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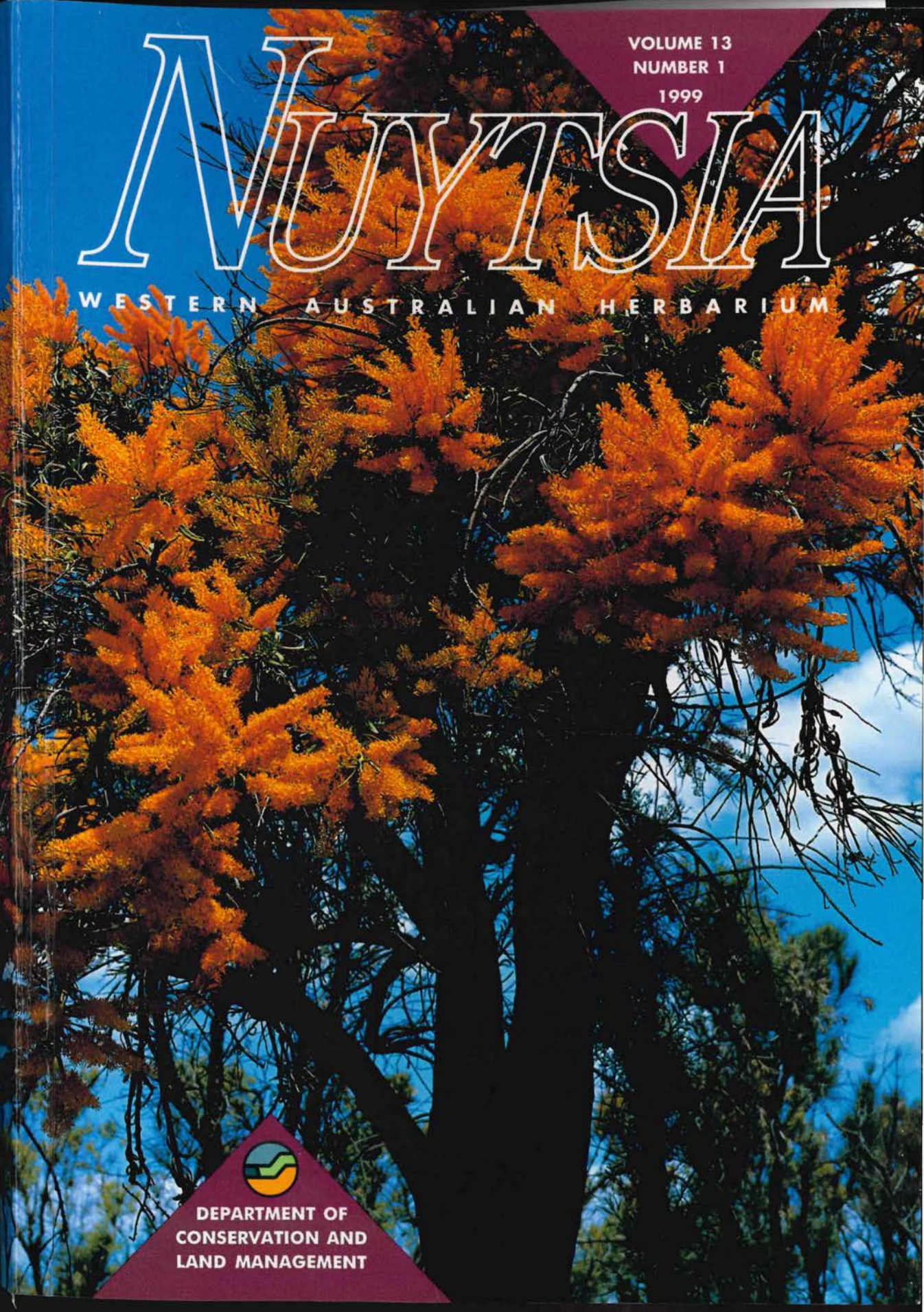

DEPARTMENT OF
CONSERVATION AND
LAND MANAGEMENT

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DEDICATED TO SID JAMES

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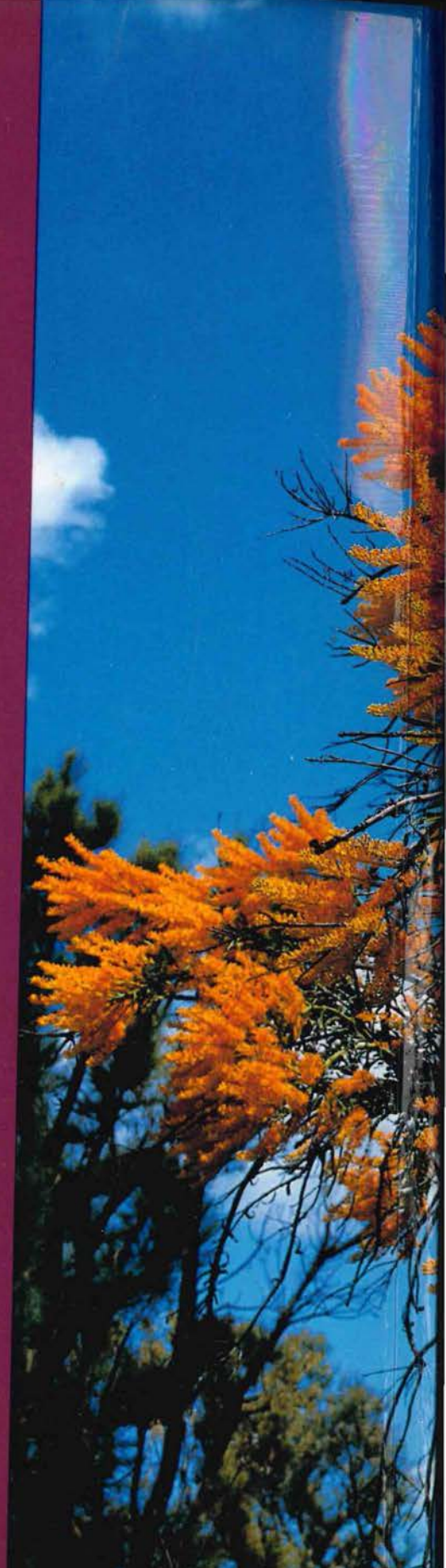

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Department of Conservation and Land Management
Western Australia

NUYTSIA

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Department of Conservation and Land Management, Western Australia

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 commemorates 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.

Cover design by Sue Marais

Photograph A.S. George

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Western Australian Herbarium,
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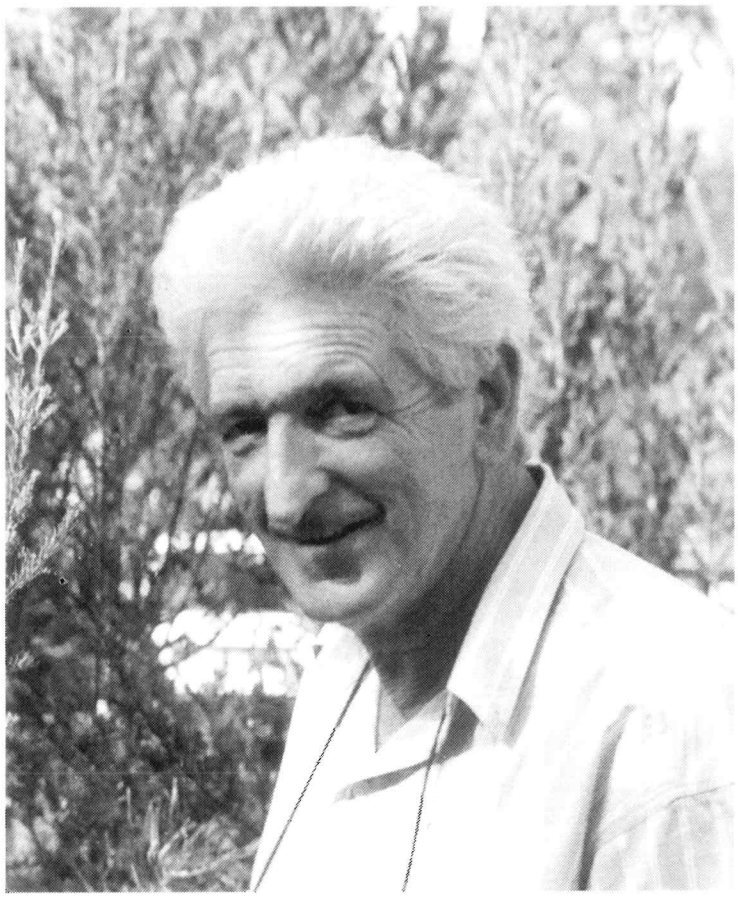
DEDICATION TO ASSOCIATE PROFESSOR SID JAMES

10 July 1933 – 7 December 1998



Associate Professor Sidney Herbert James had a passionate interest in the evolution of the Australian flora, and was always keen to encourage his students and other interested individuals in their pursuits in this field. It is therefore appropriate that this issue of *Nuytsia*, containing many papers by his students and associates, and with an emphasis on *Stylidium*, in which he had a particular interest, be dedicated to Sid.

Sid's outstanding contribution to science and knowledge of the south-western flora is described in detail in Hopper (1996). This dedication emphasises the degree of inspiration and encouragement Sid provided to a multitude of students and other people, many of whom are now in professional or managerial roles in academia, in herbaria and in a diversity of other positions relating to the study or conservation of the Australian biota. While most of Sid's own work was in cyto-evolution and population genetics, he had quite diverse interests and had an impressive knowledge and understanding

of the Australian biota. Although his own published contributions to plant taxonomy are limited, he had a keen eye for what constitutes a plant species and much work by his research group has assisted in delimiting taxa in many families. He conveyed to others the importance of understanding the variation existing in wild populations as being the key to sound taxonomy and an essential step in developing informed management for conservation. He also emphasised the need for scientific rigour, including collection of adequate vouchers and documentation of study pupulations, and this has facilitated subsequent taxonomic work such as that included in this issue of *Nuytsia*.

Sid James made a very significant contribution to plant biology and conservation. The following papers testify that the influence of this inspirational friend and colleague is continuing. His name is commemorated in the species *Laxmannia jamesii* Keighery and the newly described *Stypandra jamesii* Hopper.

Reference

Hopper, S.D. (1996). Associate Professor S.H. James – tribute to a plant population geneticist. *In:* Hopper, S.D., Chappill, J.A., Harvey, M.S. & George, A.S. (eds) "Gondwanan Heritage: Past, Present and Future of the Western Australian Biota." pp. 53–60. (Surrey Beatty & Sons: Chipping Norton, New South Wales.)

Allan Burbidge, David Coates, Steve Hopper, Greg Keighery, Kevin Kenneally, Allen Lowrie, Barbara Rye (Editor, *Nuytsia*).

A new subspecies of *Hybanthus floribundus* (Violaceae) from the Eastern Goldfields of Western Australia

E.M. Bennett

21 Currawong Drive, Gooseberry Hill 6076

Abstract

Bennett, E.M. A new subspecies of *Hybanthus floribundus* (Violaceae) from the Eastern Goldfields of Western Australia. *Nuytsia* 13 (1): 3–6 (1999). A new subspecies, *Hybanthus floribundus* subsp. *chloroxanthus* E.M. Bennett, is described. A key is provided to the subspecies of *Hybanthus floribundus*.

Introduction

Hybanthus floribundus Jacq. (Violaceae) is a widespread species throughout southern Western Australia, southern South Australia, Victoria and southern New South Wales. Bennett (1972) undertook a revision of the genus within Australia. In this work two subspecies in addition to the typical subspecies were recognized, subsp. *curvifolius* E.M. Bennett from the Kalgoorlie area and subsp. *adpressus* E.M. Bennett from the Ravensthorpe area.

When undertaking a field trip to an area east of Leonora, a further subspecies of *Hybanthus floribundus* was observed. In the field it differs from *H. floribundus* subsp. *curvifolius* in being more compact, with the leaves broader, yellow-green and overlapping the leaves above. *Hybanthus floribundus* subsp. *curvifolius* is relatively common further south between Kalgoorlie and Norseman but is also recorded in scattered locations, predominantly along creek banks, north to Leonora.

A total of 15 populations of the new subspecies were examined in the field and later back at the office. Voucher specimens taken from about half of these populations have been lodged at PERTH.

Taxonomy

Key to the subspecies of *Hybanthus floribundus*

1. Leaves antrorse to appressed; sepals petaloid, pale blue or white
   2. Apices of sepals recurved
      3. Leaves narrow, conduplicate, without pustules. (Ravensthorpe area) ..... subsp. **adpressus**
      3. Leaves broad, flat, with distinct pustules on both surfaces. (Widespread) ..... subsp. **floribundus**

2. Apices of sepals appressed to petals. (Leonora to Laverton) ..... subsp. **chloroxanthus**

1. Leaves widely spreading to patent; sepals not petaloid, blue or pale blue or green

4. Leaves conduplicate, curved. (Leonora to Norseman) ..... subsp. **curvifolius**

4. Leaves flat, not curved. (Widespread) ..... subsp. **floribundus**

Hybanthus floribundus subsp. **chloroxanthus** E.M. Bennett, *subsp. nov.*

Folia ovata, chloroxantha, 10–12 mm longa, 2–3 mm lata, basibus ad caulem ± adpressis. Flores in dichasiis vel racemis dispositi, albi. Petalum anticum manifeste calcaratum, 7 mm longum, album; petala lateralia alba venis atroviolaceis.

Typus: loose colluvium, lateritic boulders and rubble over serpentinite, 2 km east of Hage Bore, Yundamindra Station, 6785131N, 420413E, 1 August 1997, *E.M. Bennett & D. Bright* Euc1810 (*holo:* PERTH 05395771; *iso:* CANB, K, MEL, PERTH 05395798).

Leaves conduplicate, ovate 10–12 mm long, 2–3 mm wide, greenish-yellow, leaf bases appressed to the stem. Flowers in dichasia or raceme, white. Anterior petal 7 mm long, white; inner petals white occasionally with blue-mauve veining. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Yundamindra Station, 6784791N, 420617E, Oct. 1997, *E.M. Bennett & C. Harding* Hf002 (PERTH); Yundamindra Station, 6785131N, 420413E, Oct. 1997, *E.M. Bennett & C. Harding* Hf003 (PERTH); Yundramindra Station, 6784663N, 421194E, Oct. 1997, *E.M. Bennett & C. Harding* (PERTH); Glenorn Station, 6795507N, 481324E, Oct. 1997, *E.M. Bennett & C. Harding* Hf012 (PERTH); Glenorn Station, 6796650N, 381901E, Oct. 1997, *E.M. Bennett & C. Harding* Hf015 (PERTH); Minara Station, 6797350N, 382300E, Oct.1997, *E.M. Bennett & C. Harding* Hf007 (PERTH).

Distribution. East of Leonora and west of Laverton typically associated with *Hemigenia exilis*. However, other populations of *Hemigenia exilis* have been recorded north of Leonora so further surveys in these areas could possibly extend the known distribution of *Hybanthus floribundus* subsp. *chloroxanthus*.

Habitat. This subspecies appears to be restricted to consolidated lateritic caprock where the underlying bedrock is ultramafic. The soil surface is characterized by dark red-brown, iron oxide rich, consolidated laterites and ferricretes distribution. The subspecies also occurs on drainage lines where the top surface has eroded away exposing the ultramafic rock.

It occurs in Very Open Low Woodland of *Acacia* species, the dominant species being *Acacia aneura, Acacia ramulosa* and *Acacia tetragonophylla* with *Eremophila oppositifolia* and *Ptilotus obovatus*.

Phenology. Flowering recorded August to September and at some sites in October. Seeds mature from October to November.

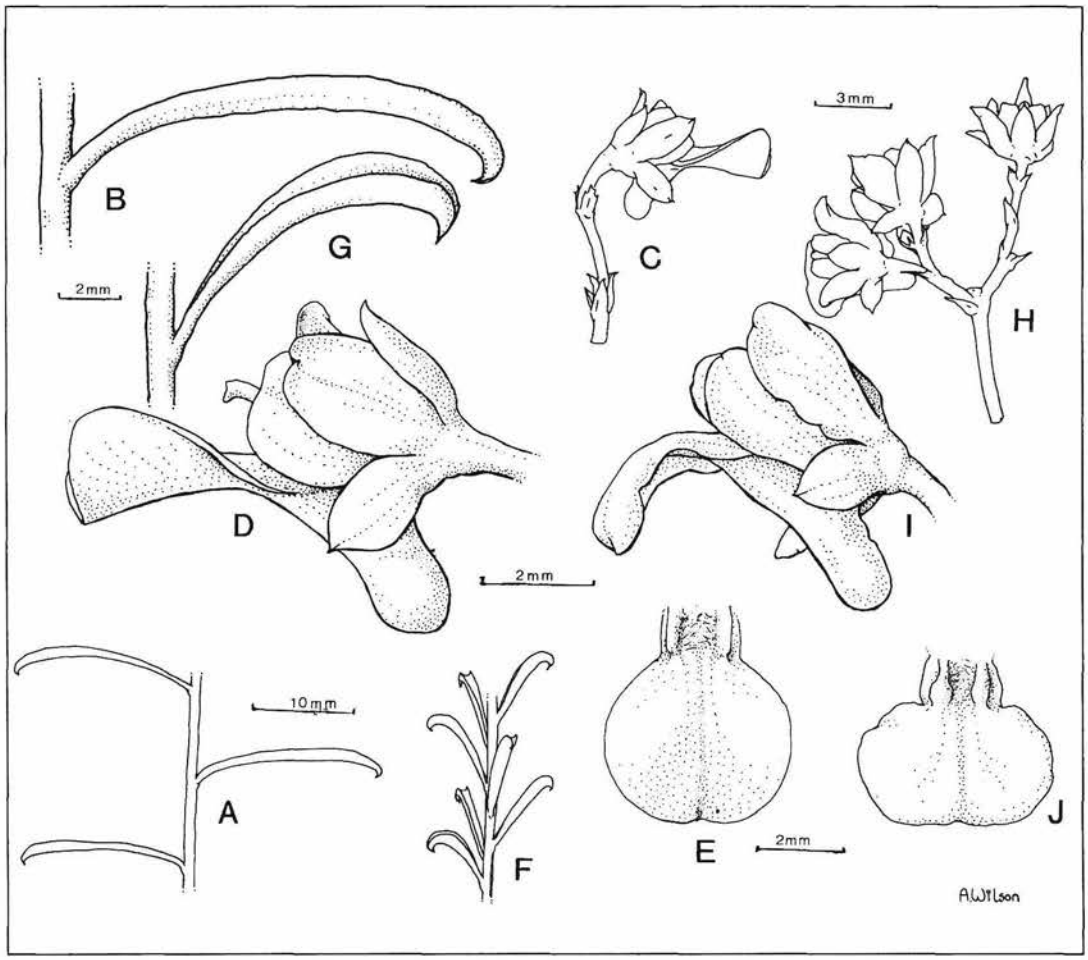


Figure 1. A–E. *Hybanthus floribundus* subsp. *curvifolius*. A – leaves spreading away from stem, B – leaf, C - unbranched inflorescence, D – flower, E – anterior petal; F–J. *Hybanthus floribundus* subsp. *chloroxanthus*. F – leaves antrorse to the stem, G – leaf, H – branched inflorescence, I – flower, J – anterior petal. Drawn from *E.M. Bennett & D. Bright* Euc. 3009 (A–E) and *E.M. Bennett & D. Bright* Euc. 1810 (F–J).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three.

Etymology. The epithet *chloroxanthus* meaning yellowish-green, is made up of the Greek words, *chloro* – green and *xanthos* – yellow, and has reference to the yellowish green colour of the leaves.

Affinities. This subspecies is closest to *Hybanthus floribundus* subsp. *curvifolius*, a subspecies which appears to be restricted to the Goldfields Region, having been recorded from Leonora south to Norseman. In the Leonora region this subspecies is recorded from along creek banks, but not associated with ultramafic soils. The differences between the two subspecies are given in Table 1.

Table 1. Comparison between *Hybanthus floribundus* subsp. *curvifolius* and *Hybanthus floribundus* subsp. *chloroxanthus*

	subsp. **curvifolius**	subsp. **chloroxanthus**
leaf orientation and density	± patent, no overlap with leaves above	± antrorse, ± overlap leaves above
leaf length (mm)	16–20	10–12
leaf width (mm)	1.5–2	2–3
leaf colour	green	greenish-yellow
inflorescence	3 or 4 flowers, racemose	>5 flowers, dichasial or occasionally racemose
flower colour	blue or pale blue with distinct blue lines	white, occasionally sepals with blue lines
length of anterior petal (mm)	5–6	7–8
upper surface of anterior petal	flat to v-shaped	margin ± recurved
soil	consolidated laterite and ferricrete	creek banks, usually rocky, never sandy
distribution	Leonora to Norseman	Leonora to Laverton

Discussion. The two subspecies appear to be similar but are readily distinguished in the field. On Yundamindra Station a few plants of *Hybanthus floribundus* subsp. *curvifolius* were observed along broad creeks where they were associated with *Acacia acuminata* subsp. *burkittii*. From the collections made so far it would appear that *Hybanthus floribundus* subsp. *chloroxanthus* is commonly associated with, or adjacent to, populations of *Hemigenia exilis*. Additional surveys should be undertaken to determine the full distribution of this new subspecies and to reassess its conservation status.

Acknowledgements

This work was in main funded by Anaconda Nickel NL and the Murrin Murrin Nickel Cobalt project. Mr Ted Mein, Mr Andrew Clayton and Mr David Kluken are thanked for their assistance with obtaining the funding and field work. Dr E. Mattiske is thanked for her professional support.

Paul Wilson is also thanked for editing the manuscript and for checking the Latin diagnosis and Anne Marie Wilson for the illustrations.

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Bennett, E.M. (1972). A revision of the Australian species of *Hybanthus* Jacquin (Violaceae). *Nuytsia* 1: 218–241.

George, A.S. (1982). *Hybanthus*. *In:* "Flora of Australia." Vol. 8. pp. 100–110.

A revision of the genus *Pericalymma* (Myrtaceae)

R.J. Cranfield

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Brain Street, Manjimup, Western Australia 6258

Abstract

Cranfield, R.J. A revision of the genus *Pericalymma* (Myrtaceae). *Nuytsia* 13 (1): 7–22(1999). The genus *Pericalymma* (Endl.) Endl. (Myrtaceae) is revised and two new species from south-west Western Australia, *P. megaphyllum* Cranfield and *P. spongiocaule* Cranfield, are described. *Pericalymma crassipes* (Lehm.) Schauer is reinstated and the new combination *P. ellipticum* var. *floridum* (Schauer) Cranfield is made. A key to the species of *Pericalymma* is provided as well as distribution maps and illustrations.

Introduction

This paper presents a revision of *Pericalymma* (Myrtaceae), a genus of four species endemic to the south-west of Western Australia. Originally given sectional status in *Leptospermum* by Endlicher (1837), *Pericalymma* was raised to generic rank by Endlicher (1840). Later, Bentham (1867) relegated *Pericalymma* to *Leptospermum* sect. *Pericalymma*. Finally Thompson (1983) reinstated *Pericalymma* to generic rank as part of her revisionary studies of *Leptospermum*, as a monotypic genus based on *Pericalymma ellipticum*. Rye (1987) retained *Pericalymma* as a monotypic genus in the "Flora of the Perth Region".

Critical examination of herbarium material of *Pericalymma* and extensive field work have been undertaken to reassess the status of *Pericalymma crassipes* and *P. floribundum*, both of which were placed in synonymy by Thompson (1983), as well as to determine the status of two new taxa. This investigation included statistical analysis of morphological data and anatomical studies of stem tissues.

Chapman (1991) lists two further species names under *Pericalymma*, *P. roseum* Turcz. and *P. teretifolium* Turcz., both described in 1852. Type photographs for both species were located at the Western Australian Herbarium (PERTH) and upon examination were considered to be species of *Kunzea*. Subsequently Toelken (1996) cited *Kunzea roseum* as a putative hybrid of *Kunzea jucunda* Diels x *Kunzea preissiana* Schauer and *Kunzea teretifolia* a synonym of *Kunzea pauciflora* Schauer.

Methods

Measurements were taken from dried material, detergent-softened where possible. All taxa have been studied in the field to record habit and habitat data, as well as flower colour. Voucher specimens have been lodged at PERTH.

Stem tissues were examined microscopically using prepared stained cross-sections. The number of large open vessels was compared with the number of thick-walled fibre tracheids present for each sample.

Selected populations of *Pericalymma*, including those showing the extremes of variation in the characters being recorded, were investigated using Analysis of Variance (ANOVA), a statistical method to establish differences between populations and within (species) populations. This study was based primarily on the analysis of the mean lengths of the bracteoles, although others characters were tested (Cranfield unpublished).

Material housed in PERTH was examined, including a photograph of the type of *Pericalymma floridum*. The type material of *Pericalymma ellipticum* was borrowed from W and a photographic record retained at PERTH. The type of *Pericalymma crassipes* was located but not seen, and assumptions have been made based on the type description.

Localities recorded on all available herbarium collections were used to produce distribution maps, but vague and general localities have not been mapped. The conservation status of all species and infraspecific taxa has been assessed and coded where appropriate, according to the Department of Conservation and Land Management's Conservation Codes for Western Australian Flora.

Morphology

Habit. All species are shrubs less than 3 m tall. The original descriptions indicate that *Pericalymma ellipticum* grows to 3 m. This study found that throughout the species range the maximum height attained was usually under 2.5 m. Two species appear to attain a height less than 0.45 m and have inflated erect or gnarled stems. All species have dichotomous spreading branchlets with various leaf densities and clustering.

Stems. Several species have inflated or swollen stems with soft brittle tissue and are usually single-stemmed. One species has non-inflated stems with harder tissue that is structurally stronger. This is usually multi-stemmed at ground level.

Leaves. The leaves are simple and subsessile. The lamina is from 1 to 12 mm long and is flat or conduplicate. The considerable range of size and shape of the larger leaves is depicted in Figure 1. All leaves are drawn at the same magnification. The leaf shapes are generally narrowly obovate with the exception of one sample which has large obovate leaves and corresponds to the new species *Pericalymma megaphyllum*. The midrib is obvious mainly in specimens that represent *Pericalymma ellipticum* and is not visible in *Pericalymma crassipes* although varying degrees of ribbing can be seen in the other two species.

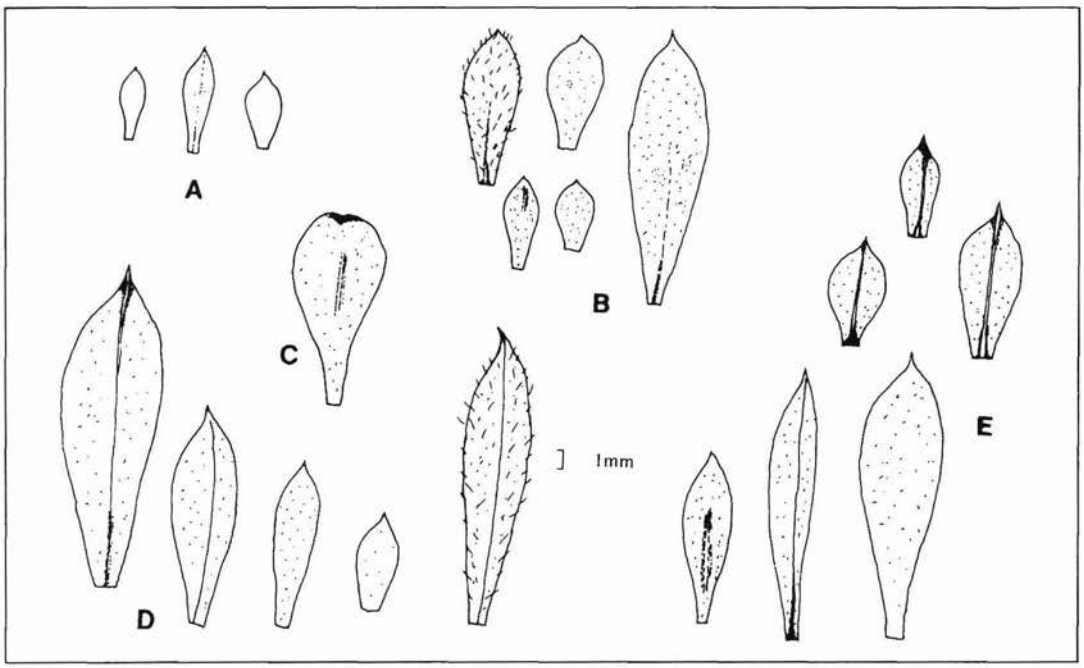

Figure 1. Leaf morphology. A – *Pericalymma crassipes*, B – *P. spongiocaule*, C – *P. megaphyllum*, D – *P. ellipticum* var. *floridum*, E – *P. ellipticum* var. *ellipticum*.

Floral leaves. The 3–5 floral leaves per flower vary in shape and are sessile. They may be absent in *P. megaphyllum*. The floral leaves are usually paired and decussate. The base of the floral leaf is winged; the size of this wing depends upon the position of the floral leaf in relation to the bracteoles.

The lower floral leaves in some instances can be mistaken for vegetative leaves and the upper floral leaves tend to merge into the bracteoles. This transitional development from vegetative to floral leaves to bracteoles accounts for the irregular number of floral leaves in the species descriptions.

Bracteoles. The bracteoles are ovate, membranous, decussate, 1–5 mm long, with varying degrees of hairiness. The lower bracts tend to be confused with the upper floral leaves and in some instances may have photosynthetic tissue present. The persistence of the bracts on old fruits can be used as an aid in determining the identity of vegetative samples of *Pericalymma.*

Figure 2 represents all species, showing the developmental trend of the vegetative leaves through floral leaves to bracteoles indicating that an adaptation of vegetative structures is initiated for floral development. This adaptation is a result of flower bud initiation in which the leaf development is slowed and the leaves modified to protect the developing flowers.

Flowers. There are usually one or two sessile flowers on the apex of the branchlets. When in pairs, the flowers open successively. The petals show great variation in presentation and size, ranging from 1 to 6 mm long. *Pericalymma crassipes* has petals which are small and tend to be inrolled slightly, and are greenish white in colour. Other species of *Pericalymma* have pink or white petals which tend to be large and presented at 90 degrees to the hypanthium. *Pericalymma ellipticum* var. *floridum* has the largest flowers and it is this feature that characterizes this variety.

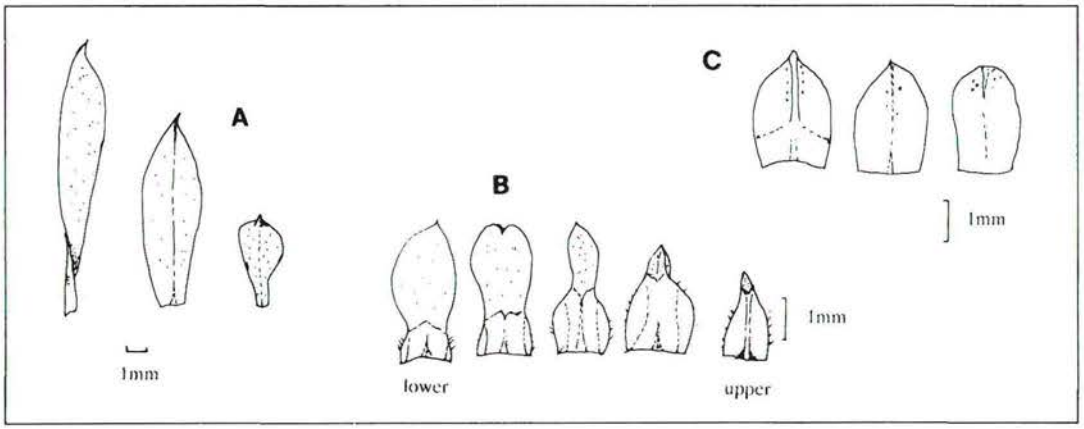

Figure 2. Morphology of A – vegetative leaves, B – floral leaves, C – bracteoles.

Geographical distribution and habitats

The distribution of the genus *Pericalymma,* as shown in Figure 3, extends from Cataby in the north to Bremer Bay in the south-east. Within this area the species are restricted to habitats associated with various wetland types or drainage channels.

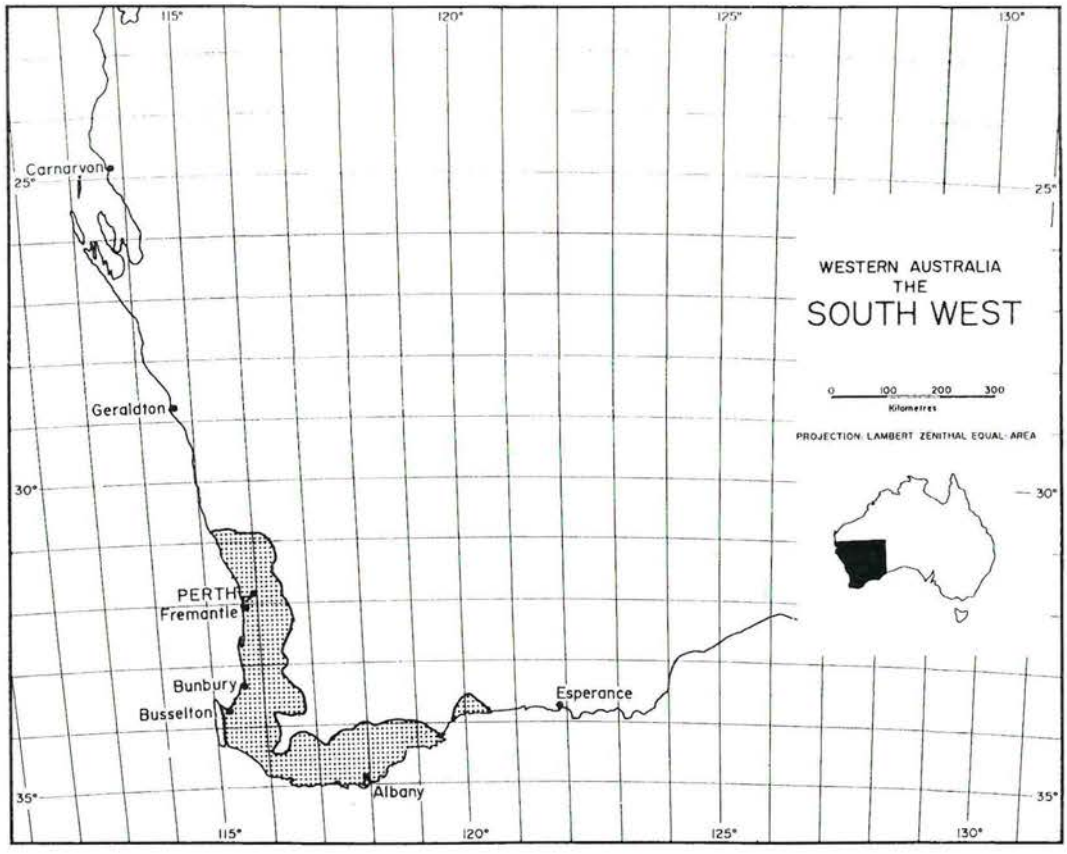

Figure 3. Distribution of *Pericalymma.*

Pericalymma species occur in various micro and macro habitats of which there are three basic types. Figure 4 depicts these three types of habitats which are described below. Evolutionary development of the species may have followed from one ecological type to the others, although the direction of this development is unknown.

Type 1 habitat. Fringing permanent or semi-permanent water bodies with associated inundation areas. Soils are usually leached sands with thin peaty surfaces.

Type 2 habitat. Low-lying poorly drained areas or swampy interdunes to plains with successive swampy flats, subjected to seasonal inundation with fresh water. Soils are leached sands with a peaty surface and a low pH. These are associated with fringing lateritic gravel soils.

Type 3 habitat. This is an elevated habitat, mostly occurring in hilly areas on seasonally swampy platforms or foot slopes with drainage channels. Soils are mainly leached sand with some clayey sands associated with lateritic soils.

Populations restricted by physical habitat barriers tended to be uniform, i.e. of a single species, while those from habitats with no obvious barriers tended to have a mixture of species, sometimes with hybrids present.

All species appear to be fire-sensitive. Species with inflated stems appear to become easily stressed and may die during prolonged droughts or following disturbance of their habitat.

Stem anatomy and statistical analysis

Baas (1977) published a paper investigating the swollen stem anatomy of *Pericalymma crassipes* [as *Leptospermum crassipes*], and indicated that some unique features were apparent when compared with other species of *Leptospermum*. Anatomical investigations conducted in 1994 (reported in Cranfield, unpub. thesis) of a range of *Pericalymma* stems indicated that distinct tissue types could be recognized superficially. These observed tissues correlated with two basic stem types, the soft inflated and the harder non-inflated stems, which correspond to one of the proposed species divisions. The brittle open porous tissue type corresponds to the inflated stem of *Pericalymma crassipes* and allied species, while the denser harder tissue type represents the non-inflated stems of *Pericalymma ellipticum*. This observation provided a useful character that could be used in a key.

Excluding *P. ellipticum*, statistical analysis of length of bracteoles indicated that several populations (corresponding with the species *P. crassipes*) were significantly different from the remainder. These populations also showed the most extreme form of stem inflation; this supported recognition of more than one species. Separation of the remaining two species (the two new species described in this paper), required another approach in which all five characters were scored (average lengths of leaves, floral leaves, bracteoles, sepals and petals). Polygon graphing of these five characters was carried out to illustrate how useful each character was for separation of the taxa.

Elimination of all the species with inflated stems from the *Pericalymma ellipticum* herbarium folders left specimens that showed some variability in flower size but insufficient differences to be separated into more than one species. Previously two species had been recognized among the hard-stemmed specimens, *P. ellipticum* and *P. floridum*.

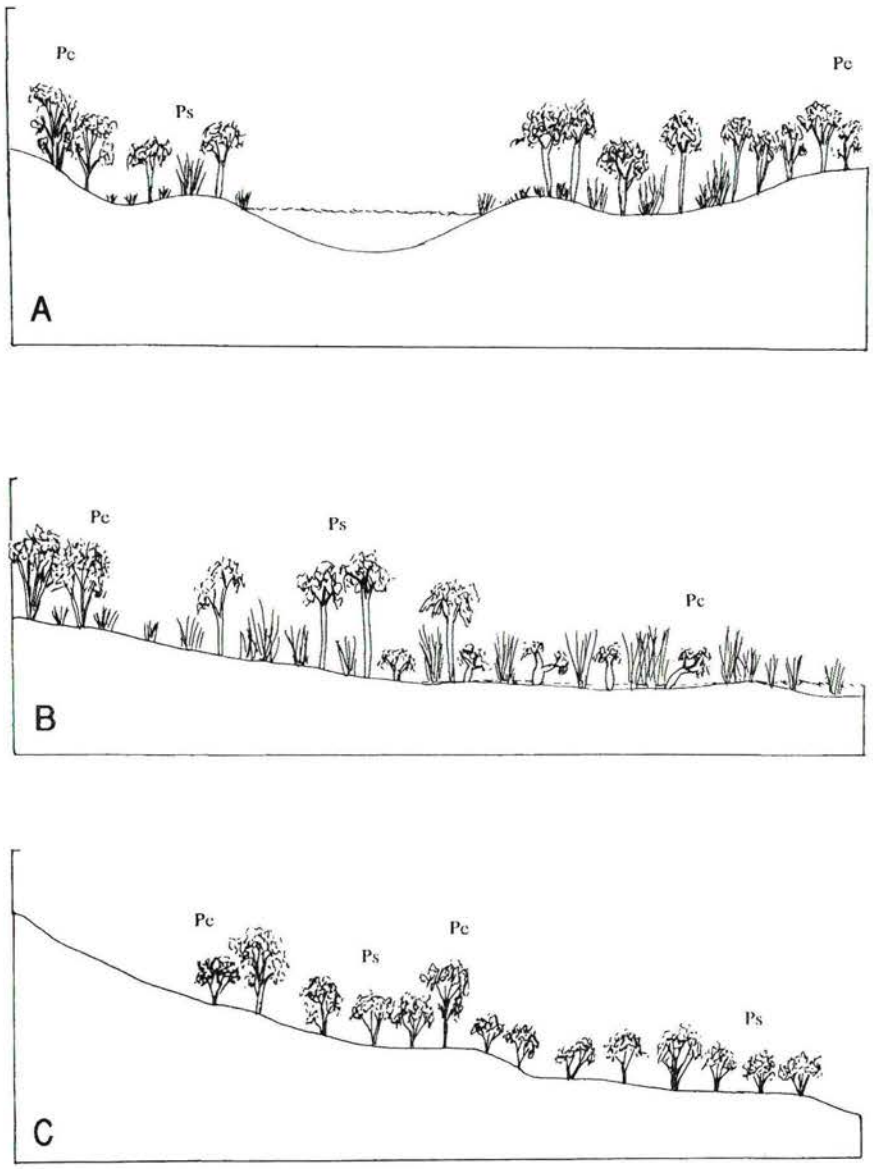

Figure 4. Schematic *Pericalymma* habitats. Pc = *P. crassipes*, Pe = *P. ellipticum* and Ps = *P. spongiocaule*. A – Type 1 habitat, fringing permanent water bodies. B – Type 2 habitat, seasonally flooded low plains. C – Type 3 habitat, elevated seasonally flooded areas.

Taxonomy

Pericalymma (Endl.) Endl. (Endlicher 1840: 1230). – *Leptospermum* sect. *Pericalymma* Endl. (Endlicher 1837: 51). *Type: Leptospermum ellipticum Endl.* [=*Pericalymma ellipticum* (Endl.) Schauer].

Dwarf to tall *shrubs*, branchlets dichotomous, flexuose. *Leaves* alternate, subsessile, entire, coriaceous. *Flowers* terminating short branchlets, 1 or 2 per branchlet; bracteoles usually 4, opposite

and decussate, sessile, intergrading with floral leaves, which in turn intergrade with vegetative leaves below. *Hypanthium* cup-shaped. *Sepals* 5, alternating with petals on hypanthium rim. *Petals* 5, spreading, ovate to obovate, longer than sepals, with a row of short hairs at the base, margin crisped, apex obtuse. *Stamens* indefinite in a single ring, free, shorter than the petals, erect, inflexed; each with a filiform filament. *Anthers* versatile; cells parallel, longitudinally dehiscent. *Ovary* 3-celled; ovules 3–5 per cell, peltate, hemitropous. *Style* inserted in a deep depression in the summit of the ovary; stigma peltate. *Fruit* a woody capsule, 3-valved. *Seeds* a maximum of 1 per cell, developed from the lowest ovule, testa with a close papillose texture.

Key to the species of *Pericalymma*

1. Main stems not obviously swollen, stem tissue firm. (Shrub to 3 m high.) ..... **P. ellipticum**
1. Main stems swollen, stem tissue soft and porous
   2. Petals 1.3–2 mm long, white to greenish white, margins inrolled slightly; stems gnarled. (Shrub to 0.45 m high.) ..... **P. crassipes**
   2. Petals 2.1–5 mm long, white to pink, not inrolled; stems erect
      3. Bracteoles 1.7–2.8 mm long; stamen filaments 0.4–0.5 mm long, leaves obovate, 4–12 x 2.1–5.0 mm. (Shrub to 0.35 m high.) ..... **P. megaphyllum**
      3. Bracteoles 2.1–3.7 mm long; stamen filaments 1.1–1.6 mm long, leaves narrowly obovate, 1.8–7.0 x 0.7–2.7 mm. (Shrub to 1.6 m high.) ..... **P. spongiocaule**

Pericalymma crassipes (Lehm.) Schauer (Schauer 1844: 120). – *Leptospermum crassipes* Lehm. (Lehmann 1842: 5). *Type:* Albany [Western Australia], October 1840, *Preiss*. No. 155 (*holo:* LD *n.v.*).

Dwarf *shrub* to 0.45 m high. *Stems* gnarled, inflated and soft. *Leaves* clustered near ends of branchlets; lamina narrowly obovate, 2.8–4.5 x 0.6–1.4 mm, glabrous, folded, venation indistinct, apex acute sometimes recurved. *Floral leaves* 3–5, sessile, obovate, 2.3–3.7 x 0.3–1.0 mm, with membranous basal wings, apex acute. *Bracteoles* 4, 2 upper and 2 lower, ovate, 1.1–2.2 x 0.5–1.8 mm, green to light brown, margin ciliate to glabrous, adaxial surface hirsute with simple hairs to glabrous, apex acute to obtuse. *Hypanthium* 2.5–2.6 x 2.0–2.5 mm, glabrous to sparsely hirsute. *Sepals* very broadly triangular, 0.9–1.6 x 0.9–1.2 mm, hirsute, margin ciliate, apex obtuse and slightly hooded. *Petals* white to greenish white, ovate, sometimes inrolled, 1.3–2.0 x 1.0–1.8 mm, apex obtuse. *Stamen filaments c.* 1.0 x 0.2–0.25 mm. *Anthers* ovate, topped with a gland, 0.3–0.35 x *c.* 0.3 mm. *Ovules* 0.25–0.3 x 0.1–0.15 mm. *Style* 1–2 x *c.* 0.3 mm. *Fruit* 2.5–3.5 x *c.* 2.5 mm glabrous to hirsute. *Seeds* obovoid, 1.35–1.50 x 0.5–0.6 mm, testa brown to black.

Selected specimens examined. WESTERN AUSTRALIA: Scott River National Park, 4 Nov. 1993, *R.J. Cranfield & D. Kabay* 8993; 11.9 km S of Mount Barker, 12 Nov. 1993, *R.J. Cranfield & D. Kabay* 9085; Albany, Feb. 1901, *Diels & Pritzel s.n.*; King George Sound, Oct. 1898, *Goaby s.n.*; William Bay National Park, 17 Oct. 1992, *B.G. Hammersley*; Irwin Inlet, Dec. 1912, *S.W. Jackson s.n.*; Bullsbrook, N of Midland Junction, 8 Aug. 1962, *N.G. Marchant s.n.*

Distribution. Pericalymma crassipes occurs in coastal south-west Western Australia from the Scott River plain near Augusta to Betty's Beach near Albany. (Figure 5A)

Habitat. Occurring mainly on coastal fresh water swamps (Type 2 habitat) with sandy soils with high peat content which are acidic and seasonally flooded. These habitats are usually dominated by tall sedges under which *Pericalymma crassipes* can be found.

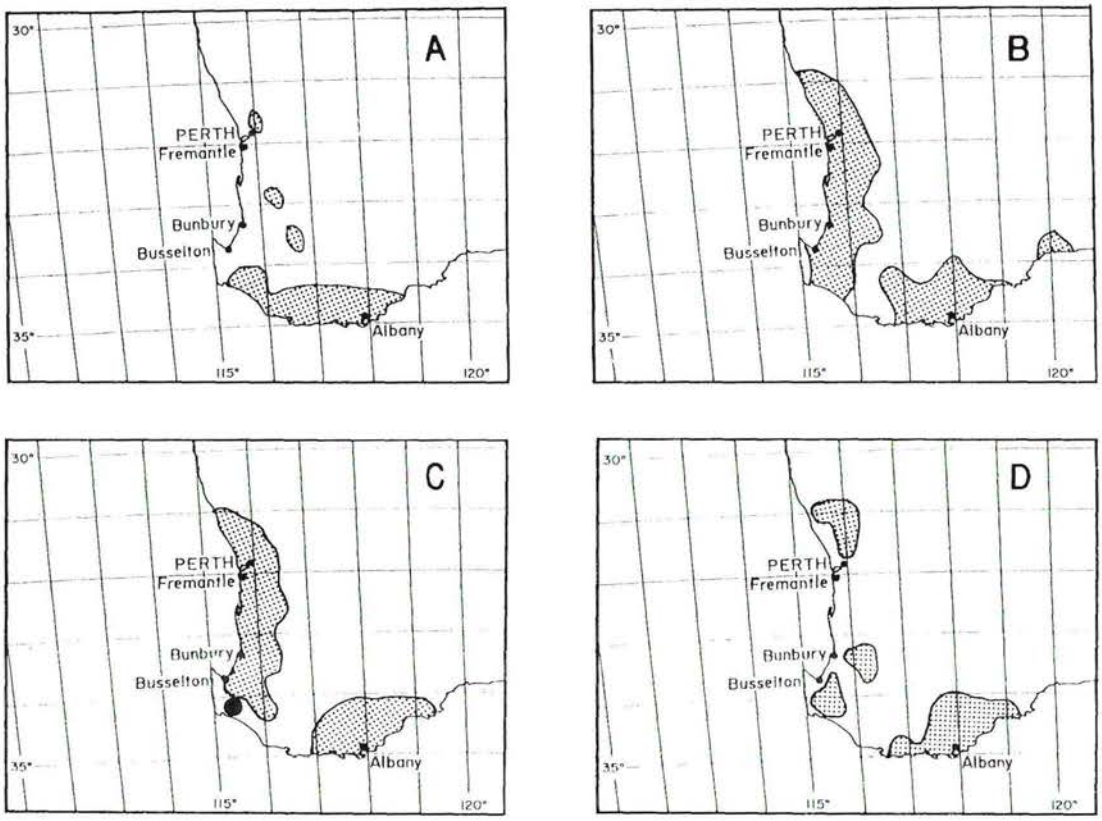

Figure 5. Distribution of *Pericalymma* species and varieties. A – *P. crassipes*, B – *P. ellipticum* var. *ellipticum*, C – *P. ellipticum* var. *floridum* (stippled) and *P. megaphylla* ●, D – *P. spongiocaule*.

Flowering period. October to November.

Conservation status. Not considered rare or endangered although occurring in restricted habitats.

Notes. The flowers of this species are small and hidden among the sedges indicating that a specialized pollinator is involved or that selfing occurs.

Pericalymma ellipticum (Endl.) Schauer (Schauer 1844: 120). – *Leptospermum ellipticum* Endl. (Endlicher 1837: 51). *Type:* King George Sound, [Western Australia], 1837, *Huegel* (*holo:* W).

Shrub to 3 m high. *Stems* erect, multi-stemmed, not obviously inflated and hard to firm. *Leaves* scattered to dense on branchlets; lamina oblanceolate to narrowly obovate, 3.5–11.3 x 0.6–4.6 mm, glabrous to sparsely hairy, flat to shallowly folded, venation obscure, apex acute and sometimes reflexed. *Floral leaves* 4, sessile, oblanceolate to ovate, 2.0–6.6 x 0.2–1.5 mm, glabrous with basal membranous wings, apex acute to obtuse. *Bracteoles* 4, 2 lower and 2 upper, ovate, 2.0–4.6 x 1.2–4.0 mm, greenish brown to light brown, glabrous to sparsely hirsute, margin glabrous to sparsely ciliate, apex acute to obtuse. *Hypanthium* 1.5–4.0 x1.75–3.0 mm, glabrous to sparsely hirsute. *Sepals*

very broadly triangular, 1.2–2.6 x 1.0–2.5 mm, glabrous to hirsute with simple white hairs, margin ciliate and sometimes inrolled, apex acute to obtuse and hooded. *Petals* white to pink, broadly ovate, 2.3–6.0 x 2.0–5.5 mm, glabrous, margin crisped, apex obtuse. *Stamen filaments* 1.0–2.1 x 0.1–0.3 mm. *Anthers* ovate, 0.2–0.5 x 0.2–0.3 mm. *Ovules* 0.2–0.3 x 0.18–0.5 mm. *Style* 1.5–3.5 x 0.2–0.5 mm. *Fruit* 2.0–5.0 x 2.0–3.5 mm, glabrous. *Seeds* obovoid to ovoid, 1.3–2.0 x 0.5–1.5 mm; testa papillose, black.

Habitat. Both varieties occur mainly on Type 3 habitat and also the elevated edges of Types 1 & 2 habitats, mainly on drier leached lateritic sands with fine layer of peat or other organic matter.

Flowering period. October to January for both varieties.

Notes. The two varieties recognized here frequently grow together in the same general habitat. In the past they have been treated as distinct species, but the only character that has been used to distinguish them is petal size, which does not give a complete separation of herbarium specimens. The absence of any other clear differences between the two taxa has led to the adoption here of varietal rank. However, the status of var. *floridum* needs further investigation, in particular to determine whether there are any microhabitat differences between the two taxa.

Key to the varieties of *Pericalymma ellipticum*

1. Petals 2–3.5 mm long ..... var. **ellipticum**
1. Petals 3.5–6 mm long ..... var. **floridum**

Pericalymma ellipticum (Endl.) Schauer var. **ellipticum**

Petals 2.0–3.5 x 2.5–3 mm. (Figure 6)

Selected specimens examined. WESTERN AUSTRALIA: Guildford, Apr. 1901, *C. Andrews s.n.*; S of Jandakot, Oct. 1961, *T.E.H. Aplin s.n.*; 10 miles [16 km] W of Yarloop, 13 Apr. 1978, *R.J. Cranfield* 112; 18 km SW of Busselton along Vasse Highway, 28 Sep. 1992, *R.J. Cranfield* 8339a; Hardy Rd, Forrestfield, 23 Oct. 1993, *R.J. Cranfield* 8945; 11 km W of Donnybrook on Capel road, 26 Sep. 1992, *R.J. Cranfield & P. Spencer* 8320; Red Gully Rd, E of Fynes Rd, W of Mogumber, 17 Dec. 1992, *E.A. Griffin* 8516.

Distribution. Pericalymma ellipticum var. *ellipticum* occurs from Jurien in the north to east of Albany in the south. (Figure 5B)

Conservation status. Not considered rare or endangered.

Pericalymma ellipticum var. **floridum** (Schauer) Cranfield, *stat. et comb. nov.*

Pericalymma floridum Schauer (Schauer 1844: 121). – *Leptospermum floridum* (Schauer) Benth. (Bentham 1867: 110). *Type:* near Guildford, Western Australia, 1839, *Preiss.* No 131 (LD *n.v.*, photograph at PERTH).

Petals 3.5–6.0 x 2.7–5.5 mm. (Figure 7)

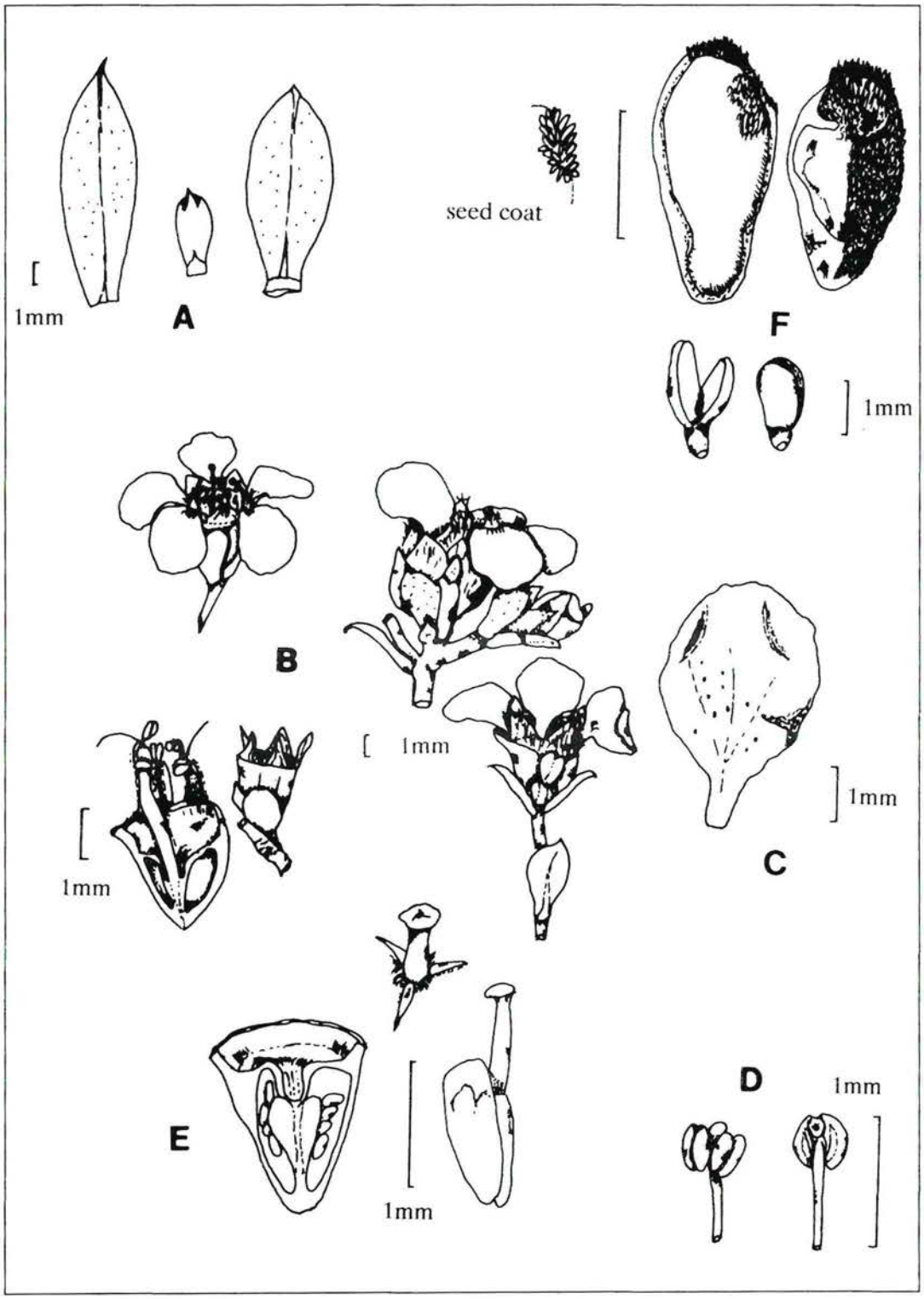

Figure 6. *Pericalymma ellipticum* var. *ellipticum*. A – leaves; B – flowering branchlets, young and old flowers and TS of flower; C – petal; D – two views of stamen; E – two views of style and its insertion point and TS of ovary; F – seeds and embryos.

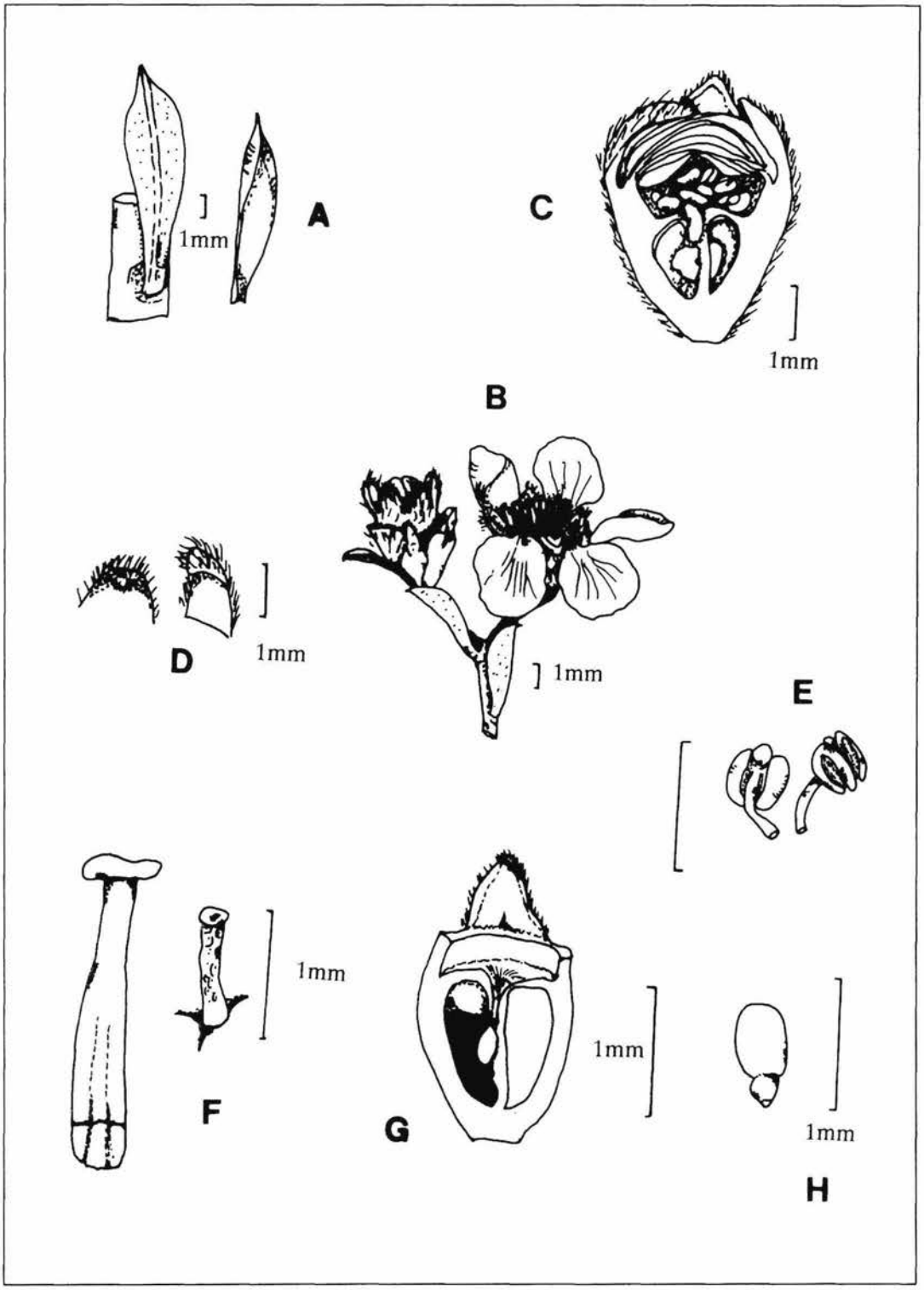

Figure 7. *Pericalymma ellipticum* var. *floridum*. A – leaves; B – flowering branchlet; C – TS of flower bud; D – two views of sepal apex; E – two views of stamen; F – style with insertion point and enlargement of style; G – seed in TS of fruit; H – seed embryo.

Selected specimens examined. WESTERN AUSTRALIA: intersection of Vahland Ave and South St, Canning Vale, 16 Oct. 1993, *R.J. Cranfield s.n.*; 1.3 km W of Wolka Rd off Cooljarloo Rd, W of Brand Highway, 27 Oct. 1993, *R.J. Cranfield & D. Kabay* 8974; 25 km E of Brookton Highway, 2 Dec. 1993, *R.J. Cranfield & D. Kabay* 9108; NW corner of Twin Swamps Nature Reserve, S of Muchea, 24 Sep. 1992, *E.A. Griffin* 6810; SE corner Moore River National Park, NW of Gingin, 17 Oct. 1992, *E.A. Griffin* 7286; Kelmscott, 11 Sep. 1897, *R. Helms s.n.*

Distribution. Pericalymma ellipticum var. *floridum* appears to occur in two main areas, one north of Perth and the other around the Busselton area, with a scattering of populations between these areas. It also occurs around Albany. (Figure 5C)

Conservation status. Not considered rare or endangered.

