from *B.W. Strong* 779 (DNA). A – flowering branch; B – male capitulum; C – leaf indumentum (x 100); D – ?*Cratystylis conocephala* x *C. microphylla*, flowering branch, male, drawn from *A. Chapman* 5/91 (PERTH); E – *Cratystylis microphylla*, flowering branch, male, drawn from *L.A. Craven* 7466 (PERTH). Scale bars all 0.5 mm.

Distribution. Northern Territory, where known from relatively few populations within a radius of *c.* 200 km of Alice Springs. (Figure 2)

Habitat. Confined to breakaway country and similar pallid eroding areas. Soils have been tested at only one site where they were found to have extremely elevated salinity levels and a ph of 7.5. Populations east of Alice Springs are typically found growing with *Eucalyptus thozetiana*, *Acacia georginae*, *Eremophila dalyana*, or *Ptilotus parvifolius*. To the west of Alice Springs associated species include *Ptilotus parvifolius*, *Sclerolaena* spp., and *Frankenia cordata*.

Flowering period. The peak flowering period is between August and November. Flowering outside this period appears to be uncommon with a single flowering specimen collected in April.

Conservation status. Albrecht *et al.* (1997) considered that a conservation code of 3RC is appropriate because there are few populations and most of these are small. It is poorly reserved with only two localised populations, each with fewer than 100 plants, known within the West Macdonnell National Park.

Etymology. The epithet is the Latin word for centre and alludes to the presence of this species in Central Australia.

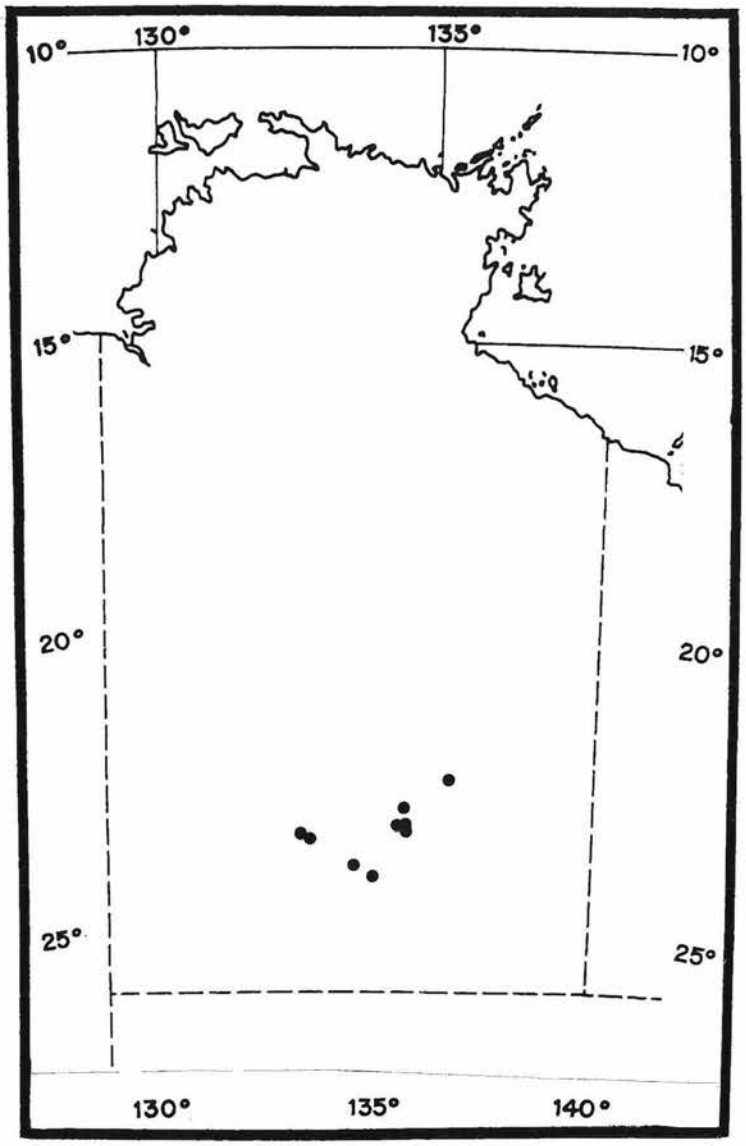

Figure 2. Distribution of *Cratystylis centralis*.