Pericalymma megaphyllum Cranfield, *sp. nov.*

Pericalymma crassipes et *Pericalymma spongiocaule* affinis sed foliis majoribus late obovatus differt.

Typus: Scott River, Western Australia, 4 November 1993, *R.J. Cranfield* 8996 (*holo:* PERTH 03715442; *iso:* AD, BRI, CANB, Curtin University, HO, K, MEL,US).

Shrub to 0.35 m high. *Stems* erect, inflated and soft. *Leaves* alternate, scattered along branchlets; lamina obovate, 4.0–11.8 x 2.1–5.0 mm, glabrous, flat, midrib visible adaxially, venation obscure, margin slightly undulate, apex obtuse to acuminate. *Floral leaves* 4 or absent, sessile, narrowly ovate, 2.1–3.3 x 0.2–0.7 mm, with membranous basal wings, apex acute and reflexed. *Bracteoles* 4, 2 lower and 2 upper, ovate, 1.7–2.8 x 0.6–1.4 mm, light brown, glabrous, margins ciliate, apex acute. *Hypanthium* 1.5–2.0 x 1.7–2.5 mm, glabrous to sparsely hirsute. *Sepals* depressed-triangular, 1.0–1.4 x 1.1–1.6 mm, glabrous to sparsely hirsute, margin sparsely ciliate, apex acute and hooded. *Petals* white or pink, broadly ovate, 2.1–3.8 x 2.0–3.8 mm, margins crisped, apex obtuse. *Stamens filaments* 0.4–0.5 x 0.15–0.16 mm. *Anthers* ovate, 0.4–0.5 x 0.4–0.45 mm. *Ovules* 0.4–0.6 x 0.15–0.2 mm. *Style* 1.0–2.0 x 0.25 mm. *Fruit* 3.0–3.5 x 2.0–2.5 mm, glabrous. *Seeds* obovoid, not seen at maturity. (Figure 8)

Distribution. Known only from type location. (Figure 5C)

Habitat. Only known to occur on a Type 3 habitat in an elevated washed area with red brown, lateritic, clayey sand.

Flowering period. November.

Conservation status. CALM Conservation Code for Western Australian Flora: Priority One.

Etymology. Named from the Greek *mega* – large and *phyllum* – leaf, in reference to the relatively large broad leaves.

Note. Further surveys and studies of this species are required to establish its relationships to other species and to determine its ranking.

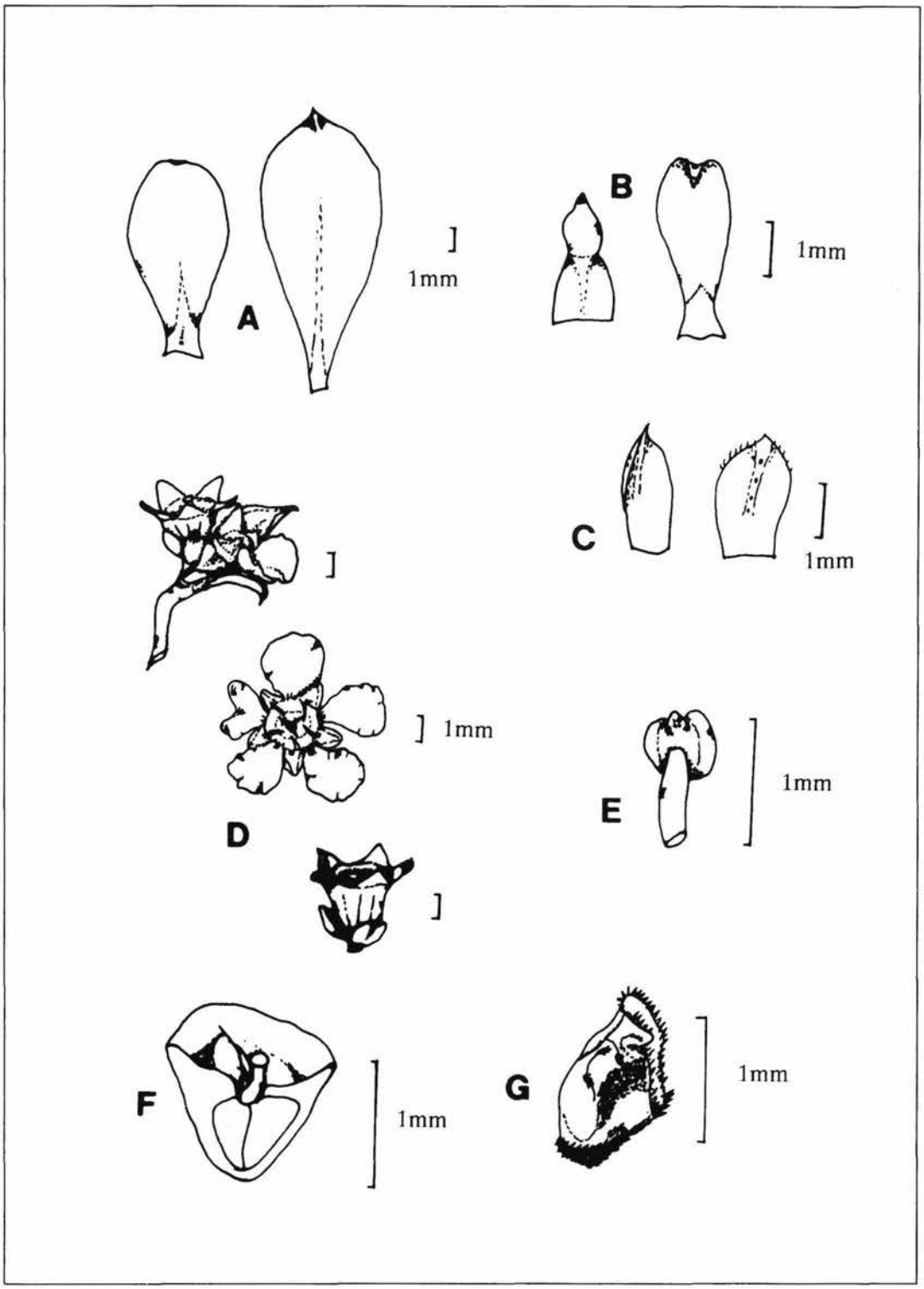

Figure 8. *Pericalymma megaphylla.* A – leaves; B – floral leaves; C – bracteoles; D – inflorescence, young and old flowers; E – stamen; F – TS of hypanthium and gynoecium; G – seed (immature).

Pericalymma spongiocaule Cranfield, *sp. nov.*

Pericalymma crassipes affinis sed planta elatiore floribus majoribus petalis margine crispatis altiter applanatis differt.

Typus: Mount Barker, Western Australia, 12 November 1993, *R.J. Cranfield* 9085 (*holo:* PERTH 03755673; *iso:* AD, BRI, CANB, Curtin University, HO, K, MEL).

Shrub to 1.6 m high. *Stems* straight, erect, inflated and soft. *Leaves* scattered or clustered near ends of branchlets; lamina narrowly obovate, 1.8–7.0 x 0.7–2.7 mm, glabrous, partially folded, venation obscured, oil glands obvious, apex acute reflexed to straight. *Floral leaves* 4, sessile, obovate, 1.0–4.5 x 0.1–1.5 mm, with membranous basal wings, apex acute. *Bracteoles* 3 or 4, 1 or 2 lower and 2 upper, opposite and decussate, sessile, ovate, 2.1–3.7 x 1.1–3 mm, light brown, hirsute to glabrous, margin hirsute, apex acute to obtuse. *Hypanthium* 3–4 x 2–3.5 mm, hirsute. *Sepals* broadly triangular, 1.1–2.4 x 0.9–1.8 mm, hirsute, margin ciliate, apex acute and hooded. *Petals* white or pink, obovate to ovate, 2.5–5 x 1.8–3.8 mm. *Stamen filaments* 1.1–1.6 x 0.1–0.2 mm. *Anthers* ovate, 0.45–0.5 x 0.3–0.45 mm. *Ovules* 0.35–0.70 x 0.15–0.35 mm. *Style* 1–2.25 x 0.25–0.35 mm. *Fruit* 3.0–5.5 x 2–3 mm, glabrous or hirsute. *Seeds* obovoid, 1.2–2. x 0.6–1.0 mm; testa black to dark brown. (Figure 9)

Selected specimens examined. WESTERN AUSTRALIA: Scott River National Park, 4 Nov. 1993, *R.J. Cranfield & D. Kabay* 8995; 6 km Nof Wellstead, 7 Dec. 1993, *R.J. Cranfield & D. Kabay* 9163; 17 km NW of Cheynes Beach, 8 Dec. 1993, *R.J. Cranfield & D. Kabay* 9189; 1.5 km W of Betty's Beach, 8 Dec. 1993, *R.J. Cranfield & D. Kabay* 9199a; 3 km E of Blackwood River Crossing on Brockman Highway, Augusta to Nannup, 3 Nov. 1978, *G.J. Keighery* 1878; Scott River, E of Augusta, 21 Sept. 1973, *E.C. Nelson* ANU17302; Blue Waters, Collie, 31 Oct. 1979, *R.A. Saffrey* 1750; Stuart Rd, 11 miles [17.6 km] from junction with Pemberton–Nannup road, 15 Oct. 1968, *J.W. Wrigley s.n.*

Distribution. Pericalymma spongiocaule occurs from Cataby near Jurien to Wellstead east of Albany. (Figure 5D)

Habitat. Occurring in Type 1 and Type 2 habitats with sandy peaty soils containing some lateritic gravel.

Flowering period. October to January.

Conservation status. Widespread, not considered rare or endangered.

Etymology. Named from the Latin *spongiosus* – porous and *caule* – stem, in reference to the soft, swollen stems.

Notes. In both of its habitats *Pericalymma spongiocaule* overtops most associated species displaying its larger and showier flowers above the surrounding plants. This suggests that this species is insect-pollinated with little selfing occurring, possibly creating considerable genetic variation within and between populations.

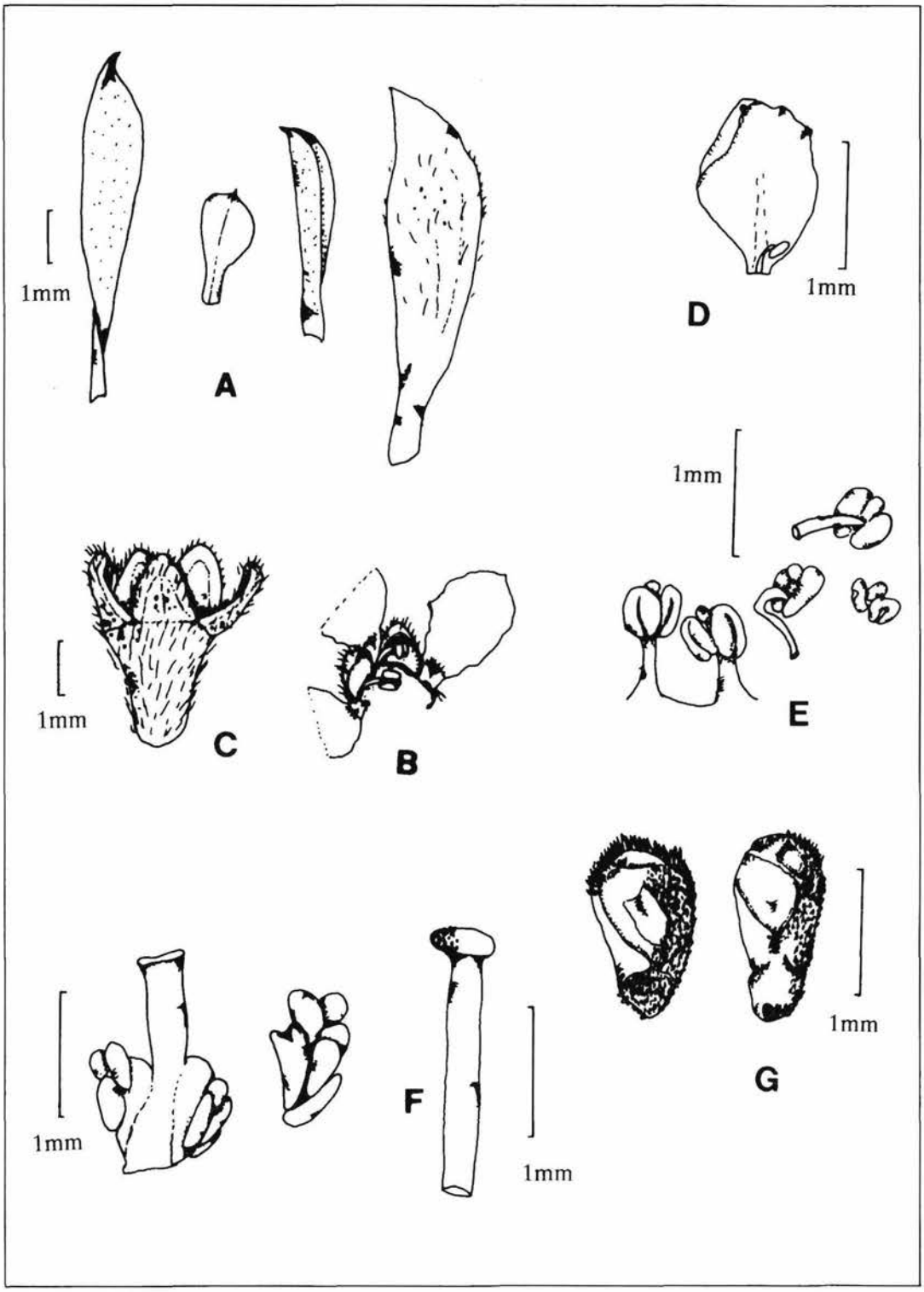

Figure 9. *Pericalymma spongiocaule*. A – leaves; B – portion of young flower; C – old flower; D – petal; E – stamens; F – two views of style and ovules; G – two views of seed.

Acknowledgements

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Two new species of *Actinotus* (Apiaceae) from Western Australia

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Abstract

G.J. Keighery. Two new species of *Actinotus* (Apiaceae) from Western Australia. *Nuytsia* 13 (1): 23–27 (1999). Two new perennial species of *Actinotus* (Apiaceae) are described and illustrated. One is confined to the higher rainfall areas of south Western Australia between Margaret River and Walpole. The other is only known from a few populations in the Whicher Range south-east of Busselton.

Introduction

The genus *Actinotus* (Apiaceae) in Western Australia consists of four (one undescribed) species of post-fire annual herbs, which are widespread in the Mediterranean and semi-arid areas of southern Western Australia, and a group of six (three undescribed) perennial taxa confined to the higher rainfall area, largely between Perth and Albany. This paper describes two of the new perennial species, both restricted to the forested areas of Western Australia.

Taxonomy

Actinotus laxus G. J. Keighery, *sp. nov.*

Differt ab *A. omnifertilis* rhizoma elongatum expansum, caulis florifer tenuissimus laxus ad 40 cm altum et umbellae parvae.

Typus: Recreation Reserve, intersection of Scott Rd and Govenor Broome Rd, Western Australia, 29 December 1990, *G.J. Keighery* 12210 (*holo:* PERTH 01994212; *iso:* CANB, K, MEL).

Slender *sub-shrub* from a spreading rhizomatous woody rootstock to over 30 cm diameter; erect flowering branches annually renewed, to 40 cm tall. *Stems* very slender, lax, pubescent when young becoming glabrous with age. *Leaves* alternate, pubescent when young, petiole 2–3 mm long; lamina trilobed (rarely with 5 lobes), 8–16 mm long, discolorous, green on upper surface, grey-green underneath. *Inflorescence* subtended by a linear leaf-like bract, peduncle 18–35 mm long, with

(6)8–12 flowers (up to 5 male, the remainder bisexual), glabrous. *Bracts* 8–10, linear, usually sparsely hairy, *c.* 2 mm long, green with a red point. *Pedicels c.* 0.5 mm long. *Flowers* white, *c.* 2 mm long. *Petals* entire, white, *c.* 1 mm long, the end inflexed, midrib prominent. *Stamens c.* 3 mm long, each with a pinkish anther *c.* 1 mm long. *Fruit* sparsely hairy, *c.* 3 mm long. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Pingerup Rd, 29 km E of Mt Chudalup, 15 Dec. 1994, *A.R. Annels & R.W. Hearn* 5200 (PERTH); 34°07'S, 115°18' E, 16 Nov. 1992, *A.R. Annels* 2982 (PERTH); Weld River Swamp, 16 km S of Shannon Mill, Dec. 1957, *D. Churchill s.n.* (PERTH); South Northcliffe Track to Gardner River, 19 Mar. 1961, *A.S. George* 2337 (PERTH); Northcliffe Forest Park, 28 Dec. 1990, *L. Graham* 600 (PERTH); Bow River, 3 Dec. 1913, *S.W. Jackson s.n.* (NSW, CANB); Walpole, 25 Jan. 1947, Mrs *M. Johnson* (PERTH); Yelverton State Forest, 19 Jan. 1990, *G.J. Keighery* 12210 (PERTH), Big Brook, Pemberton, Western Australia, Jan. 1922, *M. Koch* 2613 (NSW, MEL); Broke Inlet, 27 Jan. 1990, *G. Wardell-Johnson* 1061 (PERTH); Walpole–Nornalup National Park, 27 Jan. 1993, *J.R. Wheeler* 3799 (PERTH); Scott River Rd, *E. Wittwer* 550 (CANB).

Distribution. In discrete populations between Augusta and Walpole with an outlier in Yelverton Forest, north-east of Margaret River.

Habitat. Occurs in fresh, usually permanent swamps under dense cover of *Homalospermum firmum* and *Agonis linearifolia*, or *Reedia spathacea* or rarely seepages with *Juncus kraussii* rushes. Often associated with the other endemics of this habitat, *Cephalotus follicularis*, *Cosmelia rubra*, *Reedia spathacea* and *Homalospermum firmum*.

Flowering period. Usually flowers in summer (December to March). Flowering is not enhanced by fire.

Conservation status. Represented in several conservation reserves and State forest blocks. Restricted in range but not considered to be at risk.

Etymology. Named after the slender lax flowering branches.

Affinities. Related to *Actinotus omnifertilis* (F. Muell.) Benth., which is a short-lived post-fire perennial herb that lacks the extensive rhizome of this new species. *Actinotus laxus* is readily distinguished from all other members of the genus by its long slender lax flowering branches, which are supported by the surrounding vegetation, and its very small inflorescences. Flowering in *Actinotus laxus* does not appear to be enhanced by fire as it is in *A. omnifertilis*.

Actinotus whicheranus G.J. Keighery *sp. nov.*

Frutex e basi lignosa ramosae caulis florifer ad singulus 40 cm. altum erectus. Folia alterna, puberula, discoloria, divisa. Inflorescentia 15-35 mm. lata. Flores albi.

Typus: Sabina Rd, Whicher Range, south of Busselton, Western Australia, 19 December 1991, *G.J. Keighery* 12394 (*holo:* PERTH 03415384; *iso:* MEL, CANB, SYD).

Erect slender *sub-shrub* from a short woody above ground stem; erect flowering branches to 40 cm tall. *Stems* slender, pubescent when young, becoming glabrous with age. *Leaves* alternate, pubescent when young, petiole 25–55 mm long; lamina with three to four primary lobes and with secondary lobes,

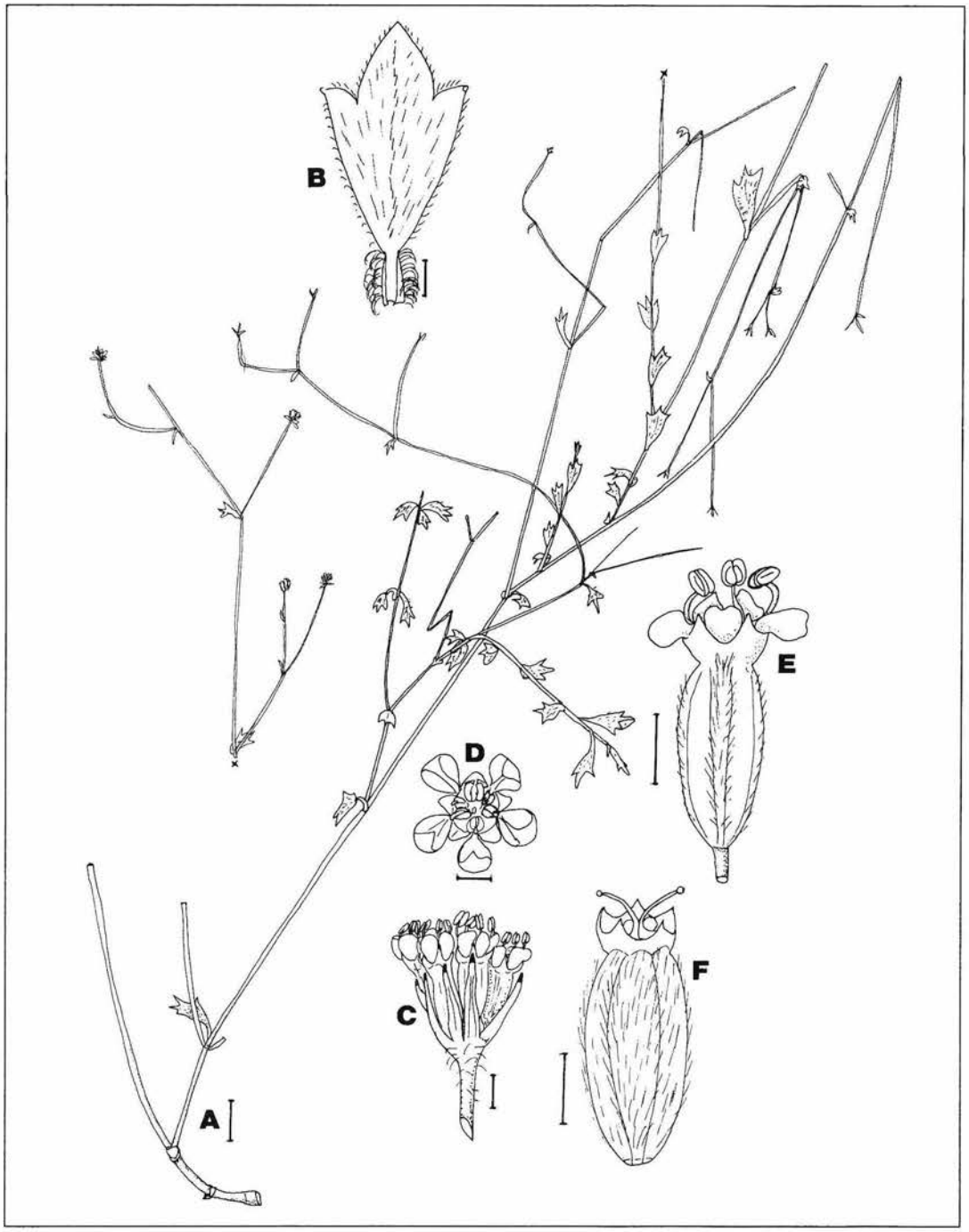

Figure 1. *Actinotus laxus*. A – flowering branch, scale bar = 1 cm, B – leaf, C – inflorescence, D – flower, top view, E – flower, side view, F – fruit. Scale bar for B–F = 1 mm. Drawn from *G.J. Keighery* 12210.

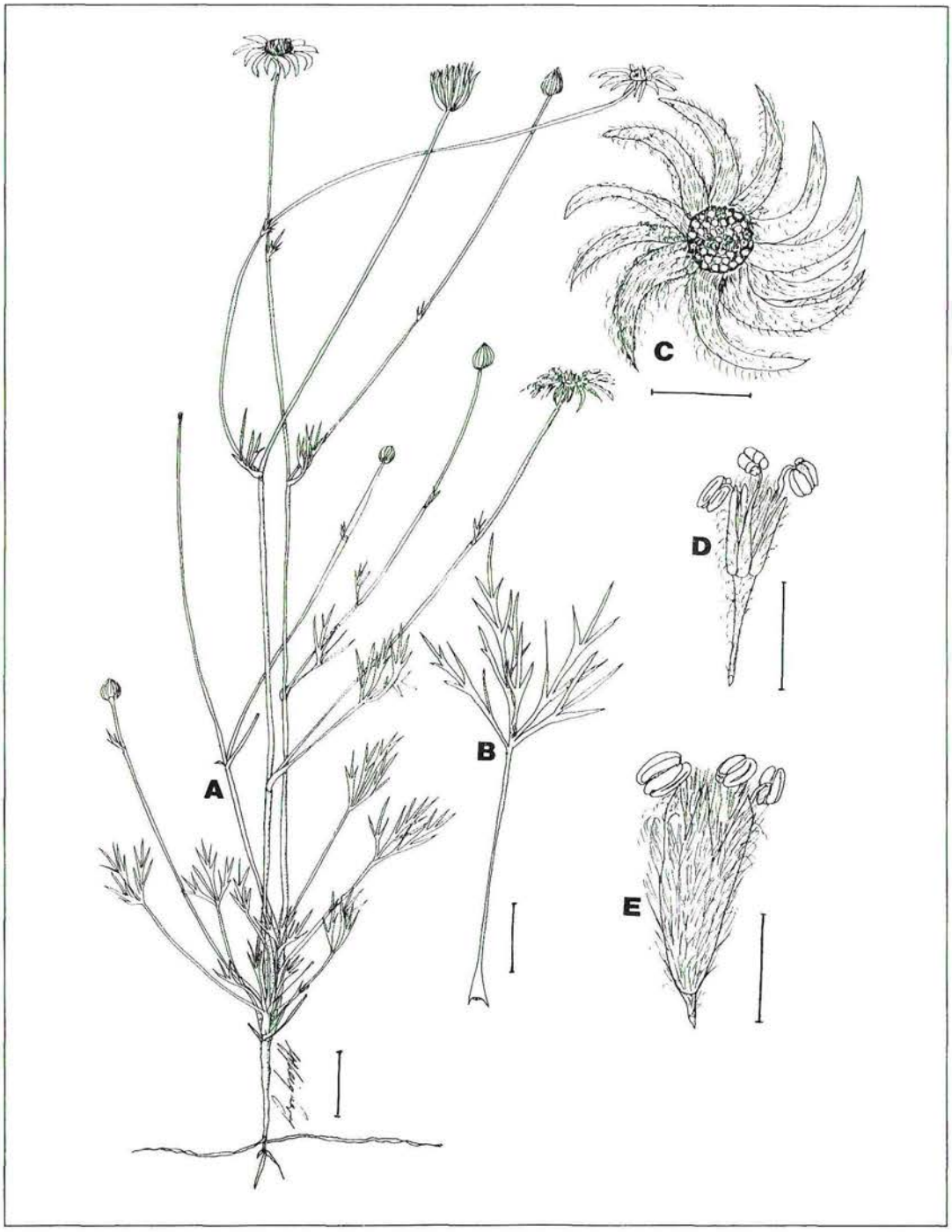

Figure 2. *Actinotus whicheranus*. A – whole plant, scale bar = 1 cm, B – leaf, C – inflorescence, D – male flower, E – bisexual flower. Scale bar for B–E = 1 mm. Drawn from *G.J. Keighery* 12394.

20–25 mm long, usually discolorous, green on upper surface, grey-green underneath. *Inflorescence* 15–35 mm diameter, subtended by a linear leaf-like bract 3–6 mm long, peduncle 5–8 cm long, with numerous flowers (up to 30% male, the remainder bisexual), glabrous. *Bracts* linear, hirsute, 4–8 mm long, usually sparsely hairy. *Pedicels c.* 0.5 mm long. *Flowers* white, *c.* 2 mm long. *Petals* entire, white, *c.* 1 mm long, the end inflexed, midrib prominent. *Stamens c.* 3 mm long, each with a pinkish anther *c.* 1 mm long. *Fruit* hairy, *c.* 3 mm long. (Figure 2)

Other specimens examined. WESTERN AUSTRALIA: Sabina Rd, 7 Jan. 1997, *D. Bright & A. Annels* SC135.7 (PERTH); E of Vasse Highway on Sabina Rd, 1 Feb.1996, *G. Keighery* 14358 (PERTH).

Distribution. Confined to a narrow band along the western margin of the Blackwood Plateau and adjacent Whicher Range Escarpment.

Habitat. Occurs in white sand pockets over laterite, under *Banksia attenuata* woodland or *Beaufortia squarrosa* tall shrubland. The species may survive mild winter fires but is killed by summer fires, regenerating from seed.

Flowering period. Usually flowers in summer (December to March).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Confined to the Whicher Range, south-east of Busselton. Highly restricted but locally common. The declaration of the proposed Whicher Range Nature Reserve will encompass most populations. Populations east of the Vasse Highway are in State forest.

Etymology. Named after the Whicher Range to which the species is confined.

Affinities. Not closely related to any other species of *Actinotus* in Western Australia. The habit of being a tufted sub-shrub with an erect short woody stem and small infloresences on long erect flowering stems is superficially similar to *A. minor* (Sm.) DC. from New South Wales and perhaps more distantly to the large-flowered *A. helianthi* Labill. from Queensland and New South Wales.

Acknowledgements

Thanks to Jenny Hart and Paul Wilson for assistance with the Latin. To Jenny and Barbara Rye for assistance in improving the paper in flow and substance.

A new species of *Opercularia* (Rubiaceae) from Western Australia

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Abstract

Keighery, G.J. A new species of *Opercularia* (Rubiaceae) from Western Australia. *Nuytsia* 13 (1): 29–32 (1999). A new species of *Opercularia* (Rubiaceae) is described: *O. loganioides* Keighery is confined to limestone cliffs on the southern margin of the Nullarbor Plain in Western Australia.

Introduction

Opercularia Gaertn. (Rubiaceae) is a small genus of 15 species endemic to temperate Australia. Unlike its close relative *Pomax* Sol., which shows its greatest species diversity in the arid zone, *Opercularia* has its major centre of diversity in south-western Australia. There are currently 10 named species of *Opercularia*, all confined to the South West Botanical Province except for *O. spermacocae* Labill., which extends north to North West Cape in the Eremean Botanical Province. One other species of *Opercularia*, newly described in this paper, is restricted to the Eremean, inhabiting limestone cliffs on the western side of the Great Australian Bight.

The limestone cliffs formed where the uplifted Nullarbor Plain meets the Great Australian Bight have a dry Mediterranean climate milder than that of the arid plain (McKenzie & Robinson 1987). Soils are often less calcareous than on the plain and this has enabled a diverse assemblage of plants from the south-west's Mediterranean climate to occur here (Keighery *et al.* 1987). There is also a suite of plants confined to (e.g. *Anemocarpa calcicola* Paul G. Wilson (Asteraceae) and the new *Opercularia* species), or centred on these cliffs (e.g. *Stenopetalum saxatile* ms. (Brassicaceae) and *Spyridium tricolor* W.R. Barker & Rye (Rhamnaceae)).

Taxonomy

Opercularia loganioides G.J. Keighery, *sp. nov.*

Typus: Twilight Cove, Western Australia, 16 October 1966, *A.S. George* 8562 (*holo:* PERTH 03258122; *iso:* CANB, K, MEL).

Frutex erectus virgatus, perennis, circa 20 cm latus, ramulis teretibus, canaliculatus. Folia, glabris, sessilis, obovata, acuminata, odorata, 2–6 mm longa. Flores 1–3, in umbellis compositis terminalibus, pedunculo 1 mm longo. Bracteis pluribus (linearibus) usque 3 mm longa.

Much-branched stiff twiggy erect foetid *sub-shrub* to 25 cm high and 20 cm wide from a slightly woody base. *Young stems* covered by glistening protuberences, slightly rough. *Older stems* leafless, grey, glabrous, with prominent longitudinal grooves, smooth, younger branches angular. *Stipules* connate to leaf base forming a sheath around nodes with one linear-triangular lobe covered in unicellular hairs. *Leaves* sessile, opposite, 2–6 mm long, 3–4 mm wide, glabrous, entire, margins recurved, apex acute. *Peduncls* solitary in the axils of leaves at the ends of branches, apparently dichotomously branching from the same node, recurved, 1–3 mm long (shorter than subtending leaves). *Inflorescence* of 1–3 flowers basally fused into hemispherical head. *Calyx* lobes linear-triangular, glabrous. *Petals* linear-triangular, glabrous. *Stamens c.* 1.5 mm long, white, with two parallel versatile anther cells. *Ovary* green, inferior, 1.5–2.0 mm long. *Styles* 2–3 mm long. *Fruit* a capsule, with 2 short umbones per cell. *Seeds* not seen. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Toolinna Cove, 5 May 1992, *P.J. Spencer & A.S. George* T12 (PERTH); Toolinna Cove, 16 Oct. 1985, *G.J. Keighery & J.J. Alford* 1022 (PERTH).

Distribution and habitat. Occurs on limestone clifftops, in deep sand or skeletal loams. Both known areas of occurrence are in Nuytsland Nature Reserve.

Phenology. Flowering appears to occur in autumn. Fruits are present from September to November.

Conservation status. CALM Conservation Code for Western Australian Flora: Priority Two. This species, although of restricted distribution, has all known populations in Nuytsland Nature Reserve and is not considered under threat.

Etymology. The specific name refers to the close resemblance to several coastal species of *Logania* R. Br. (Loganiaceae), with which genus it has been confused when not in flower.

Discussion. This species has been known by the phrase name *Opercularia* sp. Twilight Cover (A.S. George 8562). It does not appear to be closely related to any other members of the genus in Western Australia and can be readily distinguished from them by its stiff twiggy glabrous shrub habit and its small inflorescences on short recurved peduncles. Several eastern Australian species (*O. ovata* Hook. f., *O. turpis* F. Muell. and *O. varia* Hook. f.) have inflorescences on peduncles shorter than the leaves. *Opercularia ovata* is glabrous, but has larger leaves (7–18 mm long) and an inflorescence of 10–20 flowers. *Opercularia varia* has ovate, often densely hairy leaves and an erect inflorescence of 2–4 partial heads of 2–7 capsules. Both of these species are generally herbaceous perennials. *Opercularia turpis* is an erect twiggy shrub and is possibly the closest relative of *O. loganioides*, but differs in being almost leafless, dioecious and having larger inflorescences.

Acknowledgements

An Australian Biological Resources Study grant to the author enabled him to examine collections of *Opercularia* held in Herbaria throughout Australia (PERTH, AD, HO, CANB, MEL, Atherton, Alice Springs and Darwin) and at K. The curators and their staff provided access and a pleasant workplace.

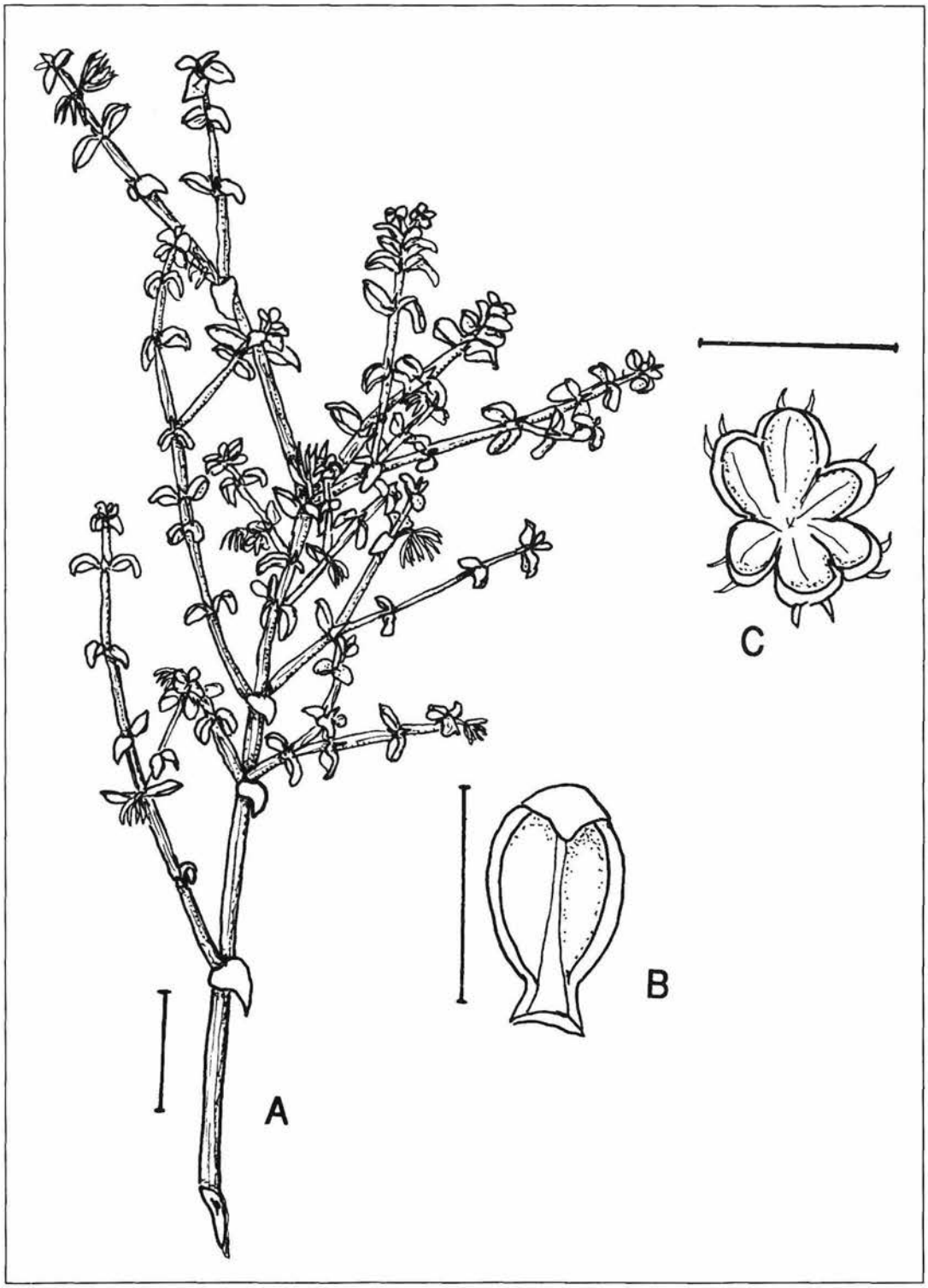

Figure 1. *Opercularia loganioides*. A – flowering branch, scale bar = 1 cm; B – leaf undersurface, scale bar = 5 mm; C – fruit, scale bar = 5 mm. Drawn from *A.S. George* 8562 (A,B) and G.J. *Keighery & J.J. Alford* 1002 (C).

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A taxonomic revision of *Trachymene* sect. *Dimetopia* (Apiaceae)

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Abstract

Keighery, G.J. and Rye, B.L. A taxonomic revision of *Trachymene* sect. *Dimetopia* (Apiaceae). *Nuytsia* 13 (1): 33–59 (1999). The monotypic genus *Uldinia* J. Black (Apiaceae) is reduced to a synonym of *Trachymene* Rudge, resulting in the new combination *Trachymene ceratocarpa* (W. Fitzg.) Keighery & Rye. A further new combination, *Trachymene* sect. *Dimetopia* (DC.) Keighery & Rye, is made for the species group to which *T. ceratocarpa* belongs, and this section is revised. Sect. *Dimetopia* is endemic to mainland Australia and comprises five small ephemeral species with few-flowered umbels, few pollen grains per anther, fruits consistently with both monocarps developed, a reduced carpophore and probably a reduced chromosome number. *Trachymene moorei* Hiroe is reduced to a synonym of *T. cyanopetala* (F. Muell.) Benth. The single species previously placed in *Uldinia* produces natural hybrids with its closest relative *Trachymene cyanopetala*, but the hybrids are sterile. Although several other pairs of species from sect. *Dimetopia* are known to coexist, no other hybrids have been observed.

Introduction

South-western Australian members of the genus *Trachymene* Rudge (Apiaceae) belong to two species groups, one group with few-flowered umbels and the other with many-flowered umbels. These groups have been recognized as separate sections under two synonymous generic names, the few-flowered species in *Dimetopia* sect. *Dimetopia* (also known by the later name of *Didiscus* sect. *Oliganthon*) and the many-flowered species in *Didiscus* DC. ex Hook. sect. *Didiscus* (also known by the illegitimate name of *Didiscus* sect. *Polyanthon* (Domin) C.A. Gardner). Neither south-western group matches *Trachymene s. str.*, which is a group of perennial species occurring in eastern Australia. An accompanying paper (Rye 1999) revises Western Australian members of sect. *Didiscus* as well as members of another species group occurring in the north of the State. Sect. *Dimetopia*, a small group of species endemic to southern mainland Australia, is treated here, with the recombination made to recognize it formally as a section of *Trachymene*.

As in most other Apiaceae, *Trachymene* species have an inferior two-carpellate fruit, with the axis between the two fruitlets known as the carpophore. The fruitlets are monocarps, that is whole carpels.

More commonly, they have been referred to as mericarps, a term that should be restricted in use (Spjut 1994: 17) for true half-carpels such as those commonly found among the Lamiales.

Fruit characters have been used to differentiate *Trachymene* and its close relative, the monotypic genus *Uldinia*, which shows greatest similarity to sect. *Dimetopia*. Originally *Uldinia* was distinguished from *Trachymene* by its lack of a "free persistent carpophore" (Black 1922: 569). A more obvious distinguishing feature of *Uldinia*, used in keys such as Blackall & Grieve (1980: 262), Eichler (1986: 980) and Powell (1992: 88), is its rather bizarre fruit ornamentation. The *Uldinia* fruit has a very distinctive appearance, each monocarp bearing rows of retrorsely hooked spine-like bristles and two large terminal projections or wings. In *Trachymene* species the carpophore is usually much more substantial than in *Uldinia* and fruit ornamentation is very varied but never exactly as in *Uldinia*.

This paper presents morphological and genetic evidence supporting the inclusion of *Uldinia* in the genus *Trachymene* and the separation of sect. *Dimetopia* from the remainder of *Trachymene*. *Trachymene* sect. *Dimetopia* is fully revised for Western Australia, where all five of its species occur, and any additional variation found in those species extending to other parts of Australia is noted.

Materials and methods

A population in which natural hybrids had been produced between *Uldinia ceratocarpa* and *Trachymene cyanopetala* was sampled near Yuna in 1974. Fresh material of both parent species was obtained for pollination trials and a dried specimen (*G.J. Keighery* 940) of the hybrid was lodged at PERTH. Artificial cross-pollination was conducted on potted plants isolated with fine wire mesh covers in an insect-proof glasshouse. Pollen collected from the anthers of *Uldinia* plants was transferred to the stigmas of emasculated *Trachymene cyanopetala* flowers. Using the artifically derived hybrid seeds from this cross, F1 hybrid plants were grown to maturity for comparison with the natural hybrids. Germination trials using freshly harvested monocarps were conducted to compare the germination percentages of the parental species with F1 hybrid seeds as well as F2 hybrid seeds derived from the artificial hybrid plants.

Morphological measurements were taken from dried herbarium specimens located at PERTH. Distribution maps were drawn up with each symbol representing the occurrence of the taxon in a 0.25 degree latitude by 0.25 degree longitude area.

Comparison of *Uldinia* and the sections of *Trachymene*

Morphological evidence

Trachymene belongs to subtribe Hydrocotylinae together with three other large genera, *Centella* L., *Hydrocotyle* L. and *Platysace* Bunge, and the following five very small, mostly monotypic, genera: *Dickinsia* Franch., *Homalosciadium* Domin, *Micropleura* Lag., *Neosciadium* Domin and *Uldinia* (Pimenov & Leonov 1993). Pimenov & Leonov also included *Chlaenosciadium* C. Norman but this genus appears to belong in subtribe Xanthosiinae. Of the genera in the Hydrocotylinae, *Uldina* is quite clearly the closest to *Trachymene*. *Uldinia* shares with *Trachymene* all the main morphological

characters that collectively separate the latter from other genera of Apiaceae, particularly the following characters: stipules absent; leaves long-petiolate, with a shallowly lobed to deeply divided lamina; umbels simple; involucral bracts slightly united at the base into a single whorl; sepals reduced; styles free, slender, with a capitate stigma; stylopodium prominent, tuberculate, becoming concave in fruit; fruit without vittae, nearly always highly bilaterally compressed. Blue is a quite common flower colour in *Uldinia* and *Trachymene*, but is uncommon in the family as a whole. Indeed the blue flower colour of *Trachymene coerulea* Graham came as a surprise when the first specimens were seen by European botanists, who had not encountered this colour before in the family apart from in the thistle-like genus *Eryngium* L. (see Hooker 1828).

Within *Trachymene*, many infrageneric groups of unspecified level (under the synonymous name *Didiscus*) were published by Domin (1908) mainly on the basis of life forms, numbers of involucral bracts and flowers per umbel, and sepal characters. Sepal characters are not of any importance in distinguishing between the two south-western Australian species groups but the other characters are significant and are discussed in a later section on breeding systems. In sect. *Dimetopia*, the few involucral bracts are narrowly ovate to obovate. In other species groups the involucral bracts are usually fairly numerous and subulate, but occasionally are fewer and narrowly ovate.

Pollen grain numbers per anther are similar in sect. *Dimetopia* and *Uldinia*, but significantly lower than in other *Trachymene* groups that have been examined (Keighery unpublished data).

Although the schizocarps of *Trachymene* species do not have wings in the form of long terminal protrusions as in *Uldinia*, wings of other kinds are fairly common among the many-flowered species. For example *Trachymene bialata* (Domin) B.L. Burtt has two narrow wings encircling the body of each monocarp and *T. villosa* (F. Muell.) Benth. has a single broad wing along the outer margin. The origins of the *Uldinia* type of wing can possibly be seen in fruit variants of *T. cyanopetala* that have few bristles, the bristles mostly occurring along the outer margin and medial lines. Some monocarps have one or more of the bristles much more enlarged at the base than the other bristles, especially in *R. Ornduff* 9309–56, and occasionally an extra-large bristle is located in about the same position as a wing in *Uldinia*. In the *Uldinia–Trachymene* hybrid the reduced wing takes the form of an even more enlarged bristle, intermediate between the *T. cyanopetala* bristle and the *Uldinia* wing.

Many *Trachymene* species have bristles of various kinds on their fruits. Again, the closest approach to the usually very prominent spine-like bristles of *Uldinia* is probably to be seen in the sparsely bristly variants of *Trachymene cyanopetala*. Some specimens, such as *K.R. Newbey* 8931, have rows of retrorsely curved or uncinate bristles occurring in the same locations as in *Uldinia* but generally shorter, more slender and flexible.

Each species in sect. *Dimetopia* can be identified by its distinctive fruit and some of the many-flowered *Trachymene* species also have a unique fruit. Some species show great infraspecific variation in monocarp ornamentation, for example having rugose or tuberculate monocarps in some individuals or populations and bristly monocarps in others. *Trachymene pilosa* is a prime example of this kind of variation. In addition, plants of this species commonly have heteromorphic fruits, with the outer (abaxial) monocarp differing markedly in ornamentation from its sister monocarp in the adaxial position, as illustrated in Wheeler (1987: Figure 206A). Heteromorphic fruits have also been recorded in several African genera including *Heteromorpha* Cham. & Schlechtd. (Tilney & van Wyk 1995), and occasionally occur in a few Australian taxa of other genera. A notable example is an unnamed *Hydrocotyle* species from Western Australia that usually has one of the monocarps prominently winged and the other wingless.

While *Uldinia* certainly lacks a full-sized persistent carpophore, opinion differs as to whether *Uldinia* has no carpophore at all (e.g. Domin 1922), a fully deciduous carpophore (e.g. Black 1922) or a partially persistent carpophore (e.g. Fitzgerald 1904). Theobald (1967: 171) states that the carpophore is absent in *Uldinia* and that the persistent remains after the monocarps are shed are "lignified extensions from the pedicel into the base of the fruit".

The term carpophore is retained here in reference to *Uldinia* as there is no other obvious term to use for the tissue separating the monocarps. Certainly a structure of some kind, probably a reduced carpophore, does persist after the monocarps are shed in *Uldinia*. This persistent structure (Figure 1A) is similar to the carpophore in other members of sect. *Dimetopia* (Figure 1B) except that it is always shorter, never reaching the full length of the commissure of the fruit.

In *Uldinia* and *Trachymene* sect. *Dimetopia* the carpophore (Figure 1A,B) is usually highly dorsiventrally compressed and therefore much narrower than the pedicel from lateral view, triangular at the base in dorsal and ventral views and becoming very slender above. In sect. *Didiscus* the carpophore (Figure 1C) is more or less terete, thicker throughout its length and less flexible. Several of the perennial *Trachymene* species of eastern Australia have a carpophore that splits to the base before the monocarps are released, the two halves bending outwards. Considerable variation in carpophore characters may occur within other genera as well. The related genus *Hydrocotyle*, which shows a similar degree of variation in monocarp ornamentation to *Trachymene*, has the carpophore persistent in some species and deciduous in others.

Theobald (1967: 172) summarized the anatomical differences between *Uldinia* and *Trachymene* as "differences in floral venation at the commissure and in the upper portion of the mericarp" and "the orientation of fibres in the endocarp". Taking these differences together with the absence of a carpophore, the nature of the wings and the "retrorse barbs and papillae" on the fruit, he concluded that there was a "basis for the distinctiveness of the genus". His studies provided support for the close relationship between *Uldinia* and *Trachymene*, but he considered the differences between them

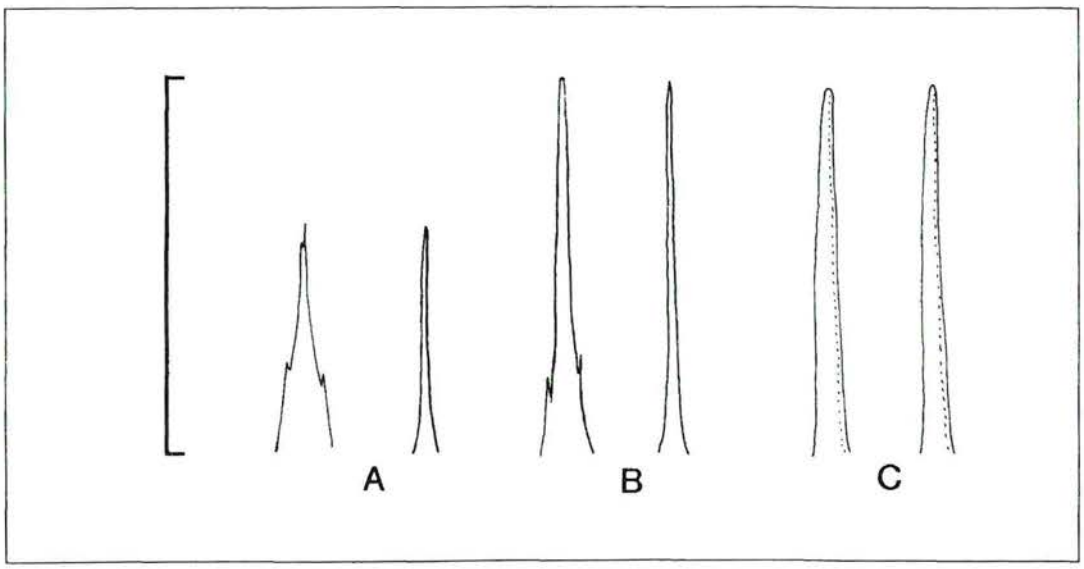

Figure 1. Adaxial and lateral views of carpophore, with magnifications varied to give all species the same commissure length, which is indicated by a bar line. A – *Uldinia*, B – *Trachymene cyanopetala*, C – *Trachymene coerulea*.

sufficient to maintain them as distinct genera. However, some of these 'differences' must be disputed; certainly papillae are common on the mature fruits of several members of *Trachymene* sect. *Dimetopia* and 'retrorse barbs', although not as well developed as in *Uldinia*, can also be present in sect. *Dimetopia*. It should also be noted that *Uldinia* shows much variation in these two characters, with the papillae often absent and the barbs sometimes rather poorly developed. As already discussed, carpophore characters are variable within *Trachymene* and might be useful for distinguishing some of the species groups within the genus, but do not seem to be sufficiently different in *Uldinia* to justify its recognition as a distinct genus.

All of the anatomical and gross morphological differences proposed above to separate *Uldinia* from *Trachymene* relate to the fruit. If bizarre fruits can be used as a sole basis for distinguishing genera, cases could be made for the recognition of further monotypic genera. For example, the Western Australian endemic species *Trachymene croniniana* F. Muell. has a fruit, illustrated in Rye (1999: Figure 6G,H), that is perhaps as highly modified and atypical of the genus as that of *Uldinia*. Only one monocarp develops and it is slightly to distinctly dorsiventrally compressed at maturity rather than being bilaterally compressed as is normal for the genus. The highly sculptured lateral extensions, including pits and narrowly winged ribs, are reminiscent of the fruit ornamentation found in some *Hydrocotyle* species. Two notable fruit developments within *Trachymene* sect. *Dimetopia* are the smooth swollen monocarps in *T. elachocarpa* and the woolly indumentum on the monocarps of *T. ornata*.

With such a high degree of variation in carpophore and fruit morphology within *Trachymene*, the fruiting characters observed in *Uldinia* do not seem very significant and are regarded here as insufficient reason to treat it as a separate monotypic genus. In *Trachymene* sect. *Dimetopia* two trends shown in fruit morphology are: (1) reduction of the carpophore to a highly compressed, fragile structure; (2) a tendency for the commissure to extend along a greater proportion of the length of each monocarp and to exceed the monocarp's width. *Uldinia* is regarded here as carrying these trends to their extreme, having the narrowest monocarps in relation to the commissure length and also the most reduced carpophores in the genus.

Hybridization

The occurrence of hybridization between species is evidence that they are closely related. A great majority of natural hybrids are produced between species belonging to the same species group within a genus; hybridization between members of different species groups within the same genus is much less common, and intergeneric hybidization is rare even under artificial conditions (e.g. Griffin, Burgess & Wolf 1988, Knobloch 1972).

Uldinia ceratocarpa hybridizes with the *Trachymene* species with which it shows the greatest morphological similarity, *T. cyanopetala*. Natural hybrids have been observed in mixed populations of *U. ceratocarpa* and *T. cyanopetala* near Yuna and near York, but not at a number of other mixed populations of these two species. Artificially produced hybrids bred from parent plants derived from the Yuna population matched the natural hybrids, confirming their origin. Germination percentages for the F1 seeds and non-hybrid seeds were similar. Although the F1 hybrids were as vigorous as the parent plants and produced a full crop of normal-sized monocarps, they showed reduced pollen fertility and the monocarps mostly lacked a fully formed seed. The F2 hybrid monocarps failed to germinate although monocarps from both parent species showed a greater than 90% germination rate.

Figure 2 illustrates a natural hybrid from the Yuna population and its parent species *Uldinia ceratocarpa* and *Trachymene cyanopetala.* Unfortunately there was no herbarium specimen of *T. cyanopetala* from the Yuna population, so the illustration of that parent was based on a specimen from the closest available population located closer to Murgoo and may therefore differ somewhat from the appearance of the species at Yuna. The hybrid is intermediate between the two parent species in its fruit morphology. Its monocarp is *c.* 3.4 x 1.9 mm, with two very reduced terminal wings *c.* 0.8 mm long (not including the apical hair or point) and with bristles present but reduced both in number and size. The bristles are mostly 0.5–0.7 mm long and are either widely distributed or concentrated along the outer margin and medial lines. The carpophore is full-sized as in *T. cyanopetala.*

Apart from the limited hybidization described above, no species of sect. *Dimetopia* have been observed to hybridize either with one another or with members of other sections of the genus. This does not result purely from spatial separation of the taxa as there are many mixed populations involving each of the possible combinations of three members of the section, *T. cyanopetala*, *T. ornata* and *T. pilosa.* It is improbable, although not impossible, that any member of sect. *Dimetopia* would be able to produce natural hybrids with a species of another genus, i.e. *Uldinia*, when all species in the section fail to hybridize even with closely related members of their own genus. An estimate obtained by Knoblock (1972) of the frequency of intergeneric hybridization in the Apiaceae was 2.5%, with only one out of the 40 reported cases of natural and artificial hybridization being between genera. Where intergeneric hybrids have been reported in the Apiaceae and other families, they always involve closely related genera and often occur in taxonomically difficult groups in which generic boundaries are uncertain. Inclusion of *Uldinia* within *Trachymene* sect. *Dimetopia* is therefore favoured by this genetic evidence.

Chromosome numbers

The base chromosome number for *Trachymene* is x=11, which is a fairly common base number in the family as a whole (Fedorov 1974; chromosome number indices up to Goldblatt & Johnson 1996). Among related genera, base chromosome numbers are known for several species of *Centella* with x=9, one species of *Micropleura* with x=10, one species of *Platysace* with x=8 (Keighery 1982a), and many species of *Hydrocotyle* with x=12, also some with x=11 and two with x=9.

Most of the many-flowered species of *Trachymene* in south-western Australia are diploid on n=11, one is tetraploid on n=22 and another shows infraspecific variation with both n=11 and n=22 recorded from different populations. Among the eastern Australian and New Guinea species, many of which are perennial, polyploidy is common, with tetraploid, hexaploid and octaploid levels recorded; see summary of previous counts in Keighery (1982a). In sect. *Dimetopia*, there is evidence of dysploidy to a base of x=10, as the only known number for the group is n=20 in *T. pilosa* (Keighery 1982a). Since this tetraploid chromosome number is unique in the genus as far as is known, perhaps it contributes to the reproductive isolation of *T. pilosa*, which fails to hybridize despite its fairly frequent co-existence with several closely related species. Chromosome number differences might, however, be more likely to result in hybrid infertility, such as occurs between *Uldinia ceratocarpa* and *Trachymene cyanopetala*, than in the prevention of hybridization.

Breeding systems

Trachymene sect. *Dimetopia* and *Uldinia* species are all small to medium-sized annuals, usually ephemeral, commonly either erect and 0.01–0.15 m high or decumbent to almost prostrate and with stems up to 0.3 m long. Rarely, especially in *Trachymene pilosa*, they are erect and 0.15–0.35 m high.

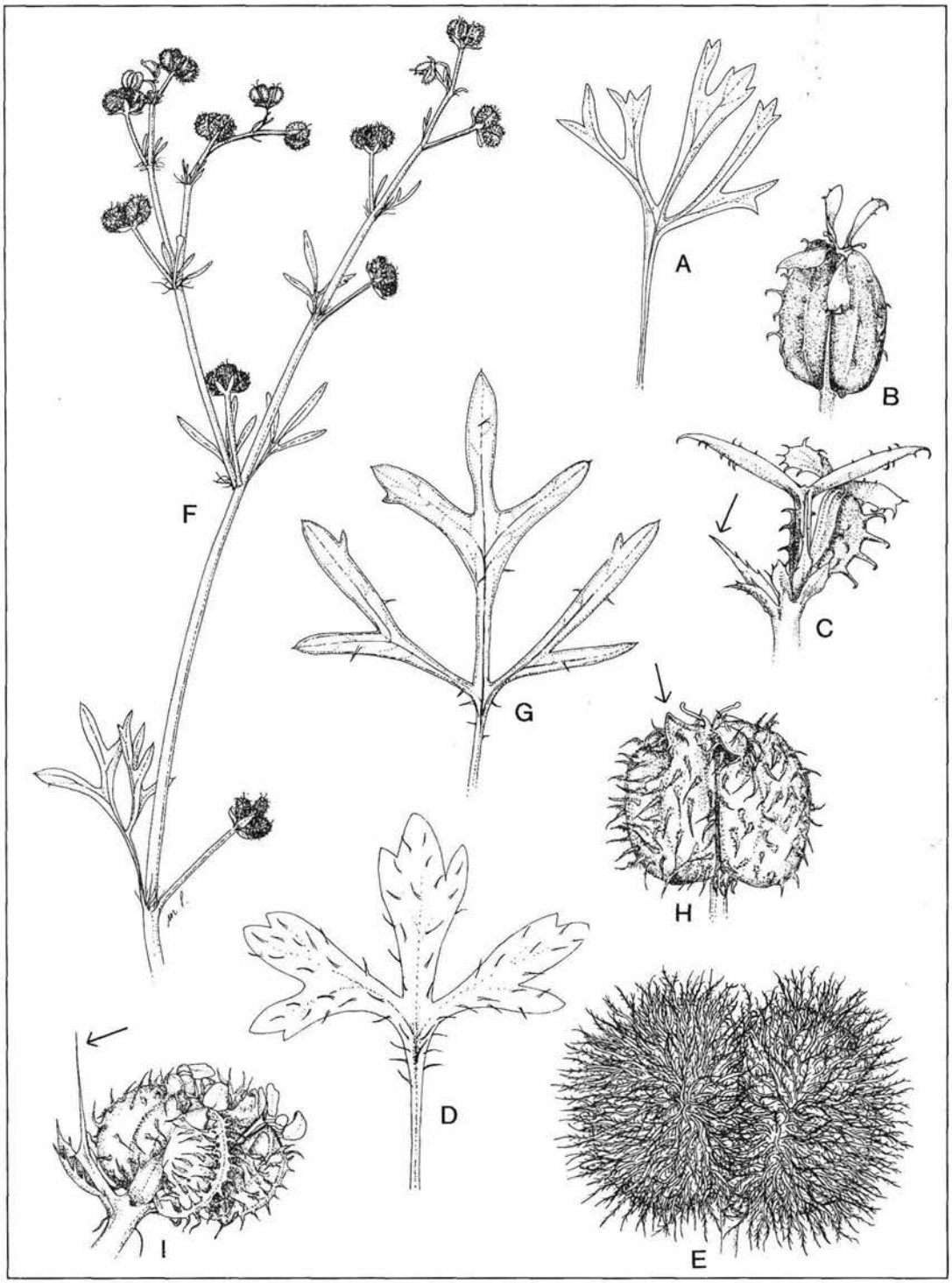

Figure 2. A–C. *Trachymene ceratocarpa*. A – leaf (x2.5), B – young fruit (x8), C – mature fruiting inflorescence with some fruits partially or fully shed, a carpophore arrowed (x6); D,E. *T. cyanopetala*. D – leaf (x2.5), E – fruit (x9); F–I. Natural hybrid between *T. ceratocarpa* and *T. cyanopetala*. F – fruiting branch (x1), G – leaf (x2.5), H – fruit with one of the reduced wings arrowed (x8), I – mature fruiting inflorescence with one fruit shed, a carpophore arrowed (x6). Drawn from *G.J. Keighery* 943 (A–C), *R.A. Saffrey* 1180 (D,E) and *G.J. Keighery* 940 (F–H).

Most have as few as 3–7 flowers and the same number of involucral bracts per umbel; however the most floriferous species, *T. pilosa*, produces usually 5–21 flowers and 5–10 bracts per umbel, but one variant has up to *c.* 50 flowers. In contrast, the *Trachymene* species in other sections of the genus are medium-sized to large annuals or perennials appearing annually from woody underground parts. Annual species in these groups are 0.1–2.5 m high, with large umbels of usually 30–200 flowers (but occasionally as few as *c.* 20 flowers in depauperate specimens), the flower number greatly exceeding the number of involucral bracts. A few of the perennial species regularly produce fairly low flower numbers per umbel, particularly the eastern Australian species *T. ochracea* L.A.S. Johnson with 20–45 flowers and *T. procumbens* (F. Muell.) Benth. with 12–30 flowers (Powell 1992).

Flowers of members of sect. *Dimetopia* and *Uldinia* are small and grouped into usually very small inconspicuous umbels. The outermost flowers are not differentiated from the inner ones except in the leafy coastal variant of *T. pilosa*. Plants occur in large numbers but do not normally mass flower after fires, although some populations of the leafy coastal variant of *T. pilosa* do so. Inflorescences are produced within the small plant or only shortly above the vegetative parts and generally attract few insect pollinators. A few small bees, wasps and flies have been recorded visiting the flowers, which appear to be primarily self-pollinated. The flowers are usually homogamous but sometimes slightly protandrous, produce negligible amounts of nectar, are fully self-compatible and self automatically on flower closure. Seed set in isolated plants approaches 100% (Keighery 1982b).

Members of the other annual *Trachymene* group of southern Australia (sect. *Didiscus*) have larger flowers grouped into large showy umbels with the outer petals of the outermost flowers often distinctly elongated, producing an effect similar to the ray florets of daisy inflorescences. Normally the plants mass flower after fires, prominantly displaying the inflorescences above the vegetative parts of the plants and attracting a large range of small to medium-sized insect pollinators, including bees, beetles, wasps, flies, butterflies and moths. Flowers are protandrous and produce noticeable amounts of nectar. Plants are almost fully self-compatible and seed set is usually high in isolated plants.

Perennial species of eastern Australia belonging to sect. *Trachymene* often produce male flowers as well as bisexual flowers, increasing the inflorescence size, food resources and pollen availability. For further details of breeding systems in *Trachymene* and a comparison with other members of the family see Keighery (1982b).

Among the *Trachymene* sect. *Dimetopia* and *Uldinia* species, the small schizocarps regularly produce two mature monocarps. In most of the many-flowered *Trachymene* species, 'asymmetric' fruits with one monocarp infertile and reduced are more common than those with bilateral symmetry (two full-sized mature monocarps). Some species, such as *Trachymene bialata*, invariably produce asymmetric fruits, the abaxial monocarp reduced to a persistent fleshy strip attached to the carpophore.

Seed dispersal

Developent of hooked bristles on the *Uldinia* fruit, and to a lesser extent in some variants of *Trachymene cyanopetala*, appears to be an effective adaptation for animal dispersal. The hairy bristles common in some *Trachymene* species, such as *T. pilosa*, also appear to be ideally suited to transport on animal fur. Strong evidence of the epizoochorous nature of the fruits is that two species in sect. *Dimetopia* have been recorded as wool aliens in the United Kingdom (Ryves 1975).

Uldinia has the added adaptation of wings, which might improve wind dispersal but perhaps are more useful in extending the hooks beyond the fruit body and so further increasing the likelihood of

animal dispersal. Few *Trachymene* species appear to have large enough wings for efficient wind dispersal, but even slight wings might significantly aid tumble-blowing.

Taxonomic treatment

Trachymene sect. *Dimetopia* (DC.) Keighery & Rye, *comb. nov.*

Dimetopia DC. (de Candolle 1830: 177) and sect. *Dimetopia* (automatically created by publication of *Dimetopia* sect. *Eriosciadium* in 1855). *Type: Dimetopia pusilla* DC. [= *Trachymene pilosa* Sm.].

Cesatia Endl. (Endlicher 1838: 11–12 [repaginated 1839: 200–201]). *Type: Cesatia ornata* Endl. [= *Trachymene ornata* (Endl.) Druce].

Dimetopia sect. *Eriosciadium* F. Muell. (Mueller 1855: 127). *Type: Dimetopia eriocarpa* F. Muell. [= *Trachymene ornata* (Endl.) Druce].

Didiscus A. *Oliganthon* Domin (Domin 1908: 27). – *Didiscus* sect. *Oliganthon* (Domin) C.A. Gardner (Gardner 1931: 100). *Type: Didiscus cyanopetalus* F. Muell. [= *Trachymene cyanopetala* (F. Muell.) Benth.], lectotype here chosen.

Maidenia Domin *nom. illeg.* (Domin 1922: 41–42) *non* Rendle (Rendle 1916: 316, t. 545). – *Dominia* Fedde (Fedde 1929: 272). *Type: Maidenia acroptera* Domin [as *M. macroptera* = *Trachymene ceratocarpa* (W. Fitzg.) Keighery & Rye].

Uldinia J. Black (Black 1922: 569–570, t. 37). *Type: Uldinia mercurialis* J. Black [= *Trachymene ceratocarpa* (W. Fitzg.) Keighery & Rye].

Annual herbs small, ephemeral. *Involucral bracts* 3–10; free portion narrowly ovate to obovate. *Umbels* 3–21(*c.* 50)-flowered. *Anthers* with few pollen grains. *Gynophore* dorsiventrally compressed, very narrowly triangular (or linear with an expanded base), flexible throughout or firm at base and flexible at apex, undivided. *Commissure* extending for most of the length of the monocarp and exceeding the width of the monocarp (except in *T. elachocarpa*).

Etymology. From the Greek *di* – two and *metopon* – brow or forehead, meaning two-browed. Presumably this refers to the different appearance of the two monocarps in the heteromorphic fruit variant of *Trachymene pilosa*, the only taxon included when the genus was originally named. The name seems appropriate for the section as a whole because the schizocarps regularly produce two mature monocarps and the word *di* implies only that there are two and not that they are necessarily different from one another.

Notes. A section of five species, occurring in southern mainland Australia, with the greatest representation in the south-west of Western Australia. These species are keyed out under couplets 7–10 in the key to all Western Australian members of the genus *Trachymene* in Rye (1999).

Domin (1908) did not indicate which taxonomic level he intended for his new infrageneric name *Oliganthon*. Presumably this is why Gardner (1931) did not cite Domin as author when he specified

sectional rank for the name. However, he included the same species as Domin, even listing them in the same order, and referred to Domin's work as the author of the combination *Didiscus junceus* (S. Moore) Domin. It therefore appears that the two names are equivalent and that Gardner's section should be regarded as a recombination of Domin's name.

Both Domin (1908) and Gardner (1931) misplaced *Trachymene elachocarpa* in the many-flowered species group *Polyanthon* [= *Didiscus*]. While *T. elachocarpa* differs from other members of sect. *Oliganthon* [= *Dimetopia*] in having a shorter commissure on the fruit, it otherwise has the typical characters of the section.

Sect. *Dimetopia* can generally be distinguished from other groups in the genus *Trachymene* by its expanded lamina (not subulate) on the bracts and more compressed carpophore, from the perennial species also by its annual life form, and from sect. *Didiscus* also by its smaller average habit and less exposed inflorescences with usually fewer flowers. It may also be the only group in the genus to have the commissure length usually exceeding the width of the monocarps. In *Trachymene* as a whole, sect. *Dimetopia* shows the greatest reduction in life cycle, bract and flower number, pollen grain number and also chromosome number, with all or some of these characters presumably being interrelated.

Trachymene ceratocarpa (W. Fitzg.) Keighery & Rye, *comb. nov.*

Hydrocotyle ceratocarpa W. Fitzg. (Fitzgerald 1904: 22–23). – *Maidenia ceratocarpa* (W. Fitzg.) Domin (Domin 1922: 42). – *Uldinia ceratocarpa* (W. Fitzg.) N.T. Burb. (Burbidge 1954: 452). *Type:* Wurarga, Western Australia, September 1903, *W.V. Fitzgerald* (*n.v.*).

Maidenia acroptera Domin (Domin 1922: 41–42). – *Dominia acroptera* (Domin) Fedde (Fedde 1929: 272). *Type:* Arrara–Lake Eliza, New South Wales, October 1912, *J.L. Boorman* (NSW, *n.v.*).

Uldinia mercurialis J. Black (Black 1922: 569–570, t. 37). *Type:* Ooldea, South Australia, 12 September 1920, *E.H. Ising* (*iso:* MEL).

Illustrations. Black (1926: Plate 40, p. 439); Eichler (1986: Figure 501A); Powell (1992: 96); Theobald (1967: Figures 1–15).

Annual herb commonly 20–100 mm high, the larger plants decumbent to prostrate and with stems up to 300 mm long. *Stems* glabrous or rarely with scattered hairs; hairs retrorse, apparently non-glandular, mostly 0.4–1.0 mm long. *Cotyledons* very narrowly obovate to linear, 11–16 mm long, entire, glabrous. *Petioles* 5–40 mm long, long-ciliate on expanded base, glabrous or with very few hairs on narrow portion; expanded base 1.5–4 mm long; hairs mostly 1–2.5 mm long. *Leaf blades* deeply 3-lobed, the primary lobes simple or further divided into 2 or 3 secondary lobes, which may be slightly further lobed, 7–21 mm long, glabrous or with a few scattered hairs. *Involucral bracts* 3–5; free portion usually ovate, rarely obovate, 2–2.5 mm long, often toothed towards apex, with a few cilia mostly 0.3–0.6 mm long. *Inflorescence* 3–5-flowered. *Petals* white or blue. *Fruiting peduncles* 5–22 mm long; pedicels mostly 0.3–2 mm long, glabrous. *Fruit* homomorphic; carpophore about half as long as the commissure and ?usually exceeding the width of the monocarp, highly compressed, very flexible; styles 0.3–0.6 mm long. *Monocarps* very compressed, with a minute reticulate pattern or minutely papillate, 2-winged, with stout bristles in two rows along outer margin and 1–5 rows of smaller bristles on each face, including a row along each medial line; body 3.2–4.3 x 1.2–1.8 mm, with outer margin either extending horizontally for a short distance beyond outer edge of stylopodium or

immediately descending at an angle of up to 20 degrees; main bristles retrorsely uncinate, 0.3–1.2 mm long, greatly thickened and up to 0.5 mm wide at base, glabrous or minutely papillate; wings formed from a terminal protrusion of each medial line, 2–5.5 x 0.5–1.3 mm, with a few retrorsely uncinate bristles 0.2–0.4 mm long. (Figures 1A, 2A–C)

Selected specimens examined. WESTERN AUSTRALIA: 7.2 km E along Simpson Rd, from Morawa to Three Springs road, 19 Sep. 1991, *R.J. Cranfield & P. Spencer* 8092 (PERTH); Menzies–Diemals road 3.7 km NW of turnoff to Johnson Rocks, 12 Sep. 1982, *H. Eichler* 23002 (PERTH); Ivor Rocks, *c.* 1 km S of White Cliffs Station Homestead, 18 Sep. 1975, *G.J. Keighery* 528 (PERTH); 3 km S of Monkey Mia towards Denham, 28 Aug. 1989, *G.J. Keighery* 10880 (PERTH); 1.1 km SE of Crows Nest Well, 35 km NW of Mt Sandiman, 21 Aug. 1987, *K.R. Newbey* 11644 (PERTH); southern margin of Rason Lake, 13 Sep. 1984, *P.G. Wilson* 12122 (PERTH).

Distribution. Occurs in the south-west of Western Australia, extending from Kennedy Range and Peron Peninsula in the Eremean Botanical Province south to Watheroo National Park and near York in the South West Botanical Province and east to Rason Lake (east of Laverton) in the Eremean. Also occurs in South Australia and New South Wales. (Figure 3A).

Habitat. Commonly occurs on or between sand dunes, recorded in red or yellow soils, often in *Acacia* shrublands, sometimes in shrublands or woodlands dominated by *Callitris*, *Eucalyptus*, *Grevillea* or other genera. Sometimes associated with granite outcrops or salt lakes.

Phenology. Flowering and fruiting period: August to November.

Conservation status. Widespread and fairly common.

Common name. The common name Creeping Carrot has been applied to this species, but is not favoured here as the plant does not show much resemblance to a carrot plant.

Notes. A detailed comparison of the morphology of this species and other *Trachymene* species is given in an earlier section of this paper. *Trachymene ceratocarpa* differs from the other members of sect. *Dimetopia* in its narrower cotyledons and monocarps, the prominent projections on the monocarps and the more reduced carpophore.

In South Australia and New South Wales there do not appear to be any variants of the species that are significantly different from those found in Western Australia and no hybrids have been reported. All known occurrences of the hybrid between *T. ceratocarpa* and *T. cyanopetala* are shown in Figure 3B.

Trachymene cyanopetala (F. Muell.) Benth. (Bentham: 1867: 348). – *Dimetopia cyanopetala* F. Muell. (Mueller 1859: 231). – *Didiscus cyanopetalus* (F. Muell.) F. Muell. (Mueller 1875: 46). – *Didiscus cyanopetalus* var. *ciliatulus* Domin (Domin: 1908: 34). *Type:* Murchison River, Oldfield (*lecto:* MEL 679941, here chosen both for *Dimetopia cyanopetala* and *Didiscus cyanopetalus* var. *ciliatulus.*)

Trachymene moorei Hiroe (Hiroe 1979: 887). – *Trachymene juncea* S. Moore *non* Bunge *nom. illeg.* (Moore 1899: 194). – *Didiscus junceus* (S. Moore) Domin (Domin 1908: 35). *Type:* Gibralter, [Western Australia], September 1895, *S. Moore* (BM, *n.v.* but photograph PERTH 01597337).

Annual herb either erect and 15–150 mm high, or decumbent to semi-prostrate and with spreading stems up to 220 mm long. *Stems* glabrous or hairy; hairs retrorse or somewhat so, 0.3–0.7 mm long, usually appearing non-glandular but sometimes obviously glandular, perhaps losing glandular apex and appearing non-glandular with age. *Cotyledons* usually narrowly obovate, 6–19 mm long, entire, glabrous. *Petioles* 2–50 mm long, long-ciliate on expanded base, glabrous or with few to many hairs on narrow portion; expanded base 1–9 mm long, sometimes with scattered hairs on outer surface; hairs mostly 0.4–1.8 mm long. *Leaf blades* deeply 3-lobed, the primary lobes simple or further divided into 2 or 3 secondary lobes, which may be slightly further lobed, 3–26 mm long, glabrous or with scattered hairs. *Involucral bracts* 3–6; free portion usually ovate or obovate, 1.4–3.5 mm long, sometimes toothed at apex, with cilia mostly 0.3–1 mm long. *Inflorescence* 3–6(7)-flowered. *Petals* blue or white. *Fruiting peduncles* 5–60 mm long; pedicels mostly 1–3 mm long, glabrous or rarely with a few hairs towards apex. *Fruit* homomorphic; carpophore as long as commissure and exceeding the width of the monocarp, highly compressed, flexible; styles 0.5–0.8 mm long. *Monocarps* very compressed, 2.6–3.4 x 1.5–2.3 mm, with a distinct medial line, usually densely bristly and shaggy-looking, sometimes sparsely bristly to glabrous, smooth or minutely papillate between the bristles, pale to medium brown at first, the surface (often hidden by bristles) becoming dark brown to almost black; outer margin extending horizontally beyond outer edge of stylopodium before curving downwards; bristles (0.2)0.4–2.5 mm long, either glabrous or with minute patent side branches up to 0.1 mm long, white to deep purple, usually *c.* 0.1 mm wide at base at maturity, if broader then compressed. (Figure 1B)

Distribution. Widespread in the south-west of Western Australia, except for the most humid portion (including the Perth Region). Occurs in the South West Botanical Province from Nerren Nerren Station and Kalbarri National Park south-east to Stirling Range, and extends inland to Koonmarra Station and near Agnew in the Eremean Botanical Province and to Uraryie Rock (south-west of Zanthus) in the South-western Interzone. Also occurs in South Australia, New South Wales and Victoria. (Figure 3C)

Habitat. Occurs in sandy soils, on granite outcrops or other rocky sites, often in *Acacia* shrublands or *Eucalyptus* woodlands.

Phenology. Flowering and fruiting period: mainly August to November.

Conservation status. Widespread and common but variants with non-bristly or sparsely bristly fruits are found in only a few localities.

Common name. A rather inappropriate common name, Purple Parsnip, has been applied to this species, which has blue not purple petals and does not resemble a parsnip plant. When in fruit, however, the plant's inflorescences may have a more purplish or pinkish appearance.

Notes. According to the protologue, this species has densely 'ciliate' bristles on the fruit. Actually the hairs or lateral branches arise and radiate from all positions on the bristles rather than being strictly marginal or in rows as implied by the term ciliate. The specimen chosen here as the lectotype for *T. cyanopetala* has uniform fruits with bristles of the densely hairy kind. Further advantages of this specimen are that it has both a definite locality and collector, and it is the first of the specimens cited by Mueller. The other material examined was:

1. Murchison River, *Oldfield* (MEL 66987) – two plants mounted on the sheet, one with densely hairy bristles and one with glabrous bristles.

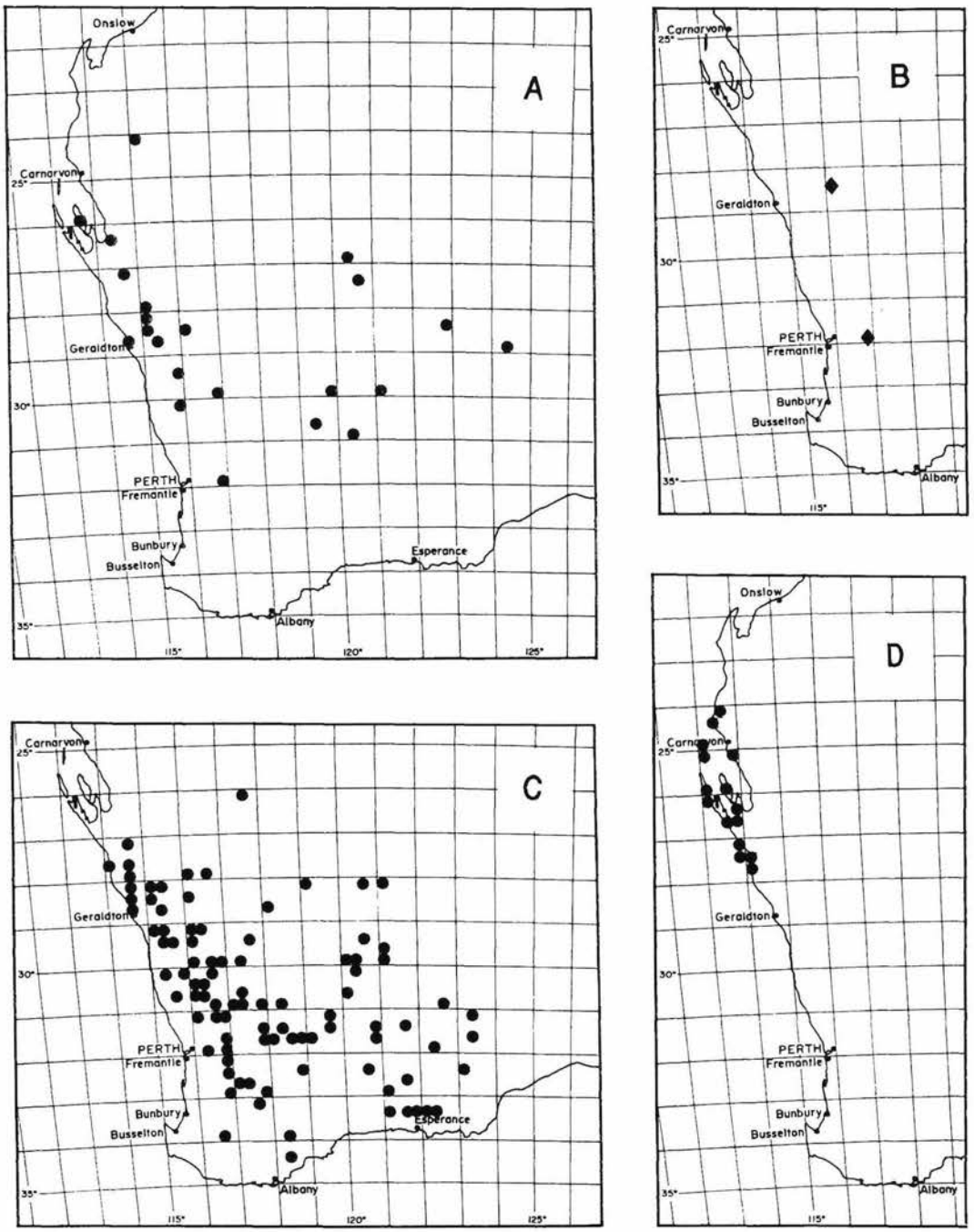

Figure 3. Distribution in Western Australia. A – *Trachymene ceratocarpa*, B – Hybrid between *T. ceratocarpa* and *T. cyanopetala*, C – *T. cyanopetala*, D – *T. elachocarpa*.

2. "Mononuka" [probably Moonymooka, Victoria], *P. Walcott* (MEL 36988) – material with densely hairy bristles.

3. Murray River, collector unknown (MEL 36986) – with mixed specimens, some having glabrous or sparsely hairy bristles and others densely hairy bristles.

Domin (1908: 34) evidently meant his *Didiscus cyanopetalus* var. *typicus* Domin *nom. inval.* to be the typical variant of *T. cyanopetala*, but included type material of this species instead under the variant he named var. *ciliatulus*. His description of var. *typicus* as having glabrous bristles also conflicts with the protologue of *T. cyanopetala*. Since Domin clearly intended one of his varieties to be equivalent to the species and cited *Oldfield* material from Murchison River, the same lectotype is chosen for his var. *ciliatulus* as for the species.

Western Australian specimens are much more variable than those from other states, showing significant differences in the number, arrangement and size of the bristles as well as in the hairiness of the bristles. Of the three main variants given below, only the first one extends to other regions of Australia. In South Australia both the hairy and glabrous kinds of bristle occur in this variant, but it appears from the description given for the species in New South Wales (Harden 1992) that only the hairy kind of bristle occurs there.

a. Densely bristly variant

Illustrations. Eichler (1986: Figure 500C); Powell (1992: 103).

Monocarps bristly throughout, pale to medium brown at first, becoming dark brown or rarely almost black; bristles slender, (0.7)1–2.5 mm long, either glabrous or with few to numerous minute patent hairs up to 0.1 mm long, the base *c.* 0.1 mm wide at maturity. (Figure 2D,E)

Selected specimens examined. WESTERN AUSTRALIA: 48 km W of Coonana near Coardonia Rocks, 18 Sep. 1973, *R.J. Chinnock* 1112 (PERTH); 1 km S of Truslove Reserve Rd on Swan Lagoon Rd, Truslove Nature Reserve, 22 Sep. 1992, *C.F. Craig* 2169 (PERTH); *c.* 2 km N of Morawa, 25 Sep. 1976, *L. Haegi* 1128 (PERTH); 9 miles [14.5 km] S of Koorda to Wyalkatchem, 6 Sep. 1974, *G.J. Keighery* 66 (PERTH); 50.7 km E of Kalbarri, 20 Sep. 1973, *G.J. Keighery* 1768 (PERTH); Dryandra State Forest, 3 Nov. 1987, *D.M. Rose* 459 (PERTH).
NEW SOUTH WALES: southern end of Narrandera Range, W of summit of Mt Bogolong, 1 Oct. 1978, *T.B. Muir* 6091 (PERTH).

Distribution. The Western Australian distribution is as described for the species as a whole but with few records in the general area where the other two variants are found (Figure 3C). Also occurs in South Australia, New South Wales and Victoria.

Habitat. Occurs in sandy soils, on granite outcrops or other rocky sites, often in *Acacia* shrublands or *Eucalyptus* woodlands.

Notes. The fruit bristles are slender, usually long and giving a shaggy appearance to the fruit, but sometimes shorter, for example in specimens from Comet Vale (*R.D. Royce* 4411, 4498) and south of Zanthus (*K.R. Newbey* 7234).

b. Intermediate variant

Monocarps with 3–5(8) rows of bristles along the medial and other lines or intermediate between the lines, usually absent between the medial line and the commissure; bristles rather stiff, patent or retrorsely curved, compressed, narrowly or very narrowly triangular, 0.3–0.6 mm long, with numerous minute hairs up to 0.1 mm long, usually *c.* 0.1 mm wide at base at maturity but sometimes 0.15–0.2 mm wide, with occasional bristles *c.* 0.3 mm wide, the broad bristles much compressed at the base.

Selected specimens examined. WESTERN AUSTRALIA: 6 km E of Beechina Hill, 27 Oct. 1980, *R.J. Cranfield* 1268 (PERTH); Boyagin Rock, 12 Sep. 1983, *R. Ornduff* 9299–22 (PERTH); Boyagin Rock, 15 Oct. 1983, *R. Ornduff* 9299–101 (PERTH); The Humps, 4 Oct. 1983, *R. Ornduff* 9309–56 (PERTH).

Distribution. Known from a few scattered localities including Boyagin Rock and The Humps, north-east of Hyden in the South West Botanical Province of Western Australia.

Habitat. Occurs in soil pockets on granite outcrops or sheets of granite, also recorded from laterite.

c. Non-bristly variant

Monocarps non-bristly or often with a few small hair-like bristles along the abaxial line or in two rows along the submarginal lines on either side of the abaxial line, occasionally also with 1 or 2 bristles on each medial line, becoming almost black (appearing very deep reddish brown when viewed with a strong light source); bristles rather stiff, patent or retrorsely curved to retrorsely uncinate, 0.2–0.4 mm long, glabrous or papillate or with patent hairs *c.* 0.05 mm long, the base becoming up to 0.2 mm wide and very compressed at maturity. (Figure 4A–C)

Selected specimens examined. WESTERN AUSTRALIA: Tutanning Reserve, 21 Sep. 1974, *A.S. George* 12867 (PERTH); Wallaroo Rock, WNW of Coolgardie, 17 Sep. 1981, *K.R. Newbey* 8931 (PERTH).

Distribution. Endemic to south-western Australia, known from a few records extending from the Menzies area of the Eremean Botanical Province south-west via the South-western Interzone to Tutanning Reserve in the South West Botanical Province.

Habitat. Occurs in soil pockets on granite outcrops or sheets of granite.

Conservation status. Previously listed under the name *T. moorei* as Priority Two of the CALM Conservation Codes for Western Australian Flora, but removed from the list because it is now considered to be a variant of *T. cyanopetala.*

Notes. This extreme variant of *Trachymene cyanopetala* was previously regarded as a distinct species, named *T. moorei*, because its dark-coloured non-bristly fruits give it a distinctive appearance. In typical *T. cyanopetala* the fruits may be just as darkly coloured on the surface at maturity but this is largely or totally hidden by the bristles so that the fruit appears to be a less dark colour. In the area where typical *T. moorei* occurs and nearby, many specimens are intermediate between typical *T. cyanopetala* and typical *T. moorei*, having sparsely bristly fruits with relatively short bristles.

Trachymene elachocarpa (F. Muell.) B.L. Burtt (Burtt 1941: 44). – *Didiscus elachocarpus* F. Muell. (Mueller 1892: 58). *Type:* between Murchison River and Shark Bay, [Western Australia], F. Mueller (*n.v.*).

Annual herb erect or decumbent, 15–50 mm high; indumentum of patent glandular hairs, those on leaf blades and bracts sometimes losing glandular apex. *Stems* rather densely hairy; hairs patent, 0.1–0.4 mm long. *Cotyledons* narrowly obovate, 3.5–6 mm long, entire, glabrous. *Petioles* 1–17 mm long, ciliate on the expanded base and sparsely to densely hairy above; base often only slightly expanded, up to 2 mm long; hairs mostly 0.3–0.6 mm long. *Leaf blades* shallowly to deeply 3-lobed, the primary lobes entire or with 2 or 3 secondary lobes, which may be further lobed, 2.5–16 mm long, with a few scattered hairs or sometimes more densely hairy. *Involucral bracts* 5–9; free portion narrowly obovate to more or less elliptic, 2–3.5 mm long, sparsely hairy on outer surface or with a few hairs along midvein, ciliate on margins; hairs mostly 0.2–0.5 mm long. *Inflorescence* 5–15-flowered. *Petals* white. *Fruiting peduncles* 5–34 mm long; pedicels mostly 0.5–4 mm long, often with a few hairs towards summit. *Fruit* homomorphic, apparently succulent; carpophore as long as commissure but shorter than width of monocarp, 0.4–0.6 mm long, highly compressed, flexible; styles 0.3–0.4 mm long. *Monocarps* swollen especially towards outer margin, 0.7–1.1 x 0.5–0.8 mm (up to 1.1 mm across the diagonal), smooth (but shallow bumpy shrinkage marks often visible on dried material), the medial line not visible; outer margin extending horizontally beyond outer edge of stylopodium before curving downwards. (Figure 4D–F)

Selected specimens examined. WESTERN AUSTRALIA: *c.* 1.4 km WSW of Red Cliff Point, Bernier Island, 26 Aug. 1998, *S.J. Claymore & A.S. Weston* 151; Herald Bay outcamp, Dirk Hartog Island, 3 Sep. 1972, *A.S. George* 11462 (PERTH); Quobba, 11 Aug. 1976, *G.J. Keighery* 830 (PERTH); Little Lagoon, 1 km from Denham, 29 Aug. 1989, *G.J. Keighery* 11308 (PERTH); Tamala Station, 20 July 1988, *G.J. Keighery & J.J. Alford* 1992 (PERTH), Dorre Island, 16 July 1959, *R.D. Royce* 5915 (PERTH); Denham, 29 Sep. 1985, *P.G. Wilson* 12232 (PERTH).

Distribution. Endemic to Western Australia, extending from near Cape Cuvier and Bernier Island in the Eremean Botanical Province south to Kalbarri National Park in the far north of the South West Botanical Province. (Figure 3D)

Habitat. Occurs in sandy soils near the coast, sometimes on dunes or overlying limestone, in low coastal shrublands or herbfields.

Phenology. Flowering and fruiting period: July to September.

Conservation status. Not considered to be at risk at present.

Notes. This was the first species of Apiaceae to have been collected in Australia, being one of the plants brought back by William Dampier after his expedition to the Shark Bay area in 1699 (George 1971). It is one of the very few *Trachymene* species in which the monocarps are not greatly compressed and possibly has the smallest fruits in the genus; certainly its fruits are smaller than those of any other Western Australian species.

Compared with other members of sect. *Dimetopia*, *T. elachocarpa* is unique in having swollen monocarps with no medial line visible and in having the commissure shorter than the width of the monocarp.

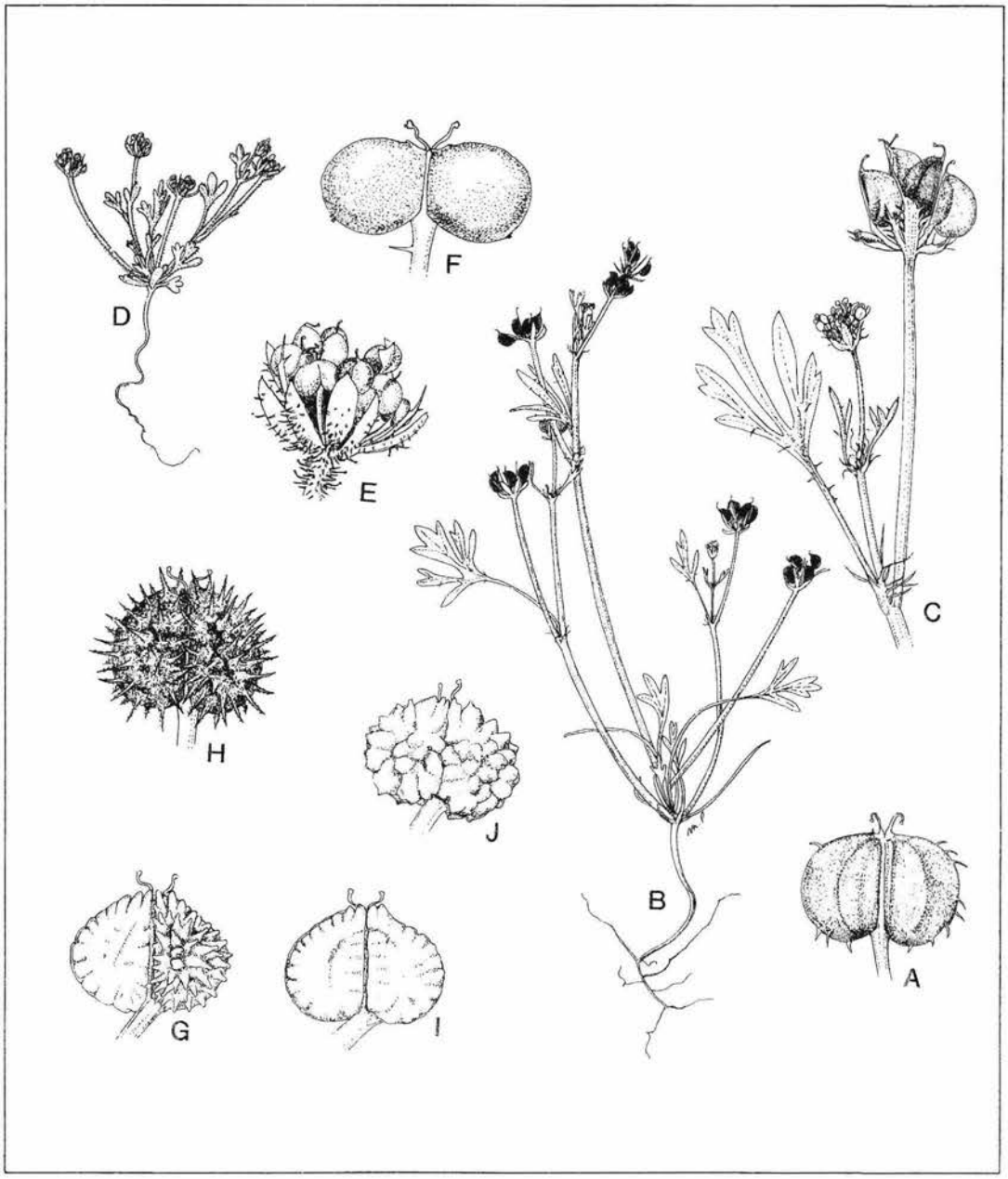

Figure 4. A–C. Non-bristly variant of *Trachymene cyanopetala*. A – fruit with a few hair-like bristles (x6), B – whole plant of specimen with fruits completely lacking bristles (x1), C – flowering and fruiting branch from B (x3.5); D–F. *Trachymene elachocarpa*. D – whole plant (x1), E – inflorescence (x5.5), F – fruit (x15); G–J. *Trachymene pilosa*. G – heteromorphic fruit, the inner monocarp shallowly tuberculate and the outer one with short bristles (x6.5), H – homomorphic fruit, both monocarps with long bristles (x8.5), I – homomorphic fruit with shallowly tuberculate monocarps (x6.5), J – homomorphic fruit with deeply tuberculate monocarps (x6.5). Drawn from *K.R. Newbey* 8931 (A–C), *G.J. Keighery* 11308 (D–F), *K.R. Newbey* 8868 (G), *G.J. Keighery* 5895 (H), *G.J. Keighery* 11485 (I) and *K.R. Newbey* 7589 (J).

Trachymene ornata (Endl.) Druce (Druce 1917: 650). – *Cesatia ornata* Endl. (Endlicher 1838: 200 or 63–64). – *Didiscus ornatus* (Endl.) Domin (Domin 1908: 35–37). *Type:* interior of western Australia, *Roe* (*n.v.*).

Dimetopia eriocarpa F. Muell. (Mueller 1855: 127). – *Trachymene eriocarpa* (F. Muell.) Benth. (Bentham 1867: 348). – *Didiscus eriocarpus* (F. Muell.) F. Muell. (Mueller 1875: 46). *Type:* near Cudnaka, in the neighbourhood of Lake Torrens, [South Australia] (*?holo:* MEL not numbered.). Also numbered specimens MEL 679943, 679944 from Cudnaka, Herbarium O.W. Sonder.

Trachymene ornata var. *semilanata* (J.M. Black) H. Eichler (Eichler 1963: 297). – *Didiscus ornatus* var. *semilanatus* J.M. Black (Black 1926: 438). *Type:* between Maree and Strangways Springs, South Australia (*n.v.*).

Illustrations. Eichler (1986: Figure 500E); Erickson *et al.* (1979: Figure 438); Powell (1992: 103).

Annual herb 20–250 mm high; indumentum (where present on vegetative organs) of glandular or non-glandular hairs, sometimes with minute lateral branches. *Stems* sparsely to densely hairy or rarely glabrous; hairs retrorse or patent, mostly 0.3–1.4 mm long. *Cotyledons* narrowly obovate, 7–24 mm long, entire, glabrous. *Petioles* 4–46 mm long, long-ciliate on expanded base and sparsely to rather densely hairy above; base sometimes only slightly expanded, 1–5 mm long, sometimes hairy on outer surface; hairs mostly 0.3–1.7 mm long. *Leaf blades* deeply 3-lobed, the primary lobes simple or further divided into 2 or 3 secondary lobes, which may be further lobed, 4–36 mm long, with more or less patent hairs. *Involucral bracts* 3–6, usually purple- or red-tinged to deeply red-purple throughout; free portion narrowly ovate to narrowly obovate, 1.8–4.5 mm long, with cilia mostly 0.2–1.0 mm long and often scattered hairs on outer surface. *Inflorescence* 3–7-flowered. *Petals* white or pale blue. *Fruiting peduncles* 10–68 mm long; pedicels mostly 2–6 mm long, glabrous or hairy. *Fruit* homomorphic, white throughout or pale purple to deep reddish purple at summit, sometimes also with a dark central portion (if indumentum shorter and less dense there); carpophore as long as commissure and exceeding the width of the monocarp, very compressed, flexible; styles 0.6–0.9 mm long. *Monocarps* very compressed, 2.0–2.7 x 1.2–1.8 mm, covered by many hairs (or very fine hair-like bristles) forming a dense woolly indumentum over whole surface or concentrated on the margin, 2.4–7 x 1.6–4.5 mm including woolly covering, with a distinct (often pale) medial line or slight to prominent medial ridge beneath the woolly layer, often prominently rugose at maturity, sometimes with a reticulate pattern of large pits to the outside of the medial ridge and a furrow to the inside of the medial ridge, sometimes distinctly beaked at apex; outer margin descending at 30–45 degrees from the outer edge of stylopodium; hairs curved or twisted into an indumentum 0.4–2.5 mm long, with a number of lateral branches; branches patent, 0.2–0.4 mm long, sometimes further branched. **Spongefruit**

Selected specimens examined. WESTERN AUSTRALIA: N of Ajana, 1 Sep. 1959, *N.T. Burbidge* 6436 (PERTH); 6 miles [10 km] E of White Cliffs Station, 18 Sep. 1975, *G.J. Keighery* 530 (PERTH); Quarderwardup Lake, SE margins of Stirling Range, 15 Oct. 1983, *G.J. Keighery* 6657 (PERTH); Ponier Rock, *c.* 65 km S of Balladonia Motel, 13 Sep. 1980, *K.R. Newbey* 7303 (PERTH); 17.5 km W of Lyons River Homestead, 19 Aug. 1987, *K.R. Newbey* 11580 (PERTH); Hyden Rock, 13 Sep. 1983, *R. Ornduff* 9307–14; York, 14 Oct. 1954, *G.G. Smith* (PERTH).
SOUTH AUSTRALIA: upper slopes of Mt John, Wilpena, 14 Sep. 1960, *D.E. Symon* 582 (PERTH).

Distribution. Widespread in the south-west of Western Australia, extending from Lyons River and Wooramel Stations in the Eremean Botanical Province south-east to Stirling Range in the South West Botanical Province and Ponier Rock in the South-western Interzone and inland to Windidda Station and Yamarna in the Eremean. Also occurs in South Australia and New South Wales. (Figure 5A)

Habitat. Commonly occurs in soil pockets or crevices on granite and other types of rocks, in moss mats and herbfields or in shrublands or low woodlands, these often dominated by *Acacia* species or *Eucalyptus* species with a mallee habit.

Phenology. Flowering and fruiting period: mainly July to October.

Conservation status. Widespread and common.

Common name. Spongefruit is accepted here as the common name for this species as it well describes its odd fruit. The dense woolly indumentum on the fruits increases their apparent size and hides the beak on the monocarps and the whitish medial line from view.

Notes. The vegetative indumentum is extremely variable. Throughout the species range and almost exclusively in some areas, the upper peduncles have long retrorse hairs, often with minute lateral branches and with the apical gland (when present) fairly inconspicuous. In many specimens from the more humid south-western part of the species range, from Wickepin and Hyden southwards, the peduncles have short prominently glandular hairs tending to be more patent, with the apical gland deep purple. Specimens with a mixture of both main kinds of hairs are also common through most of the species range.

There are two main fruit variants, one with the woolly indumentum densely covering the whole surface of the monocarp and the other with long woolly indumentum around the margin and shorter indumentum on the lateral faces of the monocarp, giving the fruit a somewhat winged appearance. The latter variant occurs in South Australia, where it has been treated as var. *semilanata* (e.g. Eichler 1986: 1007) and is apparently known only from the type locality. In Western Australia many specimens (e.g. *D.J. Pearson* 2140) have the young fruits sparsely hairy and dark in the centre, with much longer denser indumentum around the margin giving the fruits a winged appearance. Mature fruits invariably appear to be densely hairy throughout except where the indumentum has been rubbed off the medial ridges. The South Australian taxon does not appear to be any more significant than the many fruit variants of *Trachymene cyanopetala* and *T. pilosa* and shows no other morphological differences, so is not recognized here as a distinct variety.

Trachymene pilosa Sm. (Smith 1819). – *Didiscus pilosus* (Sm.) Domin (Domin 1908: 31–33). – *Trachymene pilosa* Sm. var. *pilosa* (created by publication of var. *preissiana* in 1867). *Type:* King George Sound, [Western Australia], *Menzies (n.v.).*

Dimetopia pusilla DC. (de Candolle 1830: 177). – *Didiscus pusillus* (DC.) F. Muell. (Mueller 1875: 47). *Type:* New Holland [Western Australia] (*holo:* G, *n.v.*, microfiche seen).

Dimetopia hirta Benth. (Bentham 1837: 54). *Type:* King George Sound, [Western Australia], *Huegel (n.v.)*

Trachymene pilosa var. *preissiana* Benth. (Bentham 1867: 348). – *Dimetopia preissii* Bunge (Bunge 1845: 284–285). – *Didiscus pilosus* var. *preissii* (Bunge) Domin (Domin 1908: 33). *Type:* Rottnest Island, [Western Australia], 21 August 1839, Herb. Preiss. No. 2089 (*n.v.*).

Annual herb 20–350 mm high. *Stems* usually sparsely to densely glandular-hairy, sometimes glabrous; hairs patent, 0.3–0.8(1.3) mm long. *Cotyledons* elliptic to obovate or narrowly obovate,

5–11 mm long, entire, glabrous or rarely sparsely glandular-hairy. *Petioles* 6–78 mm long, long-ciliate on expanded base, glabrous or with few to many cilia on narrow portion; expanded base 2.5–9 mm long; hairs mostly 0.5–1.5 mm long. *Leaf blades* usually very deeply 3-lobed, the primary lobes further divided into usually 3 secondary lobes, which are often further lobed, 4.5–40 mm long, with a uniform sparse indumentum or with few hairs. *Involucral bracts* (5)7–10; free portion narrowly ovate to obovate or rarely almost narrowly oblong, 1.8–4.3 mm long; cilia mostly 0.1–0.6 mm long. *Inflorescence* (5)11–21(*c.* 50)-flowered. *Petals* white. *Fruiting peduncles* 14–92 mm long; pedicels 1–7 mm long. *Fruit* heteromorphic or homomorphic (commonly bristly on outer monocarp and tuberculate-rugose to fairly smooth on inner monocarp, less commonly bristly or tuberculate on both monocarps); carpophore as long as commissure and exceeding the width of the monocarp, compressed or very compressed, stiff in basal half, somewhat flexible towards apex; styles 0.4–0.8 mm long. *Monocarps* very compressed, 1.7–3.3 x 1.4–2.4 mm, with a distinct medial line, slightly beaked at apex; outer margin usually immediately descending at a shallow angle of 10–30 degrees from the outer edge of styopodium, rarely almost horizontal; bristles up to 1.0 mm long, terete or only slightly compressed at the base at maturity and 0.1–0.4(0.5) mm wide at maturity, often very solid, minutely retrorsely barbed; tubercles (when present) prominent to reduced but always two apical ones visible on a slight beak even when the surface is otherwise rather smooth. (Figures 4G–K, 6)

Distribution. Widespread in the south-west of Western Australia. Occurs in near-coastal areas and offshore islands around the coast of the South West Botanical Province from Bernier Island (west of Carnarvon) to Middle Island, Recherche Archipelago, with an isolated coastal record from near Eyre near the border between the South-western Interzone and Eremean Botanical Province. Extends inland to Canning Hill (north of Paynes Find) in the Eremean and to Mt Walter (east of Koolyanobbing) and Jyndabinbin Rocks (south-west of Norseman) in the Interzone. Also occurs in South Australia and Victoria. (Figure 5B)

Habitat. Occurs on coastal sand dunes and inland dunes, or associated with salt lakes, or on granite outcrops, often in *Banksia*- or *Eucalyptus*-dominated vegetation.

Chromosome number. n=20 (Keighery 1982). Voucher specimens: *G.J. Keighery* 493, 2053, 2177.

Phenology. Flowering and fruiting period: August to October.

Conservation status. Widespread and common.

Common name. Hartley (1979) records the common name Dwarf Parsnip for this species but this was not followed by Wheeler (1987) and is not favoured here either.

Affinities. Trachymene pilosa has often been confused with *T. cyanopetala* but can be distinguished by having one or more of the following characters: stems with patent glandular hairs, flowers more than 7 per umbel, fruits with one or both monocarps tuberculate at least at apex and bristles with retrorse hairs, and monocarps shortly but distinctly narrowed at the apex into a slight beak. Another difference in the bristles of the two species is that the *pilosa* bristle is terete or only slightly compressed at the base, which is usually distinctly enlarged and solid at maturity, whereas the *cyanopetala* bristle is either very slender at the base or broad but very compressed.

Notes. Some other synonyms of *Trachymene pilosa* are listed by Bentham (1867: 348) and Domin (1908: 31) as follows: *Didiscus pilosus* var. *glaberrimus* Domin, *Dimetopia isocarpa* Bartl., *Dimetopia*

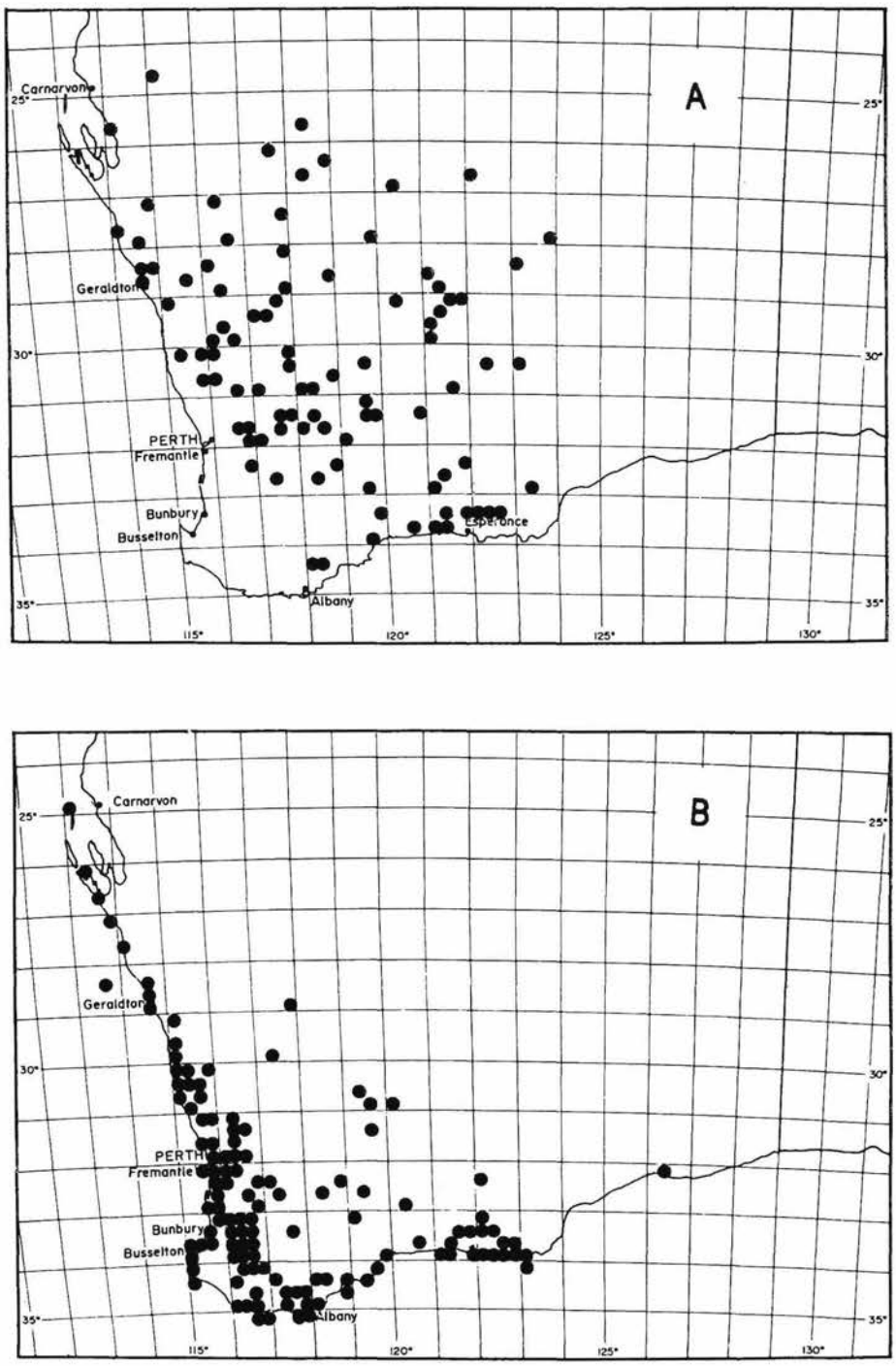

Figure 5. Distribution in Western Australia. A – *Trachymene ornata*; B – *T. pilosa*.

homocarpa Bunge, *Dimetopia walpersii* Bunge and *Pritzelia didiscoides* Walp. No type material of these taxa has been seen as they all either lack type citations or were named from cultivated material.

Trachymene pilosa is an extremely variable taxon which appears to be in the process of evolution into a number of species. A leafy variant with numerous long radical leaves forming a dense tuft equalling or exceeding the stems and with relatively long involucral bracts, is distributed from the Abrolhos islands southwards along the west coast probably to near Bunbury. Its dense domed habit is shown from top view in Figure 6. The leafy variant occurs on islands and on the Quindalup dunes system of the mainland, in relatively exposed locations including the sandy margins of saline lakes, its unusual domed growth form presumably an adaptation to its harsh environment. It has been named var. *preissiana* but is not recognized here as it appears to completely intergrade with specimens with the typical growth form.

A few plants (e.g. *G.J. Keighery* 2572 and *P.G. Wilson* 8128) have glandular hairs on the cotyledons and also on the stems just below the cotyledons. The great majority of specimens have glabrous cotyledons and the stem below them also glabrous. *T. pilosa* tends to have its leaves more divided than other species in sect. *Dimetopia* but there is considerable overlap in this character.

Inland specimens of *T. pilosa* tend to be smaller plants than the coastal specimens, with fewer flowers per umbel and with bristles either shorter or absent, the coastal specimens always having bristles on the outer monocarp or both monocarps. Coastal plants sometimes have large umbels with dimorphic flowers, the outermost flowers having the outer petal enlarged. This species shows the closest approach to the members of sect. *Didiscus*, which regularly produce large or very large umbels with dimorphic flowers.

Figure 6. Photograph of *Trachymene pilosa* taken by G.J. Keighery at Lake Coolongoolup.

In coastal areas where the species is most common, the fruit is most often heteromorphic with long bristles on the outer monocarp and the inner monocarp prominently rugose-tuberculate to fairly smooth with a few marginal tubercles. Less commonly in coastal populations the fruit is bristly on both monocarps and plants of this and the more common kind frequently occur in mixed populations. There are also populations with a mixture of two different sorts of heteromorphic fruits, some with the inner monocarp prominently tuberculate and others with the inner monocarp largely smooth, sometimes also with intermediate fruits. These variants become replaced inland by variants with shorter bristles or with both monocarps tuberculate. In heteromorphic fruits on specimens from far inland, the bristles are very short. One specimen from Lake Seabrook (*K.R. Newbey* 5872) has the bristles so reduced as to resemble a very prominent type of rugose patterning rather than bristles.

Bristle thickness is greater in southern than in north-eastern populations. In areas from Perth northwards the bristles are commonly 0.1–0.3 mm wide at the base at maturity whereas those from southern areas are mostly 0.2–0.4(0.5) mm wide.

The main fruit variants in Western Australia are listed below. Judging from the descriptions in the most recent floras for South Australia and Victoria (Eichler 1986, Willis 1972), only the variant of *T. pilosa* with the highly heteromorphic fruits occurs in those states. This is also the most common variant in Western Australia.

a. Heteromorphic variant with long bristles

Illustrations. Eichler (1986: Figure 500F); Wheeler (1987: Figure 206D).

Fruit with outer monocarp bristly and inner monocarp tuberculate; bristles 0.6–1.0 mm long.

Selected specimens examined. WESTERN AUSTRALIA: East Wallabi Island, Abrolhos Islands, 3 Oct. 1987, *J.J. Alford* 654 (PERTH); Boonanarring proposed nature reserve, off Wannamal road, 21 Sep. 1987, *J.J. Alford* 715 (PERTH); *c.* 1.7 km W of Wedge Rock, Hospital Landing area, Bernier Island, 28 Aug. 1998, *S.J. Claymore & A.S. Weston* 148; 2.5 km N of Scadden East Rd on Dempster Rd, 25 Sep. 1992, *G.F. Craig* 2221 (PERTH); S of Tamala homestead, 27 Aug. 1969, *A.S. George* 9599 (PERTH); 7.9 km N of Eyre, 1 Oct. 1984, *G.J. Keighery* 7566 (PERTH); below Jilakin Rock, 24 Oct. 1959, *C.V. Malcolm* (PERTH); Middle Island, Recherche Archipelago, 11 Feb. 1960, *R.D. Royce* 6267 (PERTH); Gibraltar Rock, Porongurup Range, 10 Nov. 1960, *G.G. Smith* (PERTH); Cape Naturaliste, 5 Nov. 1974, *D.J.E. Whibley* 5022 (PERTH).

Distribution. A very common variant in coastal and near-coastal areas of Western Australia from Bernier Island to near Eyre, and extending inland to Jilakin Rock. Also occurs in South Australia and Victoria. (Figure 7A)

Notes. As far as is known, this fruit variant includes all the leafy domed specimens that have been named var. *preissiana* and one specimen (*J.J. Alford* 654) of that is cited above.

b. Heteromorphic variant with short bristles

Fruit with outer monocarp bristly and inner monocarp tuberculate; bristles up to 0.6 mm long. (Figure 4G)

Specimens examined. WESTERN AUSTRALIA: southern end of Lake Seabrook, 11 Sep. 1979, *K.R. Newbey* 5872 (PERTH); Mt Walter, *c.* 88 km NE of Station, 16 Sep. 1981, *K.R. Newbey* 8868 (PERTH); Lake Deborah East, 26 Sep. 1981, *K.R. Newbey* 9060 (PERTH).

Distribution. A rare inland variant known from only three localities in the area south and south-east of Koolyanobbing, Western Australia. (Figure 7A)

c. Homomorphic bristly variant

Fruit with both monocarps bristly. (Figure 4H)

Selected specimens examined. WESTERN AUSTRALIA: off Talbot West Rd, 3.2 km S of Mt Talbot, 12 Nov. 1996, *M.G. Allen* 580; Spalding Park, 3 miles [5 km] N of Geraldton, 7 Sep. 1965, *A.C. Burns* 9 (PERTH); Cape Riche, 28 Oct. 1987, *E.J. Croxford* 5884 (PERTH); Middleton Beach, Albany, 1923, *Goadby* (PERTH); Tagon Bay, Cape Arid National Park, 16 Oct. 1991, *W. Greuter* 22876 (PERTH); Lake Walyungup, Rockingham, 23 Oct. 1993, *G.J. Keighery* 12779 (PERTH); Steep Point, Shark Bay, 22 Sep. 1997, *A. Markey* 1327; E boundary of Watheroo National Park, 14 Sep. 1971, *R.D. Royce* 9716 (PERTH).

Distribution. Widespread around the coast from Shark Bay to Cape Arid National Park, restricted to the coast in southern areas but extending inland on the Darling Range near Perth and progressively further inland northwards to Watheroo National Park. (Figure 7B)

d. Homomorphic tuberculate variant

Fruit with both monocarps tuberculate. (Figure 4I,J)

Selected specimens examined. WESTERN AUSTRALIA: Marramburup Rock, Porongurup Range, 15 Dec. 1986, *G.J. Keighery* 8430 (PERTH); *c.* 20 km ESE of Grass Patch, 12 Sep. 1984, *P. van der Moezel* 480 (PERTH); Condarning Rock, 3 km S of Yellowdine, 19 Sep. 1979, *K.R. Newbey* (PERTH); Nettleton Rd, 7.8 km SE of Byford, 8 Oct. 1983; *R. Ornduff* 9300–65 (PERTH); *c.* 2 km S of Newdegate, 16 Sep. 1985, *K. Schmidt* 771 (PERTH).

Distribution. Absent from the coast but a few records in near-coastal areas, extending from Darling Range, Porongurup Range and near Grasspatch inland to near Yellowdine. (Figure 7B)

e. Mixed variant.

Fruit with outer monocarp long-bristly; inner monocarp varying from long-bristly to tuberculate or smooth, often bristly only on margin or outer half.

Specimens examined. WESTERN AUSTRALIA: Canning Hill, 12 Aug. 1969, *M.I.H. Brooker* 1989 (PERTH); Goodlands Reserve, *c.* 66 km NE of Kalannie, 3 Sep. 1995, *M. Hislop* 150B *& E. Hudson* (PERTH).

Distribution. Recorded from two inland localities in the Paynes Find area, one at Canning Hill (on Wydgee Station) and the other from west of Lake Moore. (Figure 7A)

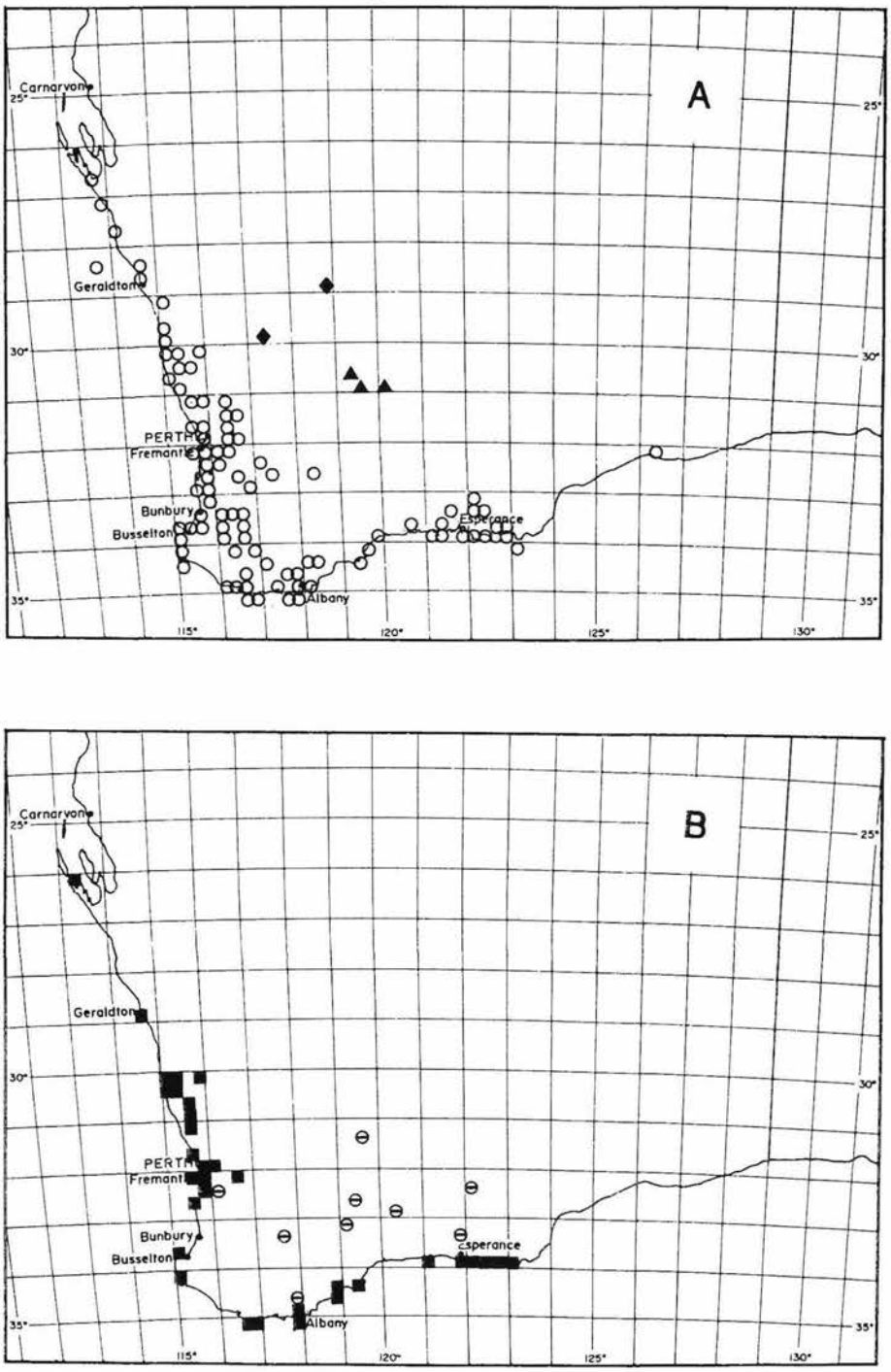

Figure 7. Distribution of variants of *Trachymene pilosa* in Western Australia. A – heteromorphic variants with long bristles O or short bristles ▲, and mixed variant ◆; B – homomorphic variants with fruits bristly ■ or tuberculate ⊖.

Notes. Unlike other variants of *Trachymene pilosa* this variant sometimes shows significant variation in the fruits borne on the same plant. The Canning Hill collection (*M.I.H. Brooker* 1989) has some specimens with homomorphic long-bristly fruits only, some specimens with the typical heteromorphic fruits only and some specimens with more than one type of fruit including intermediate fruits in which the inner monocarp is bristly on its outer half and smooth on its other half. The Goodlands Reserve collection is of a single plant, in this case the fruits all heteromorphic but some with the inner monocarp smooth and others with the inner monocarp partially bristly, the bristles occurring mainly on the margin.