Notes. A vegetative collection (*R.J. Cranfield* 6854, PERTH) of a *Cratystylis* species from Barwidgee Station, *c.* 80 km south-east of Wiluna, Western Australia, has similar foliage to *C. centralis* but since it bears no flowers its precise taxonomic position cannot be determined.

Cratystylis centralis has a woolly indumentum and globular glands on the leaves, and there are 3 or 4 flowers per capitulum. In the possession of these characters and in leaf shape it is intermediate between *C. microphylla* and *C. conocephala*. It is treated as a distinct species because neither of the other two species is found in the Northern Territory while the former is restricted to a relatively small area north and south of Kalgoorlie. In addition *C. centralis* shows little morphological variability across its geographic range despite populations being separated by 100 km or more.

Cratystylis conocephala (F. Muell.) S. Moore, *J. Bot.* 43: 138 (1905). – *Eurybia conocephala* F. Muell., *Trans. & Proc. Vict. Inst. Advancem. Sci.* 36 (1855). – *Aster conocephala* (F. Muell.) F. Muell., Fragm. 5: 79 (1865). – *Olearia conocephala* (F. Muell.) Benth., Fl. Austral. 3: 480 (1867). – *Pluchea conocephala* (F. Muell.) F. Muell., *Bot. Centralbl.* 32: 150 (1887). – *Stera conocephala* (F. Muell.) Ewart & B. Rees, *Proc. Roy. Soc. Victoria* ser. 2, 24: 264 (1912). *Type:* Murray River, South Australia, October 1848, *F. Mueller* (*lecto:* MEL 248222, lectotype here designated).

Pteronia australiensis J. Hutchinson, *Biol. Meddel. Kongel. Danske Vidensk. Selsk.* 3: 131 (1921). *Type:* Kalgoorlie, Western Australia, 7 October 1914, *C.H. Ostenfeld* 858 (*iso:* PERTH 01044036).

Densely branched *shrub* to 1.5 m high. *Leaves* obovate, obtuse to rounded, cuneate at base, 5–10 mm long, leathery, woolly tomentose, not resinous. *Capitula* (4)5(6)-flowered. *Pappus bristles* shortly plumose.

Distribution. Occurs in south-eastern Western Australia, southern South Australia, far south-western New South Wales, and far north-western Victoria. In Western Australia the species extends from the Kalgoorlie–Ravensthorpe area eastwards.

Habitat. Usually found growing in mallee woodland on calcareous soil.

Note. According to Keighery (1984), in Western Australia female plants usually predominate in a population by about 6:1.

? Cratystylis conocephala (F. Muell.) S. Moore × **C. microphylla** S. Moore

Stera microphylla Ewart & B. Rees, *Proc. Roy. Soc. Victoria* ser. 2, 24: 264, t. 55 fig. b (1912). *Type:* Lake Lefroy, Western Australia, 7 November 1891, *R. Helms* (*holo:* MEL 249445; *iso:* BM).

[*Cratystylis microphylla* S. Moore, *J. Bot.* 43: 139 (1905), *p.p.*, as to left-hand specimen on type sheet in herb. K, not as to lectotype]

[*Pluchea conocephala* var. *microphylla* F. Muell. & Tate, *Trans. & Proc. Roy. Soc. South Australia* 16: 365 (1896) *p.p.*, *nom. nud.*]

Rounded *shrub* to 0.5 m high. *Leaves* elliptic to obovate, 2–4 mm long, erect to somewhat spreading, tomentose, with globular sessile glandular hairs. *Capitula* 2-flowered. *Pappus bristles* very shortly plumose to the apex. (Figure 1D)

Other specimens examined. WESTERN AUSTRALIA: 5 km E of Norseman, *P.G. Wilson* 6044 *bis* (PERTH); 30 km SSW of Coolgardie, *A. Chapman & G. Landwehr* 5/91 (PERTH); Three Mile Hill, Coolgardie, *J. Bale* 44 (PERTH).