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A taxonomic revision of *Pithocarpa* (Asteraceae: Gnaphalieae)

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Abstract

B.J. Lepschi. A taxonomic revision of *Pithocarpa* (Asteraceae: Gnaphalieae). *Nuytsia* 13(1) : 61–74 (1999). The endemic Australian genus *Pithocarpa* Lindl. is revised, and three taxa are recognized: *P. corymbulosa* Lindl., *P. pulchella* Lindl. var. *pulchella* and *P. pulchella* var. *melanostigma* (P. Lewis & Summerh.) Lepschi. A key is provided, and all taxa are illustrated and their distributions mapped.

Introduction

Pithocarpa Lindl. (Asteraceae) is an endemic Australian genus of two species of perennial herbs or subshrubs, confined to the south-west of Western Australia. The latest taxonomic revision of the genus is that of Lewis & Summerhayes (1951), which was based on limited herbarium material. Since that time, many more collections of *Pithocarpa* have been gathered, and these have eroded the distinctiveness of the taxa described by Lewis & Summerhayes. Examination of herbarium collections at PERTH has also indicated further problems with regard to the application of some names in the genus. A taxonomic revision of *Pithocarpa* is therefore considered appropriate.

Taxonomic history and generic delimitation

Pithocarpa was erected by Lindley (1839), who recognized two species, *P. corymbulosa* and *P. pulchella*. Steetz (1845) recognized two species: *P. corymbulosa* (misapplied to *P. pulchella*) and a new taxon, *P. major* Steetz, considered by later authors (e.g. Lewis & Summerhayes 1951) to be conspecific with *P. pulchella*. Bentham (1867) adopted a broad circumscription of *Pithocarpa*, recognizing only one taxon to which he applied the name *P. corymbulosa*. This concept was followed by subsequent authors (e.g. Hoffmann 1890, Mueller 1893, Gardner 1931), until Lewis & Summerhayes (1951) provided a critical assessment of the genus. They recognized four species: *P. corymbulosa*, *P. pulchella*, and two new taxa, *P. achilleoides* and *P. melanostigma* (both segregated from *P. pulchella*). However, Lander (1987) and Wheeler (in prep.), have expressed doubt as to the validity of both of the new species described by Lewis & Summerhayes.

The generic delimitation of *Pithocarpa* has been largely stable, with most authors accepting it as a separate taxon. However, Mueller (1893) suggested reducing *Pithocarpa* to sectional rank within *Humea* Sm., and Heine (1967) relegated *Pithocarpa* to synonymy under *Calomeria* Vent. Neither of these approaches have been adopted by other workers.

Generic relationships

The generic relationships of *Pithocarpa* are not clear, and earlier authors appear to have placed undue significance on the lack of a pappus in the genus, a feature which is now considered to have evolved independently in a number of genera in the Asteraceae (Anderberg 1991). Lindley (1839) suggested a relationship between *Pithocarpa* and the genus *Humea* Sm., presumably because of the lack of a pappus in both taxa. The type of *Humea* is now considered to be synonymous with the monotypic *Calomeria*, a genus with which *Pithocarpa* would not appear to have any close relationship (Anderberg 1991). The lack of a pappus was also considered to be of significance by Hemsley (1905), who suggested that *Pithocarpa* may be related to *Thiseltonia* Hemsl., although recent work (Anderberg 1991, Wilson 1992a) points to *Hyalosperma* Steetz or *Acomis* F. Muell. as the closest relatives of *Thiseltonia*.

Anderberg (1991) included *Pithocarpa* in his study of the phylogeny of the Gnaphalieae, and suggested that it was probably closest to taxa within the broadly defined '*Lawrencella* complex' (generic limits of the taxa within this group have since been redefined by Wilson (1992b–e)). These findings were supported by a preliminary phylogenetic analysis of *Pithocarpa* and a selection of six of its putative relatives (inferred from Anderberg's work) undertaken by Lepschi (1997). In that analysis, *Pithocarpa* appears as sister to *Argentipallium niveum* (Steetz) Paul G. Wilson, included by Anderberg (1991) in the '*Lawrencella* complex' [as *Helichrysum obtusifolium* F. Muell. ex Sond.]. However, as this analysis dealt with only a selection of the possible relatives of *Pithocarpa*, the 'true' sister taxon to this genus may have been excluded.

Materials and methods

This study is based on examination of herbarium collections from AD, CANB, MEL, NSW and PERTH, as well as selected material from CGE (photographs) and K, along with observations made on live plants of all recognized taxa. All measurements were made from herbarium material (reconstituted where necessary). Conservation codes used are those adopted by the Department of Conservation and Land Management (see the end of this issue for definitions of conservation codes).

Taxonomic treatment

Pithocarpa Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). *Type: P. pulchella* Lindl., lectotype, *fide* Lewis & Summerhayes (1951).

Perennial herbs or subshrubs, vegetative parts covered with whitish, cobwebbed indumentum. *Leaves* alternate, sessile, entire, usually withered by anthesis; clustered towards the base of the main (reproductive) stems and becoming progressively more distant and smaller up the stems, grading into the outer involucral bracts; also densely clustered on very short, lateral vegetative seasonal growth units. *Capitula* either solitary or in open to more or less compact corymbs, inserted terminally on the

branches, homogamous. *Involucre* obconic, cup-shaped or broadly campanulate. *Involucral bracts* in numerous whorls, continuously variable from the outer bracts to the inner bracts, herbaceous or scarious to chartaceous; outer bracts without lamina, inner bracts with coloured, radiating lamina; stereome undivided, *c.* one- to two-thirds the length of the bract, very narrowly to narrowly winged, hairy with whitish, cobwebbed indumentum as well as some multicellular hairs on the inner bracts; lamina of all bracts glabrous. *Involucral receptacle* convex, glabrous, epaleate. *Florets* actinomorphic, all hermaphrodite; corolla tube cylindrical proximally but becoming slightly flared towards the apex, yellow to greenish-yellow, distal portion flushed purplish; some scattered, multicellular, vesicular hairs to *c.* 0.1 mm long on the abaxial surface (mostly in the proximal part of the tube), glabrous adaxially; corolla lobes 5, triangular to rounded triangular, spreading or slightly recurved to reflexed, venation not extending to lobe apices; abaxial surface with a dense covering of multicellular, vesicular hairs to *c.* 0.1 mm long, adaxial surface glabrous. *Anthers* ecalcarate, caudate, connate along the locules; anther tails delicate and membranaceous, slender, slightly shorter to slightly longer than the narrowly oblong filament collar; filament collar slightly narrower than or as wide as the filament, endothecial cells polarized; anther appendage oblong-elliptic to oblong, slightly narrower or as wide as locules, unpigmented or with purplish pigment in central portion, 0.2 mm long, one-cell thick, shallowly concave abaxially; constituent cells narrowly oblong (those on the margins and at the apex shorter and more or less quadrate), without thickened walls. *Style* swollen at the base, becoming abruptly linear above, branches spreading to recurved, stigmatic surfaces marginal (adaxial), not medially confluent, venation continuous to style apex; style apex rounded-truncate, 0.05–0.1 mm long, slightly broader than stigmatic branches, with short, obtuse sweeping hairs. *Cypsela* more or less cylindrical, glabrous or with non-myxogenic duplex hairs; carpopodium annular, *c.* 0.15 mm diameter; pericarp thinly coriaceous, smooth, glabrous, colourless, cells with thickened walls; vascular strands two, diametrically opposed, running the entire length of the seed, laterally placed with reference to cotyledons; testa free from pericarp, thinly coriaceous, reddish-brown, crystals present or absent, vascular strand running *c.* two-thirds the length of the cypsela or reaching (but not passing over) the apex, laterally placed with reference to the cotyledons; cotyledons flattened-planoconvex to planoconvex; pappus absent.

A genus of two species endemic to south-western Western Australia.

Etymology. From the Greek *pithos*, a wine jar, and *carpos*, a fruit, in reference to the shape of the cypsela (Sharr 1996).

Notes. Pithocarpa species are perennial. Previous authors (e.g. Steetz 1845, Lewis & Summerhayes 1951, Lander 1987), however, have consistently treated all taxa as annuals, although this is clearly a misinterpretation, probably a result of the unusual phenology exhibited by the genus.

Key to species and varieties

1 Involucral bracts without dark pigment; capitula in more or less compact, well-defined corymbs of 2–11 capitula, rarely solitary on lateral branches within the flowering region; ovary and cypsela glabrous. Darling Range east of Perth ..... **P. corymbulosa**

1. At least some involucral bracts marked with dark reddish-maroon on the abaxial surface; capitula in open, loose corymbs of 2–6 capitula, as well as solitary on lateral branches within the flowering region; ovary and cypsela with antrorse, clavate duplex hairs. Widespread in south-western Western Australia 2

2 Style branches yellowish-brown to brown (in life), drying brown ... **P. pulchella** var. **pulchella**

2. Style branches black or very dark brownish-black, both in life and when dried ..... **P. pulchella** var. **melanostigma**

1. Pithocarpa corymbulosa Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). – *Humea corymbulosa* (Lindl.) F. Muell., Victorian Nat. 9: 144 (1893). – *Calomeria corymbulosa* (Lindl.) Heine, Adansonia ser. 2: 7 (1967). *Type:* Swan River, Western Australia, *Toward s.n.* (*holo:* CGE, *n.v.* (photo seen at PERTH)).

Illustration. Blackall & Grieve (1975: 849).

Perennial *herb* or *subshrub* 0.7–1 m tall; *stems* erect, basal portions becoming woody and glabrescent with age, densely covered with a whitish, cobwebbed indumentum comprised of appressed to spreading flexuose hairs to 2.5 mm long. *Leaves* densely covered with a whitish, cobwebbed indumentum on the abaxial surface, somewhat sparser adaxially; lamina entire, narrowly elliptic or narrowly obovate-elliptic to very narrowly obovate, or very-narrowly ovate to linear-ovate, very narrowly elliptic to linear-elliptic or subulate for smallest leaves, 2.5–26.5 mm long, 0.25–6.5 mm wide; base weakly amplexicaul, apex acuminate, margins weakly recurved. *Synflorescence* of terminal, more or less compact to open corymbs of 2–11 capitula (these sometimes loosely aggregated to form a larger corymbose panicle), inserted terminally on the branches, or capitula rarely solitary on lateral branches within the flowering region; lateral capitula within a corymb frequently lacking developed florets. *Involucre* narrowly ellipsoid to more or less cylindrical when young, narrowly obconic to cup-shaped or broadly campanulate (due to spreading laminae of the inner bracts) at anthesis, turbinate to cylindrical with a slight medial constriction in fruit; 4.5–6 mm long, 2–3.5 mm wide at anthesis. *Involucral bracts* 30–45; stereome with a whitish, cobwebbed indumentum (dense on the outer bracts, less so on the inner bracts which also bear some multicellular hairs to *c.* 0.1 mm long); outermost bracts 2–3 mm long, 0.4–0.65 mm wide, claw narrowly oblong, lamina narrowly ovate to narrowly ovate-elliptic, scarious to chartaceous, translucent to straw-coloured when dry; median bracts similar to innermost bracts but to 6 mm long and 1.3 mm wide, with an elliptic to narrowly elliptic lamina; innermost bracts 4.2–4.8 mm long, 0.6–1 mm wide, claw narrowly oblong to narrowly cuneate, lamina narrowly elliptic to oblong-elliptic, chartaceous, white in life and when dry (although bract apices in very young buds may be flushed pink). *Involucral receptacle* 0.9–1.2 mm diameter. *Florets* 12–21. *Corolla tube* 2–2.6 mm long, 0.3–0.4 mm wide at the base, 0.4–0.5 mm wide in the throat; cells of the adaxial epidermis quadrate to oblong at very base of tube, becoming narrowly to linear-oblong above this; walls more or less straight to slightly undulate for cells in proximal *c.* one-half of tube, distinctly sinuous in cells of the distal portion. *Corolla lobes* 0.2–0.4 mm long, 0.15–0.3 mm wide; cells of the adaxial epidermis rounded-oblong to strongly rounded-quadrate (particularly at apex), walls undulate to more or less straight (sometimes distinctly sinuous at very base of lobes). *Stamens* exserted 0.1–0.35 mm beyond the corolla mouth, attached 0.35–0.5 mm up from the corolla tube base; filaments 0.6–0.8 mm long, filament collar 0.2–0.25 mm long; anther thecae 0.8–1.1 mm long, 0.15–0.25 mm wide, anther tails *c.* 0.1–0.15 mm long, anther appendage unpigmented. *Style* 1.5–1.8 mm long, yellowish-brown to brown (in life), drying brown, stigmatic branches (and sometimes distal portion of style) occasionally darker; stigmatic branches 0.6–0.7 mm long. *Cypsela* 1–1.2 mm long, 0.4–0.45 mm wide when mature, glabrous; cells of pericarp narrowly oblong, walls straight; cells of testa generally more or less quadrate to oblong (sometimes narrowly so, often rounded), walls undulate to more or less straight, scattered flat crystals also present, vascular strand running *c.* three-quarters the length of the cypsela, not passing over the apex; pappus absent. (Figure 1A–F)

Selected specimens examined. WESTERN AUSTRALIA: *c.* 200 m downstream from Lesmurdie Falls, Lesmurdie Falls National Park, Forrestfield, Perth, 10 Feb. 1996, *B.J. Lepschi & T.R. Lally* 2494 (AD, BRI, CANB, HO, K, L, MEL, NSW, P, PERTH, US); same locality, 30 Sep. 1996, *B.J. Lepschi, J.L. Morris & P.K. Murer* 3072 (CANB, MEL, PERTH); 0.8 km N of Old York Rd on Throssel Rd, just inside John Forrest National Park, E edge of Perth, 14 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2570 (AD, BRI, CANB, K, MEL, PERTH, US); same locality, 15 Sep. 1996, *B.J. Lepschi & T.R. Lally* 2994 (CANB, PERTH); same locality, 12 Jan. 1997, *B.J. Lepschi & T.R. Lally* 3335 (PERTH); Reserve C8120, Coulston Rd, Boya, 28 Jan. 1986, *P. Sawyer* 134 (PERTH); Helena Valley, Feb. 1978, *J. Seabrook* 543 (CANB, PERTH); Lesmurdie Falls, Perth, 19 Jan. 1947, *J. Souster* 623 (NSW, [K *n.v.*]).

Distribution. Occupies a very restricted range between John Forrest National Park and Lesmurdie Falls National Park in the Darling Range on the eastern edge of Perth, Western Australia. It is possible that this species is under-recorded due to its summer flowering time, and the fact that plants are very difficult to locate when not in flower. Consequently, its range may extend beyond the distribution stated above. (Figure 2A)

Habitat. Grows in gravelly or sandy loam close to granite outcrops. Recorded from *Corymbia calophylla* (Lindl.) K.D. Hill & L.A.S. Johnson woodland with a shrubby understorey (*Lepschi & Lally* 2494), open shrubland with scattered trees of *C. calophylla* (*Lepschi & Lally* 2570), and 'wandoo' (possibly *Eucalyptus accedens* W. Fitzg. or *E. wandoo* Blakely) woodland (*Seabrook* 543).

Phenology. Production of new shoots begins by at least September, with advanced flower buds produced by late December. Flowers recorded between January and April, though the main flowering period appears to be January–March, with leaves withered by the onset of flowering. Fruits have been recorded in March and April.

Chromosome number. n = 13 recorded by Lepschi & Keighery (1999).

Conservation status. CALM Conservation Codes for the Western Australian Flora: Priority Two. *Pithocarpa corymbulosa* occupies a very small range, on the edge of an expanding city in an area under pressure from urban development. Two populations occur in National Parks, but both these abut urban areas and are subject to considerable human activity. The Lesmurdie Falls population is being encroached upon by invading *Watsonia meriana* (L.) Mill. var. *bulbillifera* (L. Bolus) D.A. Cooke that is extending upslope from a nearby creekline.

Notes. Bentham (1867) adopted a broad concept of *P. corymbulosa*, including within it *P. pulchella*, and although Lewis & Summerhayes (1951) showed conclusively that the two species were distinct, the name *P. corymbulosa* has been persistently misapplied to *P. pulchella* (e.g. Marshall undated, Gibson *et al.* 1994).

2. Pithocarpa pulchella Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). *Type:* Swan River, Western Australia, *Drummond s.n.* (*holo:* CGE, *n.v.* (photo seen at PERTH)).

Pithocarpa major Steetz, *in* Lehm., Pl. Preiss. 1: 446 (1845). *Type*: In muddy gravel in woodland on the plain beyond the village of Guildford, Western Australia, 9 August 1839, *L. Preiss s.n.* (*syn:* MEL 238727).

[*Pithocarpa corymbulosa auct. non* Lindl., Edward's Bot. Reg. App. vols 1–23: xxiii (1839).]

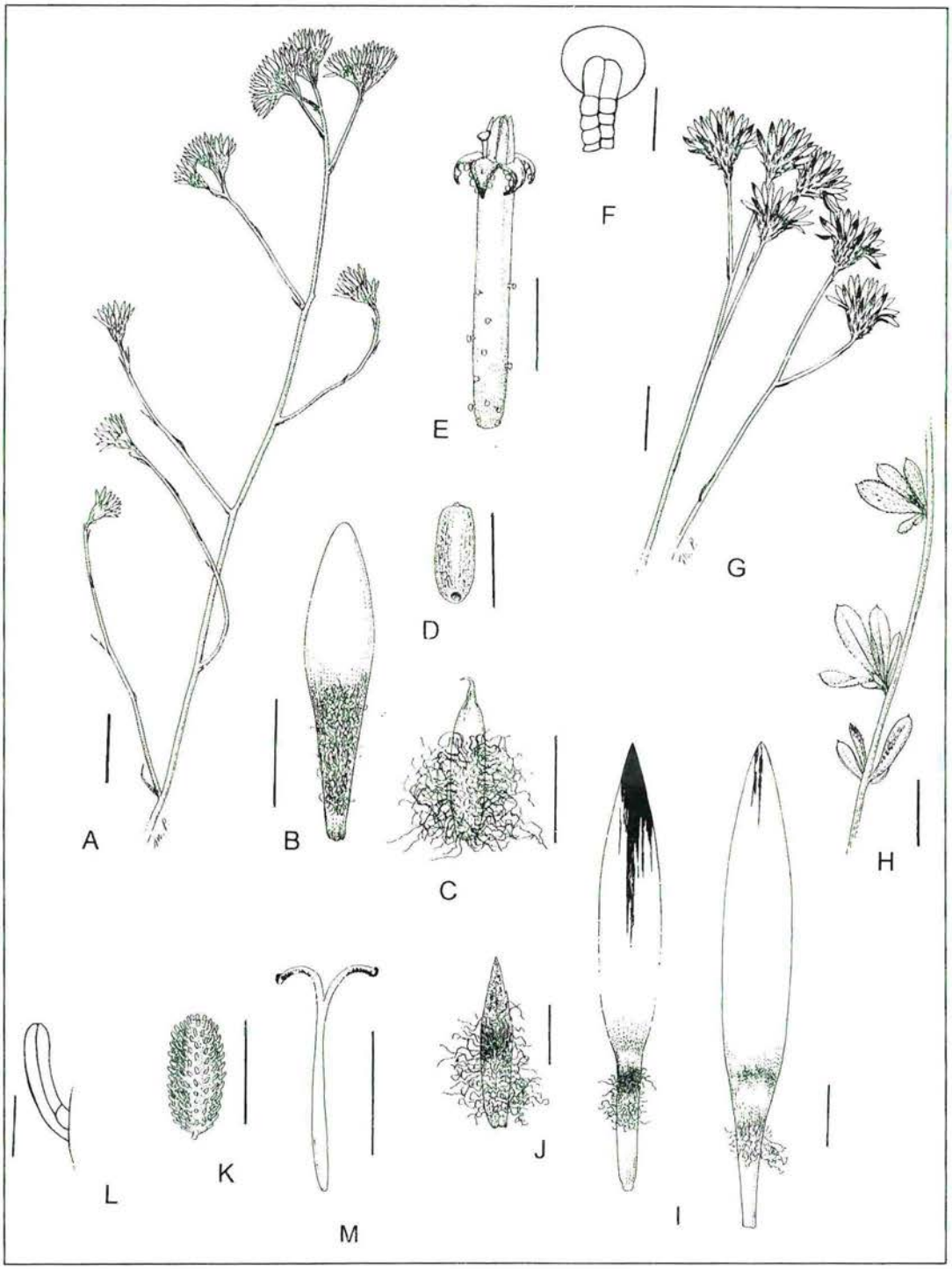

Figure 1. A–F. *Pithocarpa corymbulosa.* A – flowering branchlet, B – median involucral bract, C – outer involucral bract, D – cypsela, E – floret, F – vesicular hair from corolla tube; G–L. *P. pulchella* var. *pulchella.* G – flowering branchlet, H – branchlet with vegetative seasonal growth units, I – median involucral bracts, J – outer involucral bract, K – cypsela, L – cypsela duplex hair; M. *P. pulchella* var. *melanostigma* – style. Drawn from *Seabrook* 543 (A), *Lepschi & Lally* 2570 (B–F), *GNT* 191 (G), *Alford* 361 (H), *Lepschi & Lally* 2602 (I, J), *Lepschi & Lally* 2561 (K, L), *Grieve s.n.*, PERTH 00828033 (M). Scale bars: 10 mm (A, G, H), 1mm (B–E, I–K), 0.05 mm (F, L). All drawn by M. Pieroni, except F and L (drawn by the author).

Illustrations. Blackall & Grieve (1975: 849); Lander (1987: 696); Marshall (undated: 200) [as *P. corymbulosa*].

Perennial *herb* or *subshrub* (0.1) 0.2–0.8 m tall; *stems* erect, basal portions becoming woody and glabrescent with age, covered with a dense, or (less often) moderately dense, whitish, cobwebbed indumentum comprised of appressed to spreading, flexuose hairs to 2.5 mm long. *Leaves* densely covered with a whitish, cobwebbed indumentum on the abaxial surface, somewhat sparser adaxially; lamina entire, narrowly obovate to linear-obovate or narrowly elliptic to linear elliptic, narrowly oblong, narrowly ovate, linear-ovate, linear or subulate for smallest leaves, 2–40 mm long, 0.3–5.5 mm wide; base weakly amplexicaul, apex acute to acuminate, margins weakly recurved. *Synflorescence* of terminal, open, loose corymbs of 2–5 (6) capitula, as well as solitary, terminal capitula on lateral branches within the flowering region. *Involucre* ellipsoid to narrowly ellipsoid when young, cup-shaped to obconic (occasionally broadly so), or broadly campanulate (due to spreading laminae of the inner bracts) at anthesis and in fruit; 3–6.5 mm long, 2.1–5 (8.5) mm wide at anthesis. *Involucral bracts* 28–115 (160), stereome sparsely to densely hairy with a whitish, cobwebbed indumentum (most dense on the outer bracts, less so on the inner bracts which may occasionally be almost glabrous), inner bracts also bearing some multicellular hairs to *c.* 0.1 mm long; outermost bracts 1.2–3 mm long, 0.2–0.7 mm wide, narrowly triangular to narrowly ovate or narrowly oblong to (rarely) narrowly oblong-elliptic or narrowly oblong-obovate, sometimes spreading to recurved, herbaceous, often with a narrow, more or less translucent, scarious margin, pale brown to brown when dry, frequently tipped dark reddish-brown or maroon; median bracts similar to innermost bracts but to 9.7 mm long and 2.2 mm wide; claw narrowly cuneate, lamina broadly elliptic to narrowly elliptic, obovate-elliptic or narrowly obovate, chartaceous, white, variously tipped or streaked (longitudinally) with dark reddish-maroon on the abaxial surface (rarely the entire bract may be reddish or this colouration may be largely absent), this often fading and/or drying to pale or dark brown on preserved specimens; innermost bracts 3.8–7.9 mm long, 0.7–1.9 mm wide, claw narrowly cuneate or narrowly oblong to very-narrowly oblong or linear; lamina elliptic to narrowly elliptic, elliptic-obovate, narrowly obovate, ovate-elliptic, ovate or broadly ovate, chartaceous, generally white, rarely tipped or streaked (longitudinally) with dark reddish-maroon on the abaxial surface. *Involucral receptacle* (0.7) 1.2–2.5 (4) mm diameter. *Florets* (12) 20–70 (118). *Corolla tube* 1.4–2.7 mm long, 0.2–0.45 mm wide at the base, 0.4–0.7 mm wide in the throat; cells of the adaxial epidermis quadrate to oblong in proximal *c.* two-thirds of tube, narrowly to linear-oblong above this; walls straight to (rarely) slightly undulate for cells in proximal *c.* two-thirds of tube, distinctly sinuous in cells of the distal portion. *Corolla lobes* 0.2–0.4 mm long, 0.2–0.3 mm wide; cells of the adaxial epidermis oblong to narrowly-oblong (sometimes rounded-oblong), those at the apex strongly rounded-quadrate; walls distinctly sinuous for cells in the basal *c.* one-third of the lobes, undulate to more or less straight for cells in the distal portion. *Stamens* exserted 0.15–0.4 mm beyond the corolla mouth, attached 0.3–0.7 mm up from the corolla tube base; filaments 0.5–0.8 mm long, filament collar 0.2–0.3 mm long; anther thecae 0.7–1 mm long, 0.15–0.25 mm wide; anther tails *c.* 0.1–0.25 mm long, anther appendage unpigmented or with purplish pigment in central portion. *Style* 1.3–2.5 mm long, yellowish-brown to black (in life), drying brown to black; stigmatic branches 0.45–0.8 mm long. *Cypsela* 0.8–1.3 mm long, 0.3–0.6 mm wide when mature, more or less densely covered with antrorse, clavate duplex hairs to *c.* 0.1 mm long; cells of pericarp more or less quadrate to oblong or narrowly oblong (often rounded), walls more or less straight to undulate; cells of testa generally more or less quadrate to oblong (sometimes narrowly so, often rounded), walls undulate to more or less straight, flat crystals apparently absent, vascular strand running *c.* two-thirds the length of the cypsela or extending to the apex (but not passing over it); pappus absent. (Figure 1G–M).

Distribution. Occurs from Eneabba southwards to Augusta, Albany and Cape Riche. Extends inland as far as approximately Mogumber, Clackline and the southern edge of the Stirling Range. Bentham's (1867) record of this species [as *P. corymbulosa*] from the 'Mt Barren Range' (i.e. the Barrens in

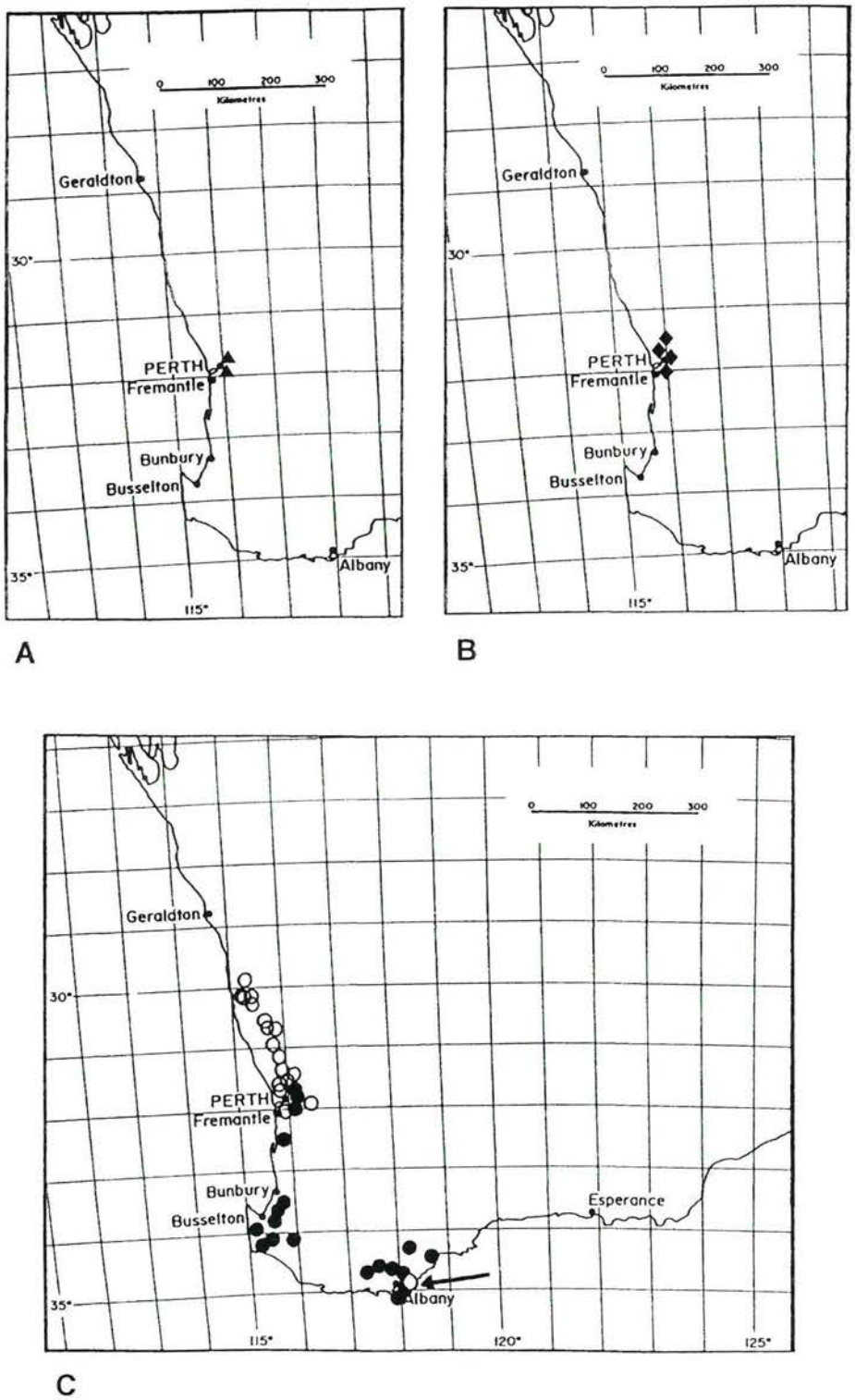

Figure 2. Distribution of *Pithocarpa* species. A – *P. corymbulosa*, B – *P. pulchella* (intermediate plants), C – *Pithocarpa pulchella* var. *pulchella* O and *P. pulchella* var. *melanostigma* ●. Outlying collection of var. *pulchella* (*Lepschi & Lally* 2581) marked with arrow.

Fitzgerald River National Park, between Bremer Bay and Hopetoun) is in error. The locality refers to Mt Barrow, *c.* 6 km due east of Mount Barker township. (Figure 2B–C).

Infraspecific taxa. *Pithocarpa pulchella* exhibits a significant degree of morphological variation throughout its range, and it was this heterogeneity that led Lewis & Summerhayes (1951) to erect *P. achilleoides* and *P. melanostigma* as segregates from *P. pulchella sens. str.* However, Lewis & Summerhayes's taxonomy was based on a small number of herbarium collections, and this is likely to have disproportionately magnified otherwise minor morphological differences. When a greater range of material is examined, the characters they used to circumscribe their taxa break down.

Lewis & Summerhayes (1951) used six quantitative and six qualitative characters to distinguish *P. achilleoides*, *P. melanostigma* and *P. pulchella*. Data from a morphometric study (Lepschi 1997) indicates that all of the quantitative characters show continuous variation throughout the range of *P. pulchella sens. lat.*, and as such do not allow the recognition of any additional taxa. Of the qualitative characters, most are very subjective and are almost impossible to quantify, while one appears to have been erroneously interpreted (these characters are discussed in more detail under the respective infraspecific taxa). Only one character, colour of the style branches, exhibits any useful variation within *P. pulchella*, although even here there are intermediates between the recognized character states.

In plants from the northern part of the range of *P. pulchella* (i.e. from the Eneabba district to the Perth district), the style-branches are yellowish-brown to brown (in life, becoming brown upon drying), while plants from the southern part of the species range (i.e. from the Perth district to the Albany district), exhibit style-branches which are black or very dark brownish-black (both in life and when dried). Occasional intermediate plants have also been seen (e.g. *Aplin* 462, *Lepschi & Lally* 2565), all but two (these with inadequate locality data) from the Perth region, where the ranges of the two variants overlap. As these entities are well defined (notwithstanding occasional intermediate individuals) and exhibit a clear geographical pattern, taxonomic recognition at varietal rank is considered appropriate. Two further characters (not considered by Lewis & Summerhayes 1951), density of indumentum on the vegetative parts and the involucral bracts, and the width of leaves on vegetative seasonal growth units, show some correlation with style-branch colouration. However, their usefulness as discriminatory characters is limited, as both appear to vary clinally within *P. pulchella* (see Lepschi 1997). Indumentum density is also a subjective character which is difficult to accurately quantify. Accordingly, they are most useful as supplementary characters.

2a. P. pulchella Lindl. var. **pulchella**

Pithocarpa achilleoides P. Lewis & Summerh., Kew Bull. 5: 437 (1951). *Type:* Wooroloo, Western Australia, November 1907, *M. Koch* 1895 (*holo:* K; *iso:* NSW 397293), *syn. nov.*

Illustrations. See under species.

Vegetative parts and outer involucral bracts densely to moderately hairy with a whitish, cobwebbed indumentum. *Leaves* on vegetative seasonal growth units 0.8–4 mm wide. *Style branches* yellowish-brown to brown (in life), drying brown. (Figure 1G–L)

Selected specimens. WESTERN AUSTRALIA: Clackline Nature Reserve (W boundary), 15 Mar. 1985, *J. Alford* 1 (PERTH); Boonanarring V.C.L. off Wannamal West Rd, Gingin, 21 Mar. 1986, *J.J. Alford* 507 (PERTH); Wanneroo Pine Plantation, 14 Apr. 1980, *H. Demarz* 8049 (CANB, PERTH); Lesueur

National Park, Beekeepers Track, 6 June 1993, *W. Evans* 567 (CANB, PERTH); corner Hammond Rd and Bartram Rd, Jandakot, 23 Mar. 1960, *A.S. George* 671 (PERTH); Nicholson Rd, *c.* 2.5 miles [*c.* 4 km] N of Forrestdale, 7 May 1961, *A.S. George* 2350 (PERTH); 7.4 km ENE of Pinjar Rd on Neaves Rd, Melaleuca Park Reserve, 7 km W of Bullsbrook, 31 Mar. 1996, *B.J. Lepschi & T.R. Lally* 2552 (AD, BRI, CANB, PERTH); 3.5 km E of Brand Highway on Mogumber West Rd, *c.* 36 km SSE of Dandaragan, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2555 (PERTH); *c.* 21.1 km NW of BP Cataby Roadhouse on Brand Highway towards Badgingarra, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2557 (AD, BRI, CANB, MEL, PERTH); 4.9 km W of Cockleshell Gully Rd turnoff on Coorow-Green Head Rd, *c.* 11.5 km ENE of Green Head, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2561 (A, AD, B, BRI, CANB, HO, K, L, MEL, MO, NSW, NY, US); same locality, 1 July 1996, *B.J. Lepschi & T.R. Lally* 2692 (AD, CANB, MEL, PERTH); Bakers Junction Nature Reserve, 2.5 km NE of Bakers Junction on road to Jerramungup, 2 May 1996, *B.J. Lepschi & T.R. Lally* 2581 (PERTH); bushland remnant adjacent Kwinana Freeway 'on ramp' at junction with South Street, Leeming, Perth, 26 May 1996, *B.J. Lepschi & T.R. Lally* 2602 (AD, BRI, CANB, HO, PERTH); 7 miles [*c.* 11.3 km] from Bindoon, 26 Apr. 1957, *H. Lewis* 32 (NSW, [K *n.v.*]); Darling Range, 1843, *L. Preiss* 27 (MEL).

Distribution. This variety occurs in the northern part of the range of *P. pulchella*, extending from Eneabba southwards to Jandakot (on the southern edge of Perth) and inland to near Mogumber and Clackline. An isolated collection (*Lepschi & Lally* 2581) also exists from near Bakers Junction, north-east of Albany.

Pithocarpa pulchella var. *pulchella* overlaps with var. *melanostigma* in the Perth region. In this area var. *melanostigma* occurs predominantly on the Darling Scarp, with var. *pulchella* on the Coastal Plain, although this distribution is not entirely exclusive. To date no examples of actual sympatry have been documented, but *Cranfield* 828 from Wanneroo may represent a mixed population of *P. pulchella* var. *pulchella* and var. *melanostigma*. This collection comprises plants with both brown (MEL sheet) and black to dark brownish-black (CANB, NSW and PERTH sheets) style-branches. (Figure 2C)

Habitat. Grows in deep sand or sand over laterite, limestone or sandstone, often with some gravelly content. Vegetation communities include low heath (often with emergent mallees), banksia woodland, eucalypt woodland (mainly *Corymbia calophylla* and/or *Eucalyptus marginata* Sm.), or mixed banksia-eucalypt woodland, the latter three generally with a shrubby understorey.

Phenology. Populations north of about Mogumber tend to begin flowering and producing new growth approximately two months before more southerly populations of this taxon (i.e. south to Jandakot), although there is overlap in phenology between northern and southern plants. New shoots are produced around late May (for northern populations), and this continues until approximately November (in southern populations). Flowers have been recorded between December and April for northern populations, and between March and June for southern populations. Fruits have been recorded between February and June.

Chromosome number. n = 13 recorded by Lepschi & Keighery (1999).

Conservation status. Widespread and common, and not considered at risk. *Pithocarpa achilleoides*, here considered synonymous with *P. pulchella* var. *pulchella*, has been regarded as a poorly known species, and was listed by the Department of Conservation and Land Management's unpublished "Declared Rare and Priority Flora List" of 1996.

Typification. At AD, MEL, NSW and PERTH there are other collections labelled as '*M. Koch* 1895' which match the type material of *P. achilleoides*. However, dates do not match that of the type material, and it is therefore uncertain whether any of these collections represent duplicates of the holotype. Accordingly, they have not been afforded any type status. Collections in question are: (1) Wooroloo, Dec. 1907, *M. Koch* 1895 (NSW 397296); (2) Wooroloo, Jan. 1908, *M. Koch* 1895 (MEL 238723, 238724, PERTH 00535702 and possibly PERTH 00535699) and (3) Wooroloo, Nov. 1908, *M. Koch* 1895 (AD 97632398).

Notes. Despite some differences in phenology between the northern populations of this variety and those from further south, there are no correlated morphological differences. Plants from northern populations tend to have a denser indumentum and somewhat broader leaves, but there is overlap and these characters appear to vary clinally throughout the range of *P. pulchella* (see under *Notes* for the species). Accordingly, separate taxonomic status is not considered appropriate.

Pithocarpa achilleoides is here placed in the synonymy of *P. pulchella* var. *pulchella*. Lewis & Summerhayes (1951) defined *P. achilleoides* on the basis of synflorescence structure, capitulum width, involucral bract number, length of the largest (= median) involucral bracts, length of the receptacle, and the number and length of the florets (notably, this circumscription encompassed only plants with yellowish-brown to brown style branches; plants with black to dark brownish-black style branches with otherwise identical capitulum and synflorescence morphology were included in their concept of *P. melanostigma*). As mentioned previously, all the quantitative characters used by Lewis & Summerhayes (1951) to define *P. achilleoides* show continuous variation throughout the range of *P. pulchella sens. lat.*, and as such are of little value in circumscribing taxa. The difference in synflorescence structure cited by Lewis & Summerhayes (1951) for *P. achilleoides* ('small corymbs of 2–5') and *P. pulchella sens. str.* ('mostly solitary.....but sometimes forming small corymbs of up to 4 capitula') also shows considerable overlap.

To judge from the infrequent application of the name *P. achilleoides* to herbarium collections, it would appear that most workers have either been reluctant or unable to recognize this taxon. Lander (1987) also specifically excluded *P. achilleoides* from his treatment of the genus for the "Flora of the Perth Region", even though *P. achilleoides* is supposedly endemic to this area, with the comment that it was probably conspecific with *P. pulchella sens. str.*, a view supported here.

2b. P. pulchella var. **melanostigma** (P. Lewis & Summerh.) Lepschi, *comb. et stat. nov.*

Pithocarpa melanostigma P. Lewis & Summerh., Kew Bull. 5: 438 (1951). *Type:* District South West Plantagenet, in scrub on damp hills not far from the sea, Western Australia, January 1901, *E. Pritzel* 243 (*holo:* K; *iso:* AD 97632397, NSW 397306).

Illustration. Blackall & Grieve (1975: 849) [as *P. melanostigma*].

Vegetative parts and outer involucral bracts moderately to sparsely hairy with a whitish, cobwebbed indumentum. *Leaves* on vegetative seasonal growth units 0.5–2.5 mm wide. *Style branches* black or very dark brownish-black (from darkly pigmented stigmatic papillae and sweeping hairs), both in life and when dried. (Figure 1M)

Selected specimens examined. WESTERN AUSTRALIA: Greenmount, E of Midland, Apr. 1901, *C. Andrews s.n.* (PERTH); S of Porongurups on Narrikup Road, 21 May 1972, *A.M. Ashby* 4480 (AD,

CANB, PERTH); Albany Commonage, 6 May 1924, *C.A. Gardner* 1649 (PERTH); 41 km W of Rocky Gully on Muir Highway, 8 June 1977, *A.S. George* 14589 (PERTH); King George Sound, May 1899, *B.T. Goadby s.n.* (NSW, PERTH); Toodyay Road, ± 20 mile peg, *s. dat., B. Grieve s.n.* (PERTH); Kalamunda, 19 km E of Perth, 17 Apr. 1986, *R. & M. Hamilton* 218 (CANB, MEL); top of Mt Barker Hill at scenic lookout, 12 Apr. 1971, *K.F. Kenneally s.n.* (PERTH); junction of Albany Highway and Yellanup Road, *c.* 15.5 km SSE of Mount Barker, 1 May 1996, *B.J. Lepschi & T.R. Lally* 2576 (PERTH); 2.3 km ESE of Slee Road on Vasse Highway, *c.* 17.5 km ESE of Busselton, 3 May 1996, *B.J. Lepschi & T.R. Lally* 2588 (A, AD, BRI, CANB, HO, K, L, MEL, NSW, PERTH, US); *c.* 14 km SSE of Capel on road to Donnybrook, 3 May 1996, *B.J. Lepschi & T.R. Lally* 2591 (AD, BRI, CANB, K, MEL, PERTH, US); Darlington, 23 June 1949, *B. Roark s.n.* (PERTH); Mt Clarence, Albany, Mar. 1911, *J. Staer s.n.* (NSW); near 45 mile peg on Brookton Highway, 23 May 1966, *GNT* 191 (PERTH); 31.5 km NW of Denmark, 27 Apr. 1993, *G.J. Wardell-Johnson* 3339 (PERTH).

Distribution. Disjunctly distributed in the southern part of the range of *P. pulchella*. The apparent gap in the distribution of this taxon may be an artefact of inadequate collecting, but this requires confirmation. Occurs from the Wanneroo–Midland area on the northern edge of Perth, south to Augusta, Albany and Cape Riche, extending inland to the southern edge of the Stirling Range. Overlaps with var. *pulchella* in the Perth area (see under that taxon for details). (Figure 2C)

Habitat. Generally recorded growing in sand (including sand over granite or laterite), sandy-loam or loam (occasionally with some gravel content), but once recorded from clay over ironstone (*Keighery* 13334). Frequently grows in winter-wet sites. Vegetation communities include heath and other shrubland formations, mallee-heath, banksia woodland and eucalypt woodland (mainly *Corymbia calophylla* and/or *Eucalyptus marginata*), the latter two generally with a shrubby understorey.

Phenology. Data on phenology is less complete than that available for var. *pulchella*. New growth is produced from approximately September to November, with flowers recorded between January and July, and fruits between March and July.

Chromosome number. n = 13 recorded by Lepschi & Keighery (1999).

Conservation status. Widespread, not regarded as rare or endangered. This taxon [as *P. melanostigma*] was formerly listed on the Department of Conservation and Land Management's list of poorly known flora as a Priority Two taxon (e.g. Hopper *et al.* 1990), but was deleted in 1992 following the location of additional populations (R. Hearn, pers. comm.).

Notes. Pithocarpa melanostigma is here reduced to varietal rank within *P. pulchella*. Lewis & Summerhayes (1951) distinguished *P. melanostigma* from *P. achilleoides* (see above) and *P. pulchella sens. str.* on the basis of stem morphology (stems slender, ascending and 'rather flexuous'), branching pattern (plants 'much branched above the base), involucral bract number, the 'flexuous' nature of the largest (= median) involucral bract margins, and the colouration of the apical portion of the involucral bracts (see below) and the style-branches. Of these characters, only one, style-branch colouration, is useful as a taxonomic discriminator (see under *Infraspecific taxa*, above). The characters of stem morphology, branching pattern and involucral bract margin are all very subjective, and were not found to be taxonomically informative during the course of this study. Examination of plants in the field also suggest that stem morphology and branching pattern are frequently influenced by environmental factors (see Lepschi 1997). Colouration of the apical portion of the involucral bracts appears to have been erroneously interpreted by Lewis & Summerhayes (1951). They describe the involucral bracts of *P. melanostigma* as being 'tipped with very dark brown', as opposed to 'medium to light brown' for

P. pulchella and *P. achilleoides*. Observations on living plants have shown that the involucral bracts of *P. pulchella sens. lat.* are marked to varying degrees with dark reddish-maroon on the abaxial surface. However, this distinctive colouration frequently fades to a light brown colour, probably through bleaching by sunlight, or may become discoloured (to more or less dark brown), possibly as a result of inadequate specimen preparation.

As is the case with all the quantitative characters utilized by Lewis & Summerhayes (1951), involucral bract number (considered diagnostic for *P. melanostigma*) varies continuously throughout the range of *P. pulchella sens. lat.* and as a result is of little use as a taxonomic discriminator.

Apart from a few regional flora treatments (e.g. Blackall & Grieve 1975, Lander 1987), and its inclusion in two studies of Gnaphalieae phylogeny (Anderberg 1991, Puttock 1994), *Pithocarpa* has received little systematic attention in recent years.

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A taxonomic review of the yellow-flowered tuberous species of *Drosera* (Droseraceae) from south-west Western Australia

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Abstract

Lowrie, A. A taxonomic review of the yellow-flowered tuberous species of *Drosera* (Droseraceae) from south-west Western Australia. *Nuytsia* 13(1): 75–87 (1999). Five tuberous species of *Drosera* (Droseraceae) with yellow flowers are endemic in south-west Western Australia. They all belong in *Drosera* sect. *Ergaleium* (DC.) Planchon. Descriptions and illustrations are presented for four of these species: *Drosera subhirtella* Planchon, *D. moorei* (Diels) Lowrie *comb. nov.*, *D. zigzagia* Lowrie *sp. nov.*, and *D. intricata* Planchon, which is reinstated. These four species are closely related and are collectively referred to here as the *Drosera subhirtella* complex. The only other tuberous species to have yellow flowers is *Drosera sulphurea* Lehm., which is reinstated here as distinct from its closest relative, the pink-flowered *D. neesii* Lehm. Although not closely related to the *Drosera subhirtella* complex, *D. sulphurea* can be confused with members of that group and therefore a key to all five yellow-flowered species is provided.

Introduction

The taxonomy of five yellow-flowered species of *Drosera* (Droseraceae), including the four closely related species referred to here as the *Drosera subhirtella* complex, is reviewed. These five species are endemic to the south-west of Western Australia and form part of a larger group, known as tuberous sundews, that constitute sect. *Ergaleium* (DC.) Planchon (Planchon 1848: 94). A total of 26 species and 8 subspecies are now recognized in this section, which is characterized by the presence of tubers, peltate leaves, and lack of stipules.

It is principally the yellow-flowered inflorescences that distinguish the *Drosera subhirtella* complex from other members of sect. *Ergaleium* having a lax or climbing life form. Even though a new species described here has an erect growth habit, it qualifies as a member of the *D. subhirtella* complex because its closest relative is considered to be *D. moorei*. Yellow-flowered inflorescences are found on only one other tuberous sundew, *Drosera sulphurea* Lehm. This distantly related species is distinguished from the *D. subhirtella* complex principally by its crescent-shaped leaves with lobes at the angles.

Drosera sulphurea was synonymized under *D. neesii* Lehm. by Marchant *et al.* (1982), but is here reinstated as a distinct species. Since it may be mistaken (because it has yellow flowers) as a member of the *D. subhirtella* complex, *D. sulphurea* is included in the key, but it is not described in full.

Taxonomy

Key to the yellow-flowered tuberous *Drosera* species

1 Leaf lamina crescent-shaped, with lobes at the angles ..... **D. sulphurea**

1. Leaf lamina broadly obovate, reniform or orbicular on most leaves, without lobes 2

2 Plants erect. Leaves solitary ..... **D. zigzagia**

2. Plants lax (often leaning on nearby herbs for support) or climbing. Leaves in groups of 3 or more 3

3 Sepals glabrous ..... **D. moorei**

3. Sepals glandular 4

4 All plant parts (excluding the sepals) glabrous ..... **D. intricata**

4. All plant parts (excluding the lowermost section of stem, stamens, styles and petals) glandular ..... **D. subhirtella**

Reinstatement of *Drosera sulphurea*

Drosera sulphurea is restricted to the Denmark–Albany region in coastal regions of south-west Western Australia. Its closest relative, *D. neesii,* also occurs in this region but has a much greater range extending east to Cape Arid and north to Kalbarri. Specimens of *D. neesii* occurring in the Hill River–Mingenew–Kalbarri region are known as subsp. *borealis* N.G. Marchant. Other than having a white tuber, *D. neesii* subsp. *borealis* barely differs from *D. neesii* subsp. *neesii.* While the status of *D. neesii* subsp. *borealis* requires further study, *D. sulphurea* shows so many morphological differences from *D. neesii* that it is undoubtedly a distinct species.

Drosera sulphurea has a yellow or yellow-blushed pink tuber, stems 40–60 cm tall, yellow petals, sparsely glandular ovary, yellowish green styles *c.* 4.5 mm long, each divided into many branching filiform segments with the apex of each segment further divided into 3 short segments, and yellowish-green stigmas terminating the ultimate segments. In contrast, *D. neesii* has a dark maroon or white tuber, stems 15–40 cm tall, pink petals, glabrous ovary, white styles *c.* 2 mm long, each divided into a number of branching terete segments, and reddish-pink stigmas forming a slightly swollen emarginate projection at the apex of each segment.

The *Drosera subhirtella* complex

Each of the species belonging to the *Drosera subhirtella* complex can be identified by its unique seed morphology. There are also significant differences within the group in the morphology of their vegetative and floral organs. Many of the distinguishing characters of the four species are given in Table 1.

Table 1. Morphological comparison of the species in the *D. subhirtella* complex.

	D. intricata	*D. moorei*	*D. subhirtella*	*D. zigzagia*
habit	lax	lax	lax	erect
leaves	mostly in 3's	mostly in 3's	mostly in 3's	solitary
lamina	mostly broadly obovate	mostly reniform	mostly orbicular	mostly broadly obovate
stems, petioles & pedicels	glabrous	glabrous	glandular	glabrous
bracteoles	laciniate, glabrous	laciniate in distal half, glabrous	laciniate, glandular	laciniate at apex, glabrous
sepals	elliptic, glandular	elliptic, glabrous	narrowly ovate, glandular	obovate glabrous
petal length	8–11.5 mm	6.5–10 mm	8.5–12 mm	5–6 mm
style length	3–3.5 mm	2–3 mm	3–3.5 mm	1–1.2 mm
seed length	1.5–2.2 mm	1.2–1.5 mm	2.5–3.5 mm	1.1–1.3 mm

Drosera intricata Planchon (Planchon1848: 293). *Type:* south-west Western Australia, *J. Drummond* 2nd coll. 7, in herb. Hook. (*holo:* K).

Drosera menziesii var. *flavescens* Benth. (Bentham 1864: 468). *Type: p.p.* as to south-west Western Australia, *J. Drummond* 2nd coll. 7, in herb. Hook. (*syn:* K).

A golden green glabrous *perennial herb*, lax, often tangled when found in colonies, scrambling or climbing, the stem of flowering specimens usually 25–40 cm long, with tuber-producing stolons (dropper roots) produced from the leaf axils. *Tuber* white, globose, covered in black papery sheaths *c.* 5 mm diam.; vertical stolon below ground, 1.5–3 cm long. *Leaves* in alternate groups of 3 (sometimes with additional lateral pairs present), the central leaf with a petiole 10–30 mm long, the lateral leaves with a petiole 5–12 mm long. *Lamina* peltate, broadly obovate on most leaves but reniform and orbicular with truncate apex on others, 1–2.5 mm long, 1.2–2 mm wide; marginal insect-catching glands 1.5–3.5 mm long; abaxial surface glabrous. *Inflorescence* paniculate, terminal, 3–12-flowered; pedicels 7–18 mm long, glabrous; bracteoles golden green, black-dotted, lanceolate, 2.5–3 mm long, margins and apex irregularly laciniate, glabrous. *Sepals* golden green, finely black-dotted, elliptic,

3.5–5 mm long, 1.5–3 mm wide, margins and apex irregularly laciniate, laciniae *c.* 1.5 mm long and tipped with a minute apical gland; abaxial surface covered with stalked glands *c.* 0.3 mm long. *Petals* yellow, obovate, 8–11.5 mm long, 5.5–7 mm wide, apex slightly crenate. *Stamens* 5–7 mm long, filaments white, anthers and pollen yellow. *Ovary* green, ellipsoid, 1.5–1.6 mm long, 1–1.5 mm diam. at anthesis; carpels 3, glabrous. *Styles* 3, golden green, 3–3.5 mm long, each branched into many filiform segments, each segment divided near apex into a number of short segments, each terminated by a simple stigma. Capsule obovoid, *c.* 3 mm long, *c.* 4 mm diam. *Seeds* black, nail-like, 1.5–2.2 mm long; base obovoid, concave, 0.5–0.6 mm diam.; shaft *c.* 0.25 mm diam. tapering towards the apex, slightly falcate, longitudinally winged on one side and apex, *c.* 0.15 mm wide. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Wamballup Nature Reserve, 23 km NW of Mount Barker, 22 Sep. 1993, *A.R. Annels* 3773 (PERTH); Near Katanning, 56 km S of Wagin, 27 Sep. 1933, *W.E. Blackall* 3121 (PERTH); *c.* 9 miles [14.4 km] E of Cranbrook along road to Borden, 10 Sep. 1974, *L. DeBuhr* 3560 (PERTH); *c.* 5 miles [8 km] E of Kendenup along the Red Gum Pass Rd, 10 Sep. 1974, *L. DeBuhr* 3588 (PERTH); *c.* 21 miles [33.6 km] E of Jerramungup along road to Ravensthorpe, 21 Sep. 1974, *L. DeBuhr* 3714 (PERTH); New Norcia road, 11 Sep. 1980, *H. Demarz* 8185 (PERTH); Kendenup, *c.* 60 km N of Albany, 18 Oct. 1957, *R. Erickson s.n.* (PERTH); *c.* 8.5 miles [13.6 km] E of Jerramungup, 11 Oct. 1973, *R. Garraty* 254 (PERTH); Near Creek W of Fisher Rd, 33° 50' S, 117° 10' E, 10 Oct. 1994, *C. Lewis* 83 (PERTH); Fish Road Reserve, Busselton, 16 Sep. 1994, *A. Lowrie* 1067 (PERTH, MEL); North East Rd near Mount Cooke, 2 Oct. 1997, *A. Lowrie* 1896 (PERTH, MEL); Serpentine River Crossing on Albany Highway, 2 Oct. 1997, *A. Lowrie* 1898 (PERTH, MEL); Beaufort River Reserve, 2 Oct. 1997, *A. Lowrie* 1904 (PERTH, MEL); junction of Great Southern Highway and Newton Rd, Cranbrook, 19 Oct. 1997, *A. Lowrie* 1938 (PERTH, MEL); Bowelling, 28 Sep. 1954, *A.R. Main s.n.* (PERTH); Harvey, 26 Sep. 1950, *R.D. Royce* 3342 (PERTH).

Distribution. Known from Busselton, Cranbrook, Jerramungup, Bowelling, Katanning, Mt Cooke area and New Norcia.

Habitat. Drosera intricata grows in grey or brown clayey sand in the beds of fast-flowing seasonal creeks, floodways, watersheds, and in shrubland with paperbarks (*Melaleuca* sp.) on the margins of winter-wet watercourses and swamps.

Flowering period. September to October.

Conservation status. Drosera intricata is a common species and currently not under threat.

Etymology. Drosera intricata is named from the Latin *intricatus* – entangled, in reference to the tangled life form of the species.

Typification. Bentham's type citation under *Drosera menziesii* var. *flavescens* consists of three collections. The Drummond collection is also the holotype of *D. intricata*. The Hill River, and Vasse River collections of Oldfield are of *D. subhirtella*.

Affinities. At a casual glance *Drosera intricata* can be mistaken for its close relative *D. subhirtella*. However, *D. subhirtella* is clearly distinguished by its yellow tuber, more widespread glandular indumentum, mostly orbicular leaves, and longer seeds with a distinctive shape. Planchon (1848) clearly described the two species in the same publication. Bentham (1864) reduced *D. intricata* to a

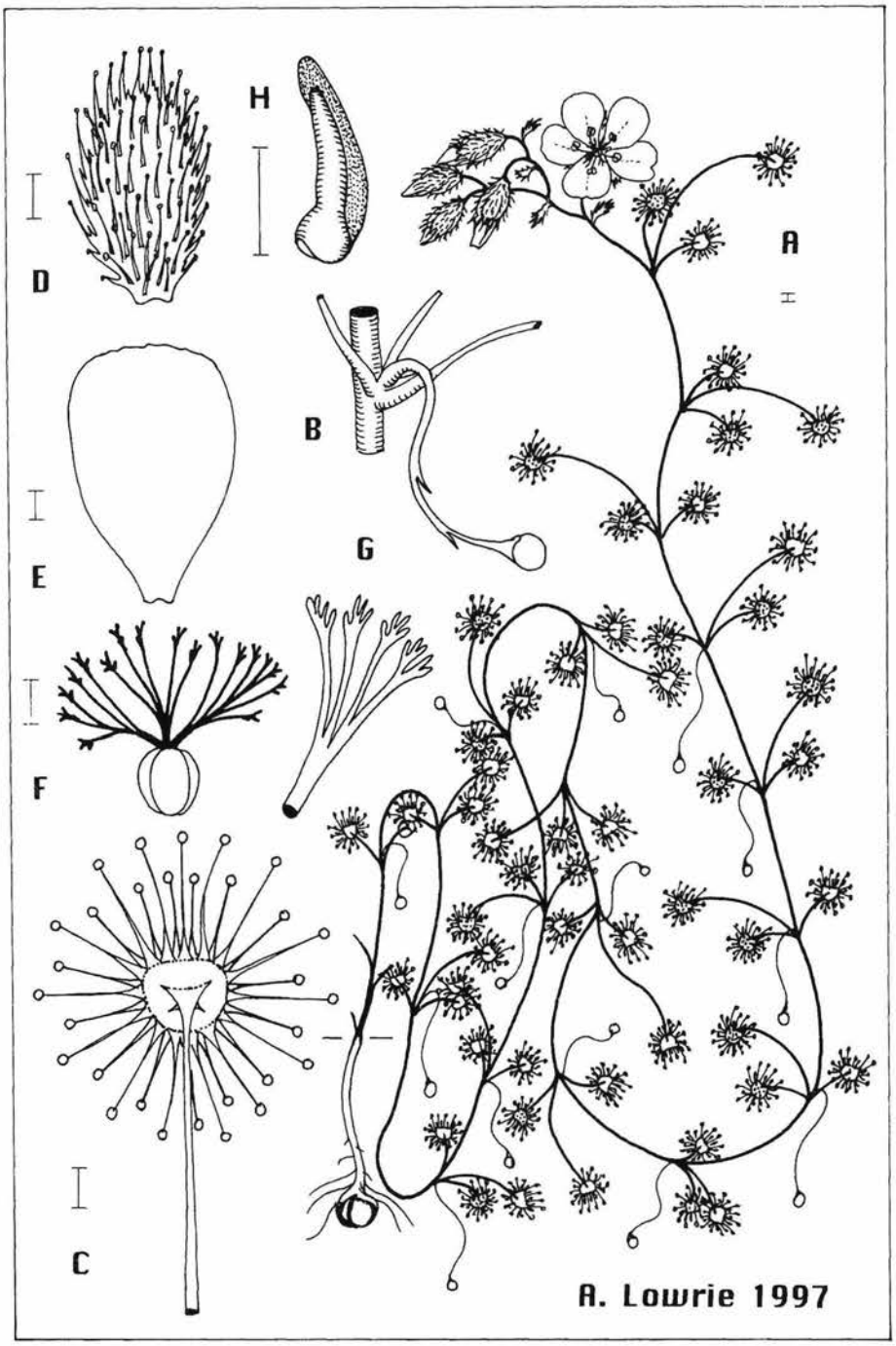

Figure 1. *Drosera intricata.* A – habit of plant; B – stem and leaf petioles section with dropper root and developing tuber; C – leaf; D – sepal, abaxial surface; E – petal; F – ovary and styles; G – style, enlarged; H – seed. Scale bars = 1 mm. Drawn from *A. Lowrie* 1896.

variety of *D. menziesii* R. Br. and *D. subhirtella* to a variety of *D. macrantha* Endl. Diels (1906) reinstated *D. subhirtella* but reduced *D. intricata* to a synonym of it. All subsequent authors have followed Diels, but *D. intricata* is now reinstated.

Drosera intricata (*A. Lowrie* 1904) was discovered growing side by side and flowering simultaneously with *D. subhirtella* (*A. Lowrie* 1905) at Beaufort River. No intermediates or apparent hybrids between the two taxa were found at the location, so they appear to be genetically isolated. This observation is further evidence that the two taxa are distinct species.

Notes. Like other climbing tuberous members of the genus, *Drosera intricata* plants use the marginal retentive glands of their lamina in two ways. Primarily these glands are used for the capture of insect prey but, when needed, a few of them become cemented to nearby vegetation for support. Glands providing support occur mainly on the longer central leaves in each group of three. Most of the glands of the attached lamina remain free and continue to capture and process prey.

Drosera moorei (Diels) Lowrie, *comb. nov.*

Drosera subhirtella var. *moorei* Diels (Diels 1906: 119). – *Drosera subhirtella* subsp. *moorei* (Diels) N.G. Marchant (Marchant *et al.* 1982: 385). *Type:* Nine-mile Rocks near Coolgardie, Western Australian Goldfields, Western Australia, September 1895, *S. Moore s.n.* (*lecto:* K, here designated); Bullabulling, Western Australia, September 1895, *S. Moore s.n.* (*paralecto:* K).

A tuberous rather fine glabrous *perennial herb*, lax, scrambling or climbing, the stem of flowering specimens 12–35 cm long, sometimes with tuber-producing stolons (dropper roots) produced from the leaf axils. *Tuber* white, globose, covered in black papery sheaths *c.* 8 mm diam.; vertical stolon below ground, *c.* 15 cm long. *Leaves* in alternate groups of 3, the central leaf with a petiole 10–25 mm long, the lateral leaves with a petiole 2–10 mm long. *Lamina* peltate, almost reniform in outline on most leaves but broadly obovate on others, 1–2 mm long, 1.5–2.5 mm wide; marginal insect-catching glands 1–2.2 mm long; abaxial surface glabrous. *Inflorescence* paniculate, terminal, 2–10-flowered; pedicels 4–15 mm long, glabrous; bracteoles linear, 2–3.2 mm long, margins entire, apex irregularly laciniate, glabrous. *Sepals* golden green, finely black-dotted, ovate, 3.5–5 mm long, 1.5–2.5 mm wide, margins entire in the lower third, remainder and apex irregularly laciniate, laciniae 0.5–2 mm long and tipped with a minute apical gland; abaxial surface glabrous. *Petals* yellow, broadly obovate, 6.5–10 mm long, 4–8 mm wide, apex irregularly crenate. *Stamens* 3.5–4.5 mm long, filaments white, anthers yellow, pollen pale yellow. *Ovary* golden green, globose, 1.5–2.5 mm diam. at anthesis; carpels 3, glabrous. *Styles* 3, golden green, 2–3 mm long, each branched into many filiform segments, each segment divided near the apex into a number of short segments, each terminated by a simple stigma. Capsule obovoid, *c.* 2.2 mm long, *c.* 2.2 mm diam. *Seeds* black, nail-like, 1.2–1.5 mm long; base subspherical, concave, 0.3–0.4 mm diam.; shaft 0.15–0.2 mm diam.; apex a rounded, flattened wing, 0.2–0.3 mm long. (Figure 2)

Other specimens examined. WESTERN AUSTRALIA: 65.2 km NE of Muckinwobert Rock, 7 Sep. 1983, *M.A. Burgman* 2218 & *S. McNee* (PERTH); Gnarlbine Rock, 28 km S of Coolgardie, 15 Sep. 1989, *B.J. Conn* 3145 & *J.A. Scott* (PERTH, MEL, NSW); *c.* 72 miles [115.2 km] E of Southern Cross along Great Eastern Highway, 17 Aug. 1974, *L. DeBuhr* 3215 (PERTH); near Howick Hill, *c.* 100 km E of Esperance, 23 Sep. 1968, *H. Eichler* 19932 (PERTH); Victoria Rocks, SW of Coolgardie, 22 Sep. 1962, *A.S. George* 4187 (PERTH); between 297 [475.2 km] – 298 [476.8 km] mile pegs Great Eastern Highway, 15 Sep. 1964, *N.G. Marchant* 64227 (PERTH); *c.* 100 km E of Southern Cross, 16 Sep. 1983, *A. Lowrie s.n.* (PERTH); Scadden road near Greens Road Nature Reserve, 11 Oct. 1997, *D.E. Murfet*

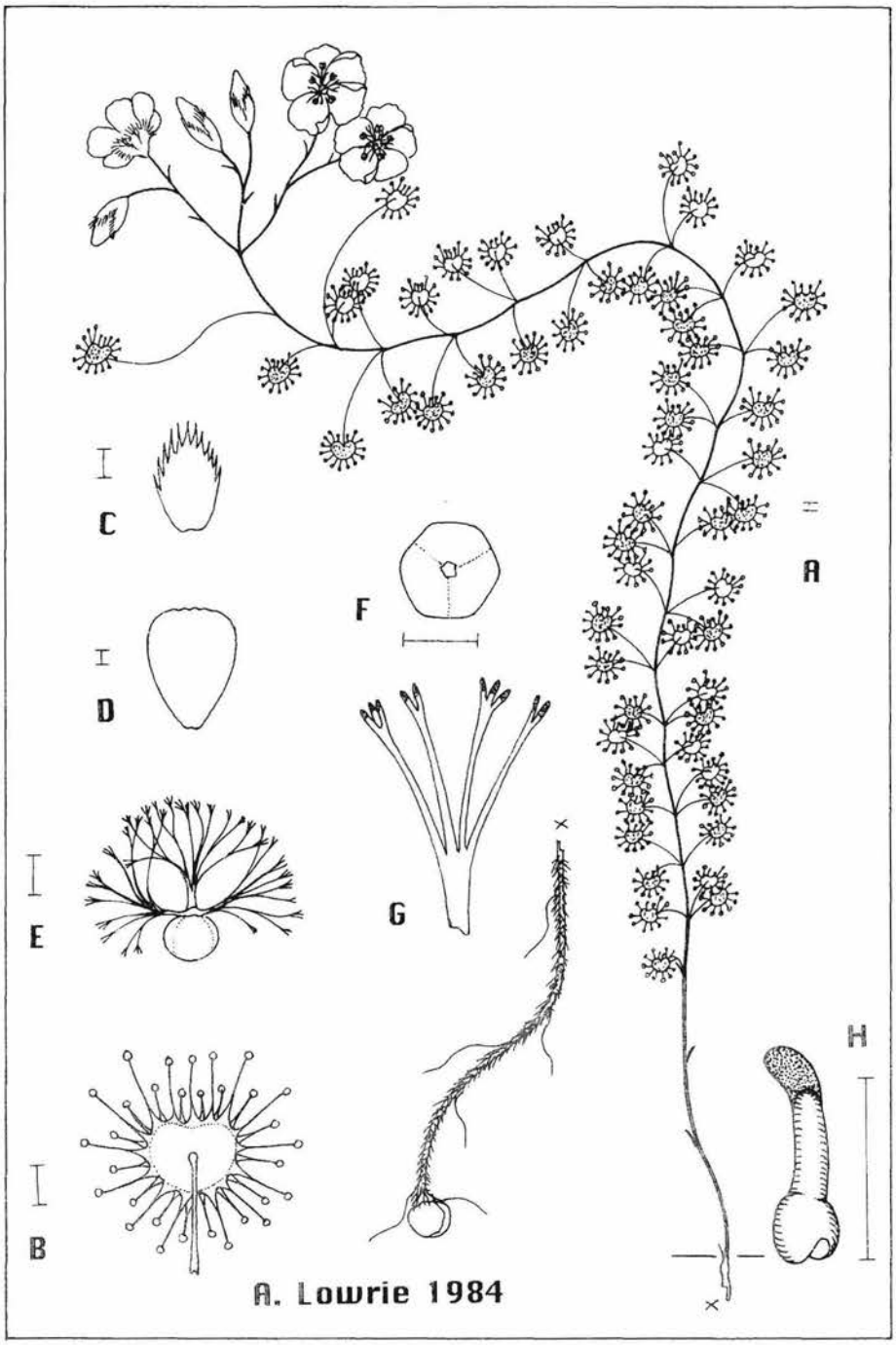

Figure 2. *Drosera moorei*. A – habit of plant; B – leaf; C – sepal, abaxial surface; D – petal; E – ovary and styles; F – ovary, base view; G – style, enlarged; H – seed. Scale bars = 1 mm. Drawn from E of Southern Cross, *A. Lowrie s.n.*, 16 Sep. 1983.

2925 (PERTH); 3.8 km NW of Seal Creek, Cape Arid, 14 Oct. 1997, *D.E. Murfet* 2949 (PERTH); 2.6 km NW of Seal Creek, Cape Arid, 14 Oct. 1997, *D.E. Murfet* 2952 (PERTH); Musson Soak, *c.* 110 km NNW of Coolgardie, 22 Aug. 1981, *K. Newbey* 8675 (PERTH); Nine Mile Rock, *c.* 93 km ENE of Southern Cross, 16 Sep. 1981, *K. Newbey* 8919A (PERTH).

Distribution. Known from Southern Cross east to Musson Soak (north-north-west of Coolgardie) and south to Scadden and Cape Arid.

Habitat. Drosera moorei grows in sandy loam on the aprons of granite outcrops where the water run-off is greatest. It also grows in the shade of small shrubs a short distance from granite outcrops.

Flowering period. September-October.

Conservation status. Drosera moorei is a common species and currently not under threat.

Etymology. Drosera moorei is named in honour of Spencer Le Marchant Moore (1850–1931), a scientific worker for the Department of Botany at the British Museum, who collected in the eastern Goldfields of Western Australia during 1894–1896.

Affinities. Drosera moorei is easily distinguished from *D. intricata* and *D. subhirtella* by its glabrous sepals. *D. zigzagia* also has glabrous sepals but is easily distinguished from *D. moorei* by its short, erect zigzag growth habit and solitary alternate leaves.

Notes. Like *Drosera intricata, D. moorei* is capable of additional tuber production by means of adventitious stolons known as dropper roots, which are commonly produced from the axils of the leaves on specimens found in very wet habitats. These additional tubers increase the number of plants in the colony the following season. *D. radicans* Marchant regularly produces additional tubers in the same manner, and this has also been observed in *D. gigantea* Lindley.

Drosera subhirtella Planchon (Planchon 1848: 292). *Type:* Swan River [Colony], south-west Western Australia, *J. Drummond s.n.*, in herb. Hook. (*holo:* K).

Drosera macrantha var. *minor* Benth. (Bentham 1864: 468). *Type:* Swan River [Colony], south-west Western Australia, *J. Drummond s.n.*, in herb. Hook. (*lecto:* K, here designated).

Drosera menziesii var. *flavescens* Benth. (Bentham 1864: 468). *Type: p.p.* as to Oldfield collections: Hill River, Western Australia, *A. Oldfield s.n.* (*syn:* MEL 96906); Vasse River, Western Australia, *A. Oldfield s.n.* (*syn:* MEL 96904).

A tuberous glandular *perennial herb,* lax, scrambling or climbing, the stem of flowering specimens 20–40 cm long. *Tuber* yellow, globose, covered in black papery sheaths *c.* 8 mm diam.; vertical stolon below ground 10–15 cm long. *Leaves* mostly in alternate groups of 3 (sometimes with additional lateral pairs present), the central leaf with a petiole 12–40 mm long, the lateral leaves with a petiole 4–5 mm long. *Lamina* peltate, orbicular on most leaves but broadly obovate on others, 2–3 mm diam.; marginal insect-catching glands 1.5–3.5 mm long; abaxial surface glandular. *Inflorescence* paniculate, terminal, 3–25-flowered; pedicels 4–15 mm long, glandular; bracteoles linear-lanceolate, 2–3.5 mm long, margins entire, apex irregularly laciniate, glandular. *Sepals* green, black-dotted, narrowly ovate, 3.5–6 mm long, 1.5–3 mm wide, margins fringed with subulate stalked glands, 0.2–0.3 mm long, apex

irregularly laciniate, laciniae 0.3–0.5 mm long and tipped with a minute apical gland; abaxial surface covered with subulate stalked glands. *Petals* yellow, broadly obovate, 8.5–12 mm long, 6–8 mm wide, apex truncate, irregularly crenate. *Stamens* 5.5–6 mm long, filaments golden green, anthers pale yellow, pollen yellow. *Ovary* green, obovoid, 1.3–2 mm long, 1.3–2 mm diam. at anthesis; carpels 3, sparsely glandular. *Styles* 3, golden green, 3–3.5 mm long, each branched into many filiform segments, each segment divided near apex into a number of short, slightly swollen and flattened segments, each terminated by an emarginate stigma. Capsule obovoid, 3–5.5 mm long, 4.5–6 mm diam. *Seeds* black, tack-like, straight, 2.5–3.5 mm long; base conic with a rounded summit, concave, 0.6–0.7 mm diam.; shaft terete 0.15–0.2 mm diam.; apex flat and pointed, falcate, resembling a knife blade, 0.7–1 mm long. (Figure 3)

Other specimens examined. WESTERN AUSTRALIA: 5 miles [8 km] E of Piawaning, 9 Sep. 1959, *T.E.H. Aplin s.n.* (PERTH); Carnamah, between Midland and Walkaway, 23 Aug. 1940, *W.E. Blackall* 4352 (PERTH); 1 km W of Great Northern Highway along Hay Flat Rd, 18 Sep. 1983, *R.J. Cranfield* 4216 (PERTH); along Hill River road *c.* 13 miles [20.8 km] W of Junction with Eneabba–Badgingarra road, 30 Aug. 1974, *L. DeBuhr* 3439 (PERTH); 2 km S of Brookton, 11 Oct. 1983, *H. Demarz* 9724 (PERTH); Bolgart, 100 km N of Toodyay, 7 Sep. 1963, *R. Erickson s.n.* (PERTH); Tammin, 8 Sep. 1942, *C.A. Gardner* 6436 (PERTH); North Bunqueen, Aug. 1953, *C.A. Gardner* 12141 (PERTH); 8.2 miles [13.2 km] E of Newdegate, 27 Sep. 1975, *J.W. Green* 4468 (PERTH); E of Northam, 16 Sep. 1983, *A. Lowrie s.n.* (PERTH); Richardson Rd, E of Miling, 6 Sep. 1997, *A. Lowrie* 1835 (PERTH, MEL); W of Agriculture Dept, Wongan Hills, 13 Sep. 1997, *A. Lowrie* 1859 (PERTH, MEL); Beaufort River Reserve, 2 Oct. 1997, *A. Lowrie* 1905 (PERTH, MEL); on road to Woodanilling *c.* 17 km E of Albany Highway, 2 Oct. 1997, *A. Lowrie* 1907 (PERTH, MEL); Woorkakanin Rock, 2 miles [3.2 km] E of Kondinin, 18 Sep. 1972, *N.G. Marchant* 72/648 (PERTH); 19 km due E Yornaning Siding, 12 Sep. 1975, *B.G. Muir* 5/9 (5.1) (PERTH); 10 km W of Varley, 3 Oct. 1997, *D.E. Murfet* 2849 (PERTH, MEL); Heathland Nature Reserve [E of Lake Grace], 5 Oct. 1997, *D.E. Murfet* 2872 (PERTH, MEL); Holland Tank [SE of Newdegate], 5 Oct. 1997, *D.E. Murfet* 2876 (PERTH, MEL); North Rd [E of Mt Madden], 6 Oct. 1997, *D.E. Murfet* 2889 (PERTH, MEL); Wongan Hills, 13 Sep. 1947, *R.D. Royce* 2179 (PERTH); Tutanning Reserve 17 miles [27.2 km] E of Pingelly, 6 Oct. 1963, *R.D. Royce* 7941 (PERTH); 2 km SW of Manmanning, 7 Sep. 1978, *B. &M. Smith s.n.* (PERTH).

Distribution. Known from Northam to Merredin, south to Beaufort River, Katanning, Newdegate and Lake King, north to Hill River region, Wongan Hills, Carnamah and Miling.

Habitat. Drosera subhirtella grows in white sand heath with *Banksia* species; yellow sand on heathland; quartzite sandplains; white lateritic sand or mallee sandplains; on heathland in ironstone gravels or light brown loam with ironstone with *Allocasuarina* species and *Leptospermum* species woodland; and in loam soils on the aprons of granite outcrops where the water run-off is greatest.

Flowering period. August–October.

Conservation status. Drosera subhirtella is a common species and currently not under threat.

Etymology. Drosera subhirtella is named from the Latin *sub* – somewhat and *hirtellus* – hairy, but less than hirsute in reference to its all-over glandular indumentum.

Affinities. D. subhirtella is easily distinguished from all other members of the *subhirtella* complex by its all-over glandular indumentum.

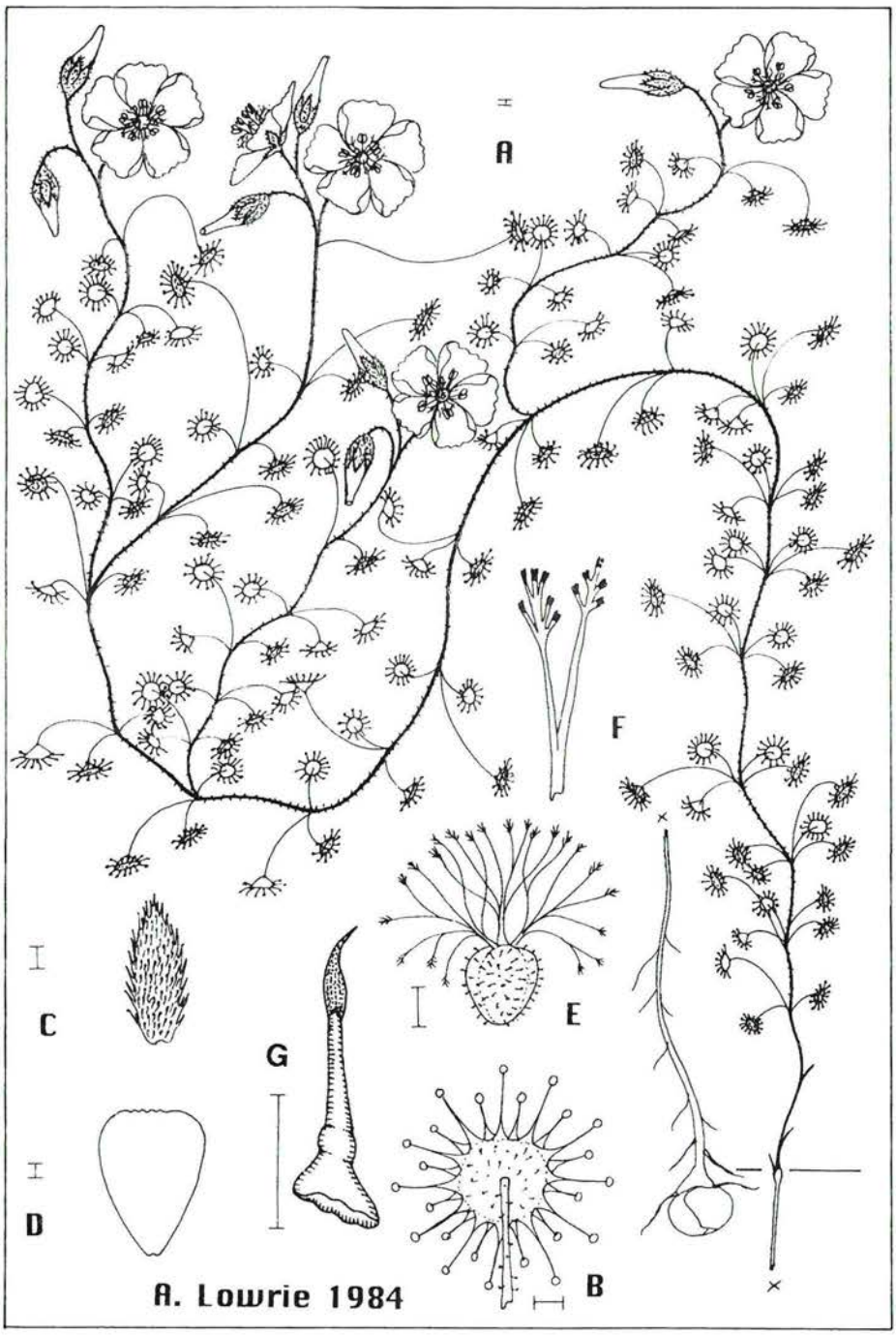

Figure 3. *Drosera subhirtella.* A – habit of plant; B – leaf; C – sepal, abaxial surface; D – petal; E – ovary and styles; F – style, enlarged; G – seed. Scale bars = 1 mm. Drawn from E of Northam, *A. Lowrie s.n.*, 16 Sep. 1983.

Notes. Drosera subhirtella is a widespread species and is often found growing with another tuberous sundew, *Drosera macrantha,* which has white or pink flowers.

Drosera zigzagia Lowrie, *sp. nov.*

Drosera moorei affinis sed planta 5–7 cm alta, caule erecto flexuoso, foliis solitariis alternatis.

Typus: Lake Seabrook, *c.* 40 km north-east of Southern Cross, Western Australia, [30° 56' 30" S, 119° 35' 30" E], 21 August 1979, *K. Newbey* 5750 (*holo:* PERTH 0066960; *iso:* MEL).

A tuberous glabrous *perennial herb*, erect, the stem of flowering specimens 5–7 cm long. *Tuber* white, globose, covered in black papery sheaths *c.* 5 mm diam.; vertical stolon below ground, 5–10 cm long. *Leaves* solitary, alternate, arising semi-erect from each bend along a zigzag stem. *Lamina* peltate, broadly obovate on most leaves but almost crescent-shaped on others, 1.5–2 mm diam.; marginal insect-catching glands 0.8–2.5 mm long; abaxial surface glabrous. *Inflorescence* paniculate, terminal, 4–9-flowered; pedicels 2–8 mm long, glabrous; bracteoles golden green, black-dotted, lanceolate, 1.5–2.5 mm long, margins entire, apex irregularly laciniate, glabrous. *Sepals* golden green, finely black-dotted, obovate, 3.5–4 mm long, 1.5–2 mm wide, margins entire, apex irregularly laciniate, laciniae 0.5–1.5 mm long and tipped with a minute apical gland; abaxial surface glabrous. *Petals* yellow, obovate, 5–6 mm long, 3.5–4 mm wide, apex entire. *Stamens* 1.7–2.2 mm long, filaments and anthers golden green, pollen yellow. *Ovary* golden green, subglobose, 1–1.2 mm diam. at anthesis; carpels 3, glabrous. *Styles* 3, golden green, 1–1.2 mm long, each branched into many filiform segments, each segment divided into a number of short segments, each terminated by a simple stigma. Capsule obovoid, 1.8–2 mm long, 1.8–2 mm diam. *Seeds* black, nail-like, slightly falcate, 1.1–1.3 mm long; base longitudinally 8-shaped, concave, 0.2–0.25 mm diam.; shaft terete, 0.1–0.15 mm diam.; apex flat, rounded, *c.* 0.1 mm long. (Figure 4)

Other specimens examined. WESTERN AUSTRALIA: Russmussen Rd, Lake Altham, 20 Oct. 1993, *A. Lowrie* 824 (PERTH, MEL); Russmussen Rd, Lake Altham, 30 July 1994, *A. Lowrie* 1062 (PERTH, MEL); E shore of Lake Hurlstone, 8 Sep. 1998, *A. Lowrie* 2096 (PERTH, MEL); South Kuender Nature Reserve, 5 Oct. 1997, *D.E. Murfet* 2868 (PERTH, MEL).

Distribution. Known from Lake Altham north of Pingrup and south of Kuender, *c.* 40 km to the north-north-east, Lake Hurlstone *c.* 100 km further north-east and at Lake Seabrook 190 km further north.

Habitat. Drosera zigzagia occurs in salt-free light brown (white on the surface) loamy sand on the slightly higher shore margins above the flood level of lakes and salt pans. It is often associated with *Drosera salina* N.G. Marchant & Lowrie, *Stylidium insensitivum* Carlquist, *S. pulviniforme* Kenneally & Lowrie, *Levenhookia leptantha* Benth. and *Frankenia* sp., growing near the Samphire zone as well as near and under *Melaleuca* shrubland.

Flowering period. August–September.

Conservation status. Drosera zigzagia is a common species at its known locations and is currently not under threat.

Etymology. The Latinized specific epithet – *zigzagia,* is derived from the name for the flexuose manner of the plant's stem which is called "zigzag" in French and English.

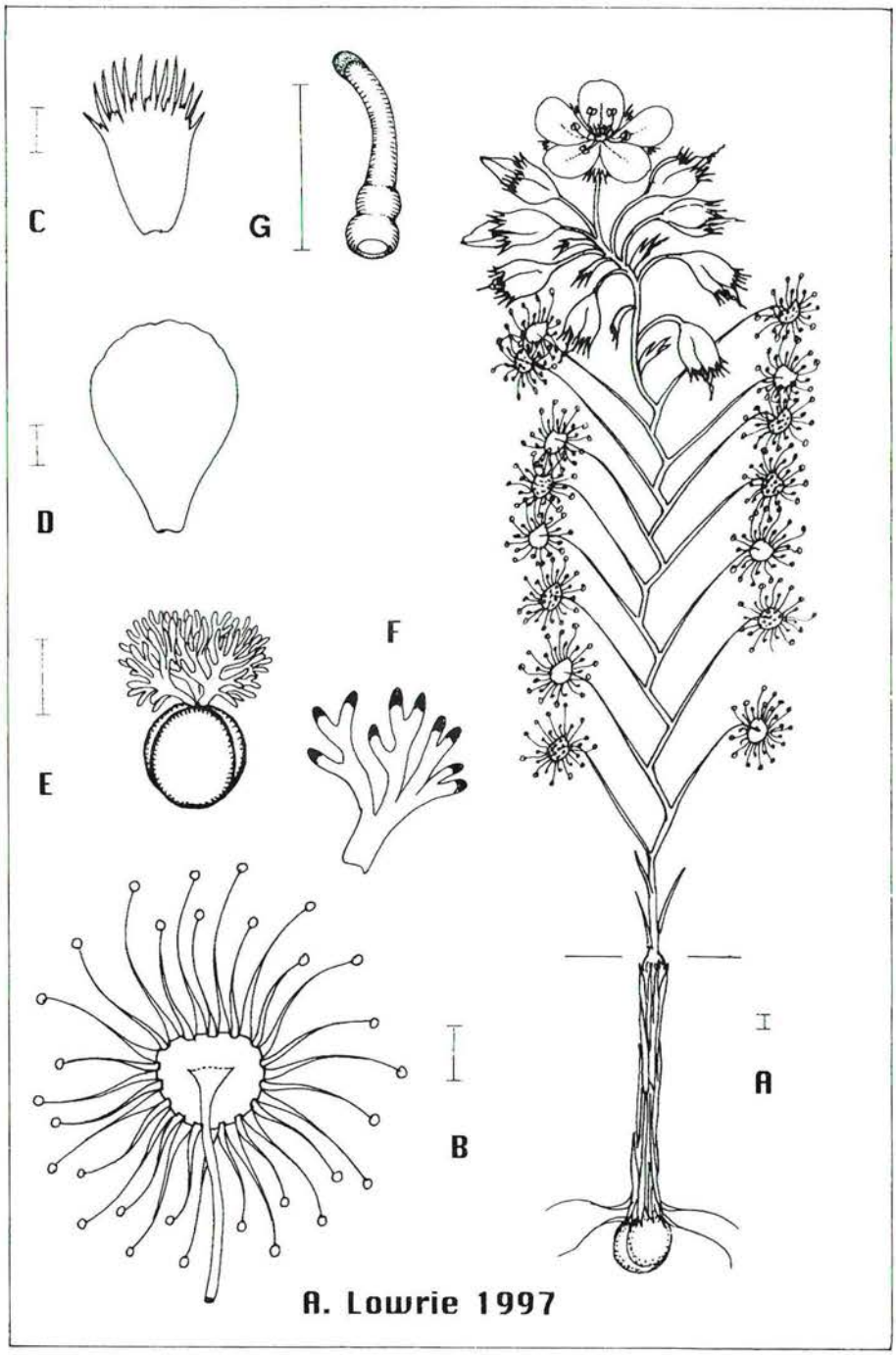

Figure 4. *Drosera zigzagia*. A – habit of plant; B – leaf; C – sepal, abaxial surface; D – petal; E – ovary and styles; F – style, enlarged; G – seed. Scale bars = 1 mm. Drawn from *A. Lowrie* 824.

Affinities. Drosera zigzagia and its closest relative *D. moorei* are glabrous plants in all their parts. *D. zigzagia* has a short and erect zigzagged stem with solitary alternate leaves, whereas *D. moorei* has a lax, scrambling, leaning and/or climbing growth habit with alternate leaves in groups of 3.

Notes. Drosera zigzagia is known only from a few widely scattered locations. It has been found growing in association either with *D. salina* or *Stylidium pulviniforme*, both of which are restricted to the margins of salt lakes. These two taxa are currently known from a number of other locations situated within the known growing range of *D. zigzagia.* It is therefore possible that *D. zigzagia* may be found at these locations when the shoreline habitats of these salt lake systems are further botanically explored.

Acknowledgements

I wish to thank Ken Hill, the 1998 Australian Botanical Liaison Officer at Royal Botanical Gardens, Kew for the type material Cibachrome photographs and descriptions of the finer details, in particular the indumentum structure and its arrangement on the type specimens; Paul Wilson for his expertise sorting out the complex nomenclature of these species and assistance with the Latin diagnosis; and Barbara Rye for her comments and the staff at the Western Australian Herbarium.

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A taxonomic revision of the creeping triggerplants (Stylidiaceae: *Stylidium* sect. *Appressae*) from southern Australia

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Abstract

Lowrie, A., Burbidge, A.H. & Kenneally, K.F. A taxonomic revision of the creeping triggerplants (Stylidiaceae: *Stylidium* sect. *Appressae*) from southern Australia. *Nuytsia* 13(1): 89–157 (1999). Twenty-three species of creeping triggerplants from southern Australia are recognized, including four new species, *S. flagellum, S. pingrupense, S. pseudosacculatum* and *S. warriedarense* Lowrie, Burbidge & Kenneally; two new names, *S. cilium* Lowrie, Burbidge & Kenneally, *S. megacarpum* Lowrie, Burbidge & Kenneally; two new combinations *S. septentrionale* (Mildbr.) Lowrie, Burbidge & Kenneally and *S. diplectroglossum* (R. Erickson & J.H. Willis) Lowrie, Burbidge & Kenneally; and four species recalled from synonymy, *S. cygnorum* W.V. Fitzg., *S. eriopodum* DC., *S. sacculatum* R. Erickson & J.H. Willis and *S. stowardii* M. Scott. The creeping triggerplants presented here belong in subg. *Nitrangium* Endl. sect. *Appressae* Mildbr. All are described and illustrated. A key for these taxa is provided.

Introduction

This paper presents a taxonomic revision of those species of *Stylidium* Swartz (Stylidiaceae) called 'creeping triggerplants' by Erickson (1958). All species in the creeping triggerplant group have leafy stems with appressed or spreading leafy terminal rosettes forming a compact or spreading tangled mat, usually raised slightly above the ground on aerial roots, which are referred to here as 'stilt roots'. Pate *et al.* (1984) described a variety of plants with this type of habit, which they termed 'stilt growth habit', including four *Stylidium* species, two of which, *S. bulbiferum* and *S. repens* are presented here because they are creeping triggerplants. Creeping triggerplants have swellings present on the stems at the ends of seasonal growth increments; we are using the term 'rosette nodes' for these.

At the time of the comprehensive review of the genus by Mildbraed (1908), eight of the species recognized by us were known, and these were dispersed between two subgenera and four sections. By the time of Erickson's (1958) overview of the genus, many more species were known, particularly as a result of Erickson's extensive field work in south-western Australia. This new knowledge led her to believe that Mildbraed's (1908) classification was artificial and she proposed (although not in a

formal taxonomic sense) a completely new arrangement of species within the genus. Her changes included placing all the creeping triggerplants, by then totalling 11 species, into a single group.

We have followed Erickson's (1958) more natural classification with some modification, as outlined below. We recognize 23 species of creeping triggerplants, 22 from south-western Australia and one from Kangaroo Island, South Australia.

Materials and methods

This revision is based on extensive field collecting, biosystematic studies and examination of herbarium material. All three authors have collected widely throughout the range of the creeping triggerplants in Western Australia, and Burbidge has also done some field observations on Kangaroo Island, South Australia.

For biosystematic studies, live material was collected and cultivated at the University of Western Australia, chromosome numbers were counted and many intra-specific and inter-specific crosses were conducted in the glasshouse (Burbidge & James 1991, A.H. Burbidge, unpubl. data).

Lowrie also collected fresh material, which was used either for preparation of voucher specimens or to establish cultivated collections for further study, and spirit materials. Morphological descriptions were drawn up using dried, spirit, fresh and cultivated material. Illustrations were drawn from fresh and spirit material.

All *Stylidium* collections in PERTH have been examined. Burbidge and Kenneally examined collections in AD, MEL and NSW and Kenneally examined material in the following European and American herbaria: B, BM, C, G, GOET, HAL, HBG, K, L, LD, M, NY, P, S, UPS. Type material in these herbaria was photographed.

All collections are cited for taxa that are poorly collected. For other taxa, specimens cited have been selected to represent the known geographic range.

Sharr (1996) has been used as the source to establish the meanings for the scientific names of taxa previously described.

Taxonomy

Stylidium sect. **Appressae**

Stylidium sect. *Appressae* Mildbr. (Mildbraed 1908: 81, 84). *Type: Stylidium adpressum* Benth.

Stylidium sect. *Repentes* Mildbr. (Mildbraed 1908: 41, 49). *Type: Stylidium repens* R. Br.

Creeping plants forming a compact or spreading tangled mat; usually raised above the ground on stilt roots developed from the rosette nodes; leafy tufts (*S. uniflorum)* or leafy stems arising from the rosette nodes, leaves deciduous by late summer except for terminal clusters of dormant juvenile leaves; internodes stoloniferous, either a modified stem with few leaves on or just below the soil surface

(*S. uniflorum)* or the product of the older leafless ascending or procumbent stems; stem leaves (in active growth) appressed or spreading, persistent or with some or all caducous by anthesis; leaves of the terminal leafy rosettes appressed, compact or spreading and persistent at anthesis; inflorescences arising from the terminal rosettes or basal leafy tufts.

Notes. Mildbraed (1908) and Erickson (1958) included *Stylidium merrallii* (F. Muell.) T.A. Durand & B.D. Jackson (1896) as a creeping triggerplant. However, *S. merrallii* was described from incomplete material and erroneously associated with these species. This species was once declared under the Western Australian Wildlife Conservation Act as 'presumed to be extinct' before it was recollected and its morphology and life form studied in the field and cultivation. This established that it was not a creeping triggerplant (Kenneally & Lowrie 1994a).

Bentham (1868) did not group the creeping triggerplants together except to place two of them (*S. bulbiferum and S. breviscapum*) in his series *Thyrsiformes* Benth., a group comprised mainly of tufted species. Mildbraed (1908) placed five creeping species in this group, which he raised to the sectional level, but still included a larger number of tufted species in the group. Mildbraed also named two new sections, each comprising a single creeping species, and placed one further creeping species (*S. tepperianum*) in yet another section, sect. *Lineares* (Benth.) Mildbr. together with ten tufted species.

Erickson (1958) placed all the creeping triggerplants together but did not indicate a formal taxonomic category for them. We are nominating one of Mildbraed's groups, sect. *Appressae* for all species of creeping triggerplants and placing his other group, sect. *Repentes* into synonymy.

Key and synopsis of the creeping triggerplant groups

When closely related species are placed together, the 23 creeping triggerplants fall into nine groups. These groups are keyed out then outlined below. For each group the main characteristics, known chromosome numbers and member species are given.

1. Corolla lobes vertically paired ..... **Group G**
1. Corolla lobes laterally paired
   2. Throat appendages 4–8
      3. Inflorescence of solitary terminal flowers
         4. Leaves of the flowering stems spreading at the apex ..... **Group E**
         4. Leaves of the flowering stems compact and appressed at the apex ..... **Group F**
      3. Inflorescence multiflowered – or never consistently 1-flowered
         5. Inflorescence a 1-sided raceme with 1–6 flowers. Throat appendages 8. Leaves all in dense rosettes ..... **Group H**
         5. Inflorescence a 4–10-flowered dichasium. Throat appendages 6. Leaves extending along stems as well as in rosettes ..... **Group A**
   2. Throat appendages 2 or absent
      6. Leaves long-linear, in dense sub-basal tufts. Peduncles mostly 1-flowered, pilose ..... **Group I**
      6. Leaves linear to narrowly ovate to spathulate, extending along the stems and in rosettes borne well above the ground. Peduncles 1–15-flowered, if mostly 1-flowered then glandular

7. Peduncle with both long and short glandular hairs ..... **Group D**
7. Peduncle pilose and/or glandular but not with two types of glandular hairs
   8. Leaves terete in the distal part, the hyaline margin absent or restricted to base, apical mucro remaining small and blunt on those leaves produced at anthesis ..... **Group B**
   8. Leaves flattened in distal part, the hyaline margin serrate, ciliate or just ragged near the base, apical mucro sharp on those leaves produced at anthesis ..... **Group C**

Group A

Leaves ovate-lanceolate, with translucent white hyaline, apical mucro sharp and basal spur prominent, leaves appressed or spreading along the stems, spreading at the apex. *Inflorescence* a compound dichasium, 4–10-flowered; peduncle glandular. *Throat appendages* 6. *Labellum* with basal appendages and apical point.

1. *Stylidium adpressum* n = 15
2. *S. cygnorum* n = 15

Group B

Leaves linear, terete in the upper part with translucent white hyaline absent – hyaline sometimes present near the base, apical mucro very small and blunt, leaves semi-appressed along the stems, spreading at the apex. *Inflorescence* at the beginning corymbose or a crowded indeterminate umbel with flowers almost sessile or forming a compact panicle when distinctly pedicellate, peduncle bearing pilose hairs sometimes tipped with a gland. *Throat appendages* absent.

3. *S. breviscapum* n = 13
4. *S. eriopodum* n = 13
5. *S. neglectum* n = 13
6. *S. stowardii* n = 13

Group C

Leaves linear-lanceolate, marginal translucent white hyaline serrate, ciliate or just ragged near the base, apical mucro sharp on leaves produced at anthesis – the presence of which are sometimes few – mixed with those that are blunt, leaves semi-erect along the stems in active growth, spreading at the apex. *Inflorescence* peduncle arising from each apical leafy rosette mostly solitary when bearing a multiflowered panicle but peduncles more than one when 1-flowered, peduncle(s) glandular, sparsely glandular or glandular-pilose. *Throat appendages* 2 or absent. *Labellum* boss either with basal appendages or bearing a few glands instead.

7. *S. bulbiferum* n = 14
8. *S. burbidgeanum* n = 14
9. *S. cilium* n = 14
10. *S. megacarpum* n = 14
11. *S. septentrionale* n = 14

Group D

Leaves linear, clavate or spathulate, bearing a white crenate, serrulate or irregularly serrate-laciniate hyaline and a longitudinal ridge-like keel, apical mucro sharp, shortly pointed or absent, leaf base rounded with opposite margins winged-serrate. *Inflorescence* paniculate, 2–15-flowered, peduncle bearing long and short glandular hairs. *Throat appendages* absent. *Labellum* with basal appendages and shortly pointed or bearded apex.

12. *S. dielsianum* n = 15
13. *S. induratum* chromosome number unknown
14. *S. warriedarense* n = 30

Group E

Leaves linear or lanceolate, with translucent white hyaline, apical mucro sharp and basal spur prominent, leaves appressed along the stems, spreading at the apex. *Inflorescence* peduncle(s) arising from each apical leafy rosette 1-flowered, peduncles glandular or pilose glandular. *Throat appendages* 6 or 8. *Labellum* with or without basal appendages but apical point always present.

15. *S. diplectroglossum* n = 15
16. *S. flagellum* n = 15
17. *S. pingrupense* n = 30
18. *S. repens* n = 15

Group F

Leaves lanceolate or lanceolate-lageniform, with translucent white hyaline, apical mucro sharp and basal spur prominent, leaves appressed along the stems, compact and appressed at the apex. *Inflorescence* peduncle solitary and 1-flowered at the apex of each leafy stem, peduncle pilose when almost sessile, pilose and densely glandular when long. *Throat appendages* 4 or 6. *Labellum* with or without basal appendages but apical point always present.

19. *S. pseudosacculatum* n = *c.* 30
20. *S. sacculatum* chromosome number unknown

Group G

Leaves lanceolate, with translucent white hyaline bearing irregular spike-like teeth, apical mucro sharp and basal spur prominent, leaves appressed along the stems, compact and not spreading at the apex; inflorescence racemose, 2–5-flowered; peduncle densely glandular; corolla lobes vertically-paired. *Throat appendages* bump-like on the petal base folds. *Labellum* with apical point but without basal appendages.

21. *S. choreanthum* n = 15

Group H

Leaves linear-lanceolate, with translucent white serrate hyaline and sharp apical mucro, leaves of the apical rosettes spreading. *Inflorescence* a 1-sided raceme, 1–6-flowered, peduncle bearing short

glandular hairs. *Throat appendages* 8. *Labellum* without basal appendages but with apical point and margins winged.

22. *S. tepperianum* chromosome number unknown

Group I

Leaves linear, with translucent white irregular erose-serrate hyaline and blunt apical mucro, rosettes arising from the soil and forming a leafy tuft. *Inflorescence* peduncle pilose, mostly 1-flowered and arising from the base of the leafy tuft. *Throat appendages* absent. *Labellum* with basal appendages.

23. *S. uniflorum* n = 14

Key to the creeping triggerplant species

1 Inflorescence a 1-sided raceme. Occurring in South Australia (Kangaroo Island) ..... **22. S. tepperianum**

1: Inflorescence not a 1-sided raceme. Occurring in Western Australia (south-west region) 2

2 Rosette nodes and adjoining stems below soil surface ..... **23. S. uniflorum**

2: Rosette nodes and adjoining stems above soil surface 3

3 Corolla lobes vertically paired ..... **21. S. chorcanthum**

3: Corolla lobes laterally paired 4

4 Inflorescence mostly uniflowered 5

4: Inflorescence multiflowered 11

5 Gynostemium with dilated cunabulum (see Figure 19F,G) in the upper portion 6

5: Gynostemium narrow in the upper portion 7

6 Hypanthium base hidden within the apical leafy rosette. Labellum without basal appendages ..... **20. S. sacculatum**

6: Hypanthium mostly free of the apical leafy rosette. Labellum with basal appendages ..... **19. S. pseudosacculatum**

7 Plants with mostly rosette node clusters (lignotuber-like) on the soil surface. Hypanthium 8–20 (mostly 15) mm long ..... **10. S. megacarpum**

7: Plants with solitary rosette nodes on stilt roots scattered throughout the tangled and matted plant network above the soil surface. Hypanthium 1.5–3.5 mm long 8

8 Apical leafy rosette with a solitary uniflowered peduncle. Corolla lobe pairs of equal size and shape; labellum with basal appendages 9

8: Apical leafy rosette with many uniflowered peduncles produced in succession. Corolla lobes all of a different size and shape; labellum without basal appendages 10

9 Leaf margins entire. Hypanthium glabrous. Throat appendages 8 ..... **17. S. pingrupense**

9: Leaf margins hyaline irregularly serrate. Hypanthium with glandular pilose hairs. Throat appendages 6 ..... **15. S. diplectroglossum**

10 Stilt-rooted plants low to the ground. Leaves lanceolate, 3–5 mm long, *c.* 0.7 mm wide. Sepals shorter than the hypanthium at anthesis. Labellum apical point almost as long as the boss ..... **18. S. repens**

10: Stilt-rooted plants erect and semi-erect up to 35 cm tall. Leaves narrowly lanceolate, 5–9 mm long, *c.* 1 mm wide. Sepals longer than the hypanthium at anthesis. Labellum with a very small apical point ..... **16. S. flagellum**

11 Leaves bearing thickened white edges, hyaline and keel 12

11: Leaf margins without thickened white edges, entire or bearing a translucent white hyaline 14

12 Plants forming erect compact bushes 10–22 cm high (including the stilt roots). Leaves linear, hyaline margins serrate ..... **13. S. induratum**

12: Plants spreading over the soil surface, prostrate and shortly stilt rooted. Leaves spathulate or clavate, hyaline margins serrate-laciniate or crenate and/or serrulate 13

13 Leaves spathulate, with prominent apical mucro, lunate in section, hyaline margins irregularly serrate-laciniate. Labellum boss *c.* 0.4 mm wide, basal appendages *c.* 0.7 mm long ..... **14. S. warriedarense**

13: Leaves clavate, with apical mucro mostly small or lacking, lenticulate in section in the lower parts, trigonal in the upper parts, hyaline margins mostly crenate, often serrulate, or a combination of both. Labellum boss *c.* 0.5 mm wide, basal appendages *c.* 1.5 mm long ..... **12. S. dielsianum**

14 Peduncle bearing non-glandular pilose hairs 15

14: Peduncle bearing glandular hairs 17

15 Labellum with apical point and basal appendages, all 5 sepals of a similar length ..... **3. S. breviscapum**

15: Labellum without apical point and basal appendages, 3 sepals longer than the other 2 16

16 Hypanthium sessile. Smaller sepals *c.* 1.2 mm long. Inflorescence including peduncle with pilose hairs ..... **4. S. eriopodum**

16: Hypanthium pedicellate. Smaller sepals *c.* 0.5 mm long. Inflorescence glandular with some pilose hairs on peduncle ..... **6. S. stowardii**

17 Inflorescence a narrow panicle. Hypanthium almost sessile 18

17: Inflorescence a compound dichasium or panicle. Hypanthium pedicellate 19

18 Leaves 5–15 (mostly 10–12) mm long, with a sharp apical mucro at anthesis. Hypanthium *c.* 6 mm long; corolla *c.* 11 mm wide. Labellum without apical point and basal appendages ..... **8. S. burbidgeanum**

18: Leaves 6–10 (mostly 6–7) mm long, with small blunt apical mucro at anthesis. Hypanthium *c.* 4.5 mm long; corolla *c.* 8 mm wide. Labellum with apical point and basal appendages ..... **5. S. neglectum**

19 Inflorescence a compound dichasium 20

19: Inflorescence a panicle 21

20 Leaves ovate, 2.5–4 mm long, *c.* 1.3 mm wide, appressed along the length of the flowering stems. Hypanthium elliptic, *c.* 4.5 mm long, *c.* 2 mm wide at anthesis. Pollen blue ..... **1. S. adpressum**

20: Leaves lanceolate, 6–8 mm long, *c.* 1.8 mm wide, mostly spreading, along the length of the flowering stems. Hypanthium linear-lanceolate, *c.* 7 mm long, *c.* 1.5 mm wide at anthesis. Pollen white ..... **2. S. cygnorum**

21 Terminal rosette (central) leaves (produced at anthesis) hyaline margins ciliate ..... **9. S. cilium**

21: Terminal rosette leaves (produced at anthesis) hyaline margins mostly entire or serrate 22

22 Leaf hyaline margins serrate. Apical leaf mucro sharp. Rosette nodes forming a compact cluster (lignotuber-like) mostly on the soil surface ..... **7. S. bulbiferum**

22: Leaf hyaline margins entire. Apical leaf mucro blunt. Rosette nodes on stilt roots above the soil surface ..... **11. S. septentrionale**

1. Stylidium adpressum Benth. (Bentham 1868: 22). – *Candollea adpressa* (Benth.) F. Muell. (Mueller 1883: 86).*Type:* 'W. Australia' [Western Australia], *Drummond* 3rd coll. n. 182. (*lecto:* K, here designated; *isolecto:* E, K, BM, W); *Drummond* 2nd coll. n. 38 (*syn:* K).

Illustrations. Erickson (1958) colour plate 16, figure 4; page 74, plate 18, figures 1–11. Grieve & Blackall (1982) pages 760 & 763, n. 87. Mildbraed (1908) page 85, figure 24A–F.

Creeping perennial *herb;* elevated up to 4 cm above the soil surface on wiry stilt roots and branched a little so as to form a clump up to 10 cm diam. *Stems* between the rosette nodes leafless, flowering stems 1–4 cm long, scabrid in varying degrees, arising in groups of 2 or 3 (rarely more) from the rosette node junctions, mostly bearing appressed persistent leaves along their entire length and sometimes bearing semi-erect leaves in the upper portions as well, terminating in a crowded compact apical leafy rosette. *Leaves* ovate, 2.5–4 mm long, 0.8–1.3 mm wide, apical mucro translucent white, 0.1–0.2 mm long, basal spur translucent white, 0.1–0.2 mm long, hyaline margins translucent white, mostly entire with the occasional scattered serrate tooth. *Inflorescence* a compound dichasium, 2–10-flowered, 1.5–3.5 cm long including peduncle, glandular; pedicels 1.5–3 mm long; floral bracts linear, 1.5–2 mm long; bracteoles linear, alternate, 1–1.5 mm long. *Hypanthium* elliptic at anthesis, 3–4.5 mm long, 1.2–2 mm wide, 8-shaped in section, glandular. *Sepals* 5, all free to the base, ovate, 1.4–2 mm long, with translucent white entire margins and apical mucro, glandular. *Corolla* white or pink with purple marks near the base of the lobes, abaxial surface white or pale pink (yellow with pink margins in the juvenile bud stage), glandular, laterally paired; anterior lobes elliptic, *c.* 5 mm long, *c.* 3 mm wide; posterior lobes obovate-elliptic, *c.* 5 mm long, *c.* 2.3 mm wide. *Throat* appendages 6, pale greenish white, subulate, papillose, the 2 closest to the labellum *c.* 0.5 mm long, the others *c.* 1 mm long. *Labellum* boss yellowish green, ovate, *c.* 0.8 mm long, *c.* 0.3 mm wide; apical point reddish, subulate, *c.* 0.7 mm long, papillose; basal appendages reddish, subulate, *c.* 0.7 mm long, papillose. *Gynostemium* 4–6.5 mm long; anthers black, vertically paired, abaxial surface with a few long translucent white moniliform hairs along the margins, pollen from just opened anthers purple but quickly turning cobalt blue when exposed to air; stigma elliptic, *c.* 0.5 mm long, *c.* 0.3 mm wide, cushion-shaped. *Capsule* elliptic, 8-shaped in section, 5–5.5 mm long, 2–3 mm wide. *Seeds* brown, obovoid, *c.* 0.4 mm long, *c.* 0.3 mm diam., bullate. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: near Yelbeni, NW of Merredin, 17 Oct. 1887,*W.E. Blackall* 3546 (PERTH); 6 miles [9.6 km] W of Moora, 6 May 1974 [not in flower], *A.H. Burbidge* 1487 [voucher for chromosome count of 2n = 30] (PERTH); 15.8 km N of Eradu, 30 Aug. 1974, *A.H. Burbidge* 1680B (PERTH); Koorda, near the drive-in theatre, 6 Sep. 1974, *A.H. Burbidge* 1683 (PERTH); 22 km N of Irwin, 22 Sep. 1974, *A.H. Burbidge* 1708 (PERTH); 1/4 mile [0.3 km] E of Harrismith, 8 Oct. 1974, *A.H. Burbidge* 1724 (PERTH); 29 km N of Eneabba on Three Springs Road, 28 Sep. 1975, *A.H. Burbidge* 2103 (PERTH); Strawberry–Walkaway road, 4.8 km S of cross-roads near breakaway, 28 Sep. 1975, *A.H. Burbidge* 2108 (PERTH); 3.3 km N of road which goes to quarry SW of Mt Adams, i.e. SE of Dongara, 29 Sep. 1975, *A.H. Burbidge* 2110 (PERTH); 5.5 km

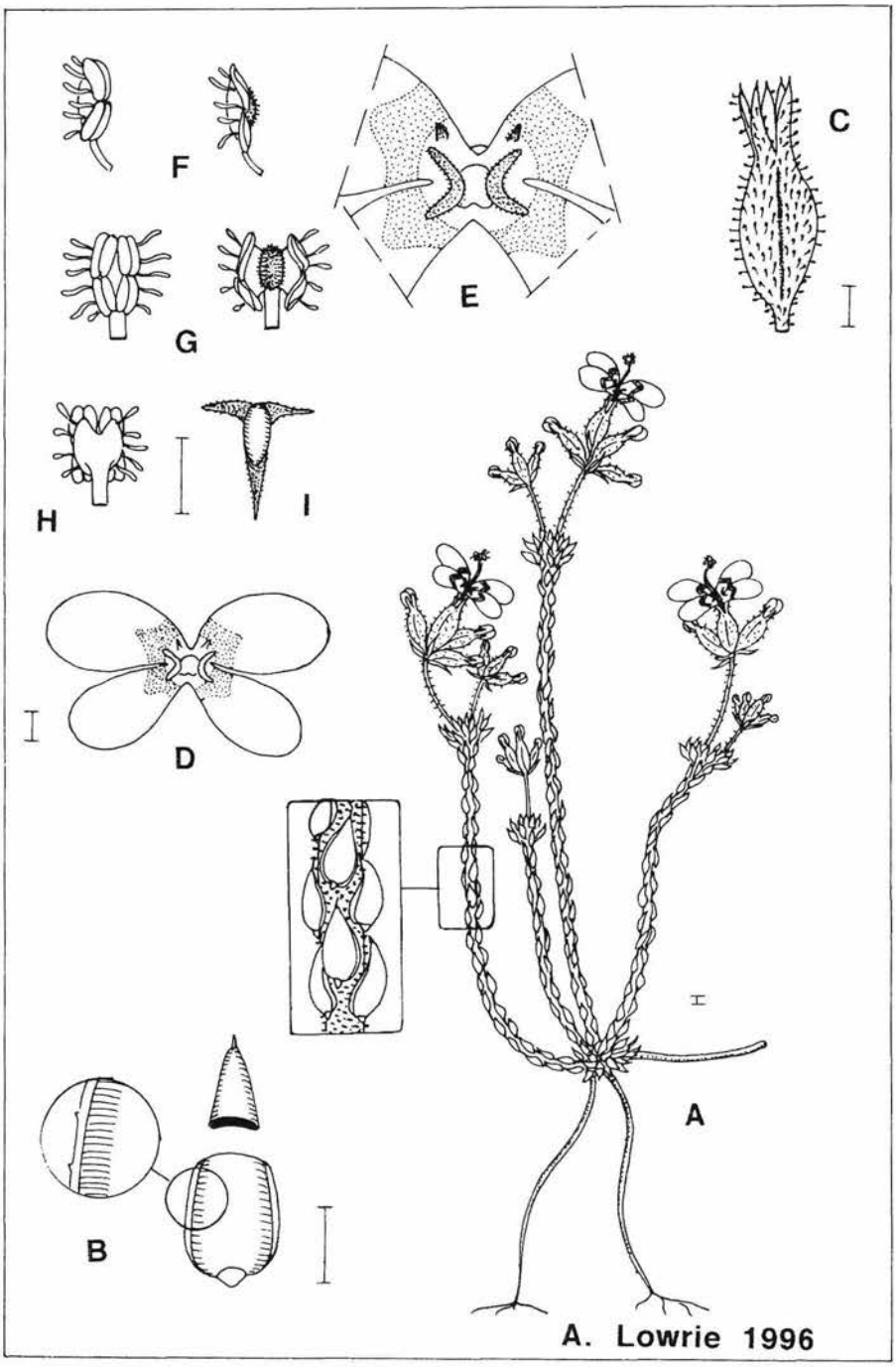

Figure 1. *Stylidium adpressum* A – habit of flowering plant with major axis enlargement, left; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 1542 (PERTH).

S down gravel road S of gravel pit SW of Mt Adams, i.e. SE of Dongara, 29 Sep. 1975, *A.H. Burbidge* 2111 (PERTH); Brand Highway, 26 miles [41.6 km] S of turnoff to Eneabba from Dongara–Mingenew road, 29 Sep. 1975, *A.H. Burbidge* 2112 (PERTH); 25.2 km N of Kellerberrin, 5 Oct. 1975, *A.H. Burbidge* 2133 (2 sheets) (PERTH); 24 miles [38.4 km] W of Mullewa on road to Geraldton, 6 Sep. 1967, *S. Carlquist* 3005 (PERTH); Bolgart, 40 km N of Toodyay, 6 Sep. 1952, *R. Erickson s.n.* (PERTH); Tarin Rock, 10 Sep. 1962, *C.A. Gardner* 13832 (PERTH); Mullewa Plains, Sep. 1931, *C.A.Gardner & W.E. Blackall s.n.* (PERTH); 3 miles [4.8 km] S of Winchester on Geraldton Highway, Oct. 1973, *S.H. James* 73.10/7 (PERTH); entrance to Calingiri Cemetery, 15 Oct. 1988, *A. Lowrie s.n.* (PERTH); on Nangetty–Walkaway Rd, 22.2 km E of Walkaway, *A. Lowrie* 284 (PERTH); entrance to Calingiri Cemetery, 13 Sep. 1996, *A. Lowrie* 1542 (PERTH).

Distribution. Widely distributed in two contiguous regions, bordered by Northam and Kellerberrin in the south to Geraldton and Mullewa *c.* 400 km to the north-west; and from Kellerberrin and Merredin to Harrismith and Tarin Rock *c.* 150 km to the south.

Habitat. Grows in cream coloured clayey sand, yellow sand over laterite or sandy loam on heathland with *Acacia* and *Eucalyptus* species.

Flowering period. August to October.

Chromosome number. n = 15 (Burbidge & James 1991).

Conservation status. A common species and currently not under threat.

Etymology. The epithet *adpressum* is from the Latin *ad* – towards and *pressus* – pressed, in reference to the leaves closely flattened or pressed along the stems below the terminal leafy rosettes.

Affinities. Its closest relative, *Stylidium cygnorum*, differs in having lanceolate leaves, a narrower hypanthium and white pollen. It also usually differs in having spreading leaves, but some specimens in the Badgingarra–Eneabba area have appressed leaves.

Notes. The *Stylidium adpressum* designated lectotype sheet housed at K has two specimens mounted in the top right corner of the sheet. These specimens have been selected because they are well presented and represent the typical size of mature plants to be found in the wild.

Mildbraed (1908: 84) misspelt this species name, *Stylidium appressum.* The MEL isolectotype material is missing (Mair & Pescott 1969: 607; 1970: 824).

2. Stylidium cygnorum W. Fitzg. (Fitzgerald 1902: 16). *Type:* 'In the vicinity of Perth. – W.V.F. – Fl. Oct.–Nov.' [Perth area, Western Australia, 1901, *W.V. Fitzgerald s.n.*]. (*holo:* MEL; *iso:* PERTH 1640402, 1640410, 1640976, NSW, all ex herb. W.V. Fitzgerald).

Stylidium adpressum var. *patens* R. Erickson & J.H. Willis (Erickson & Willis 1956: 16). *Type:* from sandy heath and *Banksia* country, a mile [1.6 km] or so north of Yanchep, Western Australia, 4 October 1954, *R. Erickson s.n.* (*holo:* MEL; *iso:* PERTH 1640399, K).

Illustrations. Erickson (1958) page 74, plate 18, figures 12–13. Grieve & Blackall (1982) page 760, n. 87a.

Creeping perennial *herb*, elevated up to 8 cm above the soil surface on wiry stilt roots and branched a little to form a clump up to 10 cm diam. *Stems* between the rosette nodes leafless, flowering stems 5–10 cm long, sparsely scabrid, mostly glabrous, arising in groups of 3 or more from the rosette node junctions, bearing semi-erect and spreading persistent leaves along their length and terminating in a crowded spreading apical leafy rosette. *Leaves* lanceolate, 6–8 mm long, 0.6–1.8 mm wide, basal spur translucent white, 0.4–0.6 mm long, apical mucro 0.1–0.3 mm long, hyaline margins translucent white, irregularly serrate. *Inflorescence* a compound dichasium, 4–10-flowered, 10–30 (mostly 20–25) mm long including peduncle, glandular; pedicels 0.5–1.5 mm long; floral bracts linear, 3–4.5 mm long; bracteoles linear, 1.5–2 mm long. *Hypanthium* linear-lanceolate at anthesis, 5–7 mm long, 0.9–1.5 mm wide, 8-shaped in section, glandular. *Sepals* 5, all free to the base, ovate, 2–2.5 mm long, with translucent white minutely scarious margins and apical mucro, glandular. *Corolla* white or pink with purple marks near the base of the lobes, abaxial surface white or pinkish (yellow in the juvenile bud stage), glandular, laterally paired; anterior lobes elliptic, *c.* 5 mm long, *c.* 3 mm wide; posterior lobes obovate-elliptic, *c.* 5 mm long, *c.* 2.5 mm wide. *Throat* appendages 6, white or pink, green at the base, subulate, the 2 closest to the labellum *c.* 0.6 mm long, the others *c.* 0.8 mm long. *Labellum* boss pale green, ovate, *c.* 0.7 mm long, *c.* 0.4 mm wide; apical point red, subulate, *c.* 0.5 mm long; basal appendages red, subulate, *c.* 0.5 mm long. *Gynostemium* 5.5–6.3 mm long; anthers yellow, vertically paired, abaxial surface with long translucent white moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 0.6 mm long, *c.* 0.4 mm wide, cushion-shaped. *Capsule* narrowly elliptic, 7–8.5 mm long, 1.7–2.6 mm wide, 8-shaped in section. *Seeds* rust orange, ovoid-ellipsoid, 0.45–0.5 mm long, 0.25–0.2 mm diam., papillate. (Figure 2)

Other specimens examined. WESTERN AUSTRALIA: near 32 mile [51.2 km] peg, N of Yanchep, 1 Oct. 1974, *A.H. Burbidge s.n.* (PERTH); 13 km S of Calingiri, 20 Oct. 1975, *A.H. Burbidge* 2175 (PERTH); 6 miles [9.6 km] W of Wyening, on road to Great Northern Highway, 20 Oct. 1975, *A.H. Burbidge* 2184 (PERTH); 0.4 km S of Cockleshell Gully, 15 Sep. 1976, *A.H. Burbidge* 2326 (PERTH); 37 mile [59.2 km] peg, Great Northern Highway, i.e. 4.8 km N of Muchea turnoff, 27 Oct. 1976, *A.H. Burbidge* 2390 (PERTH); 6.1 km E of Dewar's Pool turnoff from Great Northern Highway, 27 Oct. 1976, *A.H. Burbidge* 2395 (PERTH); 5.5 km N of Cockleshell Gully, 28 Sep. 1977, *A.H. Burbidge* 2510 (PERTH); along Moore River road, just S of Regans Ford and W of the highway from Gingin to Eneabba, 6 Oct. 1974, *S. Carlquist* 5948 (PERTH); 3.5 km E along Mistletoe Road (N of Yanchep), 4 Oct. 1976, *D. Coates s.n.* (PERTH); Wannamal West Rd, 500 m E of Gingin–Eneabba road on Hill River scarp, 7 Oct. 1975, *S.D. Hopper s.n.* (PERTH); Lancelin–Mogumber Road, near Gingin intersection, 14 Oct. 1962, *S.H. James s.n* (PERTH); about 2 miles [3.2 km] E of Wanneroo Rd, off Clarkson Rd, Aug. 1965, *S.H. James* 65.8/21 [voucher for chromosome count of 2n = 30] (PERTH); Mt Yokine, near TV studios, Oct. 1965, *S.H. James* 65.10/61 [2 sheets, vouchers for chromosome count n = 15] (PERTH); 120 miles [192 km] N of Perth on Brand Highway, near road to Cervantes, 30 Oct. 1974, *S.H. James s.n.* (PERTH); on Jurien Bay road at turn off of first track E of Banovich Rd, 27 Oct. 1989, *A. Lowrie s.n.* (PERTH); on Yeal Swamp Rd, *c.* 0.5 km E of Lancelin Rd, Yanchep, 23 Oct. 1990 *A. Lowrie* 132 (PERTH); Lorian Rd, 0.5 km E of Sydney Rd, Gnangarra, 30 Oct. 1990, *A. Lowrie* 142 (PERTH); on Great Northern Highway, 2 km NE of Wandena Rd (N end), Muchea, 26 Oct. 1991, *A. Lowrie* 441 (PERTH); Perth, 15 Nov. 1899, *Dr A. Morrison s.n.* (PERTH).