Distribution. Found between Coolgardie and Norseman, Western Australia.

Notes. Specimens are intermediate in morphology between *C. microphylla* and *C. conocephala* and one botanist has noted (see above) that the putative parents were observed at the same site as the presumed hybrid.

Cratystylis microphylla S. Moore, *J. Bot.* 43: 139 (1905). *Type:* Lake Lefroy, Western Australia, *R. Helms* (*lecto:* K, right-hand specimen on sheet, lectotype here designated; *isolecto:* PERTH 01044044).

[*Pluchea conocephala* var. *microphylla* F. Muell. & Tate, *Trans. & Proc. Roy. Soc. South Australia* 16: 365 (1896) *p.p.*, *nom. nud.*]

Densely branched *shrub* to 1 m high. *Leaves* congested, erect and appressed to branch, semiterete, 1–2 mm long, finely grey-tomentose, resinous. *Capitula* 1-flowered. *Pappus bristles* sparsely denticulate or smooth towards apex. (Figure 1E)

Distribution. Found from *c.* 100 km north of Kalgoorlie south to Norseman in Western Australia.

Habitat. Grows in yellow sandy loam, which is often saline or calcareous.

Note. In about half of the herbarium specimens of *C. microphylla* some or all the florets are galled. In these florets the corolla does not form and the pappus is replaced by lanceolate scales that are similar in texture to the cartilaginous involucral bracts.

Cratystylis subspinescens S. Moore, *J. Bot.* 43: 139 (1905). *Type:* near Hunt's Well, Western Australia, *R. Helms* (*holo:* K *n.v.*).

Stera subspinescens Ewart & B. Rees, *Proc. Roy. Soc. Victoria* ser. 2, 24: 265, t. 55 fig. c (1912). *Type:* Lake Lefroy, Western Australia, December 1891, *R. Helms* (*n.v.*).

[*Pluchea conocephala* var. *subspinescens* F. Muell. & Tate, *Trans. & Proc. Roy. Soc. S. Australia* 16: 365 (1896), *nom. nud.*]

Rounded divaricately branched grey *shrub* to 1 m high; branchlets spinescent, appressed-villous. *Leaves* spreading, narrowly elliptic to narrowly spathulate, 3–12 mm long, appressed-villous with medifixed hairs. *Capitula* 3–6-flowered. *Pappus bristles* scabrid.

Distribution. Found in semi-arid areas of Western Australia from the central west coast at Point Quobba south-east to Norseman and Plumridge Lake.

Habitat. Associated with calcareous or saline soil and frequently found around salt lakes. Sometimes forming a dominant cover in saltbush steppe (Keighery 1984).

Acknowledgements

The Australian Botanical Liaison Officer, Rod Seppelt, while at the Kew Herbarium, arranged for the preparation of a Cibachrome copy of the type sheet of *Cratystylis microphylla,* and Ken Hill, also when the Liaison Officer, photographed the isotype sheet of *Stera microphylla* at the BM. The illustrations were prepared by Annemarie Wilson. The work was undertaken while one of us (P.G.W.) was in receipt of a grant from the Australian Biological Resources Study.

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SHORT COMMUNICATIONS

Validation of the name *Caladenia serotina* (Orchidaceae)

In our recent treatment (Hopper & Brown 2001) of Western Australian members of the genus *Caladenia* R. Br. (Orchidaceae), a portion of the text was omitted at the top of page 145. Owing to this printing error, the new species *Caladenia serotina* was not validly published as most of its type citation was missing. The full description for this species is reproduced below to provide a valid publication for it. *Caladenia serotina* was illustrated in Figure 28A–F and mapped in Figure 27C of Hopper & Brown (2001).