Distribution. Widely distributed in the region bordered by Perth and Calingiri in the south to Jurien and Eneabba *c.* 250 km to the north.

Habitat. Grows in white silica sand amongst heath in *Banksia* woodlands.

Flowering period. September to October.

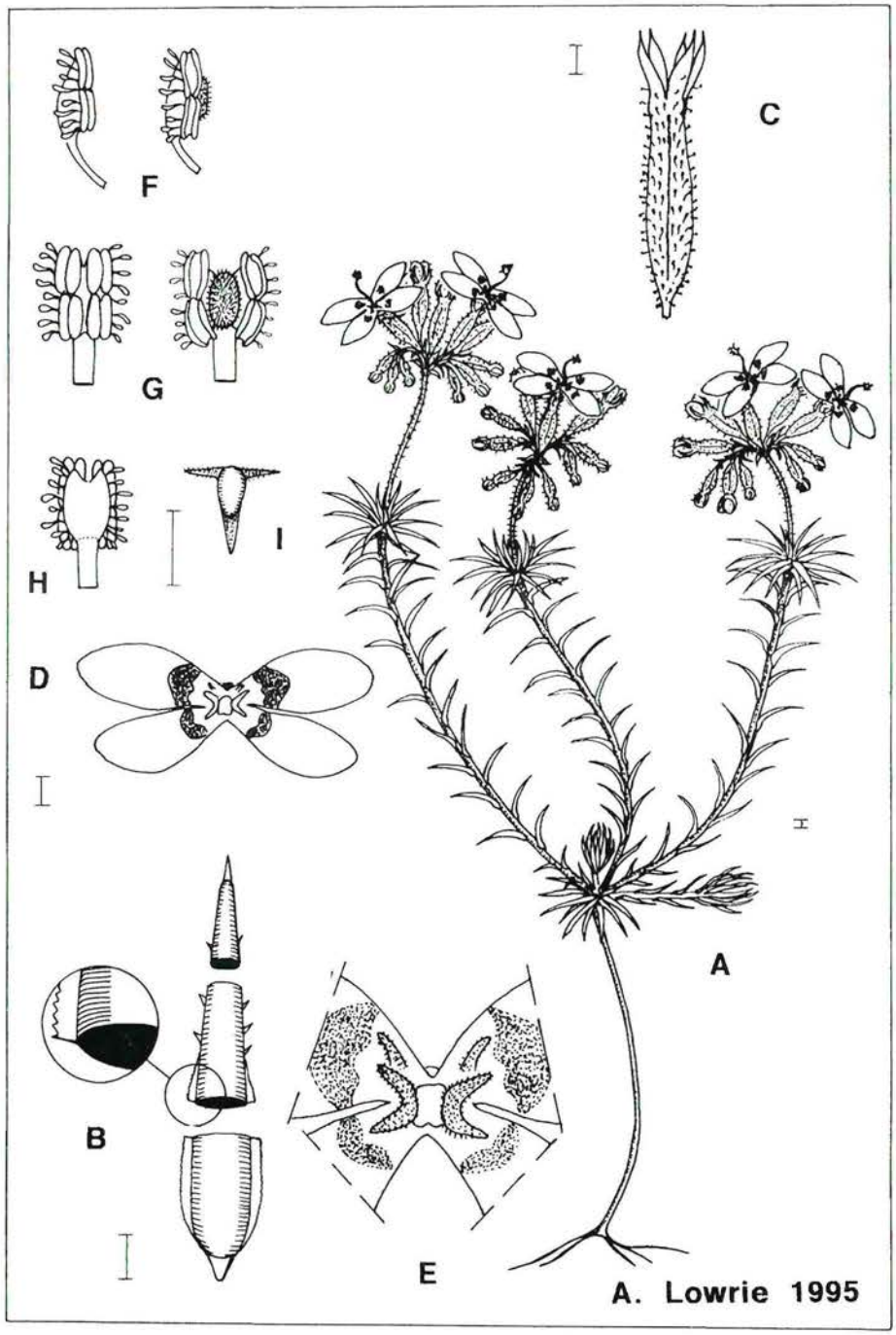

Figure 2. *Stylidium cygnorum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 132 (PERTH).

Chromosome number. n = 15, 2n = 30 (James 1979).

Conservation status. A common species in the *Banksia* woodlands north of Perth and currently not under threat.

Etymology. The epithet *cygnorum* is from the Latin *cygnus* – swan, in reference to the Swan River district where this species is found.

Affinities. Its closest relative is *Stylidium adpressum* which differs in having persistent mostly ovate leaves appressed along the length of the flowering stems; elliptic hypanthium at anthesis; and cobalt blue pollen.

3. Stylidium breviscapum R. Br. (Brown 1810: 572). – *Candollea breviscapa* (R. Br.) F. Muell. [as *breviscapea*] (Mueller 1883: 86). *Type:* Bay 1 south coast [Lucky Bay, Cape Le Grand, Western Australia, 1801], *R. Brown* 2608 (*lecto:* BM, here designated).

Stylidium involucratum F. Muell. (Mueller 1859: 154). – *Stylidium breviscapum* var. *erythrocalyx* Benth. [as *breviscapus*] (Bentham 1868: 31). – *Stylidium breviscapum* var. *involucratum* (F. Muell.) Mildbr. *nom. inval.* (Mildbraed 1908: 92). *Type:* 'In montibus Fitzgerald Range, Mx.' [Mt Barren Ranges, Western Australia, *Maxwell*] (*holo:* MEL 672624).

Illustration. Grieve & Blackall (1982) page 758, n. 86a.

Creeping perennial *herb*; elevated up to 7 cm above the soil surface by wiry stilt roots and shortly branched with leafless stems between rosette nodes to form compact clumps up to 10 cm diam. *Stems* 5–6 cm long, bearing a few persistent scattered leaves along their length, upper leaves in a terminal tuft, with 2 or 3, but sometimes more stems arising from the rosette nodes. *Leaves* linear, 5–15 mm long, 0.6–0.8 mm wide, terete in the upper part, lenticulate in section in the lower part, with a small apical blunt projection. *Inflorescence* corymbose, 2.5–4 cm long including peduncle, bearing pilose hairs tipped with minute glands, clearly pedicellate; pedicels 2–3 mm long; floral bracts linear, 3–4 mm long; bracteoles linear, 1.5–2.5 mm long. *Hypanthium* elliptic, 3.5–4.5 mm long, 1.2–1.7 mm wide, 8-shaped in section, glandular. *Sepals* 5, all free to the base, 1.6–2.5 mm long at anthesis. *Corolla* white with reddish marks near the throat, abaxial surface glandular, lobes laterally paired; anterior lobes obovate-elliptic, *c.* 4 mm long, *c.* 2 mm wide; posterior lobes obovate-elliptic, slightly curved, *c.* 5.5 mm long, *c.* 2.8 mm wide. *Throat* without appendages. *Labellum* boss ovate, *c.* 0.6 mm long, *c.* 0.3 mm wide; apical point *c.* 0.5 mm long; basal appendages subulate, *c.* 0.3 mm long, papillose. *Gynostemium* 4.5–6 mm long; anthers pale yellow, diagonally paired, abaxial surface with short translucent pale red moniliform hairs along the margins, pollen pale yellow; stigma elliptic, *c.* 0.7 mm long, *c.* 0.3 mm wide, cushion-shaped. *Capsule* narrowly elliptic, 6–8 mm long, 1.8–3 mm wide, 8-shaped in section. *Seed* rust orange, ellipsoid with 4 flat sides, slightly longitudinally twisted, *c.* 0.9 mm long, *c.* 0.4 mm diam., sparsely verrucate. (Figure 3)

Other specimens examined. WESTERN AUSTRALIA: Wittenoom Hills, 31 miles [49.6 km] NNE of Esperance, 15 Oct. 1970, *T.E.H. Aplin* 3946 (PERTH); slope of Mt Ragged, 19 Oct. 1974, *T.E.H. Aplin* 4336 (PERTH); King George's Sound, SW Australia, Baxter [ex Allan Cunningham's Australian Herbarium, both specimens bottom of sheet] (K); Base of Mt Ragged, Cape Arid National Park, 18 May 1975, *A.H. Burbidge* 1881 (PERTH); Esperance aerodrome, 9 Oct. 1974, *A.H. Burbidge* 1729 (PERTH); Condingup Peak, E of Esperance, 10 Oct. 1974, *A.H. Burbidge* 1734 (PERTH); Lucky Bay, E of Esperance, 10 Oct. 1974, *A.H. Burbidge* 1738 (PERTH); Mt Burdett, 26 Oct. 1975, *A.H. Burbidge* 2220

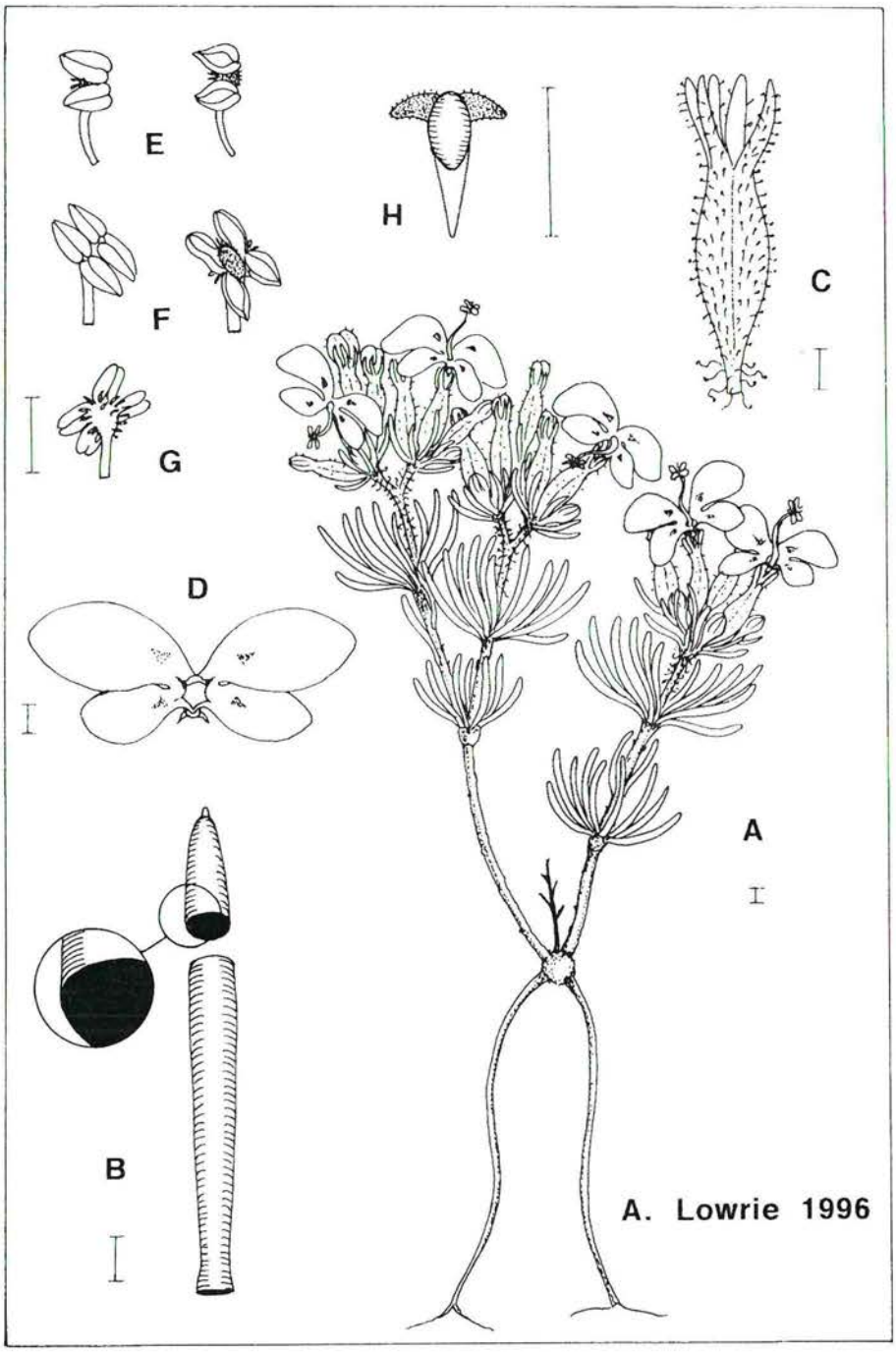

Figure 3. *Stylidium breviscapum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 1385 (PERTH).

(PERTH); 10 km SW of Wittenoom Hills, i.e. NE of Esperance, 27 Oct. 1975, *A.H. Burbidge* 2221 (PERTH); on Wittenoom Rd, 1 km NE of Plowman's Rd, which is 33 km from Esperance, 27 Oct. 1975, *A.H. Burbidge* 2222 (PERTH); Thistle Cove, E of Esperance, 27 Oct. 1975, *A.H. Burbidge* 2225 (PERTH); Washpool Howick Hill, between the hill and the road, i.e. on NE side of hill, 28 Oct. 1975, *A.H. Burbidge* 2226 (PERTH); Mt Ragged, Cape Arid National Park, 28 Oct. 1975, *A.H. Burbidge* 2230 (PERTH); base of Mt Ragged, Cape Arid National Park, 29 Oct. 1975, *A.H. Burbidge* 2231 (PERTH); road, S of Munglinup, 30 Oct. 1975, *A.H. Burbidge* 2241 (PERTH); East Mt Barren, 30 Oct. 1975, *A.H. Burbidge* 2245 (PERTH); 75 km E of Ravensthorpe, 1978, *A.H. Burbidge* 2556 (PERTH); Elverton, near Ravensthorpe, 1 Oct. 1978, *A. H. Burbidge* 2557 (PERTH); 28.4 km E of Ravensthorpe, 29 Aug. 1975, *D.J. Coates s.n.* (2 sheets) (PERTH); Mt Desmond, 19 Oct. 1960, *C. A. Gardner* 12882 (PERTH); East Mt Barren, 22 Oct. 1961, *C.A. Gardner* 13682 (PERTH); Whoogarup Range, SW of Ravensthorpe, 1 Nov. 1965, *A.S. George* 7196 (PERTH); Esperance airport, Oct. 1972, *S.H. James* 72.10/28 [voucher for chromosome count of n = 13] (PERTH); slopes of Mount Le Grand, Oct. 1974, *S.H. James* 74.10/16 (PERTH); summit of Mt Desmond near Ravensthorpe, 10 Nov. 1995, *A. Lowrie* 1385 (PERTH); Cape Arid and Fitzgerald Ranges, *Maxwell s.n.* (K); SW end Cape Arid Range, *Maxwell s.n.* (MEL); W face of Mt Ragged to near summit, 3 Oct. 1970, *R.A. Saffrey* 1317 (PERTH) 600 metres NE of Lucky Bay, 33° 59' S, 122"13° 30' E, 7 Oct. 1970, *I. Solomon* 295 (PERTH).

Distribution. Widely distributed in the south coastal region between Albany and Cape Arid National Park.

Habitat. Grows in sandy soils over and alongside of granite rocks in sheltered areas very near the shores of the ocean; in laterite soils in sub-coastal areas.

Flowering period. August to December.

Chromosome number. n = 13 recorded as *Stylidium breviscapum* var. *erythrocalyx* Benth. (Burbidge & James 1991).

Conservation status. Widely distributed and not considered to be at risk.

Etymology. The epithet *breviscapum* is from the Latin *brevis* – short and *scapus* – scape in reference to the short peduncle.

Affinities. The nearest relatives to *Stylidium breviscapum* are *S. stowardii* and *S. eriopodum.* S. *breviscapum* is distinguished from these two species by having a labellum with basal appendages and apical point; and 5 sepals all of a similar length.

Notes. The *Stylidium breviscapum* designated lectotype sheet housed at BM has been selected because it is a Robert Brown collection.

4. Stylidium eriopodum DC. (de Candolle 1839: 784). – *Type:* 'in Novå-Hollandiå ad Swan-river legit cl. *Drummond* ... (v.s. å cl. inv.)' [Western Australia, 1839, *J. Drummond* 547]. (*holo:* G-DC; *iso:* BM, K).

Illustrations. Erickson (1958) colour plate 16, figure 5; page 82, plate 21, figures 1–9. Grieve & Blackall (1982) page 758, n. 86 in part [inland form = *S. stowardii*]; photograph, colour plate X, centre left .

Creeping perennial *herb*; elevated up to 6 cm above the soil surface by wiry stilt roots, rosette nodes connected by branching leafless stems 8–25 mm long, forming compact clumps up to 15 cm diam. *Stems* 3–7 cm long, usually 2 or 3, but sometimes more arising from rosette nodes with persistent leaves often scattered along their length, upper leaves in a terminal tuft. *Leaves* of the terminal tuft linear, 10–35 mm long, 0.8–1 mm wide, semi-terete in the upper part, lenticulate in section in the lower part, with a small apical blunt projection; leaves along the stems linear, 2.5–5 mm long, 0.6–1 mm wide, with irregularly serrate translucent white hyaline lower margins and sharp apical mucro. *Inflorescence* 2.5–5 cm long including peduncle, peduncle bearing only pilose hairs, in the early stage of anthesis forming a crowded indeterminate umbel, later in fruit elongating to form verticillate cymes; pedicels extremely short to sessile; floral bracts and bracteoles, linear, 3–4 mm long. *Hypanthium* narrowly ovate at anthesis, 4.5–7 mm long, 1–2.3 mm wide, 8-shaped in section, glandular. *Sepals* 5, all free to the base, 3 lobes 0.7–1.5 mm long, 2 lobes slightly shorter 0.4–1.2 mm long. *Corolla* lobes from the apex yellow, then orange, with red marks near the base, followed by pale green, abaxial surface lemon yellow, glandular, lobes laterally paired; anterior lobes obovate, *c.* 2.2 mm long, *c.* 1.6 mm wide; posterior lobes obovate-falcate, *c.* 5 mm long, *c.* 2 mm wide. *Throat* without appendages. *Labellum* boss pale green, ovate, *c.* 0.6 mm long, *c.* 0.4 mm wide, with a short apical reddish beard. *Gynostemium* 5.5–6.3 mm long; anthers pale green, vertically paired, abaxial surface with short translucent white moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 0.9 mm long, *c.* 0.7 mm wide, cushion-shaped. *Capsule* ovate, 6–8.5 mm long, 2.5–3.5 mm wide, 8-shaped in section, slightly longitudinally twisted. *Seed* dark brown, ± ovoid-ellipsoid, with 4 flat sides and slightly longitudinally twisted, 0.6–0.65 mm long, 0.3–0.4 mm diam., densely papillose. (Figure 4)

Other specimens examined. WESTERN AUSTRALIA: 12 miles [19.2 km] NW of Wickepin on road to Pingelly, 8 Oct. 1974, *A.H. Burbidge* 1721A (PERTH); quarter mile [0.4 km] E of Harrismith, 8 Oct. 1974, *A.H. Burbidge* 1722 (PERTH); 9 km W of Tarin Rock siding, 9 Oct. 1974, *A.H. Burbidge* 1726 (PERTH); 10.2 km E of Ongerup, 24 Oct. 1974, *A.H. Burbidge* 1781 (PERTH); 40 km E of Hedges, which is S of Narembeen, 6 Oct. 1975, *A.H. Burbidge* 2149 (PERTH); about 1.5 km E of Kulin, on road to Lake Grace, 7 Oct. 1975, *A.H. Burbidge* 2156 (PERTH); 11 km from Jitarning, on EW road which is NW of Jitarning, 7 Oct. 1975, *A.H. Burbidge* 2160 (PERTH); 13 km S of Calingiri, 20 Oct. 1975, *A.H. Burbidge* 2177 (PERTH); 8.9 km N of Bolgart, near Wyening, 5 Oct.1977, *A.H. Burbidge* 2519 (PERTH); Bolgart, Oct. 1949, *R. Erickson s.n.* (2 sheets) (PERTH); Corrigin–Quairading road, S of Quairading (Wanemusking East Rd corner) sports ground entry, 24 Oct. 1996, *B.A. Fuhrer* 96/95 (PERTH, MEL); 158.5 miles [253.6 km] S of Perth on Katanning–Wagin road, Oct. 1966, *S.H. James* 66.10/40 [voucher for chromosome count of n = 13] (PERTH); Tutanning Reserve, 28 Oct. 1966, *K.F. Kenneally* (PERTH); Wongan Hills, 15 Oct. 1988, *A. Lowrie s.n.* (PERTH); 10 km E of Nyabing, 4 Nov. 1990, *A. Lowrie s.n.* (PERTH); before Red Hill, top of escarpment on Toodyay Rd before Gidgegannup [in fruit], 11 May 1991, *A. Lowrie* 254 (PERTH); off Dewar's Pool–Bindoon Rd 19.5 km from Great Northern Highway, *c.* 3 km S on bush track, 26 Oct. 1991, *A. Lowrie* 438 (PERTH); on Toodyay road, top of the escarpment, Red Hill, 10 Nov. 1991, *A. Lowrie* 512 [voucher for chromosome count of n = 13] (PERTH); Dardadine South Rd, *c.* 4 km W of the junction with Albany Highway, 31 Oct. 1994, *A. Lowrie* 1073 (PERTH); SE corner of Pederah Nature Reserve *c.* 3 km from Jilikan Flatrocks Rd on Lake Grace–Kalgarin Highway, 9 Nov. 1995, *A. Lowrie* 1373 (PERTH); gravel pit on Jilikan Flatrocks Rd, *c.* 20 km from turn off to the Pederah Nature Reserve, 9 Nov. 1995, *A. Lowrie* 1378 (PERTH).

Distribution. Widely distributed in region bordered by the Darling Range east of Perth; south-east to Denmark *via* Pingelly and Wagin; north-east to the Stirling Range; north to Narembeen; and north-west to Wongan Hills. It also occurs on the coast in the Dunsborough area west of Busselton.

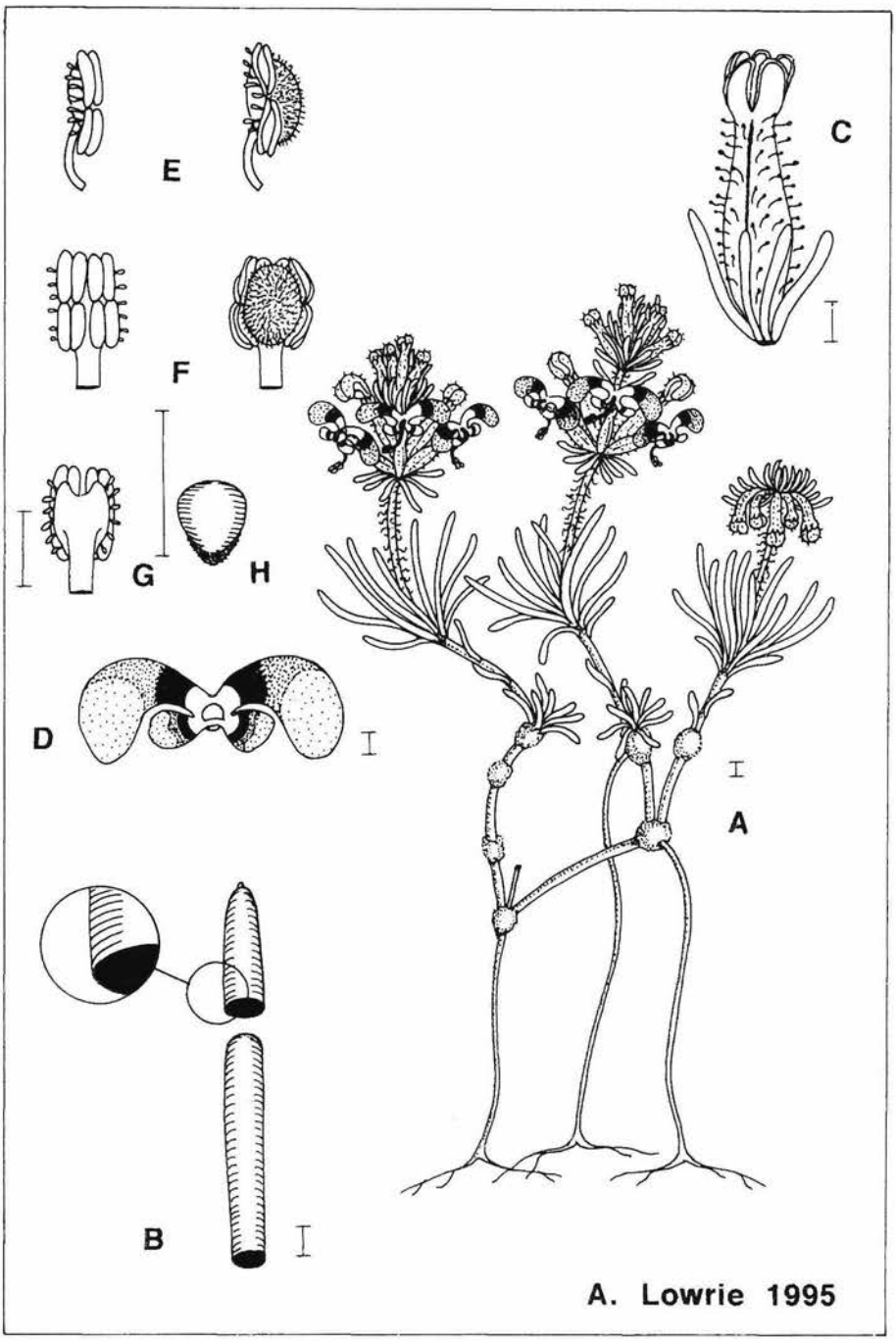

Figure 4. *Stylidium eriopodum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from cultivated material, origin Wongan Hills (PERTH).

Habitat. Grows in gritty loam soils over and along side of granite rock and in clayey sand over laterite usually in shrubland or Eucalypt woodlands.

Flowering period. October, November.

Chromosome number. n = 13, recorded as *Stylidium breviscapum* (Burbidge & James 1991).

Conservation status. Widely distributed and currently not considered to be at risk.

Etymology. The epithet *eriopodum* is from the Greek *erio* – wool and *podos* – foot in reference to the woolly peduncles.

Affinities. Its closest relatives are *Stylidium breviscapum* and *S. stowardii*. *S. breviscapum* differs in having a labellum bearing an apical point and basal appendages, all sepals of equal length, and a peduncle bearing pilose hairs tipped with minute glands. *S. stowardii* differs in having a round labellum with an entire margin, flowers clearly pedicellate, 3 sepals 0.5–1 mm (mostly 0.5 mm) longer than the other 2, and an inflorescence glandular throughout with both glands and pilose hairs on the peduncle.

Notes. The isotype of *Stylidium eriopodum* at K shares its sheet with two specimens of *S. breviscapum* labelled 'King George's Sound, S. W. Australia, Baxter.' Both specimens of *S. breviscapum* are ex Allan Cunningham's Australian Herbarium.

5. Stylidium neglectum Mildbr. (Mildbraed 1908: 89). *Type:* 'Avon: Wyola, an salzhaltigen lehmigen Stellen, gern im Schutze von Büschen 225 m ü M', Western Australia, October 1901, *Diels* 5034 (*holo:* W).

Stylidium dielsianum f. *ebulbosum* Mildbr. (Mildbraed 1908: 90). *Type:* 'Ohne Standortsangabe', Western Australia, *Drummond* 3rd coll. n. 171 (*holo:* W).

Illustrations. Erickson (1958) page 78, plate 19, figure 19 [as a dwarf form of *S. dielsianum*]; page 80, plate 20, figures 17–22 [as *S. bulbiferum* var. *septentrionale*]. Grieve & Blackall (1982) page 760, n. 89. Mildbraed (1908) page 85, figures G–J.

Creeping perennial *herb;* elevated up to 5 cm above the soil surface on wiry stilt roots, with 1–4 (sometimes more) stems up to 7 cm long arising from rosette nodes, with leaves scattered along their length and forming a leafy apical rosette. *Leaves* lanceolate, 6–10 (mostly 6–7) mm long, 0.6–1 mm wide near the base, 0.4–0.5 mm wide near the apex, semi-terete in the lower part, terete in section in the upper part, with entire margins hyalined translucent white, with a small apical blunt projection. *Inflorescence* to 2–3 cm long including peduncle, forming a narrow panicle, densely covered with long and short glandular hairs; pedicels 0.3–1 mm long; floral bracts, linear, 2.2–4.5 mm long; bracteoles linear, 0.8–1.5 mm long. *Hypanthium* lanceolate at anthesis, 3–5 mm long, 0.8–1.3 mm wide at the base, 0.4–0.5 mm wide at the apex, 8-shaped in section, densely covered with glandular hairs. *Sepals* 5, mostly all free to the base, but sometimes 3 free and 2 joined for half the length, 1–2.5 mm long. *Corolla* pink, abaxial surface very pale pink, glandular, lobes laterally paired; anterior lobes obovate, *c.* 2.5 mm long, *c.* 1.5 mm wide; posterior lobes obovate, slightly curved, *c.* 4 mm long, *c.* 2 mm wide. *Throat* and petal bases white, with purple marks between the white and the pink coloured zones, without appendages. *Labellum* boss round, *c.* 0.6 mm diam.; basal appendages

c. 0.3 mm long. *Gynostemium* 4–6.5 mm long, anthers green, vertically paired, abaxial surface with a few short translucent white moniliform hairs towards the apex, pollen greenish yellow; stigma elliptic, *c.* 1 mm long, cushion-shaped. *Capsule* narrowly ovate-elliptic, 8-shaped in section, 4–6 mm long, 1.2–1.6 mm wide near the base, 0.4–0.8 mm wide near the apex. *Seed* (not quite fully mature) light brown, ellipsoid, 0.4–0.5 mm long, 0.25–0.3 mm diam., papillose. (Figure 5)

Other specimens examined. WESTERN AUSTRALIA: no locality, no date, *E. Bailey s.n.* [voucher for illustration (Grieve and Blackall 1982: 760)](PERTH); 27.7 km N of Lake Grace, 24 Oct.1974, *A.H. Burbidge* 1779 (PERTH); 16.6 km E of Wave Rock turnoff, E of Hyden, 17 July 1975 [not in flower], *A.H. Burbidge* 1980 (PERTH); Mt Hampton, 1 Sep. 1975 (not in flower), *A.H. Burbidge* 2033 (PERTH); 12.8 km E of the railway line at Hedges, 6 Oct.1975 (not in flower), *A.H. Burbidge* 2140 (PERTH); near Bendering, 18 Oct. 1961, *C.A. Gardner* 13618 (PERTH); 3 miles E of Muntagin Rock, Aug. 1965, *S.H.James* 65.8/26 [voucher for chromosome count of 2n = 26] (PERTH); 1 mile [1.6 km] NE of Merredin, 6 Nov. 1973, *G.J. Keighery* 2819 (PERTH); W of the Wongan Hills Agriculture Dept,. 27 Oct. 1990, *A. Lowrie* 138 (PERTH); on Goldfields Rd, 0.7 km E of Chandler–Merredin Rd, opposite golf course, N side of road, 23 Nov. 1993, *A. Lowrie* 826 (PERTH); on Kondinin–Hyden road, 3.6 km W of Hyden, 24 Nov. 1993, *A. Lowrie* 828, 829 & 830 (PERTH); on Hyden–Ravensthorpe road, 1.6 km E of Hyden, 24 Nov. 1993, *A. Lowrie* 831 (PERTH); on Hyden–Ravensthorpe road, 12.1 km E of Hyden, 24 Nov. 1993, *A. Lowrie* 832 (PERTH); on Hyden–Ravensthorpe road, 14.5 km E of Hyden, 24 Nov. 1993, *A. Lowrie* 833 (PERTH); on Hyden–Ravensthorpe road, 23.9 km E of Hyden, 24 Nov. 1993, *A. Lowrie* 834 (PERTH); 9.8 km S of the junction of Hyden–Norseman road (technically still on Hyden–Ravensthorpe road) near Lake Carmody, 25 Nov. 1993, *A. Lowrie* 835 (PERTH); E side of rock, road access to area on Holt Rock–North Rd *c.* 100 m NE of Hyden–Ravensthorpe road, Holt Rock, 25 Nov. 1993, *A. Lowrie* 836 (PERTH); on Duck Rock West Rd, 2.1 km W of the turnoff to East Hyden, 25 Nov. 1993, *A. Lowrie* 839 (PERTH); Wave Rock, near Hyden, 7 July 1974 (not in flower), *B. Powell* 1597 (PERTH); Sandalwood Rock, 14 Nov 1989, *B.H. Smith* 1260 (MEL); *c.* 0.25 mile [0.4 km] W of research Station Homestead, Avon Bot. District, 30° 50' S, 116° 42' E,12 Oct.1990, *B.H. Smith* 1372 (MEL).

Distribution. Occurs at widely scattered locations in the region bordered by Merredin; south to Lake Grace; south-east to Ravensthorpe; north-west to Holt Rock; north to Mt Hampton and nearby Sandalwood Rocks; and north-west towards Merredin. A larger variant occurs in the Wongan Hills area.

Habitat. Grows in brown loam over granite rock and in clayey soils in winter wet depressions.

Flowering period. November, December. Specimens in cultivation continue to flower well into December. It appears *Stylidium neglectum* is an opportunist species capable of extending its flowering period in good seasons.

Chromosome number. 2n = 26 (James 1979).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. *Stylidium neglectum* was listed 1991 as Presumed Extinct. Field studies by one of us (A.L.), discovered localized but healthy populations of *S. neglectum* near Merredin and at a number of locations in the Hyden region. Most of these were roadside locations or water catchment reserves and not one of these was in a Nature Reserve. The type location unfortunately is weed-infested to the point where most native herbs have disappeared.

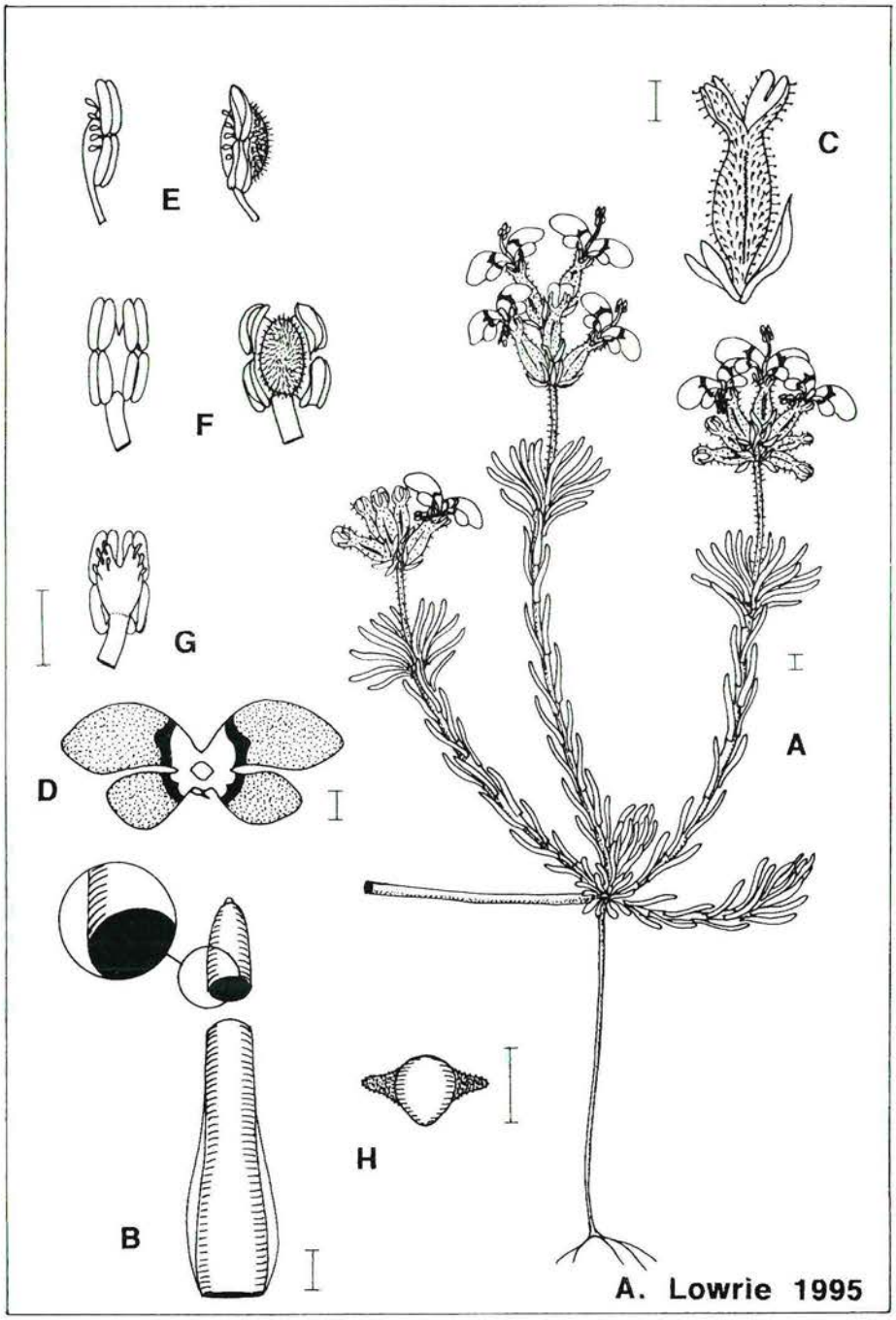

Figure 5. *Stylidium neglectum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 138 (PERTH).

Etymology. The epithet *neglectum* is from the Latin *neglectus* – overlooked, in reference to this species being hitherto unidentified.

Affinities. Stylidium neglectum is distinguished from other taxa in the *S. breviscapum* complex by its narrow paniculate inflorescence, which is densely covered with long and short glandular hairs (including the peduncle), and its round labellum boss with basal appendages only.

Notes. The type sheet for *Stylidium dielsianum* f. *ebulbosum*, which was determined and photographed (by K.F.K.) in W, is applicable to *S. neglectum*. The sheet was annotated by Mildbraed with the unpublished name, *Stylidium neglectum* Mildbr. var. *majus*. Mildbraed was then closer to the issue regarding the specimen as a variant of *S. neglectum* than in the name he finally published under *Stylidium dielsianum*. Mildbraed (1908: 50) also listed the type collection (Drummond ser. III. n. 171) erroneously under *Stylidium repens*.

A larger variant of *Stylidium neglectum* is found in the Wongan Hills region, 80 km north-east of James Drummond's farm and residence at Toodyay. Drummond's 3rd collection included collections from north-east of Bolgart (Erickson 1969) which is 30 km north of Toodyay and a distance of 50 km south-west of Wongan Hills, and this may have been where *Drummond* ser. III, n. 171 was collected.

Live potted specimens of the larger variant of *Stylidium neglectum* collected at the Wongan Hills site (*A. Lowrie* 138) in 1993 proved to be comparable with live potted specimens of the typical variant of *S. neglectum* collected from the Holt Rock site (*A. Lowrie* 836) in the same year.

6. Stylidium stowardii M. Scott (Scott 1915: 91). *Type:* Nangeenan, Western Australia, *Stoward* 121 (*lecto:* K, here designated); between Perth and Coolgardie, railway between Cunderdin and Dedari, Western Australia, *Thistleton-Dyer* 87 (*syn:* K).

Illustrations. Erickson (1958) page 82, plate 21, figures 10–11. Grieve & Blackall (1982) page 758, n. 86 [inland form only].

Creeping perennial *herb;* elevated up to 3 cm above the soil surface by wiry stilt roots, rosette nodes connected by branching leafless stems 0.8–15 mm long, forming compact clumps mostly up to 10 cm diam., rarely to 20 cm diam. *Stems* up to 3 cm long, 2–4, but sometimes more arising from the rosette nodes, bearing scattered leaves along their length with the upper leaves in a terminal tuft. *Leaves* of the terminal tuft linear, 5.5–7.5 mm long, 0.5–0.9 mm wide, semi-terete in the upper part, lenticulate in section in the lower part, with a small apical blunt projection; leaves along the stem flatter, with irregularly serrate translucent white hyaline margins and a sharp apical mucro. *Inflorescence* corymbose, 1–1.5 cm high including peduncle, glandular throughout, peduncle also bearing pilose hairs; pedicels 1.5–4.5 mm long; floral bracts linear, 2.5–3 mm long; bracteoles 1.5–2 mm long. *Hypanthium* at anthesis, narrowly elliptic, narrowly ovate or oblong, 3.5–6 mm long, 1–1.7 mm wide, 8-shaped in section, slightly longitudinally twisted, glandular. *Sepals* 5, all free to the base, 3 lobes 1.5–2.2 mm long, 2 lobes substantially shorter, 0.5–1.5 mm long. *Corolla* adaxial surface snow white with pink marks at the base of each lobe, abaxial surface white, yellow and glandular along the mid-vein zones, lobes laterally paired; anterior lobes obovate-elliptic, *c.* 2.5 mm long, *c.* 1.5 mm wide; posterior lobes oblanceolate-falcate, *c.* 5 mm long, *c.* 2.5 mm wide. *Throat* without appendages. *Labellum* boss round, *c.* 0.5 mm diam. *Gynostemium* 5.5–6.5 mm long; anthers yellowish green, vertically paired, abaxial surface glabrous, pollen white; stigma elliptic, *c.* 1 mm long, *c.* 0.8 mm wide, cushion-shaped. *Capsule* unknown. *Seed* unknown. (Figure 6)

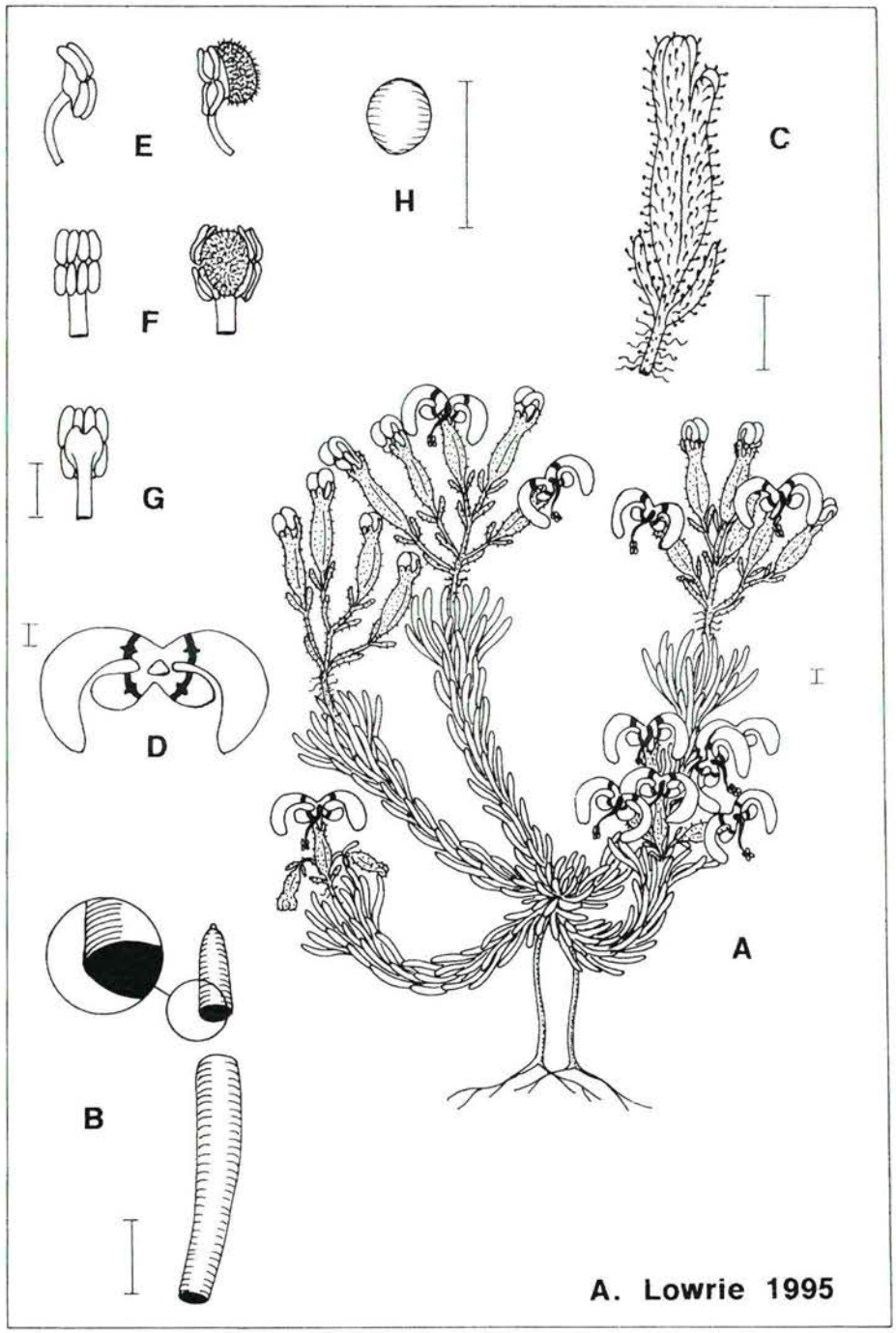

Figure 6. *Stylidium stowardii* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from cultivated material, origin south end of North Rd, Mount Madden area (PERTH).

Other specimens examined. WESTERN AUSTRALIA: 27.7 km N of Lake Grace, 24 Oct. 1974, *A.H. Burbidge* 1775 (PERTH); Merredin–Narembeen road, 17 km S of Great Eastern Highway, 6 Oct. 1975, *A.H. Burbidge* 2135 (PERTH); 26 km E of Lake King township, 25 Oct. 1975, *A.H. Burbidge* 2200 (PERTH); 28 km N of Lake Grace (near turnoff to Mordetta), 24 Oct. 1975, *A.H. Burbidge* 2189 (PERTH); 10.5 km E of Lake King, 25 Oct. 1975, *A.H. Burbidge* 2198 (2 sheets) (PERTH); SE of Newdegate on road to Pallinup Rocks, 28 Aug. 1975, *D.J. Coates s.n.* (PERTH); 27 miles [43.2 km] W of Ravensthorpe and ± 18 miles [28.8 km] N of Ongerup road, 30 Oct. 1965, *A.S. George* 7066 (PERTH); 14 miles [22.4 km] S of Merredin on road to Muntagin, Aug. 1965, *S.H. James* 65.8/24 [voucher for chromosome count of 2n = 26] (PERTH); 15 miles [24 km] N of Ravensthorpe on road to Lake King, Oct. 1972, *S.H. James* 72.10/20 [voucher for chromosome count of n = 13] (PERTH); *c.* 36 km E of Hyden on the road to the cross road of Mt Holland–Forrestania road, 24 Sep. 1989, *A. Lowrie s.n.* (PERTH); 5 km N of Merredin on Merredin–Nungarin Rd, 1 Oct. 1989, *A. Lowrie s.n.* (PERTH); on road to Bruce Rock, 33.4 km S of Doodlakine, 16 Oct. 1990, *A. Lowrie* 113 (PERTH); *c.* 50 km E of Hyden on the road to the cross road of Mt Holland–Forrestania road,17 Oct. 1990, *A. Lowrie* 117 (PERTH); *c.* 20 km W of Ongerup, 11 Nov. 1974, *D.J.E. Whibley* 5275 (PERTH).

Distribution. Widely distributed in region bordered by Doodlakine; south to Bruce Rock; south-east to Lake Grace; south to Ongerup; east to Ravensthorpe; north-west to Lake King; north-east to Forrestania; north to Mt Holland; and north-west to Merredin.

Habitat. Grows in yellowish sands and red soils.

Flowering period. September, October.

Chromosome number. n = 13, 2n = 26, both as *S. breviscapum* (Burbidge & James 1991).

Conservation status. A common species and currently not under threat.

Etymology. The epithet *stowardii* honours Frederick Stoward (1866–1931), botanist with the Department of Agriculture, Western Australia 1911–1917.

Affinities. Its nearest relatives are *Stylidium breviscapum* and *S. eriopodum. S. breviscapum* differs in having a labellum bearing an apical point and basal appendages, all sepals of equal length, and a peduncle bearing pilose hairs tipped with minute glands. *S. eriopodum* differs by having a labellum bearing a short apical beard, flowers almost sessile, three sepals 0.2–0.3 (mostly 0.3) mm longer than the other two, and a peduncle bearing only pilose hairs.

Notes. The *Stylidium stowardii* designated lectotype sheet housed at K has been selected because it best represents the original description, a copy of which is attached to the top left corner of the sheet.

7. Stylidium bulbiferum Benth. (Bentham 1837: 73). – *Candollea bulbifera* (Benth.) F. Muell. (Mueller 1883: 86). – *Stylidium bulbiferum* Benth. var. *bulbiferum* (Benth.) Sond. (Sonder 1845: 388). – *Stylidium bulbiferum* Benth. f. *bulbiferum* (Benth.) Mildbr. (Mildbraed 1908: 92). *Type:* Swan River, [Western Australia], *Hügel* (*lecto:* BM, here designated); Freemantle [Fremantle], [Western Australia], *Hügel* (*syn:* W).

Stylidium bulbiferum f. *macrorrhizum* Mildbr. (Mildbraed 1908: 92). *Type:* Bellevue, Western Australia, *E. Pritzel* 838 (*lecto:* PERTH 02956535, here designated; *isolecto:* K, S, BM, B, NSW, E,

W); Distr. Darling: Swan, auf sumpfigen Alluvialflächen mit lehmigem Boden Western Australia, (*syn:* B, *n.v.*); Midland Junction, Western Australia, October 1901, *Diels* 5112 (*syn:* B, *n.v.*).

Illustrations. Erickson (1958) page 80, plate 20, figures 11–16. Grieve & Blackall (1982) page 761, figure 90; photograph, colour plate XI, top right.

Stylidium proliferum DC. (de Candolle 1839: 783). *Type:* 'in Novå-Hollandiå ad Swan-river legit cl. *Drummond.* ... (*v. s. å cl. inv.*)' [Western Australia, *J. Drummond*] (*holo:* G–DC).

Stylidium recurvum Graham (Graham 1842: t. 3913). *Type:* 'I first saw this species in the nursery of Mr. CUNNINGHAM, Comely Bank, near Edinburgh, where it flowered in a frame in May, 1840. In the month following, we received it at the Botanic Garden, Edinburgh, from Mr. HENDERSON'S nursery in the Edgeware-road, and at the same time from Mr. JACKSON, Nurseryman, Kingston, Surrey. It is indigenous to the neighbourhood of Swan River, [Western] Australia.' (*lecto:* Illustration t. 3913 in Graham 1842, here designated).

The following description only applies to the typical variant. A creeping perennial *herb*; with lignotuber-like rosette nodes situated mostly at the soil surface, leafy stems many, arising from rosette nodes, together forming an erect compact bush-like clump up to 18 cm in diam., nearby asexually reproduced leafy clumps sometimes still attached by a leafless horizontal stem *c.* 5 cm long, nearby leafy clumps mostly free of the parent plant, many bush-like clumps often meshed together to form compact colonies up to 45 cm diam. *Stems* lacking between the rosette nodes forming lignotuber-like bases, stems between the rosette node clusters when present leafless, flowering stems up to 12 cm long arising singly or in groups of 2–3 from each rosette node within the basal cluster, bearing leaves along their length and terminating in a crowded spreading apical leafy rosette. *Leaves* of the apical rosette linear, 8–15 mm long, 0.5–0.8 mm wide, apex with a sharp translucent white mucro, 0.4–0.5 mm long, margins bearing white translucent white serrulate hyaline margins in the lower portion, serrate-laciniate in the upper parts, elliptic in section, *c.* 0.5 mm thick; leaves along the erect stems similar but *c.* half the length of apical rosette leaves. *Inflorescence* 2–4 cm long including peduncle, 1–5-flowered, but mostly 3-flowered, glandular-pilose; pedicels 5–9 mm long; floral bracts linear, 3–3.5 mm long; bracteoles linear, 1.8–2 mm long. *Hypanthium* oblong-linear at anthesis, 7–10 mm long, 0.4–1 mm wide, glandular. *Sepals* 5, all free to the base, oblanceolate, 2–2.5 mm long, glandular. *Corolla* pink to dark pink with reddish marks near the petal bases, abaxial surface white or pale pink, glandular, lobes laterally paired; anterior lobes obovate, *c.* 4 mm long, *c.* 2.5 mm wide; posterior lobes oblanceolate-slightly falcate, *c.* 6 mm long, *c.* 2 mm wide. *Throat* yellow, without appendages. *Labellum* boss pale green, broadly ovate, *c.* 0.6 mm long, *c.* 0.6 mm wide; with a small reddish apical beard; basal appendages pale green, subulate, *c.* 0.3 mm long, papillose. *Gynostemium* 6.5–7 mm long, anthers yellow, laterally paired, abaxial surface with translucent white moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 1 mm long, *c.* 0.8 mm wide, cushion-shaped. *Capsule* unknown. *Seed* unknown. (Figure 7)

Other specimens examined (of typical variant). WESTERN AUSTRALIA: 4.4 km W of main road (Old Coast Road), on road S of Tim's Thicket, which is S of Dawesville, 26 Oct. 1977, *A.H. Burbidge* 2526 [voucher for chromosome count of n = 14] (PERTH); Cottesloe Beach, 1902, *A.G. Hamilton s.n.* (NSW); 4.5 km W of Old Coast Rd, 6 km S of Dawesville, Yalgorup National Park, 13 Oct. 1993, *B.J. Keighery & N. Gibson* 356 (PERTH); Redemptora Rd, Navel Base [Henderson industrial area], 25 Oct. 1987, *G.J. Keighery* 9226 (PERTH); *c.* 1 km E from the ocean behind beach sand dunes on Tim's Thicket Rd, Dawesville, S of Mandurah, 27 Oct. 1991, *A. Lowrie* 445 (PERTH); Yeal Swamp Rd, limestone quarry *c.* 3 km E of Wanneroo–Lancelin Rd, 22 Oct. 1995, *A. Lowrie* 1356 (PERTH); on hill at the

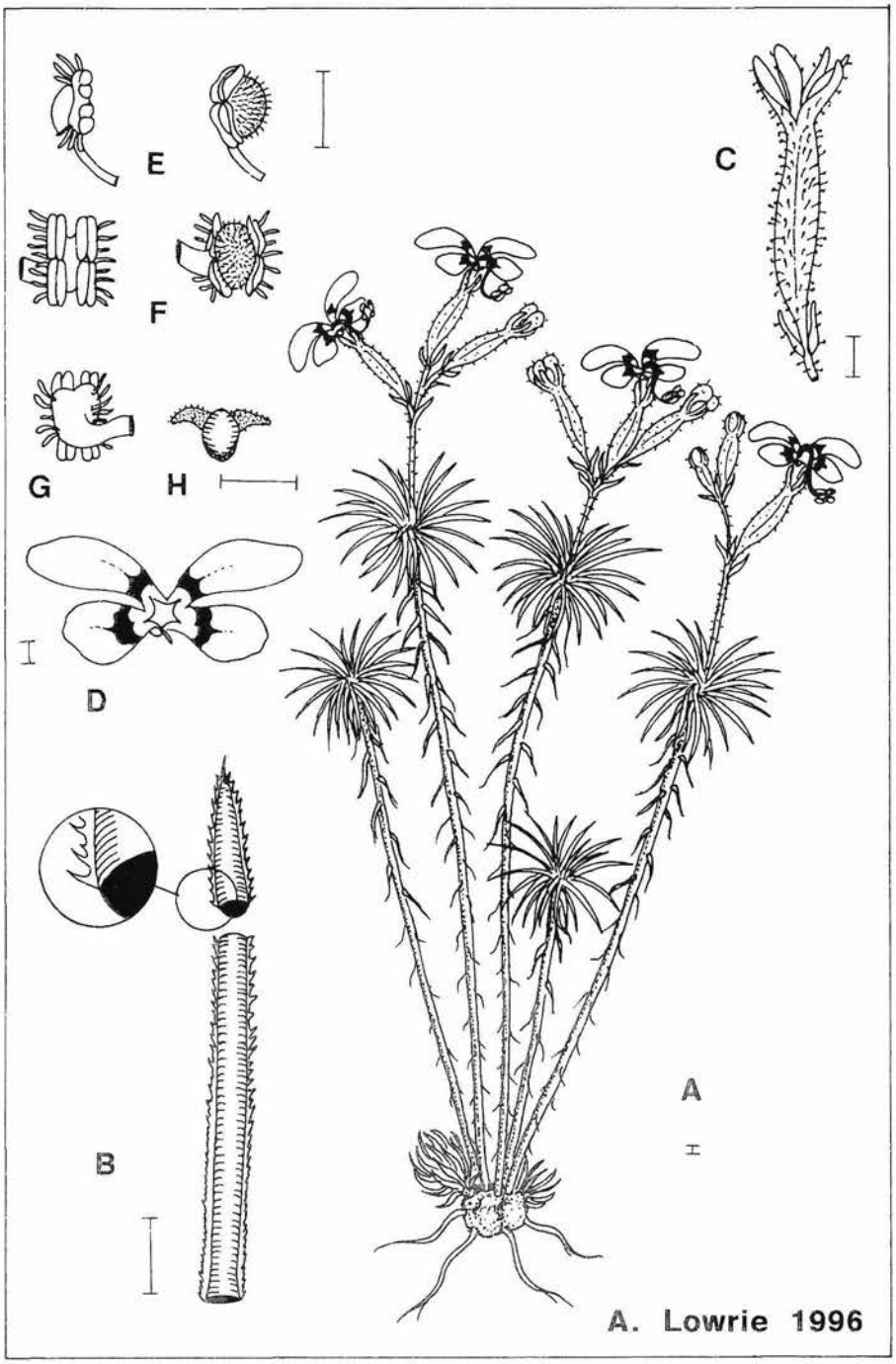

Figure 7. *Stylidium bulbiferum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 1356 (PERTH).

junction of Redemptora & Egmont Rds, Henderson industrial area [specimens in vegetative growth only], 19 Sep. 1998, *A. Lowrie* 2104 (PERTH).

Other specimens examined (of atypical Darling Range variant). WESTERN AUSTRALIA: clay-gravel in Darling Range Guildford, Armadale, Kelmscott near Perth, Sept–Nov. 1901 & 1902 grows in dense masses, fl. pink. HERB. CECIL ANDREWS [specimens on same sheet with type for *Stylidium bulbiferum* bottom right] (BM); Roleystone on Brookton Highway, *c.* 2 km from Albany Highway, 25 Oct. 1974, *A.H. Burbidge* 1802 (PERTH); Ford Road, Lesmurdie, 8 Oct. 1975, *A.H. Burbidge* 2169 (PERTH); Toodyay–Chittering Road, 6 Nov 1975, *A. H. Burbidge* 2263 (PERTH); Crystal Brook Road, part way up scarp, 31 Oct. 1976, *A.H. Burbidge* 2403A (PERTH); W slopes of Mt Cooke, 16 Nov 1977, *A.H. Burbidge* 2541 (2 sheets) (PERTH); 8–9 km NE of Pearce on road to Lower Chittering, 14 Oct. 1976, *D. J. Coates s.n.* (PERTH); Maida Vale, 29 Sep. 1930, *G. R. Dickins s.n.* (PERTH); Darling Scarp near zig-zag carpark at top, 3 Oct. 1996, *M.G. Corrick* 11257 with *B.A. Fuhrer* (PERTH, MEL); Darlington, mid-Nov 1951, *J. Gentilli s.n.* (PERTH); 6.6 km N of Muchea on Great Northern Highway, 7 Oct. 1975, *S. D. Hopper s.n.* (PERTH); Granite ridge above end of Owen Road, Darlington, Oct. 1965, *S. James* 65.10/26 [voucher for chromosome count of n = 14] (PERTH); Darling Scarp above Bullsbrook, Oct. 1971, *S.H. James* 71.10/19 [voucher for chromosome count of n = 14] (PERTH); Darlington, Oct. 1973, *S.H. James* 73.10/14 (PERTH); Roleystone, mid-Oct., *E. Jenkins & W. Ives s.n.* (PERTH); Old Crystal Brook Road, 3 Oct. 1966, *K. F. Kenneally s.n.* (2 sheets) (PERTH); on Mills Rd, Kelmscott, 3 km E of Tonkin Highway, 8 Oct. 1990, *A. Lowrie* 159 (PERTH); on Albany Highway 5.6 km N of Glen Eagle picnic grounds, 10 Nov. 1990, *A. Lowrie* 187 (PERTH); on Great Northern Highway in swamp on the corner of Wandena Rd (south end) Muchea, 2 Oct. 1991, *A. Lowrie* 358 (PERTH); on Great Northern Highway *c.* 2 km N of the junction of Wandena Rd (S end), Muchea, 2 Oct. 1991, *A. Lowrie* 359 (PERTH); on Clenton Rd S of Ewing Rd, Gidgegannup, 10 Nov. 1991, *A. Lowrie* 508 (PERTH); Maida Vale, 10 Oct. 1926, *A.G. Nicholls s.n.* (PERTH); Bickley, 9 Oct. 1951, *A. Notley s.n.* (PERTH); Darlington, 12 Oct. 1949, *B. Roack s.n.* (PERTH); Albany Highway, 48 km S of Perth, 12 June 1982 (not in flower), *G. J. Weber s.n.* (PERTH); Darlington, 31 Oct. 1931, *R.F. Williams s.n.* (2 sheets) (PERTH).

Other specimens examined (of atypical *Stylidium* sp. C variant). WESTERN AUSTRALIA: S side of Hotham River bridge on Pingelly–Narrogin road, 3 July. 1977, *A.H. Burbidge* 2481 [voucher for chromosome count of 2n = 28] (PERTH); Near Canning Weir, 16 Nov 1977, *A.H. Burbidge* 2539 (2 sheets) (PERTH); Boulder Rock, Brookton Highway, 16 Nov 1977, *A.H. Burbidge* 2536 (2 sheets) (PERTH); Sullivan Rock, Albany Highway, 16 Nov 1977, *A.H. Burbidge* 2543 (3 sheets) (PERTH); 48 km NW of Dale on Brookton Highway, 17 Nov. 1985, *A.H. Burbidge* 3964 (PERTH); North East Rd 32° 29' 21" S 116° 18' 20" E, *c.* 80 km SE of Perth, 19 Nov. 1996, *A. Lowrie* 1620 (PERTH); Boulder Rock on Brookton Highway, 16 Nov. 1977, *R. Tinetti s.n.* (PERTH).

Distribution. Specimens comparable to the type are known only from the coastal region from Yanchep south to Dawesville. Other variants occur in the Darling Range east and south east of Perth.

Habitat. The typical variant grows near the coast in the grey sandy soils caught in the crater-like depressions of sharp jagged limestone cap rock outcrops as well as on the aprons and ledges covered with similar skeletal soils and limestone scree alluvium. Atypical variants occur in a wide variety of soil types mainly associated with sheet laterite and/or granite rock. Typical habitats include loam or laterite watersheds; sandy loam along the margins of winter wet water courses; and gritty loam on the aprons of granite outcrops.

Flowering period. October (atypical variants October to November).

Chromosome number. n = 14, typical variant recorded as *Stylidium* species A (Dawesville); n = 14, atypical Darling Range variant; and 2n = 28, atypical *Stylidium* sp. C variant (Burbidge & James 1991).

Conservation status. The type variant is currently common at the Yanchep and Dawesville locations but both of these locations are threatened as they lie in the path of rapidly expanding coastal urban development. Populations have been recorded on White Hill within the Yalgorup National Park but the status of these populations is currently unknown. A population exists on an undeveloped [at 19 September 1998] industrial block in Henderson *c.* 12 km south of Fremantle. This is currently the closest surviving population known to the type locality. Populations from the intermediate area, for example near Fremantle, may now be extinct. The *Stylidium* species C variant (see below) is currently designated as CALM Priority Two. Further study is needed.

Etymology. The epithet *bulbiferum* is from the Latin *bulbus* – bulb and *fero* – I bear, in reference to the lignotuber-like rosette nodes of the species.

Affinities. The nearest relatives to *Stylidium bulbiferum* are *S. cilium*, *S. megacarpum* and *S. septentrionale*. *S. bulbiferum* can be distinguished from all of these taxa except *S. megacarpum* by its lignotuber-like rosette nodes situated mostly at the soil surface. *S. megacarpum* differs from *S. bulbiferum* by having a lax lateral leafy stem growth habit, mostly uniflowered inflorescences and a longer hypanthium.

The strong similarity between the two *Stylidium bulbiferum* type collections, 'Swan River. *Hügel*' at BM and 'Freemantle. *Hügel*' at W suggests they are most likely to be from the same gathering. The type for *S. proliferum* collected by Drummond is comparable to the *A.H. Burbidge* 2526 and *A. Lowrie* 445 collections (PERTH).

Notes. The *Stylidium bulbiferum* f. *macrorrhizum* designated lectotype sheet housed at PERTH has been selected as it represents the original description. The syntypes of this taxon from B are presumed to have been destroyed in World War II.

Stylidium recurvum was named from cultivated material. No type specimen has been found. However, a solitary specimen without collection or collector details, stamped Herbarium Hookerianum 1867 and contained within a pencilled border on a shared sheet with an isolectotype of *Stylidium cilium* 'Swan River, *Drummond* 541' at K is somewhat similar to the *S. recurvum* illustration Graham (1842: t. 3913). This may have been the specimen used as the study for the illustration. Capsule measurements are not available from Graham's illustration but the specimen at K has capsules 8–11 mm long. Among our specimens, the ones showing greatest similarity to this illustration are from south of Byford (e.g. *A. Lowrie* 449) and are of the Darling Range variant (see below) of *Stylidium bulbiferum.*

Typical *Stylidium bulbiferum* is restricted to coastal limestone areas from Yanchep to south of Mandurah. It is characterized by having its lignotuber-like rosette nodes situated mostly at the soil surface.

Other variants commonly occur throughout the Darling Range east of Perth. These variants are characterized by having rosette nodes on stilt-roots mostly situated above the soil surface. They are characterized by having leaves bearing fine serrate-edged translucent white hyaline margins which are often entire and without hyaline in the upper parts.

Another variant of *Stylidium bulbiferum* is known from along the Albany Highway south-east of Armadale near Boulder Rock (*Stylidium* sp. C of Burbidge & James 1991). It is characterized by terminal rosette leaves having a fine translucent white entire hyaline with some leaves bearing a few short spines near the apex and at anthesis producing leaves with serrate-ciliate hyaline margins; labellum with basal appendages, *c.* 0.8 mm long, *c.* 0.4 mm wide; anterior and posterior corolla lobes not falcate and < 0.5 mm difference in length; and a late flowering time. The name *Stylidium bulbiferum* f. *macrorrhizum* applies to one of these variants.

The precise status of these atypical variants requires further study, including chromosome and allozyme research and detailed karyotype analysis. For now we are retaining these Darling Range variants under *Stylidium bulbiferum*, but they may prove to be distinct species.

8. Stylidium burbidgeanum Lowrie & Kenneally (Lowrie & Kenneally 1997: 185–187). *Type:* On Watheroo Rd, 2 km east of Brand Highway, Western Australia, 30° 21' S, 115° 30' E, 27 October 1989, *A. Lowrie* 296 (*holo:* PERTH 04431308; *iso:* MEL).

Creeping perennial *herb*; elevated up to 5 cm above the soil surface on wiry stilt roots, with 2–4, but sometimes more leafy stems up to 6 cm long arising from the rosette nodes, bearing scattered leaves along their length and terminating in an apical leafy rosette. *Leaves* linear, 5–15 (mostly 10–12) mm long, 1–1.2 mm wide, terete in the upper part, semi-terete in the lower part with margins hyalined translucent white and minutely serrate, with a small apical blunt projection, later leaves at anthesis bearing a sharp mucro. *Inflorescence* 4–6 cm long including peduncle, forming a narrow panicle, densely covered with long and short glandular hairs; pedicels < 0.5 mm long; floral bracts, linear, 3–4 mm long; bracteoles 2–2.5 mm long. *Hypanthium* lanceolate at anthesis, 8-shaped in section, 5.5–6 mm long, 1.5–1.8 mm wide at the base, 0.5–1 mm wide at the apex, densely covered with glandular hairs. *Sepals* 5, all free to the base, 2–2.5 mm long. *Corolla* pink, abaxial surface very pale pink, sparsely glandular, lobes laterally paired; anterior lobes obovate, *c.* 2.5 mm long, *c.* 1.5 mm wide; posterior lobes obovate-falcate, *c.* 5.5 mm long, *c.* 2.7 mm wide. *Throat* and petal bases white, with purple marks between the white and the pink coloured zones, without appendages. *Labellum* boss round, *c.* 0.8 mm long, *c.* 0.7 mm wide without basal appendages, margins near the base provided with a few glandular hairs, attached to the base of the corolla tube sinus. *Gynostemium* 5–7 mm long, anthers green, vertically paired, abaxial surface with a few short marginal translucent white moniliform hairs, pollen grey; stigma elliptic, *c.* 1.1 mm long, *c.* 0.6 mm wide, double-cushion-shaped. *Capsule* *c.* 7 mm long. *Seed* unknown. (Figure 8)

Other specimens examined. WESTERN AUSTRALIA: Eneabba–Mingenew Rd, NE of Eneabba, 2 Dec. 1992, *E.A. Griffin* 8067 (PERTH); 3 km W of Brand Highway on Greenhead Rd (Breakaway Property) 13 Dec. 1996, *M. Hislop* 643 (PERTH); 12.3 km W of Three Springs on road to Eneabba, 5 Sep. 1975, *S.H. James* 75.9/5 [voucher for chromosome count of n = 14] (PERTH); S end of Banovich Road, creek crossing *c.* 2.5 km N of the Jurien Bay road, 27 Nov. 1988, *A. Lowrie s.n.* (PERTH); along Brand Highway, 13.5 km N of Regan's Ford, 6 Oct. 1982, *K.H. Rechinger* 58204 (PERTH).

Distribution. Known from three regions: Badgingarra–Mount Lesueur–north-east to the Green Head road; north-east of Eneabba; and Kalbarri National Park.

Habitat. Grows on winter wet creek margins and adjacent watersheds in loamy soil. In white silica sand in winter wet depressions.

Flowering period. October to December.

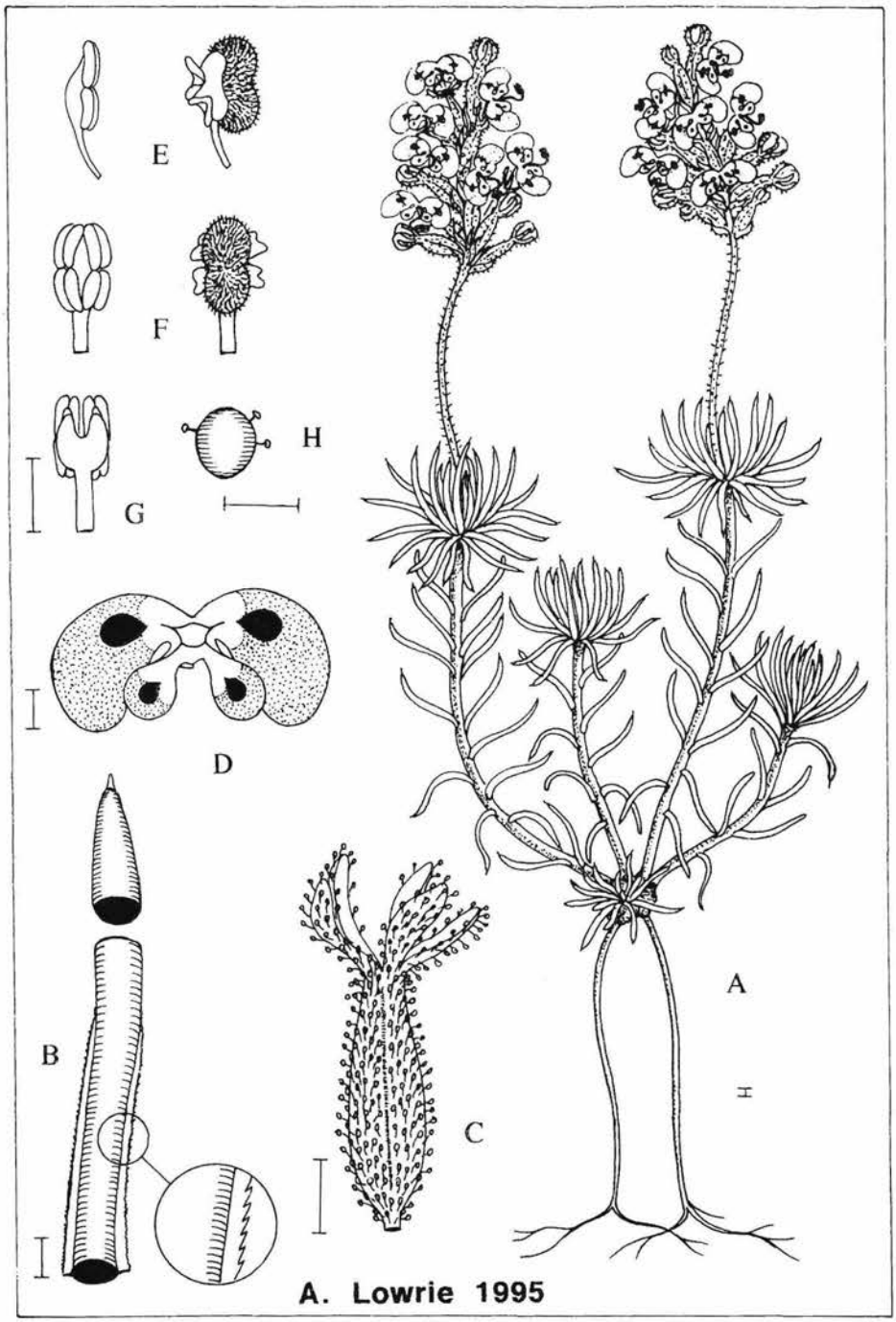

Figure 8. *Stylidium burbidgeanum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 296 (PERTH).

Chromosome number. n = 14 (Burbidge & James 1991).

Conservation status. This species occurs in three widely separated regions, all of which are currently not under threat.

Etymology. The epithet *burbidgeanum* is named in honor of Dr Allan H. Burbidge, co-author of this paper, who first discovered this species.

Affinities. Stylidium burbidgeanum is distinguished from other taxa in the *S. bulbiferum* complex by its narrow paniculate inflorescence, which is densely covered with long and short glandular hairs (including the peduncle), the obovate-falcate shape of the posterior corolla lobes, and its labellum without basal appendages.

9. Stylidium cilium Lowrie, Burbidge & Kenneally, *stat. et nom. nov.*

Stylidium bulbiferum ß *ciliatum* Sond. (Sonder 1845: 388). – *Stylidium recurvum* var. *ciliatum* (Sond.) Planchon (Planchon 1854:81). *Type:* 'Swan-River' [Western Australia], *J. Drummond* 541 (*lecto:* MEL 672623, here designated; *isolecto:* BM, E, K (2 sheets), W (2 sheets), MEL 672622).

Illustrations. Erickson (1958) page 80, plate 20, figures 1–10. Grieve & Blackall (1982) page 761, n. 90c.

Creeping perennial *herb*; elevated above the soil on stilt roots 1–3.5 cm long, branched a little so as to form a clump up to 12 cm diam. *Stems* between the rosette nodes leafless, 6–12 mm long, flowering stems up to 3 cm long arising singly or in groups of 2–3 from the rosette nodes, bearing leaves along their length and terminating in crowded spreading apical leafy rosette. *Leaves* of the apical rosette linear-lanceolate, 5–8 mm long, 0.5–0.7 mm wide, lenticulate in section, 0.35–0.4 mm thick, with a sharp apical mucro bearing short basal ciliae, 0.5–0.8 mm long, margins ciliate, ciliae 0.3–0.4 mm long; leaves along the flowering stems about half the length of apical rosette leaves, leaf shape and margin ciliae similar but apical mucro very much shorter and blunt. *Inflorescence* uni-flowered, 1.5–3.5 cm high including scape, each apical rosette bearing up to 3 uni-flowered scapes but only ever one flower open in the group at the one time, sparsely glandular; floral bracts and bracteoles similar to the apical rosette leaves, 1.5–3 mm long. *Hypanthium* oblong-falcate at anthesis, 8–10 mm long, 0.7–1 mm wide. *Sepals* 5, all free to the base, oblong, 3 lobes 2.5–3 mm long, 2 lobes 2–2.5 mm long. *Corolla* pink with reddish marks at the bases, abaxial surface pale pink with darker pink marks at the base, sparsely glandular, lobes laterally paired; anterior lobes obovate-elliptic, *c.* 4.7 mm long, *c.* 2.5 mm wide; posterior lobes oblanceolate–slightly falcate, *c.* 6.5 mm long, *c.* 2.2 mm wide. *Throat* yellow, without appendages. *Labellum* boss yellowish orange, sub-orbicular, *c.* 0.7 mm diam. with a few marginal glandular hairs; basal appendages yellow, subulate *c.* 0.5 mm long, papillose. *Gynostemium* 7.5–9 mm long; anthers green, laterally paired, abaxial surface with long translucent white moniliform hairs along the margins, pollen glassy white; stigma elliptic, *c.* 1 mm long, *c.* 0.6 mm wide, cushion-shaped. *Capsule* narrowly ovoid, 10–12 mm long, 2–2.3 mm wide, 8-shaped in section. *Seed* brownish orange, ellipsoid, 0.5–0.6 mm long, 0.3–0.4 mm diam., papillose. (Figure 9)

Other specimens examined. WESTERN AUSTRALIA: 14.4 km S of Calingiri, 20 Oct. 1975, *A.H. Burbidge* 2173 (PERTH); 13 km S of Calingiri, 20 Oct. 1975, *A.H. Burbidge* 2176 (PERTH); turnoff to Dewar's Pool from Great Northern Highway, N of Bindoon, 27 Oct. 1976, *A.H. Burbidge* 2394 (PERTH); 6.1 km E of turnoff to Dewar's Pool from Great Northern Highway, N of Bindoon, 27 Oct.

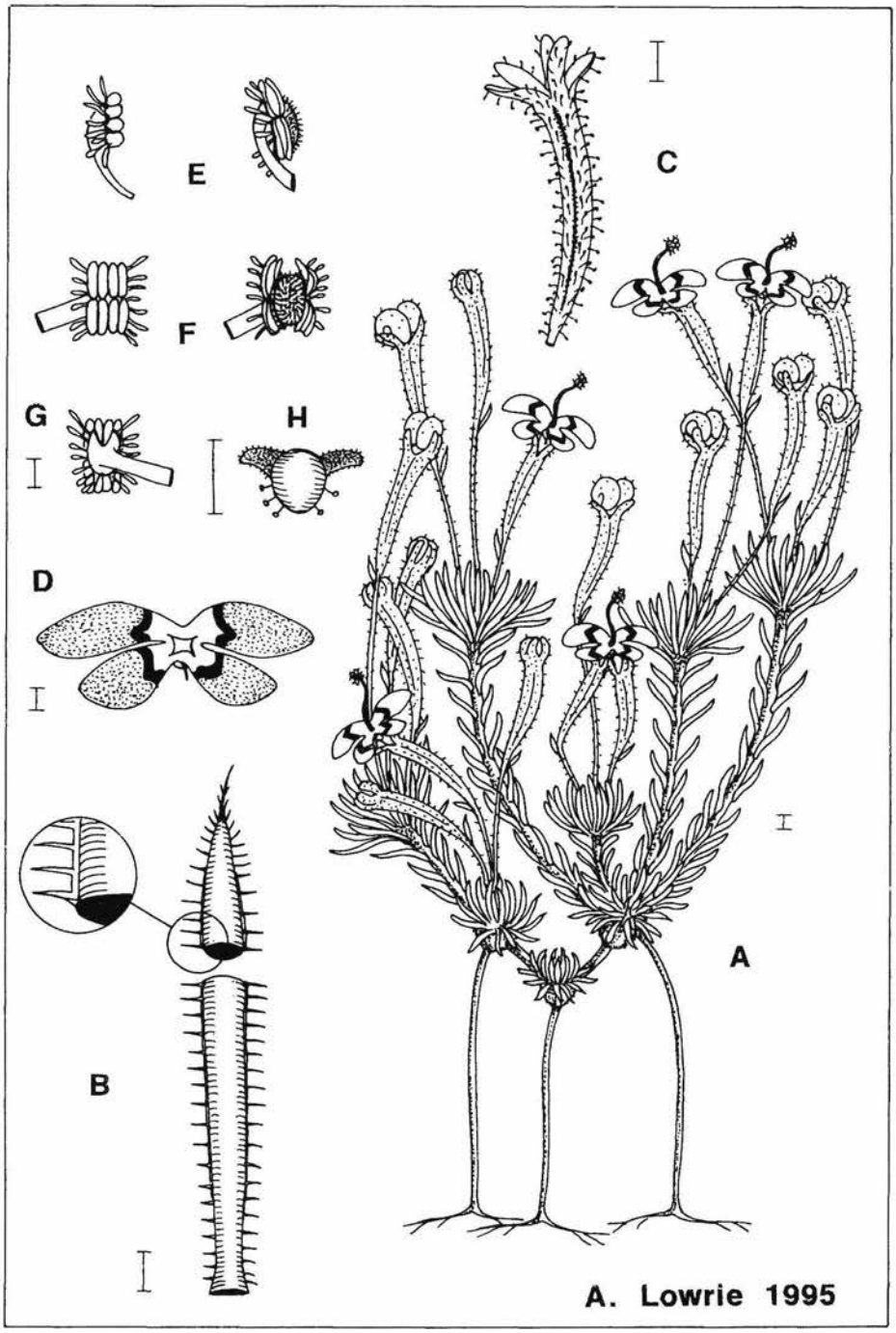

Figure 9. *Stylidium cilium* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 109 (PERTH).

1976, *A.H. Burbidge* 2396 (PERTH); 9.2 km E of Great Northern Highway on road to Calingiri, 27 Oct. 1976, *A.H. Burbidge* 2399 (2 sheets) (PERTH); 8.9 km N of Bolgart, near Wyening, 5 Oct. 1977, *A H. Burbidge* 2520 (PERTH); W of Wyening, 5 Oct. 1977, *A.H. Burbidge* 2522 (PERTH); Bolgart, Sep. 1949, *R. Erickson s.n.* (2 sheets) (PERTH); 66.5 km N of Perth on Great Northern Highway, Oct. 1965, *S.H. James* 65.10/59 (2 sheets) (PERTH); 2 miles [3.2 km] S of Calingiri on road to Bolgart, Oct. 1973, *S.H. James* 73.10/23 (PERTH); 1 mile [1.6 km] W of Bolgart on Bolgart West Road, Sep. 1974, *S.H. James* 74.9/21 [voucher for chromosome count of n = 14] (PERTH); Wongan Hills road between Great Northern Highway and Calingiri, 15 Oct. 1988, *A. Lowrie s.n.* (PERTH); N side of Wongan Hills–Calingiri Rd, 3.9 km E of Great Northern Highway, 16 Oct. 1990, *A. Lowrie* 109 (PERTH); on the corner of Great Northern Highway and Hay Flat Rd between Bindoon and New Norcia, *A. Lowrie* 433 (PERTH) [multi-flowered variant] 42 km S of New Norcia, 13 Oct. 1977, *C.I. Stacey* 623, (PERTH) [multi-flowered variant].

Distribution. Known from the region bordered by New Norcia, Bindoon, Bolgart and Calingiri.

Habitat. Grows in laterite soils in Eucalypt woodlands.

Flowering period. October.

Chromosome number. n = 14, recorded as *Stylidium bulbiferum* Benth. var. *ciliatum* (James 1979, Burbidge & James 1991).

Conservation status. Common and currently not under threat.

Etymology. The epithet from the Latin *cilium* – eye-lash, refers to the leaves being fringed with hairs.

Affinities. The nearest relatives to *Stylidium cilium* are *S. bulbiferum, S. megacarpum* and *S. septentrionale. S. cilium* is distinguished from these taxa by having the margins of its leaves distinctly ciliate.

Notes. The epithet *ciliatum* could not be taken up for this species as it is already in use for *Stylidium ciliatum* Lindl. (Lindley 1839: 28) which is a member of the *S. piliferum* R. Br. complex.

A variant of this taxon (*A. Lowrie* 433, *C. I. Stacey* 623) with 1- as well as 2- and 3-flowered scapes on the same plant is found between Bindoon and New Norcia.

10. Stylidium megacarpum Lowrie, Burbidge & Kenneally, *stat. et nom. nov.*

Stylidium bulbiferum var. *macrocarpum* Benth. (Bentham: 1868: 31). *Type:* Harvey River, [Western Australia], *Oldfield* (*lecto:* K, here designated).

Illustration. Grieve & Blackall (1982) page 761, n. 90b.

Creeping perennial *herb*; with many leafy stems arising erect (new inner ones) as well as lax and horizontal with the upper parts bent upwards (older outer ones) from a lignotuber-like rosette node cluster situated mostly on the soil surface but sometimes on short stilt-roots. Leafy stems 4–16 cm long, together either forming an open (in young plants) or crowded (in older plants), erect and lax spreading compact prostrate bush-like clump up to 30 cm in diam. (in open plants), to 45 cm diam.

(in older plants) where nearby asexually reproduced leafy clumps sometimes still attached by leafless horizontal stems have formed additional leafy clumps mostly free of the parent plant but have meshed together to form larger densely compact colonies. *Stems* between the rosette nodes when present leafless, flowering stems up to 16 cm long arising in groups of 2–15 from each lignotuber-like rosette node cluster, bearing leaves along their length and terminating in crowded spreading apical leafy rosette. *Leaves* of the apical rosette linear at anthesis, 12–20 mm long, 0.7–0.1 mm wide at the base, 0.5–0.6 mm wide towards the apex, margins entire except for a ragged translucent white hyaline on each side near base, with a sharp translucent white apical mucro, 0.2–0.5 mm long, juvenile leaves within this same terminal leafy rosette at anthesis bearing a longer apical mucro 0.5–1 mm long and ciliate margins, elliptic in section, 0.3–0.4 mm thick; leaves along the stems similar but about half the length of apical rosette leaves and bearing an apical mucro much shorter and blunt. *Inflorescences* mostly uni-flowered, often 2–3-flowered, sometimes more flowered 1.5–5 cm long including peduncle, peduncles mostly more than 1 per apical leafy rosette, glandular; pedicels when present 5–20 mm long; floral bracts absent on uni-flowered inflorescences, floral bracts when present similar to bracteoles, linear, 2–3 mm long. *Hypanthium* oblong-linear at anthesis, often slightly falcate, 8–20 (mostly 15) mm long, 1–1.4 mm wide. *Sepals* 5, all free to the base, oblanceolate, 2.5–3.5 mm long. *Corolla* various shades of pink, cream or rarely white with reddish purple marks near the petal bases, abaxial surface white, glandular, lobes laterally paired; anterior lobes obovate-elliptic, *c.* 6.5 mm long, *c.* 2.7 mm wide; posterior lobes oblanceolate–slightly falcate, *c.* 8.5 mm long, *c.* 2.5 mm wide. *Throat* pale yellow, with 2 papillose appendages *c.* 0.4 mm long, *c.* 0.2 mm diam. situated at the base of the anterior lobes. *Labellum* boss pale green, broadly ovate, *c.* 0.8 mm long, *c.* 0.9 mm wide; basal appendages reddish, subulate, *c.* 0.5 mm long, papillose. *Gynostemium* 7.5–11.5 mm long, anthers brown, laterally paired, abaxial surface with a few short translucent white moniliform hairs along the margins, pollen cobalt blue; stigma suborbicular, *c.* 1.3 mm diam., cushion-shaped. *Capsule* unknown. *Seed* unknown. (Figure 10)

Other specimens examined. WESTERN AUSTRALIA: Castle Rock Bay, 19 June 1977, *A.H. Burbidge* 2457 (PERTH); Castle Rock Bay, 26 Oct. 1977, *A.H. Burbidge* 2529 (PERTH); 0.2 km W of Carbunup Bridge, on Wildwood Rd, 26 Oct. 1977, *A.H. Burbidge* 2533 [voucher for chromosome count of 2n = 28] (PERTH); Jindong–Treeton Road, 31 July 1975 (not in flower), *S.D. Hopper s.n.* (PERTH); on Boyanup Rd *c.* 2 km E of South Western Highway, N of Capel, 1 Nov. 1987, *A. Lowrie s.n.* (PERTH); same loc., 1 Nov. 1991, *A. Lowrie* 460 (PERTH); same loc., 5 Dec. 1996, *A. Lowrie* 1645 (PERTH); on the corner of Vasse Highway and Acton Park Rd, Busselton, 2 Nov. 1991, *A. Lowrie* 468 (PERTH); behind general store, Carbunup, S of Busselton, 2 Nov. 1991, *A. Lowrie* 476 (PERTH); S of carpark, Castle Rock Bay, Meelup, S of Busselton, 2 Nov. 1991, *A. Lowrie* 477 (PERTH); *c.* 1 km from ocean, Castle Rock Bay, Meelup, S of Busselton, 2 Nov. 1991, *A. Lowrie* 479 (PERTH); [4 separate collections on one sheet] Harvey River, Oldfield [*syntype*, top left], [hand written label] 'fl. rose, dry basalt rocks, C. [Cape] Naturaliste', no date or collector details [top right], Udoc [?], W. Australia, *K.F.G. Logue* 7/1889 [bottom left], Swan River district, *I.A. Brewer* 2/74 [bottom right] (K).

Distribution. Known from the region between Boyanup and Busselton; south to Carbunup River; and west to Cape Naturaliste. Also recorded from Harvey River south of Mandurah but not seen there by us in the field.

Habitat. Grows on the coast, often within 20 metres of the seashore in blackish sand amongst granite boulders; in black peaty sand or red loamy soils in wet depressions inland in sub-coastal regions.

Flowering period. November.

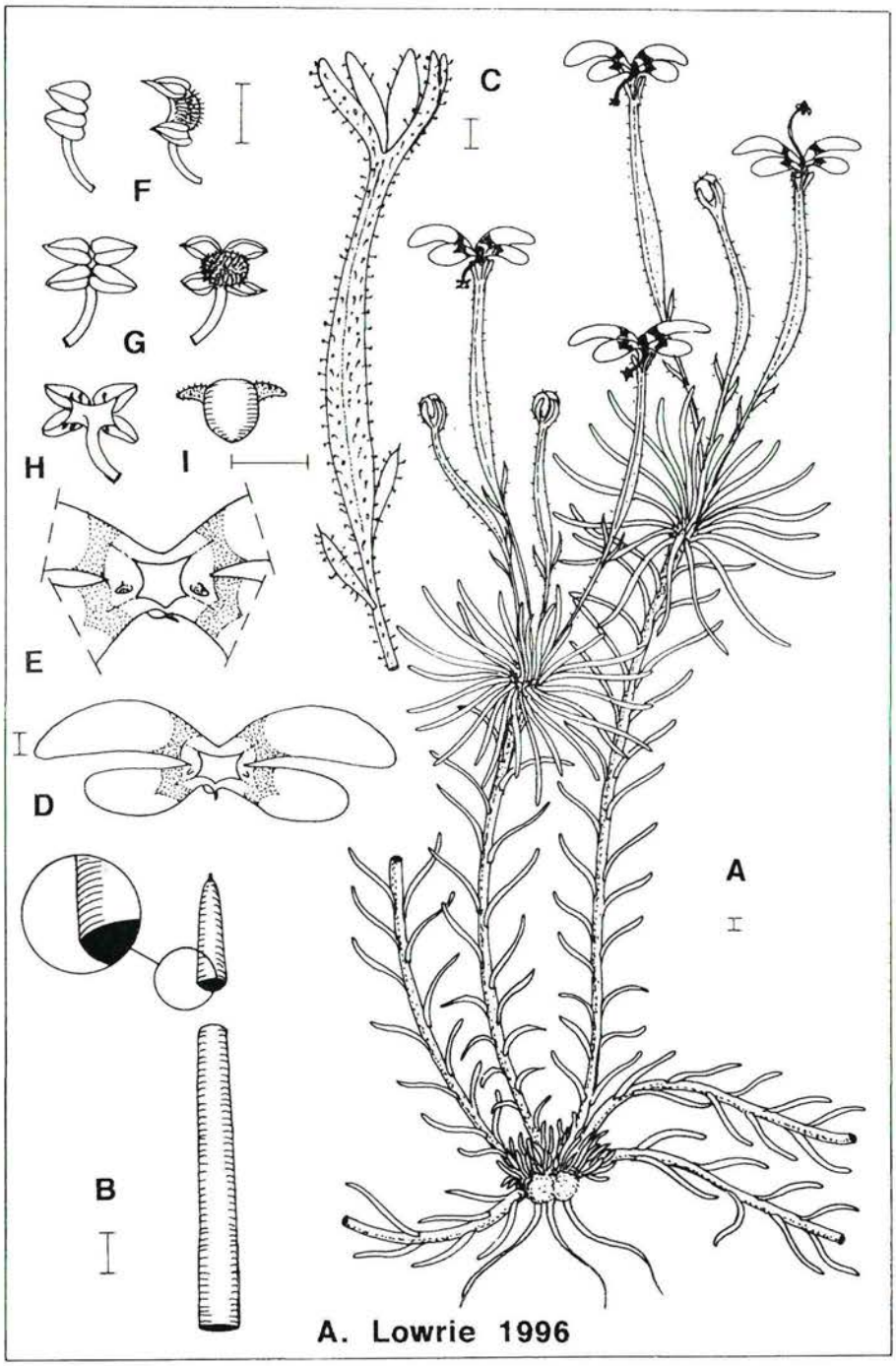

Figure 10. *Stylidium megacarpum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 1645 (PERTH).

Chromosome number. n = 14, [Forrest Rd, Dunsborough] recorded as *Stylidium* species B (Dunsborough), in Burbidge & James (1991).

Conservation status. Common and currently not under threat.

Etymology. The epithet *megacarpum* from the Greek *mega* – large and *carpus* – fruit, in reference to this species long capsule.

Affinities. The nearest relatives to *Stylidium megacarpum*, are *S. bulbiferum, S. cilium, S. septentrionale* and *S. uniflorum.* Excluding *S. uniflorum, S. megacarpum* can be distinguished from these species by having rosette nodes mostly clustered lignotuber-like on the soil surface with erect as well as lax horizontal spreading leafy stems bearing inflorescences mostly 1-flowered, often 2- or 3-flowered, sometimes with more flowers and peduncles mostly more than 1 per apical leafy rosette; corolla posterior petal pairs *c.* 15 mm across; and hypanthium 8–20 (mostly 15) mm long.

Stylidium uniflorum differs from *S. megacarpum* by having rosette nodes and leafless connecting horizontal stems below the soil surface and caespitose basal leaves.

Notes. The epithet *macrocarpum* could not be taken up for this species as it is already in use for *Stylidium macrocarpum* (Benth.) R. Erickson & J.H. Willis (Erickson & Willis 1955: 135).

The *Stylidium megacarpum* designated lectotype is mounted in the top left corner of a mixed sheet. It was selected because its type location and collector 'Harvey River, *Oldfield* ' label immediately below the specimen matched that cited for this taxon when it was known as *S. bulbiferum* var. *macrocarpum.*

Bentham (1868: 31) erroneously indicated that the *Stylidium recurvum* illustration Graham t. 3913 matched Oldfield's Harvey River collection that has been chosen here as the lectotype. The only other details Bentham recorded in his *S. bulbiferum* var. *macrocarpum* description are 'Capsule almost sessile, 8 to 9 lines [16.8–18.9 mm] long'. Capsules matching Bentham's measurements are present on the Harvey River specimen, but *Stylidium recurvum* appears to be a synonym of *S. bulbiferum* (see notes under that species) and to have much shorter capsules.

A specimen of *Stylidium megacarpum* from Cape Naturaliste, placed top right on the 'Harvey river, *Oldfield*' K sheet shares the same 'FLORA AUSTRALIENSIS. named by Mr BENTHAM.' printed label. This specimen was not cited by Bentham in his *Stylidium bulbiferum* var. *macrocarpum* treatment. The two collections at the bottom of the same sheet are also *S. megacarpum.*

11. Stylidium septentrionale (Mildbr.) Lowrie, Burbidge & Kenneally, *stat. nov.*

Stylidium bulbiferum var. *septentrionale* Mildbr. (Mildbraed 1908: 92–93). *Type:* 'Distr. Irwin: Victoria, zwischen Champion Bay [Geraldton] und White Peak auf sandigem oder kiesigem Boden an kahlen Stellen', Western Australia, September 1901, *E. Pritzel* 635 (*lecto:* W, here designated; *isolecto:* PERTH, K, B); same location, *L. Diels* 4148 (*syn:* B, *n.v.*); Oakagee, Western Australia, *Oldfield* 393 (*syn:* MEL 672620, 672621).

Illustration. Erickson (1958) colour plate 16, figure 7. Grieve & Blackall (1982) page 761, n. 90d.

Creeping perennial *herb*; elevated above the soil on stilt roots up to 3 cm long, irregularly branched so as to form a tangled matted network up to 15 cm diam. *Stems* between the rosette nodes leafless, 10–20 mm long, flowering stems up to 3 cm long, 1–3 arising from the rosette node junctions, bearing a few leaves along their length and terminating in crowded spreading apical leafy rosette. *Leaves* of the apical rosette linear, 6–12 mm long, 0.5–0.6 mm wide, mostly with a blunt apical mucro 0.1–0.2 mm long, margins bearing a fine irregularly serrate edged translucent white hyaline, increasing in width towards the base, terete in the upper parts, lenticulate in section in the lower parts, 0.4–0.6 mm thick; leaves along the stems similar but *c.* half the length of apical rosette leaves and apical mucro much shorter and blunt. *Inflorescence* 3–3.3 cm long including peduncle, peduncle 2 cm long, forming a panicle, glandular; pedicels 1–2.5 mm long; floral bracts linear, 3–4 mm long; bracteoles subulate, 1–1.5 mm long. *Hypanthium* oblong at anthesis, 4–5 mm long, 0.8–1.2 mm wide, 8-shaped in section, glandular. *Sepals* 5, all free to the base, oblanceolate, 1–1.5 mm long. *Corolla* pink with whitish yellow near the petal bases, abaxial surface pale pink, glandular, lobes laterally paired; anterior lobes obovate-elliptic, *c.* 4.5 mm long, *c.* 2 mm wide; posterior lobes elliptic, *c.* 5.5 mm long, *c.* 2.7 mm wide. *Throat* whitish yellow, without appendages. *Labellum* boss pale yellow, broadly ovate, *c.* 0.8 mm long, *c.* 0.7 mm wide, margins with a few glandular hairs; basal appendages subulate, red-tipped, *c.* 0.2 mm long, papillose. *Gynostemium* 5–7 mm long, anthers blackish, laterally paired, abaxial surface with a few short translucent white moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 1.5 mm long, *c.* 0.8 mm wide, cushion-shaped. *Capsule* oblong, 5–9 mm long, 1.2–1.4 mm wide, 8-shaped in section. *Seed* brown, ± ovoid-ellipsoid, with 4 flat sides, 0.5–0.8 mm long, 0.25–0.3 mm diam., papillose. (Figure 11)

Other specimens examined. WESTERN AUSTRALIA: Yandanooka (breakaway country), 1932, *A.M. Baird s.n.* (PERTH); 6 km N of turnoff to Yerina Spring, 20 Sep., *A.H. Burbidge s.n.* (PERTH); White Peak, N of Geraldton, 10 Sep. 1953, *R. Erickson s.n.* (PERTH); Eneabba–Three Springs road, 5 Aug. 1975 (not in flower), *S.D. Hopper s.n.* (PERTH); 10 km N of Yillingarra West Road along Mogumber–Moora road, 14 Oct. 1976, *S.D. Hopper s.n.* (PERTH); 212 miles [339.2] N of Perth on the Geraldton Highway, Sep. 1972, *S.H. James* 72.9/1 (PERTH); 7.9 km SW of Three Springs on Eneabba road, 5 Sep. 1975, *S. H. James* 75.9/3 [voucher for chromosome count of n = 14] (PERTH); Gillingarra, 5 Oct. 1988, *A. Lowrie s.n.* (PERTH); Bindoon–Moora Highway, 0.6 km S of Gillingarra, 20 Oct. 1989, *A. Lowrie s.n.* (PERTH); on the corner of Lynch Rd and Three Springs–Morawa road, 22 Sep. 1990, *A. Lowrie* 266 (PERTH); on Midlands Rd, 12.6 km N W of Three Springs, 28 Sep. 1991, *A. Lowrie* 353 (PERTH); White Peak, *c.* 2 km E of the highway N of Geraldton, 7 Oct. 1991, *A. Lowrie* 370 (PERTH); *c.* 25 km E of Kalbarri, on Ajana–Kalbarri road, 4 Sep. 1992, *A. Lowrie* 642 (PERTH); Table Hill, in rocky places, no date, *F. Muell. s.n.* (MEL).

Distribution. Widely distributed from Kalbarri; south to Yandanooka east of Dongara; east to Three Springs; and south to Mogumber.

Habitat. Grows in laterite soils or in clayey sand over granite.

Flowering period. September, October.

Chromosome number. n = 14, (James 1979).

Conservation status. Common and currently not under threat.

Etymology. The epithet *septentrionale* from the Latin *septentrionalis* – northern, in reference to this species belonging to the north.

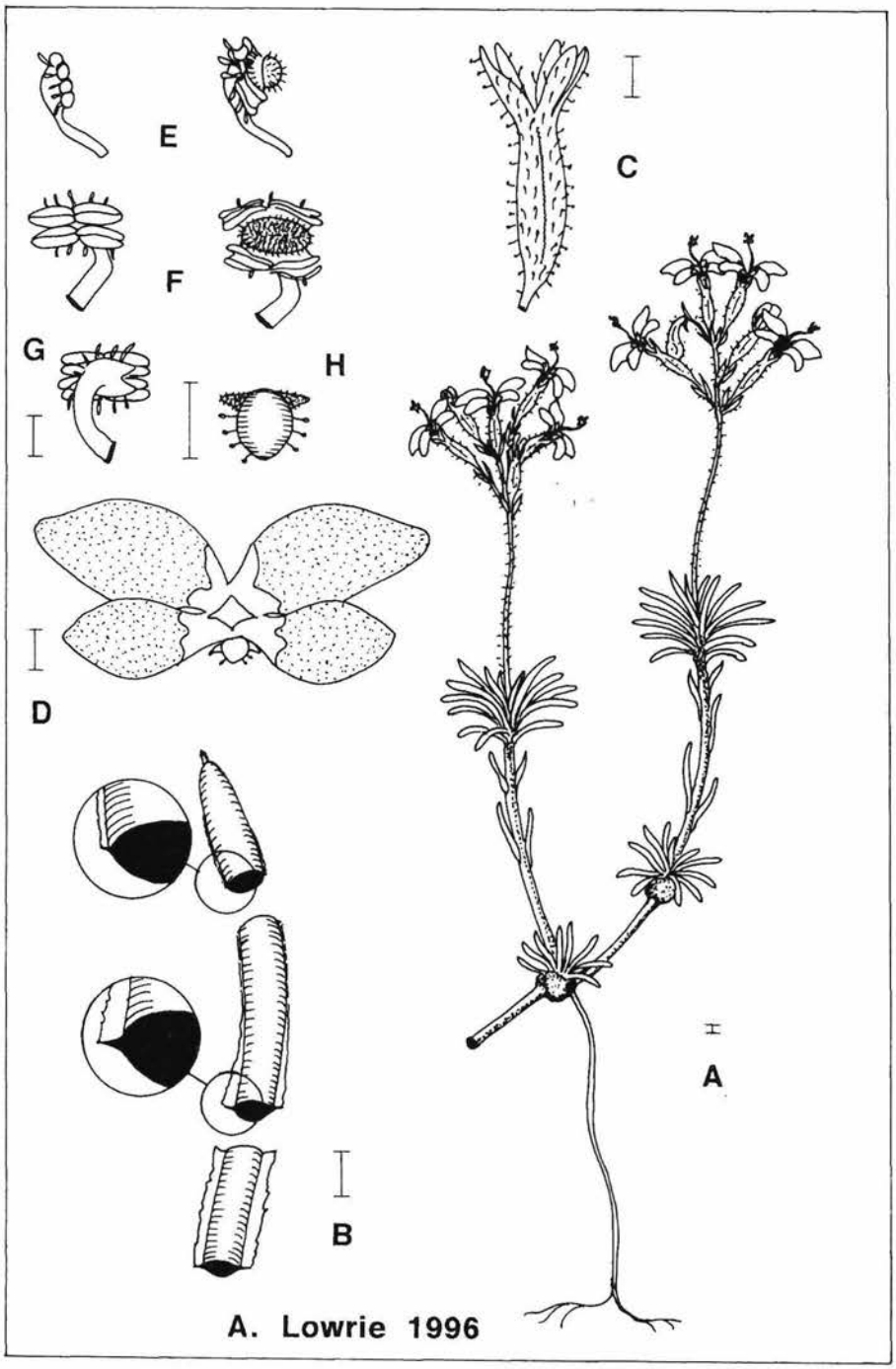

Figure 11. *Stylidium septentrionale* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 370 (PERTH).

Affinities. The nearest relatives to *Stylidium septentrionale* are *S. bulbiferum, S. cilium* and *S. megacarpum. S. septentrionale* can be distinguished from these taxa by all leaves mostly having a short blunt apical mucro; peduncle mostly 2–3 times longer than the inflorescence; and hypanthium 4–5 mm long.

Notes. We have selected the *E. Pritzel* 635 collection in W for the lectotype as it has been annotated by Mildbraed. Mildbraed's type location ' between Champion Bay and White Peak' is much more precise than the recorded location 'In fruticetis inter flumina Moore et Murchison' on the lectotype *E. Pritzel* 635. The area between Champion Bay [Geraldton] and White Peak [*c.* 20 km northwards] is situated *c.* 300 km north of the Moore River and *c.* 80 km south of the Murchison River.

Our description and illustration were taken from specimens collected from White Peak (*A. Lowrie* 370). Specimens from Gillingarra (near the Moore River) and the Three Springs–Morawa road are always much larger specimens than those found between Geraldton and White Peak. However, regardless of specimen size the peduncles are mostly 2–3 times longer than the inflorescence.

12. Stylidium dielsianum E. Pritz. (Diels & Pritzel 1905: 596). *Type:* pr. Southern Cross [near Southern Cross, Western Australia], in solo argilloso interdum inundato, *E. Pritzel* 871. (*lecto:* W, here designated; *isolecto:* B, K, PERTH, NSW); in distr. Coolgardie pr. Golden Valley, [Western Australia], [1888], *Merrall* (*syn:* MEL 672619).

Illustrations. Erickson (1958) colour plate 16, figure 2. Grieve & Blackall (1982) page 761, n. 91. Mildbraed (1908) page 90, figure 26, A–D.

Creeping perennial *herb;* mostly appressed to the soil surface and irregularly branched so as to form a spreading tangled matted network up to 100 cm diameter, or when elevated above the soil, 2.5–7 cm high on stilt roots 1–4 cm long. *Stems* between the rosette nodes greyish, leafless, 1–15 cm long, rosette nodes often retaining a tuft of leaves, flowering stems straw coloured, 1–15 cm long arising from the rosette node junctions when short or appressed to the soil surface when long, bearing persistent appressed leaves and terminating in an apical leafy rosette. *Leaves* clavate, lenticulate in section in the lower parts, trigonal in the upper parts, with a longitudinal ridge-like keel on the apical abaxial leaf surface, basally rounded, 6–12 mm long, 0.6–1 mm wide near the apex, 0.4–0.5 mm at the base, rounded base 0.8–1 mm long, 0.6–0.8 mm wide, apical mucro white, shortly pointed and/or absent even on the same specimen, rounded base opposite margins white, winged-serrate, hyaline margins white, mostly crenate, often serrulate, or a combination of both. *Inflorescence* forming a narrow panicle, 2–8-flowered, 1–3 cm high including peduncle, densely covered with long and short glandular hair; pedicels 1–2.5 mm long; floral bracts and bracteoles, similar to the leaves, floral bracts 4–6 mm long; bracteoles 2.5–3.5 mm long. *Hypanthium* oblong at anthesis, 3.5–6 mm long, 0.8–1.4 mm wide, densely glandular. *Sepals* 5, 3 ovate, free to the base, the central lobe often slightly longer, 2 obovate, joined for almost half their length, 1.6–2 mm long, densely glandular. *Corolla* pink with reddish purple marks near the base of the lobes, abaxial surface pink with reddish stripes, slightly glandular lower on the lobes and extending onto the corolla tube, laterally paired; anterior lobes obovate *c.* 3 mm long, *c.* 2 mm wide, posterior lobes obovate, *c.* 4 mm long, *c.* 1.2 mm wide. *Throat* white surrounded by a little yellow, without appendages. *Labellum* boss yellow, ovate, *c.* 0.8 mm long, *c.* 0.5 mm wide; with a red short apical beard flanked by 2 small bump-like appendages; basal appendages reddish orange, subulate, apex rounded, *c.* 1.5 mm long, *c.* 0.3 mm wide. *Gynostemium* 7–10 mm long, anthers olive green, vertical paired, abaxial surface with long translucent white moniliform hairs along the margins, pollen greyish green; stigma elliptic, *c.* 0.9 mm long, *c.* 0.6 mm wide, cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 12)

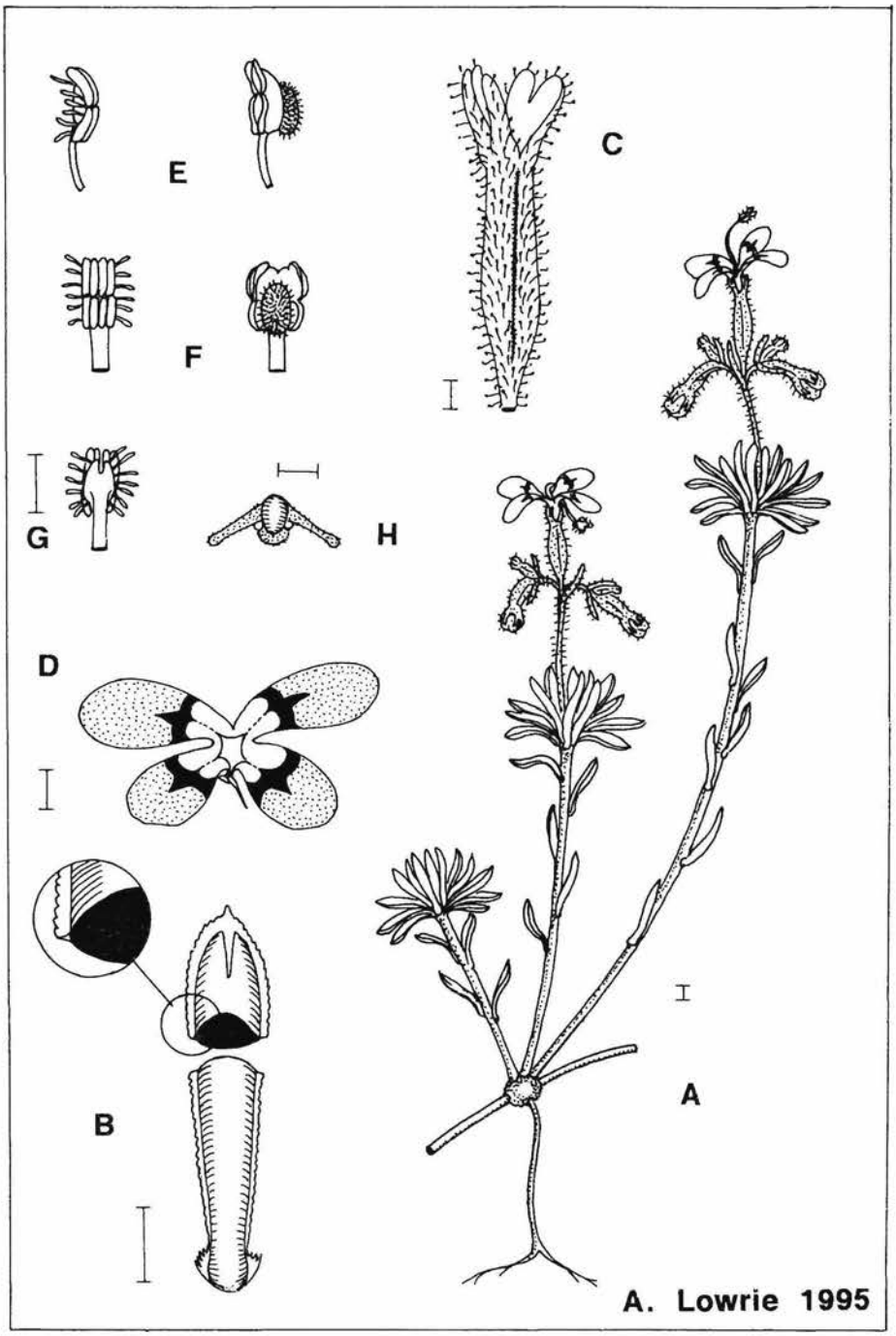

Figure 12. *Stylidium dielsianum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie s.n.* 1 Oct. 1989 (PERTH).

Other specimens examined. WESTERN AUSTRALIA: 10 km S of Queen Victoria Rock, 2 Sep. 1975, *A.H. Burbidge* 2051 (PERTH); 80.1 km E of Lake King, 25 Oct. 1975, *A.H. Burbidge* 2201 (PERTH); Peak Charles, 26 Oct. 1975, *A.H. Burbidge* 2206 (PERTH); Southern Cross, Aug. 1952, *R. Erickson s.n.* (PERTH); Walgoolan (E of Merredin), 1 Oct. 1955, *R. Erickson s.n.* (K); 4 miles [6.4 km] E of Boorabbin, Oct. 1963, *S.H. James* 63.10/1 [voucher for chromome count of n = 15] (PERTH); Bencubbin–Trayning, Aug. 1966, *S.H. James* 66.8/35 [voucher for illustration of *Stylidium dielsianum* (Grieve & Blackall 1982: 761)] (PERTH); Merredin, 9 Oct. 1923, *M. Koch s.n.* (K); 5.5 km E of Merredin, 1 Oct. 1989, *A. Lowrie s.n.* (PERTH); Hatter's Hill–Varley road, 9.3 km W of the state barrier vermin fence, 17 Oct. 1990, *A. Lowrie* 120 (PERTH); entrance to Mangowine Homestead near the base of Mount Grey, 13 Oct. 1991, *A. Lowrie* 403 (PERTH); Merredin–Bruce Rock road, 5 km W of Bruce Rock, Eujinyn, 15 Aug. 1992, *A. Lowrie* 609 (PERTH); Parker's Range, 1890, *E. Merrall s.n.* (MEL).

Distribution. Widely distributed in the region bordered by Mukinbudin in the north; south-west to Trayning; south-east to Merredin; south to Bruce Rock; south-east to Varley; east to Peak Charles; north to Queen Victoria Rocks south-west of Coolgardie; and west to Southern Cross.

Habitat. Grows in clayey sand or red loamy sand in woodlands and open shrublands.

Flowering period. October, November.

Chromosome number. n = 15 (James 1979, Burbidge & James 1991).

Conservation status. Common and currently not under threat.

Etymology. The epithet *dielsianum* honours Friedrich Ludwig Emil Diels (1874–1945) a director of the Berlin botanical gardens. During 1900–1901, he and E. Pritzel travelled widely in south-west Australia and collected about 5700 botanical specimens. Their joint work, *Fragmenta Phytographiae Australiae Occidentalis* is one of the major authorities on the Western Australian flora.

Affinities. Its nearest relatives are *S. induratum* and *S. warriedarense*. *S. induratum* differs in having linear leaves, semi-lenticulate in section, with a serrate hyaline margin and apical mucro; plants forming erect compact bushes 10–22 cm high including the stilt roots; and labellum boss *c.* 0.5 mm wide, with basal appendages *c.* 0.5 mm long.

S. *warriedarense* differs in having spathulate leaves, lunate in section, with an irregularly serrate–laciniate hyaline margin and apical mucro; plants only on stilt roots mostly confined to small clumps; and labellum boss *c.* 0.4 mm wide, with basal appendages *c.* 0.7 mm long.

Notes. We have selected the *E. Pritzel* 871 collection in W for the lectotype as it has been annotated by Mildbraed.

13. Stylidium induratum M. Scott (Scott 1915: 90). *Type:* Victoria Desert: Camp 54 (Elder Exploring Expedition), [Mound Spring, McKay's Creek, Western Australia, 29° S, 125° E], September [1891], *R. Helms* (*lecto:* K, here designated; *isolecto:* NSW 154814).

Illustrations. Erickson (1958) page 78, plate 19, figures 10–11. Grieve & Blackall (1982) page 762, n. 92.

Creeping perennial *herb*; elevated above the soil on stilt roots up to 8 cm long and irregularly branched and forming an erect compact bush 10–22 cm high, up to 20 cm diameter. *Stems* between the rosette nodes greyish, leafless, 1–8 cm long, rosette nodes often retaining a tuft of leaves, flowering stems 2–6 cm long arising from the rosette node junctions, bearing persistent leaves along their length and terminating in an apical leafy rosette. *Leaves* linear, semi-lenticulate in section, with a longitudinal ridge-like keel on the apical abaxial surface, 5–10 mm long, 0.8–1 mm wide near the apex, narrowed to 0.6–0.7 mm wide near the base, 0.8–1 mm wide at the base, spur-like base rounded 0.3–0.7 mm long, opposite margins white, winged-serrate, apical mucro white, sharp, 0.3–0.5 mm long, hyaline margins white, serrate. *Inflorescence* paniculate, 8–15-flowered, 3–5 cm high including peduncle, densely covered with long and short glandular hairs; pedicels 0.5–2.5 mm long; floral bracts and bracteoles, similar to the leaves, floral bracts 6–8 mm long; bracteoles 2–3 mm long. *Hypanthium* oblong at anthesis, 5.5–7 mm long, 1–1.8 mm wide, glandular. *Sepals* 5, 2–4 mm long, glandular, 3 narrowly-ovate, free to the base, 2 obovate, joined for *c.* two thirds of their length. *Corolla* pink with dark pink marks near the base of the lobes, abaxial surface pink, dark pink and slightly glandular along the mid-vein, laterally paired; anterior lobes obovate *c.* 4 mm long, *c.* 2.2 mm wide, posterior lobes elliptic, *c.* 4 mm long, *c.* 2.3 mm wide. *Throat* white, without appendages. *Labellum* boss pale green, ovate, *c.* 0.7 mm long, *c.* 0.5 mm wide; with an apical short reddish serrate-papillose beard; basal appendages reddish, subulate, papillose, *c.* 0.5 mm long. *Gynostemium* 9.5–11.5 mm long, anthers yellow, vertical-paired, abaxial surface with short translucent white moniliform hairs along the margins, pollen white; stigma round, *c.* 0.5 mm diam., cushion-shaped. *Capsule* 7.5–10 mm long, 2–2.5 mm wide. *Seeds* light brownish orange, ovoid, 0.4–0.5 mm long, 0.45–0.5 mm diam., bullate. (Figure 13)

Other specimens examined. WESTERN AUSTRALIA: Anketell on Sandstone–Mount Magnet road, 13 Sep. 1968, *A.M. Ashby* 2601 (PERTH); Queen Victoria Springs, 26 Jan. 1959, *W.H. Butler s.n.* (PERTH); Queen Victoria Springs, Great Victoria Desert, 19 Oct. 1995, *D.J. Edinger* 1026 (PERTH); 12 miles [19.2 km] W of Sandstone, Oct. 1947, *F.G. Forman s.n.* (PERTH); 15 miles [24 km] SW of Youanmi on road to Paynes Find, 20 Oct. 1962, *D.W. Goodall* 47 (PERTH); 3 miles [4.8 km] S of Paynes Find on Great Northern Highway, Aug. 1973, *S.H. James* 73.8/5 (PERTH); on road from Cue to Sandstone, 1.6 km E of Pinnacles turn off, 14 Aug. 1993, *A. Lowrie* 799 (PERTH); on road from Cue to Sandstone, 1.6 km E of Pinnacles turn off, 9 Oct. 1995, *A. Lowrie* 1348 (PERTH).

Distribution. Known from scattered locations in the region bordered by Paynes Find; north to Cue; east to Sandstone; and south to Anketell east of Mount Magnet. Also known from the type location in the Great Victoria Desert *c.* 230 km north of Rawlinna on the Trans-Australian Railway on the Nullarbor Plain.

Habitat. Grows in sandy soils caught in gnammas on the flat-topped summits of breakaways.

Flowering period. September, October.

Chromosome number. Unknown.

Conservation status. Common and currently not under threat.

Etymology. The epithet *induratum* is from the Latin *induratus* – hardened, in reference to the hard white thickening (hyaline) of the leaf margins.

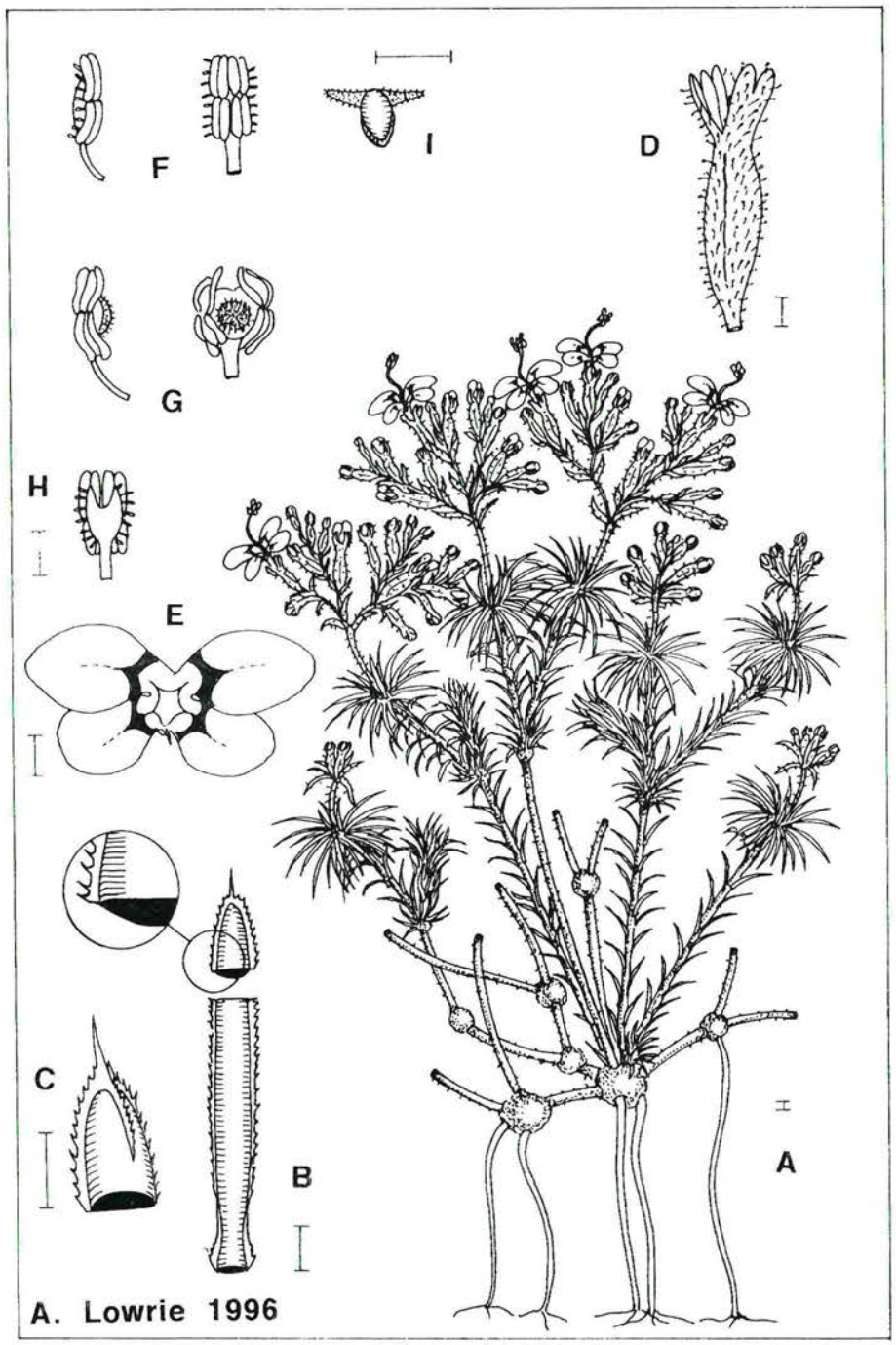

Figure 13. *Stylidium induratum* A – habit of flowering plant; B – leaf; C – enlarged abaxial view of leaf tip, serrate hyaline margins, keel and mucro; D – hypanthium; E – corolla; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 799 (PERTH).

Affinities. Its nearest relatives are *Stylidium dielsianum* and *S. warriedarense*. *S. dielsianum* differs in having clavate leaves, lenticulate in section in the lower portion, trigonal in the upper portion, with hyaline margin mostly crenate, often serrulate or a combination of both and apical mucro very short or absent; plants spreading widely over the soil surface mostly appressed to the soil surface or 2.5–7 cm high when elevated on stilt roots; and labellum boss *c.* 0.5 mm wide, with basal appendages *c.* 1.5 mm long.