Caladenia serotina Hopper & A.P. Br., *sp. nov.*

A *Caladenia longicauda* Lindl. floribus plus coloratis petalis sepalisque saepissime rigide ferentibus et postea florescentia differt.

Typus: c. 16 km north of Manjimup on South Western Highway, 34°05'S, 116°11'E, Western Australia, 13 December 1985, *S.D. Hopper* 4765 (*holo:* PERTH 00909106; *iso:* AD!, CBG!, K!, MEL!, NSW!, PERTH 02416328).

Illustrations. N. Hoffman & A. Brown, Orchids of South-West Australia, 1st edn, p. 68, [as *Caladenia* sp.] (1984), 2nd edn, p. 70 (1992) and rev. 2nd edn with suppl., p. 70 (1998).

Plant solitary or in small clumps. *Leaf* erect, linear, 10–20 cm x 4–20 mm, pale green, basal third usually irregularly blotched with red-purple. *Scape* 25–60 cm tall. *Flowers* 1–3(4), *c.* 8–10 cm across, white or creamy-yellow to maroon with maroon markings on calli and pale maroon to pink lines on the back of petals and sepals; floral odour faintly to strongly sweet. *Sepals and petals* stiffly held, linear-lanceolate in basal 1/5–1/3, then abruptly narrowing to a densely glandular long-acuminate filamentous apex lacking a tumescent osmophore; glandular hairs elongate, cylindrical. *Dorsal sepal* erect to curving forward near apex, 5.5–10 cm x 2.5–3 mm. *Lateral sepals* spreading, obliquely downcurved, 5.5–10 cm x 3–6 mm. *Petals* horizontal basally, then downcurved, 4.5–8 cm x 2–4 mm. *Labellum* obscurely 3-lobed, uniformly coloured except basal lamina sometimes with pale maroon radiating stripes, stiffly articulate on a claw *c.* 2 mm wide; lamina narrowly to broadly cordate in outline when flattened, 16–30 x 10–14 mm, basal third curving from erect to horizontal, middle third nearly horizontal, apical third sharply recurved, margins at widest point moderately curved upwards and terminated by obliquely to vertically ascending calli; lateral lobes erect with entire margins within 4 mm of the claw, becoming fimbriate with slender acuminate narrowly fusiform pale to dark maroon sometimes white-tipped calli to 7 mm long which are abruptly decrescent near midlobe; midlobe margins with short broad forward-facing obtuse calli decrescent towards the apex. *Lamina calli* in 4 rows (sometimes towards apex up to 8, or 4 or 2 rows, or irregularly aggregated) extending at least 3/4 the length of the labellum, pale to dark maroon, golf stick-shaped, the longest *c.* 2 mm tall, decrescent towards apex and becoming sessile. *Column* 13–22 x 7–10 mm, winged, greenish yellow with maroon blotches and suffusions. *Anther c.* 3.5–4.5 x 3.5–4.5 mm, maroon with yellowish suffusions. *Pollinia c.* 3–4 mm long, yellow. *Stigma c.* 3–4 mm wide, yellow-green. *Capsule* not seen.

Selected specimens examined. WESTERN AUSTRALIA: Byford, S of Armadale, 1 Nov. 1968, *Byrne* 2 (PERTH 00290475); N of Dinninup, Nov. 1983, *E. Chapman s.n.* (CANB, PERTH 00245577); 2.5 km SW of Augusta, *c.* 1 km S of Golf Course road, 34°20'S, 115°08'E, 26 Oct. 1984, *E. Chapman s.n.* (PERTH 00404349); just NW of Kulikup, 33°50'S, 116°40'E, 3 Nov. 1977, *A.S. George* 15046 (PERTH 00290858); N side of Mt Manypeaks, 40 km E of Albany, 12 Dec. 1986, *G.J. Keighery* 9021 (PERTH 00855170); Wright Rd, 1 km N of Brockman Highway, *c.* 15 km E of Bussell Highway, 34°09'S, 115°14'E, 11 Dec. 1985, *S.D. Hopper* 4745 (PERTH 00907561); Muir Highway, 0.8 km W of Thomsons Rd turnoff, *c.* 50 km ESE of Manjimup, 34°27'S, 116°38'E, 13 Dec. 1985, *S.D. Hopper* 4763 (PERTH 00909114); Chespeake Rd, 1 km E of Shannon River Bridge, *c.* 35 km NW of Walpole, 34°51'S, 116°23'E, 8 Dec. 1987, *S.D. Hopper* 6326 (PERTH 01191934); off Muir Highway, N side, *c.* 400 m W from Thompson Rd, 4 Dec. 1990, *W. Jackson* BJ192 (PERTH 01700006); Dinninup, E of Boyup Brook, 18 Nov. 1970, *C. Sumner s.n.* (PERTH 00335932).

Distribution and habitat. Ranges from the vicinity of Perth south to Augusta and eastwards to Manypeaks. Occurs in winter-wet swamps or adjacent to creeks at the northern end of its range, but is widespread in most habitats at the southern end. These include coastal heath, *Banksia* woodland, paperbark (*Melaleuca*) swamps, granite outcrop scrub, Jarrah/Marri (*Eucalyptus marginata/Corymbia calophylla*) forest, and Karri (*Eucalyptus diversicolor*) forest. Soils vary from sands to lateritic loams.

Flowering period. November to January. Flowers earlier near Perth than in southern localities.

Etymology. Named from the Latin *serotinus* (late-coming), alluding to the late flowering season of the species.

Notes. Caladenia serotina is a sporadically distributed but locally common species that may grow with or adjacent to earlier-flowering members of the *C. longicauda* Lindl. complex including *C. longicauda*, *C. christineae* Hopper & A.P. Br. and *C. harringtoniae* Hopper & A.P. Br. The only related species with which *C. serotina* grows and which is similarly late-flowering is *C. pholcoidea* Hopper & A.P. Br. This differs in its much smaller labellum and its longer narrower pale-yellow petals and sepals. *C. serotina* tends to flower in greater profusion after fire. It hybridizes occasionally with *C. radiata* Nicholls and with *C. corynephora* A.S. George to produce the hybrid *C.* x *aestantha* Hopper & A.P. Br.

Reference

Hopper, S.D. & Brown, A.P. (2001). Contributions to Western Australian Orchidology: 2. New taxa and circumscriptions in *Caladenia*. *Nuytsia* 14: 27–307.

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Acacia peregrinalis, a new name for *A. peregrina* (Leguminosae: Mimosoideae)

When describing the endemic New Guinea species *Acacia peregrina* (McDonald & Maslin 2000) we had overlooked Willdenow's earlier use of this name, which is now referable to the New World species *Anadenanthera peregrina* (L.) Speg. A new name is published here to provide a valid name for our *Acacia* species.

Acacia peregrinalis M.W. McDonald & Maslin, *nom. nov.*

Acacia peregrina M.W. McDonald & Maslin, *Austral. Syst. Bot.* 13: 67, fig. 22 (2000), *nom. illeg.*, *non A. peregrina* (L.) Willd. (1806).

Reference

McDonald, M.W. & Maslin, B.R. (2000). Taxonomic revision of the Salwoods: *Acacia aulacocarpa* Cunn. ex Benth. and its allies (Leguminosae: Mimosoideae: section Juliflorae). *Australian Systematic Botany* 13: 21–78.

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CONSERVATION CODES FOR WESTERN AUSTRALIAN FLORA

R: Declared Rare Flora – Extant Taxa (= Threatened Flora = Endangered + Vulnerable)

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Threatened Species Scientific Committee.

X: Declared Rare Flora – Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searhcing, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for Environment, after recommendation by the State's threatened Species Scientific Committee.

1: Priority One – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral aniamls, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

4: Priority Four – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.

Referees for Volume 14

The assisitance of referees in providing expert review of papers submitted to *Nuytsia* is gratefully acknowledged. The referees consulted for Volume 14 include those listed below. Each paper was also refereed internally by *Nuytsia* Committee members.

George, A.S.
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