Stylidium warriedarense differs in having spathulate leaves, lunate in section, with an irregularly serrate-laciniate hyaline margin; plants only on stilt roots mostly confined to small clumps; and labellum boss *c.* 0.4 mm wide, with basal appendages *c.* 0.7 mm long.

Notes. We have selected the sheet housed at K as the lectotype for *Stylidium induratum,* which is very similar to the isolectotype housed at NSW, because of the additional information attached to the K sheet. Along with a copy of the published description, there are also detailed pencil sketches of the floral parts. These were drawn by Rica Erickson from this material at Kew on the 11 Nov. 1955. These sketches provided the study for the pen and ink drawings of *S. induratum* published by Erickson (1958).

Stylidium induratum, S. dielsianum and *S. warriedarense* can sometimes, in addition to their own distinctive leaf type, exhibit a small number of either one or both relative's leaf types in the early stages of new growth. It is not until leafy growth arises a little above the rosette node that the characteristic leaf type of each species is consistently produced.

14. Stylidium warriedarense Lowrie, Burbidge & Kenneally, *sp. nov.*

Stylidio dielsiano E. Pritz. affinis sed foliis spathulatis, in sectione lunatis, marginibus hyalinis irregulariter serrato-laciniatis differt.

Typus: Warriedar–Perenjori road, 29.9 km W of the Warriedar Homestead front gate, Western Australia, 28 September 1991, *A. Lowrie* 342 (*holo:* PERTH 05091349; *iso:* MEL).

Creeping perennial *herb;* elevated above the soil on stilt roots up to 2.5 cm long and irregularly branched so as to form a network up to 7 cm high and generally up to 15 cm diameter. *Stems* between the rosette nodes greyish, leafless, 1–4 cm long, rosette nodes often retaining a tuft of leaves, flowering stems mostly 1–9 cm long but sometimes up to 20 cm long (shorter ones erect, longer ones spreading), arising from the rosette node junctions, bearing a few persistent leaves along their length and terminating in an apical leafy rosette. *Leaves* spathulate, lunate in section, with a longitudinal ridge-like keel on the abaxial leaf surface in the upper part, 5–7 mm long, 1.3–1.5 mm wide near the apex, 0.6–0.8 mm wide at the base, spur-like base straw-coloured, rounded, apical mucro sharp, white, 0.1–0.3 mm long, rounded base opposite margins white, winged-entire, leaf hyaline margins white, irregularly serrate-laciniate. *Inflorescence* paniculate, 5–10-flowered, 2–3 cm high including peduncle, densely covered with long and short glandular hairs; pedicels 0.5–2.5 mm long; floral bracts and bracteoles, similar to the leaves, floral bracts 3–6.5 mm long; bracteoles 2–3 mm long. *Hypanthium* oblong at anthesis, 4–7 mm long, 1–1.5 mm wide, glandular. *Sepals* 5, 3 narrowly-ovate, free to the base, 2 obovate, joined for two thirds of their length, *c.* 2 mm long, glandular. *Corolla* white or pink with reddish purple marks near the base of the lobes, abaxial surface white or pink, slightly glandular, laterally paired; anterior lobes obovate *c.* 4.5 mm long, *c.* 2.5 mm wide, posterior lobes elliptic, *c.* 5 mm long, *c.* 2.5 mm wide. *Throat* pale green, without appendages. *Labellum* boss pale green, ovate, *c.* 0.7 mm long, *c.* 0.4 mm wide; with reddish short apical papillose point and margins; basal appendages reddish, subulate, papillose, *c.* 0.7 mm long. *Gynostemium* 4.5–7.5 mm long, anthers

pale yellow, vertical-paired, abaxial surface with very short translucent white moniliform hairs along the margins, pollen pale yellow; stigma elliptic, *c.* 0.7 mm long, *c.* 0.6 mm wide, cushion-shaped. *Capsule* 6.5–7 mm long, 1.5–2 mm wide. *Seeds* rust orange, subglobose, 0.35–0.4 mm long, 0.4–0.5 mm diam., papillose. (Figure 14)

Other specimens examined. WESTERN AUSTRALIA: *c.* 12 km E of Mullewa on the road between Mullewa and Yalgoo, 4 Oct. 1966, *E.M. Bennett* 1523 (PERTH); 15 km E of Mullewa along road to Pindar, 6 Oct. 1991, *W. Greuter* 22575 (PERTH); 221 mile [353.6 km] peg on Wubin–Paynes Find section of Great Northern Highway, Aug. 1973, *S.H. James* 73.8/4 [juvenile inflorescence] (PERTH); S of Johnson Rocks, 6 Nov. 1991, *G.J. Keighery* 12448 (PERTH); Wubin Rocks, 6 Sep. 1997, *A. Lowrie* 1846 [voucher for chromosome count of n = 30] (PERTH); Mt Farmer, 6 Sep. 1991, *D. E. Murfet* 1129 (PERTH); White Wells turn off, 7 Sep. 1991, *D.E. Murfet* 1132 (PERTH); Mt Gibson 29° 36'S, 117° 11' E, 4 Oct. 1984, *B.H. Smith* 463 (PERTH); 32 km W of Warriedar Homestead, 26 Sep. 1986, *P.G. Wilson* 12287 (PERTH).

Distribution. Known from scattered locations in the region bordered by Mullewa, south to Wubin, and north-east to Warriedar. Also known from yellow sand plain country *c.* 300 km east of the type location, *c.* 20 km south of Johnson Rocks.

Habitat. Grows in red loam-laterite soils, red sandy loam in mulga scrub or yellowish sand on heathland.

Flowering period. September, October.

Chromosome number. n = 30, S.H. James & A. Lowrie (previously unpublished data).

Conservation status. Common and currently not under threat.

Etymology. The epithet *warriedarense* refers to the Warriedar Sheep Station *c.* 55 km west-north-west of Paynes Find in south-west Western Australia where this species was first discovered.

Affinities. Its nearest relatives are *Stylidium induratum* and *S. dielsianum*. *S. induratum* differs in having linear leaves, semi-lenticulate in section, with a serrate hyaline margin and apical mucro; plants forming erect compact bushes 10–22 cm high, including the stilt roots; and labellum boss *c.* 0.5 mm wide, with basal appendages *c.* 0.5 mm long.

Stylidium dielsianum differs in having clavate leaves, lenticulate in section in the lower portion, trigonal in the upper portion, with hyaline margin mostly crenate, often serrulate or a combination of both and apical mucro very short or absent; plants spreading widely over the soil surface mostly appressed to the soil surface or 2.5–7 cm high when elevated on stilt roots; and labellum boss *c.* 0.5 mm wide, with basal appendages *c.* 1.5 mm long.

15. Stylidium diplectroglossum (R. Erickson & J.H. Willis) Lowrie, Burbidge & Kenneally, *stat. nov.*

Stylidium repens var. *diplectroglossum* R. Erickson & J.H. Willis (Erickson & Willis 1956: 15). *Type:* from the plains between Kendenup and Mondurup Peak in the Stirling Range, Western Australia, November 1953, *C. Morris s.n.* (*holo:* MEL; *iso:* PERTH 1642014).

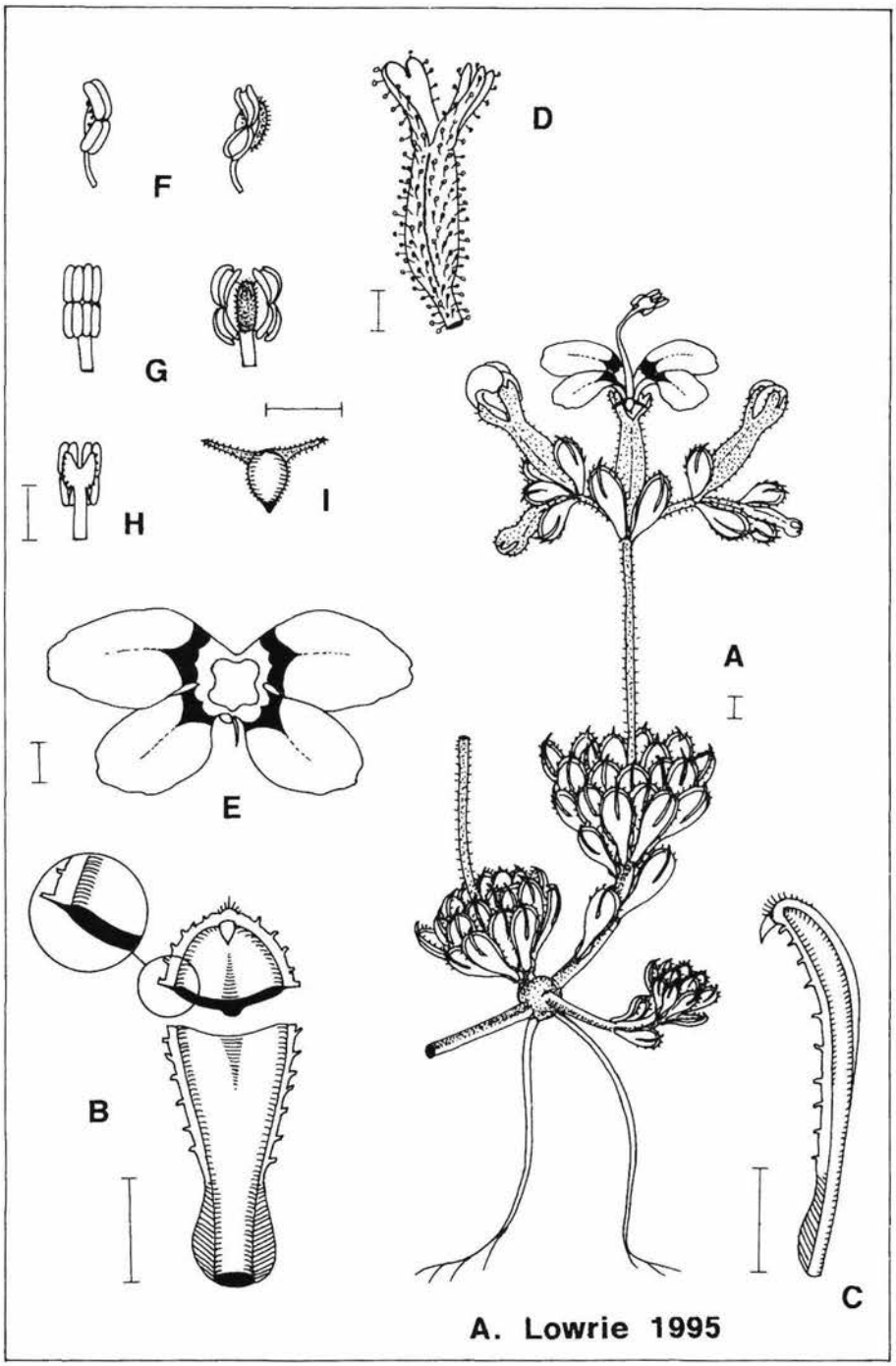

Figure 14. *Stylidium warriedarense* A – habit of flowering plant; B– leaf; C– lateral view of leaf, serrate-laciniate hyaline margins, keel and mucro; D – hypanthium; E – corolla; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *P.G. Wilson* 12287 (PERTH).

Illustrations. Erickson (1958) page 72, plate 17, figures 9–16. Grieve & Blackall (1982) page 762, n. 93a.

Creeping perennial *herb*, elevated above the soil on stilt roots up to 2 cm long and irregularly branched so as to form a tangled matted network up to 100 cm diameter. *Stems* between the rosette nodes leafless 1–4 cm long, flowering stems 1–5 cm long arising from the rosette node junctions which often still retain a tuft of leaves, bearing persistent appressed leaves along their length and terminating in compact apical leafy rosette. *Leaves* linear, 3.5–4.5 mm long, 0.4–0.5 mm wide, apical mucro sharp, translucent white, 0.1–0.4 mm long, basal spur translucent white, 0.5–0.7 mm long, hyaline margins translucent white, irregularly serrate. *Inflorescence* uni-flowered, hypanthium mostly held above the terminal leafy rosette, peduncle 4–7 mm long, pilose-glandular (each pilose hair twisted and curled irregularly along its length and tipped with a gland); floral bracts and bracteoles not visible. *Hypanthium* oblong-elliptic at anthesis, 3–3.5 mm long, 0.7–1.2 mm wide, sparsely pilose-glandular. *Sepals* 5, all free to the base, subulate, 1.5–2.5 mm long, margins and apical mucro translucent white, margins serrate, glabrous. *Corolla* pink with dark pink marks near the base of the lobes, abaxial surface pink, glabrous, laterally paired; anterior lobes elliptic *c.* 4.5 mm long, *c.* 2 mm wide, posterior lobes obovate-elliptic, *c.* 4.5 mm long, *c.* 2 mm wide. *Throat* white, appendages 6, subulate, each *c.* 0.5 mm long. *Labellum* boss green, ovate, *c.* 0.5 mm long, *c.* 0.3 mm wide; apical point reddish, subulate, *c.* 0.5 mm long; basal appendages reddish, aciculate, *c.* 1 mm long. *Gynostemium* 4.7–5.5 mm long, anthers maroon, vertical-paired, abaxial surface of anthers glabrous, pollen white; stigma orbicular, *c.* 0.3 mm diam., cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 15)

Other specimens examined. WESTERN AUSTRALIA: plains south of Stirling Range towards Kendenup, Oct. 1932, *R. Erickson s.n.* [Topotype label in J.H. Willis' handwriting] (NSW); on Knights Rd, Porongurup, 34° 36' 05" S, 117° 52' 17" E, 20 Oct. 1997, *A. Lowrie* 1949 (PERTH); on Woolgenilup Rd, Woolgenilup, 34° 33' 39" S, 117° 57' 15" E, 20 Oct. 1997, *A. Lowrie* 1960 [voucher for chromosome count of n = 15] (PERTH).

Distribution. Known only from the plains between the Porongurup Range and Stirling Range.

Habitat. Grows on loamy soils in low shrubland.

Flowering period. October to December.

Chromosome number. n = 15, S.H. James & A. Lowrie (previously unpublished data).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. Now only known from two locations, Wooljinilup and Porongurup, both of which are currently not under threat. The imprecise location for the type 'plains between Kendenup and Mondurup Peak in the Stirling Range' has mostly been cleared for agriculture and attempted relocation of the species in this region by one of us (A.L.) has been unsuccessful.

Etymology. The epithet *diplectroglossum* is from the Greek *dis* – double, *plectron* – cock's spur and glossa – tongue, in reference to the long basal appendages and apical point of the labellum.

Affinities. Its closest relatives are *Stylidium repens* and *S. pingrupense*. *S. repens* differs in having many uni-flowered inflorescences per apical rosette and all corolla lobes of a different length. *S. pingrupense* differs in having leaves with entire hyaline margin and throat appendages 8.

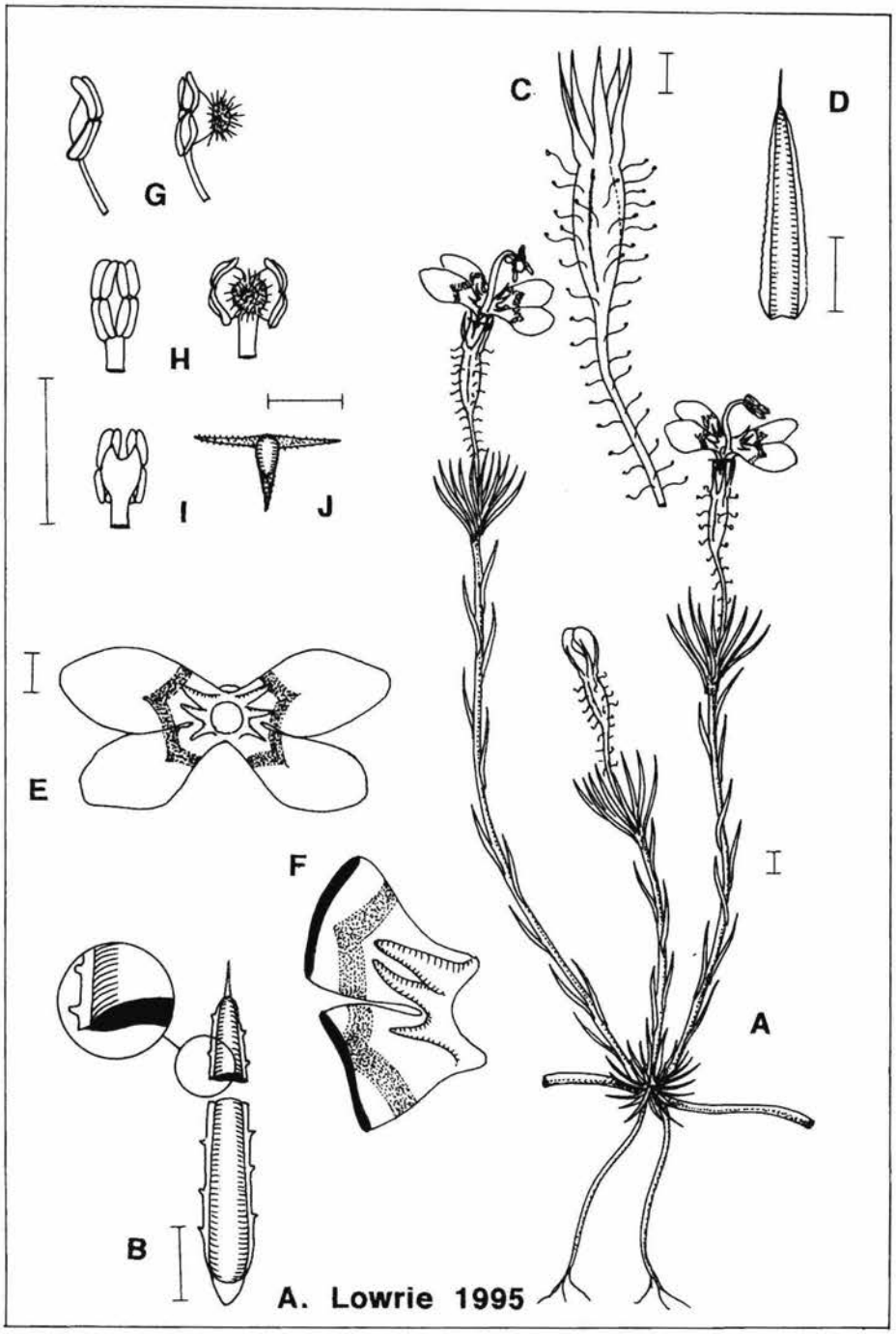

Figure 15. *Stylidium diplectroglossum* A– habit of flowering plant; B – leaf; C – hypanthium; D – sepal; E – corolla; F – throat appendages, enlarged; G – lateral view of gynostemium tip (with stigma at right); H – face view of gynostemium tip (with stigma grown out, right); I – back of gynostemium; J – labellum. Scale bar = 1 mm. Drawn from cultivated material, origin Knights Rd, Porongurup.

Notes. In live specimens of *Stylidium diplectroglossum* the compact apical leafy rosette can be seen to form an orderly 5-angled arrangement. That is, at each angle the leaves are precisely stacked upon each other with the oldest leaf on the outside and the youngest near the centre. This distinctive 5-angled arrangement is also found on the central juvenile leaf and stipule bud of *Drosera androsacea* Diels which occurs with *S. diplectroglossum*.

16. Stylidium flagellum Lowrie, Burbidge & Kenneally, *sp. nov.*

Stylidio repenti R. Br. affinis sed habito erecto vel semi-erecto ad 35 cm alto, foliis anguste lanceolatis, 5–9 mm longis, c. 1 mm latis, sepalis sub anthesi hypanthio longioribus, et acumine labelli minuto differt.

Typus: on Banovich Rd, off Jurien Bay road, west of Brand Highway, Western Australia, 30° 13' S, 115° 12' E, 26 April 1992, *A. Lowrie* 578 (*holo:* PERTH 05091276; *iso:* MEL).

Creeping perennial *herb*, elevated above the soil on long stilt roots and branched a little so as to form a small erect clump, stems between rosette nodes erect and semi-erect (not horizontal, spreading and mat-forming as in *Stylidium repens*). *Stems* between the rosette nodes leafless, flowering stems 5–15 cm long, arising in groups of 2 to 5 from the rosette node junctions, leaves absent along their length and terminating in a crowded spreading apical leafy rosette. *Leaves* narrowly lanceolate, 5–9 mm long, 0.8–1 mm wide at the base, apical mucro sharp, translucent white, 0.3–0.5 mm long, basal spur translucent white 0.3–0.5 mm long, hyaline margins white, irregularly serrate. *Inflorescence* uni-flowered, each apical rosette bearing up to 10 flowers, each produced in succession, hypanthium held above the terminal leafy rosette, peduncles red, 10–15 mm long, glandular; floral bracts and bracteoles hidden in the apical leafy rosette at the base of the peduncle, translucent white, scale-like, subulate, *c.* 2.5 mm long. *Hypanthium* obovate at anthesis, 1.5–2.5 mm long, 1–1.2 mm wide, glandular. *Sepals* 5, 3–3.5 mm long, forming 2-major lobes, one major lobe ovate, joined for two-thirds of its length from the base then divided into 3 subulate segments at the apex, the other major lobe joined for a third of its length from the base then divided into 2 subulate segments at the apex, each major lobe including the 5 divided segments bearing a marginal translucent white hyaline, glandular in the lower portions. *Corolla* white to various shades of pink with reddish purple marks near the base of the lobes, abaxial surface pinkish, glandular in the mid-vein area, laterally paired; each anterior and posterior petal on either side of the labellum of a similar length but each of the 4 petals always of a different width, anterior lobes ovate-elliptic, apex truncate and slightly erose, one lobe *c.* 5.5 mm long, *c.* 2.5 mm wide, the other lobe *c.* 4 mm long, 2.3 mm wide, posterior lobes obovate, apex truncate and slightly erose, one lobe *c.* 5.5 mm long, *c.* 2 mm wide, the other lobe *c.* 4 mm long, *c.* 1.5 mm wide. *Throat* appendages 6, white to various shades of pink, subulate. *Labellum* boss pale green, ovate, *c.* 0.8 mm long, *c.* 0.5 mm wide; apical point red, *c.* 0.2 mm long. *Gynostemium* linear-tapering, 6–6.5 mm long, anthers pale yellow, vertically paired, abaxial surface with translucent white moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 0.6 mm diam., cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 16)

Other specimens examined. WESTERN AUSTRALIA: 0.5 km N of Hill River bridge, 30 Apr. 1970, *T.E.H. Aplin* 3136 (PERTH); 200 m N of turnoff to Cockleshell Gully from Jurien Bay road, 9 May 1974, *A.H. Burbidge* 1531 (PERTH); Cockleshell Gully, 20 Apr. 1975, *A.H. Burbidge* 1852 (PERTH); 2.8 km S of Mimegarra Road on Gingin–Eneabba road, 30 Apr. 1975, *A.H. Burbidge* 1859 [voucher for chromosome count of n = 15 (2 sheets)] (PERTH); about 15 km SW of Eneabba, 16 June 1975, *A.H. Burbidge* 1909 (PERTH); 200 m N of Hill River, on Brand Highway, 8 July 1975, *A.H. Burbidge* 1932A (PERTH); 7 miles [11.2 km] SE of Badgingarra, 23 Apr. 1976, *A.H. Burbidge* 2296 (PERTH);

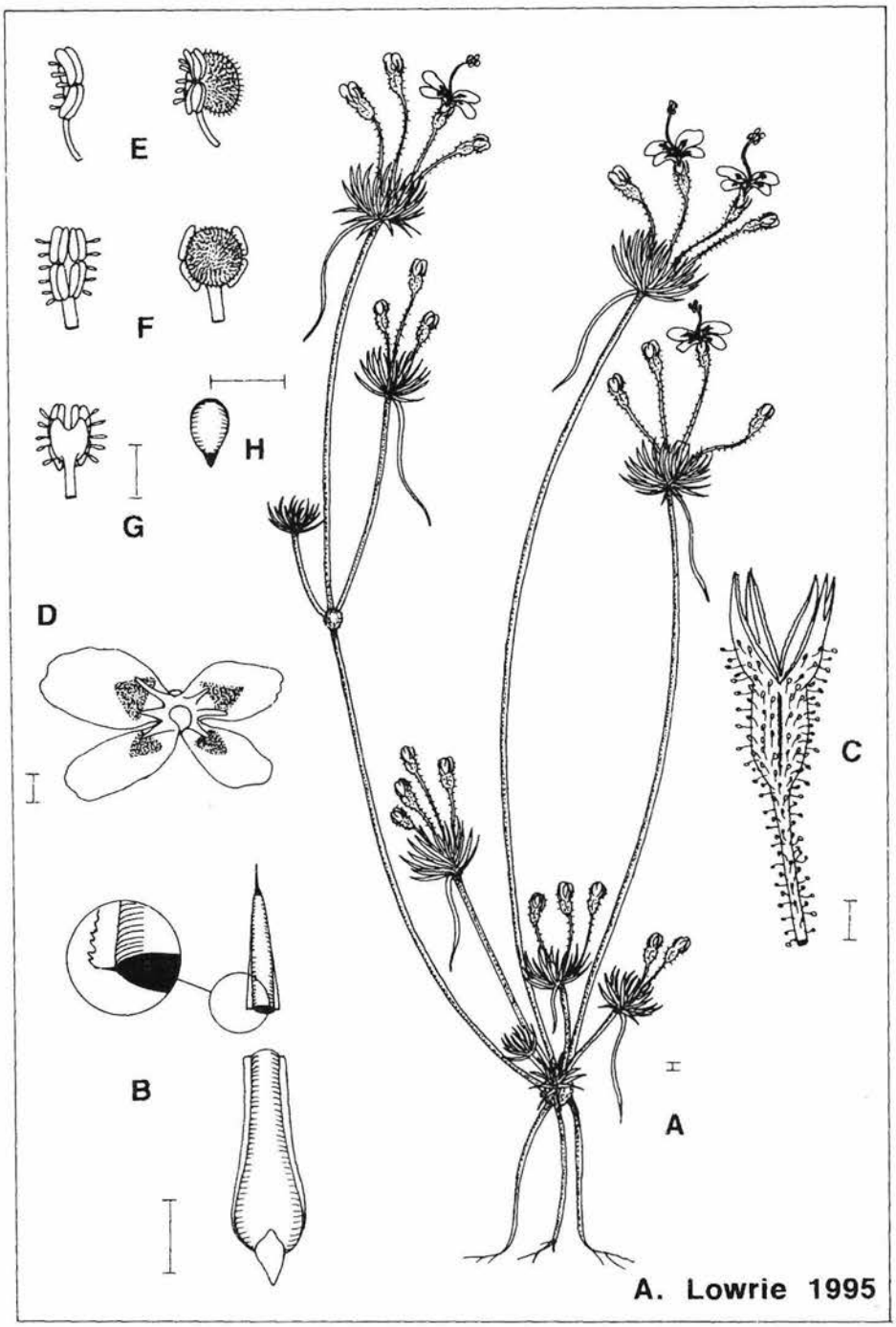

Figure 16. *Stylidium flagellum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 578 (PERTH).

junction Wongonderrah Rd & Brand Highway, 11 June 1988, *B.J. Keighery* 148 (PERTH); 15 km N of Cataby on Brand Highway, 26 Apr. 1992, *A. Lowrie* 577 (PERTH); Banovich Rd, Mt Lesueur, 12 May 1993, *A. Lowrie* 706 (PERTH).

Distribution. Widespread in the Badgingarra, Eneabba and Mt Lesueur region.

Habitat. Grows in white silica sand over laterite in low heathland, usually high in the landscape.

Flowering period. April to July.

Chromosome number. n = 15 (Burbidge & James 1991).

Conservation status. A common species and currently not under threat.

Etymology. The epithet, from the Latin *flagellum* – a naked whip-like runner, refers to the long, erect and semi-erect leafless stems between the rosette nodes and the leafy apical rosettes.

Affinities. Its closest relative is *Stylidium repens* which differs in having a horizontal, spreading and low to the ground growth habit; lanceolate leaves, 3–5 mm long; sepals shorter than the hypanthium at anthesis; and labellum with apical point almost as long as the boss.

Notes. Stylidium flagellum coexists with *S. repens* (*A. Lowrie* 578A) at the type location, apparently without hybridizing. Both species were flowering at the time of collection. *S. flagellum* only flowers in autumn and winter whereas *S. repens* can flower any month of the year and individual plants may flower twice each year (Erickson 1950).

17. Stylidium pingrupense Lowrie, Burbidge and Kenneally, *sp. nov.*

Stylidio repenti R. Br. affinis sed inflorescentia solitaria uni-flor aper rosettam foliosam terminalem, hypanthio glabro, lobis corollae in paribus equalibus, appendicibus faucis 8, et labello appendicibus basalibus ornato differt.

Typus: on road to Borden, *c.* 5 km from Hassell Highway, 34° 20' S, 118° 45' E, Western Australia, 20 October 1993, *A. Lowrie* 818 (*holo:* PERTH 05091357; *iso:* MEL).

Creeping perennial *herb*; elevated above the soil on stilt roots 1–1.5 cm long, irregularly branched to form a tangled matted network up to 100 cm diameter. *Stems* between the rosette nodes leafless 3–6 cm long, flowering stems 3–7 cm long arising from the rosette node junctions which often still retain a tuft of leaves, bearing persistent appressed leaves along their length and terminating in compact apical leafy rosette. *Leaves* linear, 8–10 mm long, 0.6–1 mm wide near the base, apical mucro sharp, translucent white, 0.2–0.4 mm long, basal spur translucent white, 0.3–0.5 m long, hyaline margins translucent white, entire. *Inflorescence* solitary, uni-flowered, hypanthium mostly held above the terminal leafy rosette, peduncle 7–22 mm long, glandular; floral bracts and bracteoles absent. *Hypanthium* oblong at anthesis, 3.5–5.5 mm long, 0.7–1.2 mm wide, glabrous. *Sepals* 5, all free to the base, narrowly lanceolate, margins and sharp apical mucro translucent white, 2–2.5 mm long, glabrous. *Corolla* white or pink with reddish marks near the base of the lobes, abaxial surface a little glandular near the base, laterally paired; anterior lobes elliptic, *c.* 7 mm long, *c.* 3.5 mm wide, posterior lobes obovate, *c.* 7 mm long, *c.* 3 mm wide. *Throat* appendages 8, subulate, papillose, each opposite

pair of a different length in the range of 0.6–1.3 mm long. *Labellum* boss ovate, *c.* 0.5 mm long, *c.* 0.4 mm wide; apical point subulate, *c.* 1 mm long, glabrous; basal appendages aciculate, *c.* 0.8 mm long, papillose. *Gynostemium* 6–6.5 mm long, anthers vertical-paired, abaxial surface glabrous; stigma, *c.* 0.5 m diam., cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 17)

Other specimens examined. WESTERN AUSTRALIA: 11.7 km E of road junction in Ongerup, 30 Oct. 1975, *A.H. Burbidge* 2251 (PERTH); Toompup Rd, 11.8 km from Laurier Rd (i.e. NE of Stirling Range), 19 Oct. 1976, *A.H. Burbidge* 2355 (PERTH); S of Gairdner River, 18 Aug. 1977, *A.H. Burbidge s.n.* (PERTH); 2 miles [3.2 km] E of Bremer Bay on track to West Mt Barren, Aug. 1975, *D.J. Coates s.n.* (PERTH); TV mast & Trig Hill, W of Jerramungup, Highway 1, 11 Oct. 1992, *E.J. Croxford* 6585 (ALBANY); W of Fitzgerald River, on road to Bremer Bay from Fitzgerald River, 31 Aug. 1975, *D.J. Coates s.n.* (2 sheets) (PERTH); W of vermin fence, Ravensthorpe Road, Sep. 1960, *S.H. James* 60.9/1.1 [voucher for chromosome count of n = 30] (PERTH); N of the Stirling Range, on Borden Road, 2.9 miles S of Cranbrook turnoff, Oct.1971, *S.H. James* 71.10/91 (PERTH); *c.* 2 km S of Tieline Rd, *c.* 13 km NW of Ongerup, 23 Sep. 1989, *A. Lowrie s.n.* (PERTH); on Borden–Bremer Bay road, *c.* 3.9 km SE of Mungerup South Rd, *c.* 15 km SE of Borden, 20 Oct. 1993, *A. Lowrie* 822 (PERTH).

Distribution. Known from the region bordered by Bremer Bay, Borden, Ongerup, Pingrup and the Fitzgerald River.

Habitat. Grows in rocky loam, white clay soil, sandy laterite gravel or white sand in shrublands, usually with low mallee (*Eucalyptus* species).

Flowering period. September, October.

Chromosome number. n = 30 (Burbidge & James 1991).

Conservation status. A common species at known locations and currently not under threat.

Etymology. The epithet *pingrupense* is in reference to the area south of Pingrup where one of us (A. L.) first became aware of the species in the field.

Affinities. Its closest relative is *Stylidium diplectroglossum* which differs in having leaves with irregularly serrate hyaline margins, a glandular hypanthium, and 6 throat appendages.

It may be confused with *Stylidium repens* which differs in having mostly more than one 1-flowered peduncles per terminal leafy rosette, a glandular hypanthium, all corolla lobes of a different length, 6 throat appendages, 2 of which are minute, and no basal appendages on the labellum.

18. Stylidium repens R. Br. (Brown 1810: 571). – *Candollea repens* (R. Br.) F. Muell. (Mueller 1883: 86). *Type:* '(M.) v.v.' [King George Sound, Western Australia, December 1801, *R. Brown* 2637] (*lecto:* BM, here designated; *isolecto:* E, K, MEL 672618, NSW).

Stylidium radicans Sond. (Sonder 1845: 381). *Type:* 'In arenosis subumbrosis prope oppidulum Perth', [Western Australia], 16 June 1839, *Preiss* 2300 (*lecto:* MEL 672627, here designated; *isolecto:* MEL 672626 and 672628, LD [left side of sheet]; same locality and date, *Preiss* 2299 (*syn:* MEL 672625, 672629, 672628 [in clear packet], W [2 sheets], LD [right side of sheet]); King George's Sound, [Western Australia], *Hügel,* (*syn:* W); Swan-River. [Western Australia], *Capt. Mangles* (*syn: n.v.*).

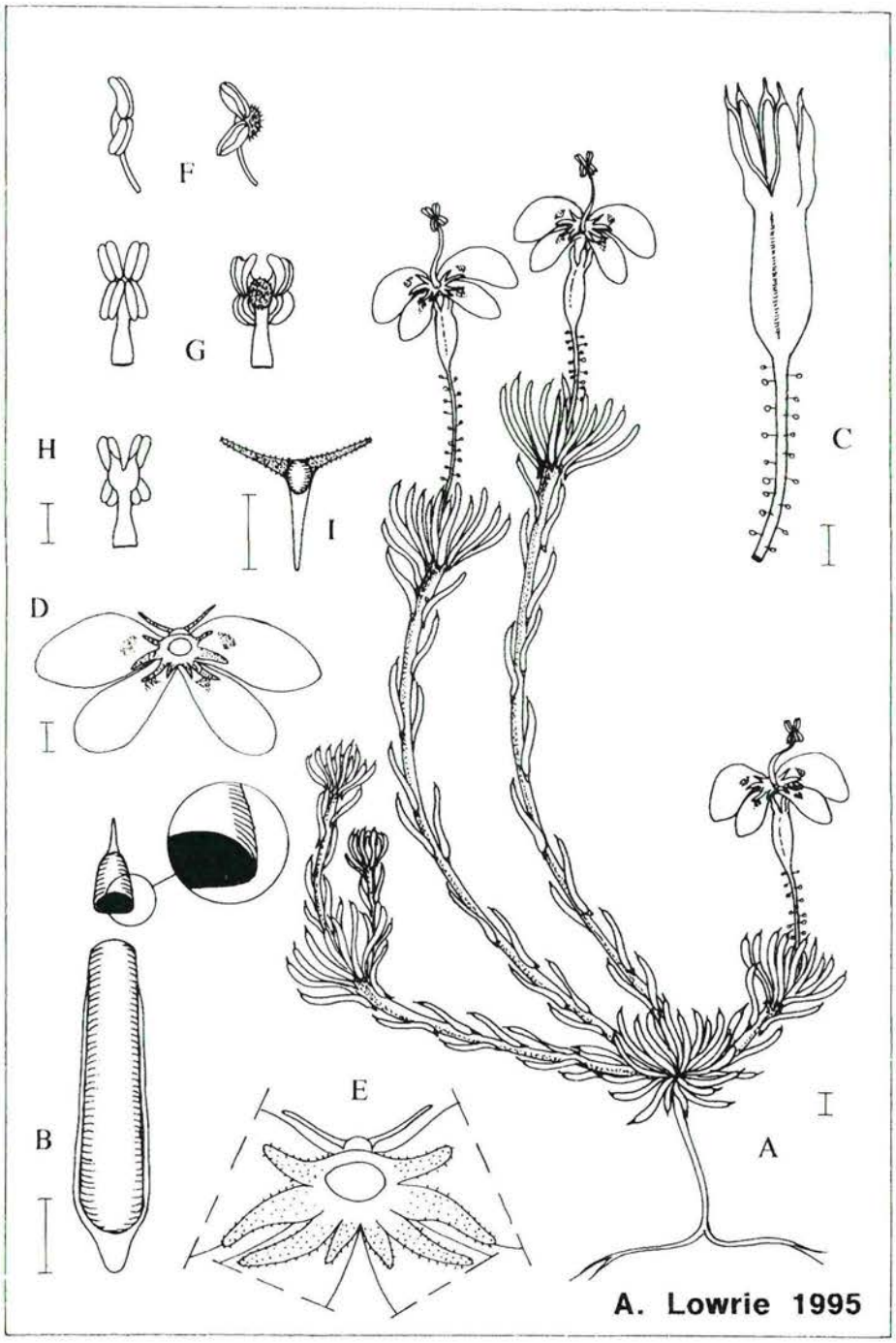

Figure 17. *Stylidium pingrupense* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie s.n.* 23 Sep. 1989 (PERTH).

Illustrations. Erickson (1958) colour plate 16, figure 3; page 72, plate 17, figures 1–8. Grieve & Blackall (1982) page 762, n. 93. Mildbraed (1908) page 49, figure 15, A–E.

Small creeping perennial *herb*; elevated above the soil on short stilt roots and irregularly branched to form a tangled matted network up to *c.* 200 cm diameter. *Stems* between the rosette nodes leafless, flowering stems 1–8 cm long arising from the rosette node junctions, often bearing persistent appressed leaves along their length and terminating in compact apical leafy rosettes. *Leaves* lanceolate, 3–6 mm long, 0.6–0.8 mm wide near the base, apical mucro sharp, translucent white 0.2–0.3 mm long, basal spur translucent white 0.4–0.8 mm long, hyaline margins white, irregularly minutely serrate, gradually reducing in width from the base towards the apex. *Inflorescences* 1–3 but mostly more than 1 if favourable growing conditions persist, each peduncle uni-flowered, 10–20 mm long, densely glandular; floral bracts and bracteoles subulate, hyaline margins translucent-white, minutely irregularly serrate, *c.* 1.5 mm long, hidden within the apical leafy rosettes. *Hypanthium* ellipsoid at anthesis, 1.7–3 mm long, 0.8–1.5 mm wide, 8-shaped in section, densely glandular. *Sepals* 5, fused almost to the apex, 1.3–1.7 mm long, arranged in groups of 2 and 3 to form 2 lips, hyaline margins translucent white, minutely irregularly serrate, glabrous. *Corolla* white with reddish marks near the base of the lobes, abaxial surface white, pinkish red along the middle, glandular, laterally paired, all lobes of a different length, anterior lobes obovate-elliptic, *c.* 5 mm long, *c.* 2.5 mm wide, and *c.* 3.5 mm long, *c.* 2 mm wide, the larger of the posterior lobes elliptic, *c.* 4.5 mm long, *c.* 1.5 mm wide, the smaller lobe obovate, *c.* 3 mm long, *c.* 1.5 mm wide. *Throat appendages* 6, white, papillose, larger 4 in 2 pairs, each pair forming a boomerang-shape, 1 pair *c.* 1 mm long, the other *c.* 0.5 mm long, remaining 2 appendages minute, conical. *Labellum* attached below the sinus, boss narrowly ovate, *c.* 0.6 mm long, *c.* 0.3 mm wide; apical point subulate in outline, *c.* 0.5 mm long. *Gynostemium* linear-tapering 4.5–6 mm long, anthers black, vertically paired, abaxial surface bearing minute transparent white, clavate, moniliform hairs along the margins, pollen white; stigma elliptic, *c.* 0.8 mm long, *c.* 0.5 mm wide, cushion-shaped. *Capsule* ellipsoid, 2.5–3 mm long, 1.2–1.5 wide. *Seeds* brown, ovoid, 0.45–0.5 mm long, 0.45–0.5 mm diam., minutely papillate. (Figure 18)

Other specimens examined. WESTERN AUSTRALIA: *c.* 25 miles [40 km] W of Mullewa on road to Geraldton, 7 May 1974, *A.H. Burbidge* 1503 (2 sheets) (PERTH); 370 mile [592 km] peg, N of Northampton, 7 May 1974, *A.H. Burbidge* 1511 (PERTH); Hale Rd, Forrestfield, 22 June 1974, *A.H. Burbidge* 1582 (PERTH); 13 km S of Grass Patch, 9 Oct.1974, *A. H. Burbidge* 1733 (PERTH); Lucky Bay, E of Esperance, 16 May 1975, *A.H. Burbidge* 1890 (PERTH); Darling Scarp, near top of Crystal Brook Rd, 4 July 1975, *A.H. Burbidge* 1923 (PERTH); 18 km N of Eneabba, 16 June 1975, *A.H. Burbidge* 1910 (PERTH); 13 km S of Mt Ridley (approx. NE of Esperance), 26 Oct.1975, *A.H. Burbidge* 2215 (PERTH); *c.* 34 km W of Esperance at Dalyup West, 30 Oct.1975, *A.H. Burbidge* 2239 (PERTH); N of Gnowangerup, turnoff to Pingrup, 28 Aug. 1975, *D.J. Coates* (PERTH); Youngs Siding, *c.* 1951, *R. Erickson s.n.* (PERTH); Scott River sandplain, 18 Apr. 1976, *S.D. Hopper s.n.* (PERTH); Mt Yokine, near TV studios, Oct.1965, *S.H. James* 65.10/60 [voucher for chromosome count of n = 15 (2 sheets)] (PERTH); Watheroo Rd, 1 km E of Brand Highway, 27 Oct.1989, *A. Lowrie s.n.* (PERTH); turn off to Hellfire Bay, Cape Le Grande, 8 Dec. 1990, *A. Lowrie* 228 B (PERTH); Boyanup Rd West, 3.6 km W of the junction of Railway and Trigwell roads, N of Capel, 1 Nov. 1991, *A. Lowrie* 461 (PERTH); *c.* 1 km from ocean, Castle Rock Bay, Meelup, S of Busselton, 2 Nov. 1991, *A. Lowrie* 480 (PERTH); Marine Drive, S face of Mt Clarence, Albany, 27 Nov. 1991, *A. Lowrie* 543 (PERTH); Banovich Rd off Jurien Bay road, W of Brand Highway, 26 Apr. 1992, *A. Lowrie* 578A (PERTH); 3.2 km N of Wongan Hills, 13 Sep. 1996, *A. Lowrie* 1544 (PERTH); Camp Quairanup, near Albany, 8 Jan. 1977, *B.L. Rye* (PERTH).

Distribution. Widespread throughout the south-west region of Western Australia from Kalbarri in the north to Esperance in the south-east.

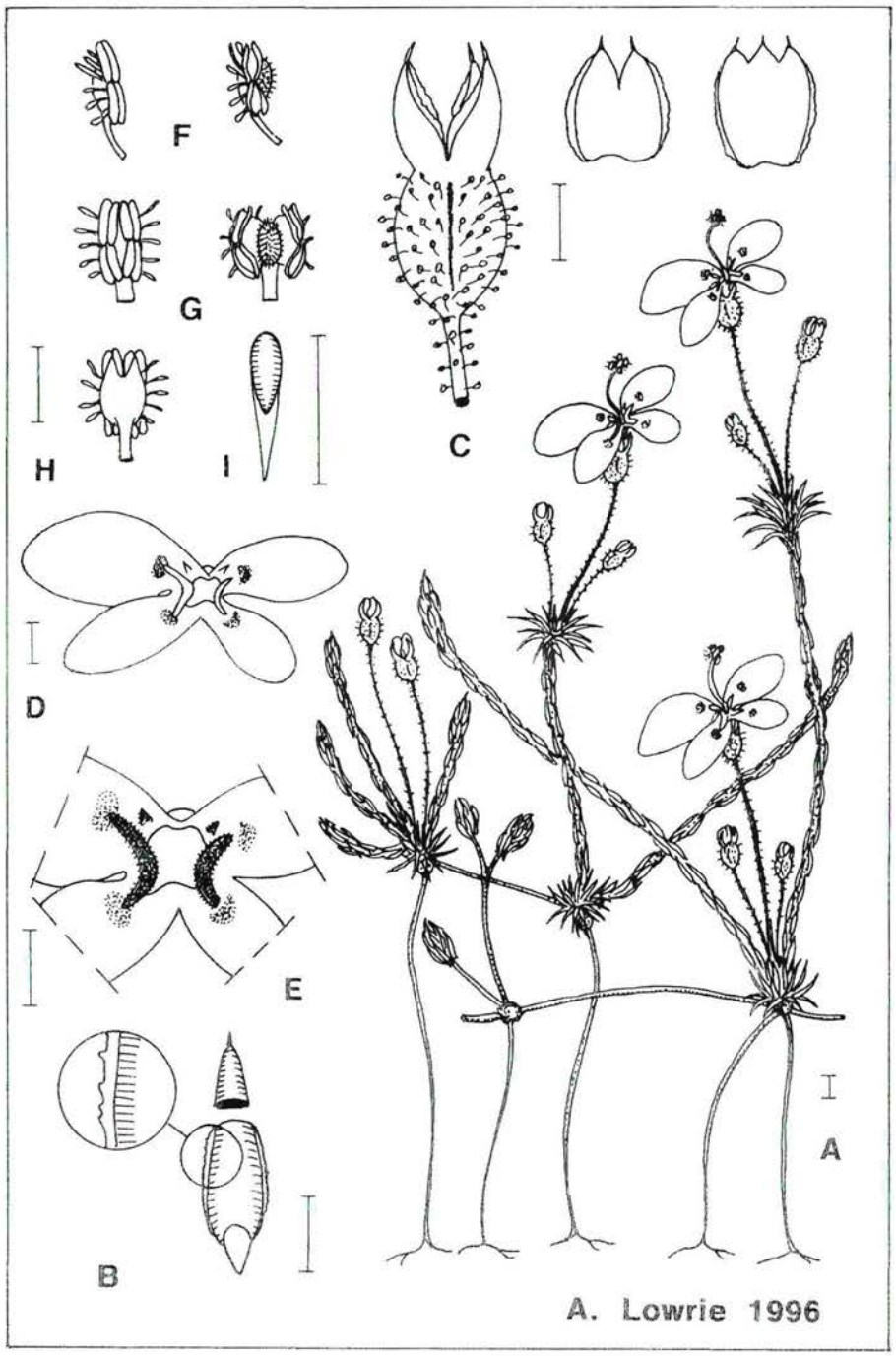

Figure 18. *Stylidium repens* A – habit of flowering plant; B – leaf; C – hypanthium with illustration of the 2 & 3 fused sepals lips right; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 1544 (PERTH).

Habitat. Grows in white, grey or yellow sand in open forest, swamp margins and heathland.

Flowering period. Any month of the year. Individual plants may flower twice in the same year (Erickson 1950).

Chromosome number. n = 15 (Burbidge & James 1991).

Conservation status. A common and widespread species and currently not under threat.

Etymology. The epithet *repens* – prostrate and crawling, is from the Latin and refers to the creeping growth habit of the species.

Affinities. Its closest relative is *Stylidium flagellum* which differs by having an erect or semi-erect growth habit up to 35 cm tall, narrowly lanceolate leaves 5–9 mm long, sepals longer than the hypanthium at anthesis, and a labellum with a very small apical point.

Stylidium repens may be confused with *S. pingrupense* and *S. diplectroglossum* which differ in having a solitary uni-flowered inflorescence per terminal leafy rosette, corolla lobes in equal length pairs, and a labellum with basal appendages.

Notes. We have selected the sheet housed at BM as the lectotype for *Stylidium repens,* because it is complete material of a Robert Brown collection. The MEL 672627 sheet has been selected for the lectotype of *S. radicans* because the sheet has Herb. W. Sonder label and has also been previously examined [top left corner of label folded forward and bearing the letter B] by Bentham for his "Flora Australiensis".

A variant with a twisted column, unusually shaped petals and a chromosome number 2n = 30 has been found on the Coorow–Greenhead Road. It may prove to be a separate species.

19. Stylidium pseudosacculatum Lowrie, Burbidge & Kenneally, *sp. nov.*

Stylidio sacculato R. Erickson & J.H. Willis affinis sed pedicellis ultra rosettam foliosam terminalem extensis, appendicibus faucis 6, labello appendicibus basalibus ornato differt.

Typus: on Great Eastern Highway 3.2 km west of Tammin, Western Australia, 31° 38' S, 117° 29' E, 16 October 1990, *A. Lowrie* 112 (*holo:* PERTH 5091284; *iso:* MEL).

Illustrations. Carlquist (1969) page 33, figure 34 [black & white photograph]. Grieve & Blackall (1982) page 762, n. 93b.

Creeping perennial *herb;* elevated above the soil on stilt roots 2–3 cm long and irregularly branched so as to form a tangled matted network up to 45 cm diam. *Stems* between the rosette nodes leafless 4.5–6.5 cm long, flowering stems 2–12 cm long arising as well as spreading from the rosette node junctions, bearing persistent appressed leaves along their length and terminating in compact apical leafy rosette. *Leaves* lanceolate-lageniform, 3.5–5 mm long, 0.8–1 mm wide near the base, 0.3–0.4 mm wide near the apex, apical mucro sharp, translucent white, 0.3–0.4 mm long, basal spur translucent white, 0.4–0.8 mm long, hyaline margins translucent white, serrulate. *Inflorescence* solitary, uni-flowered, hypanthium held on peduncle 3–5 mm above the terminal leafy rosette,

peduncle pilose within the terminal leafy rosette, densely glandular above; without visible floral bracts and bracteoles. *Hypanthium* oblong at anthesis, 2.7–3.5 mm long, 1–1.2 mm wide, sparsely glandular or pilose. *Sepals* 5, all free to the base, narrowly lanceolate, margins translucent white, 2–2.5 mm long, glabrous. *Corolla* white blushed pink with reddish marks near the base of the lobes, abaxial surface white, pinkish along the middle, shortly glandular all over, laterally paired, anterior lobes elliptic, *c.* 6 mm long, *c.* 2 mm wide, posterior lobes elliptic, *c.* 6 mm long, *c.* 2 mm wide. *Throat* green, appendages 6, white, subulate, 4 opposite, in pairs of *c.* 0.5 mm and *c.* 1 mm long at the base of the anterior petal lobes, 2 opposite, both *c.* 0.5 mm long at the base of the posterior lobes. *Labellum* boss green, ovate, *c.* 0.7 mm long, *c.* 0.5 mm wide; apical point reddish, triangular in outline, *c.* 1 mm long, margins glandular; basal appendages white, acicular, *c.* 1 mm long. *Gynostemium* strap-like, 5–5.5 mm long, hinged below the anthers, with a dilated cunabulum above the sensitive torosus, abaxial surface glabrous, anthers vertically paired, abaxial surface of anthers bearing a few small transparent white moniliform hairs; stigma round, *c.* 0.4 mm diam., cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 19)

Other specimens examined. WESTERN AUSTRALIA: on Great Eastern Highway, 3 km W of Tammin 3 Aug. 1974, *A.H. Burbidge* 1691 [voucher for chromosome count of n = c. 30] (PERTH); 12 miles [19.2 km] NW of Wickepin on road to Pingelly, 8 Oct. 1974, *A.H. Burbidge* 1720 (2 sheets) (PERTH); 2 miles [3.2 km] W of Tammin, 5 Oct. 1975, *A.H. Burbidge* 2132 (PERTH); 18.5 km W of Corrigin, 23 Oct. 1974, *A.H. Burbidge* 1770 (PERTH); 18 km from Wickepin on road to Pingelly, 25 Oct. 1974, *A.H. Burbidge* 1789, 1790, 1791 (2 sheets) (PERTH); 29.7 km W of Corrigin, near a parking bay, 6 Oct. 1976, *A.H. Burbidge* 2329A (PERTH); Charles Gardner Reserve, S of Tammin, 8 Nov., no year date, *A.H. Burbidge s.n.* (PERTH); 39 miles [62.4 km] E of Brookton on road to Corrigin, 8 Oct. 1967, *S. Carlquist* 3693 (PERTH); about 110 miles [176 km] E of Perth on Great Eastern Highway, Oct. 1972, *S.H. James* 72.10/2 (PERTH); 2 miles [3.2 km] W of Tammin, 9 Nov. 1974, *G.J. Keighery* 342 (PERTH); Wallaby Hills Reserve on Goldfields Rd, E of York, 12 Oct. 1991, *A. Lowrie* 391 (PERTH); 17 km W of Wickepin, 21 Oct. 1972, *E. Wittwer* 876 (PERTH).

Distribution. Known from scattered locations in the region bordered by Wickepin in the south; *c.* 120 km north-west to York; *c.* 80 km north-east to Tammin; *c.* 85 km south-east to Corrigin; and *c.* 60 km south-west back to Wickepin.

Habitat. Grows in white sandy soil over laterite or loamy sand amongst an alluvium of scattered granite rocks .

Flowering period. September, October.

Chromosome number. n = *c.* 30 (Burbidge & James 1991).

Conservation status. The type population west of Tammin, situated on the margins of a gravel pit and road material dump, is small and currently under threat. The taxon as a whole does not appear to be under threat.

Etymology. The epithet *pseudosacculatum* is from the Latin *pseudo* – false, in reference to this species not being *Stylidium sacculatum* and *saccatum* – pouched, in reference to the dilated gynostemium portion (now know as the cunabulum (Kenneally & Lowrie 1994b) situated immediately below the anthers where the anthers or stigma hinge forward to be cradled on the cunabulum while at rest in the set position.

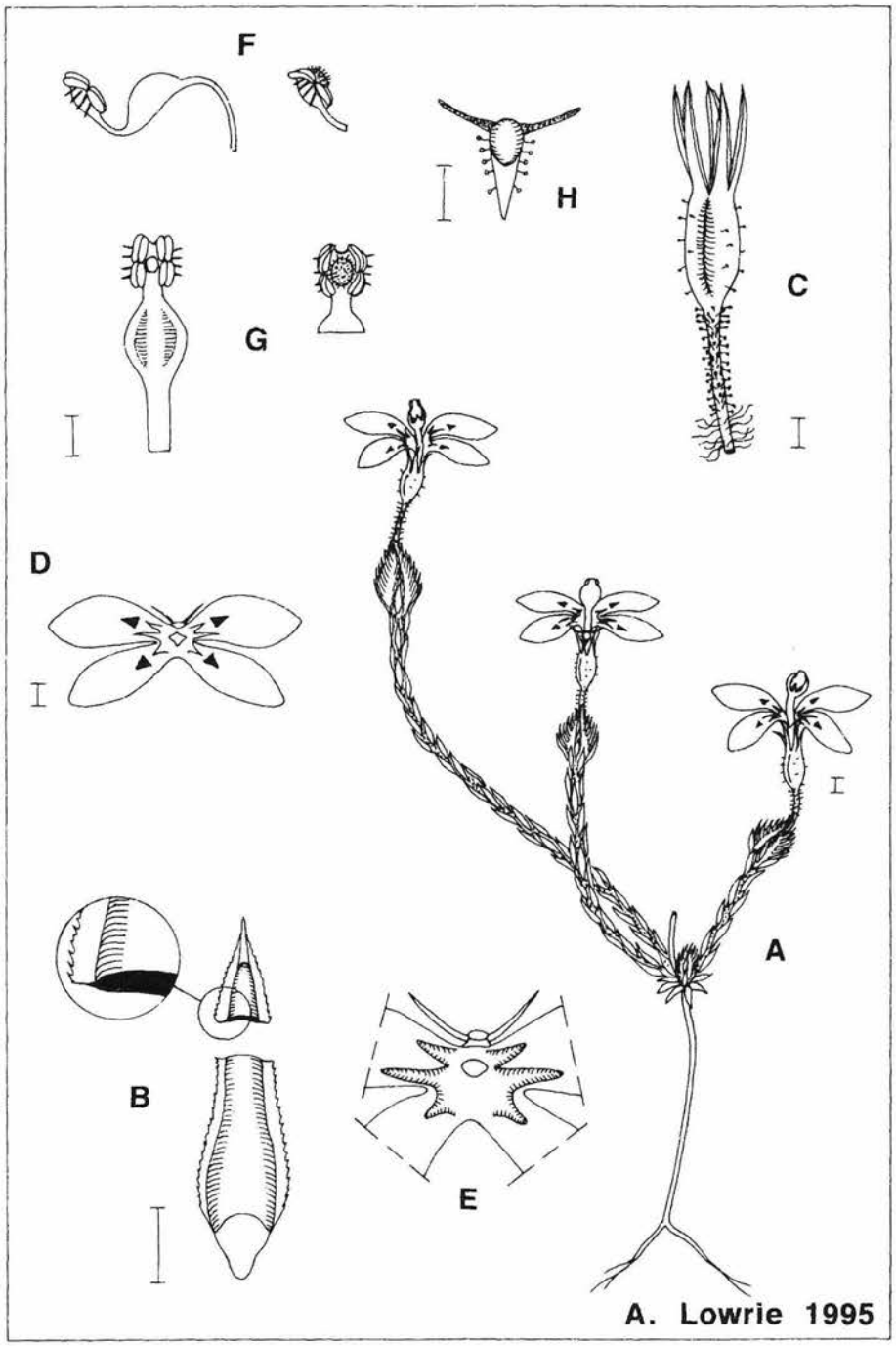

Figure 19. *Stylidium pseudosacculatum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium column (and gynostemium tip with stigma at right); G – face view of gynostemium column showing the dilated cunabulum below the anthers (and gynostemium tip with stigma grown out, right); H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 112 (PERTH).

Affinities. Its closest relative is *Stylidium sacculatum* which differs in having the peduncle and basal half of the hypanthium enclosed within the terminal leafy rosette, 4 throat appendages, no basal appendages on the labellum, and the abaxial surface of the gynostemium glandular.

Notes. Stylidium pseudosacculatum was previously treated as a hybrid between *S. sacculatum* and *S. diplectroglossum*, both of which have been treated as varieties of *S. repens*. The widened gynostemium cunabulum and the labellum with filiform basal appendages of this taxon were considered by Carlquist (1969) to be characters probably based on a few genes which may characterize some populations and not others.

Stylidium pseudosacculatum is not a hybrid. It is known to coexist with the widespread and common *S. repens* but never with *S. sacculatum*, which occurs north of its range. *S. pseudosacculatum* is consistent in its major morphological characters, although its inflorescence indumentum is variable. For example specimens from the type location have a sparsely glandular hypanthium and those from the Wallaby Hills district have a pilose hypanthium.

20. Stylidium sacculatum R. Erickson & J.H. Willis (Erickson & Willis 1956: 13). – *S. repens* var. *sacculatum* (R. Erickson & J.H. Willis) Carlquist (Carlquist 1969: 32). *Type:* Piawaning, Western Australia, 7 October 1952, *R. Erickson s.n.* (*holo:* MEL; *iso:* K, PERTH 1642065).

Illustrations. Carlquist (1969) page 33, figure 33 [black & white photograph]. Erickson (1958) colour plate 16, figure 1; page 72, plate 17, figures 17–25.

Creeping perennial *herb*; elevated above the soil on stilt roots 2.5–3 cm long and irregularly branched so as to form a tangled matted network up to 45 cm diam. *Stems* between the rosette nodes leafless 1.5–2 cm long, flowering stems 2–8 cm long arising from the rosette node junctions which often still retain a tuft of leaves, bearing persistent appressed leaves along their length and terminating in compact apical leafy rosette. *Leaves* lanceolate, 3–4 mm long, 0.6–0.9 mm wide near the base, 0.3–0.4 mm wide near the apex, apical mucro sharp, translucent white, 0.2–0.4 mm long, basal spur translucent white, 0.5–0.8 mm long, hyaline margins translucent white, serrate. *Inflorescence* solitary, uni-flowered, hypanthium mostly held for half its length within the terminal leafy rosette, peduncle *c.* 1 mm long, pilose; without visible floral bracts and bracteoles. *Hypanthium* linear-oblong at anthesis, 6–7.5 mm long, 0.6–1 mm wide, finely glandular. *Sepals* 5, all free to the base, narrowly lanceolate, margins translucent white, 2.5–4 mm long, glabrous. *Corolla* white blushed pink with purple marks near the base of the lobes, abaxial surface white and finely glandular along the middle, laterally paired; anterior lobes obovate *c.* 6 mm long, *c.* 3 mm wide, posterior lobes obovate, *c.* 6 mm long, *c.* 3 mm wide. *Throat* appendages 4, white blushed pink, subulate, in opposite pairs at the base of the anterior petal lobes. *Labellum* boss ovate, *c.* 0.5 mm long, *c.* 0.5 mm wide; apical point triangular in outline, *c.* 0.5 mm long, margins glandular; basal appendages absent. *Gynostemium* strap-like, 5–6 mm long, hinged below the anthers, with a dilated cunabulum above the sensitive torosus, abaxial surface a little glandular, anthers yellow, vertically paired, abaxial surface bearing small transparent white moniliform hairs and a few glands, pollen white; stigma cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 20)

Other specimens examined. WESTERN AUSTRALIA: 13.9 km W of Wongan Hills on road to Calingiri, 20 Oct.1975, *A.H. Burbidge* 2183 [2 sheets] (PERTH); Bolgart, Oct.1949, *R. Erickson s.n.* (NSW); Bolgart 40 km N of Toodyay (NE of Perth), Oct. 1952, *R. Erickson s.n.* (PERTH); 10.6 miles [16.9 km] W of Wongan Hills on road to Calingiri, Oct.1973, *S.H. James* 73.10/24 (PERTH); on Bindoon–Moora road, 0.6 km S of Gillingarra, 20 Oct. 1989, *A. Lowrie s.n.* (PERTH); Calingiri township at turn off to cemetery on Calingiri–Wongan Hills road, 27 Oct. 1990, *A. Lowrie* 141(PERTH).

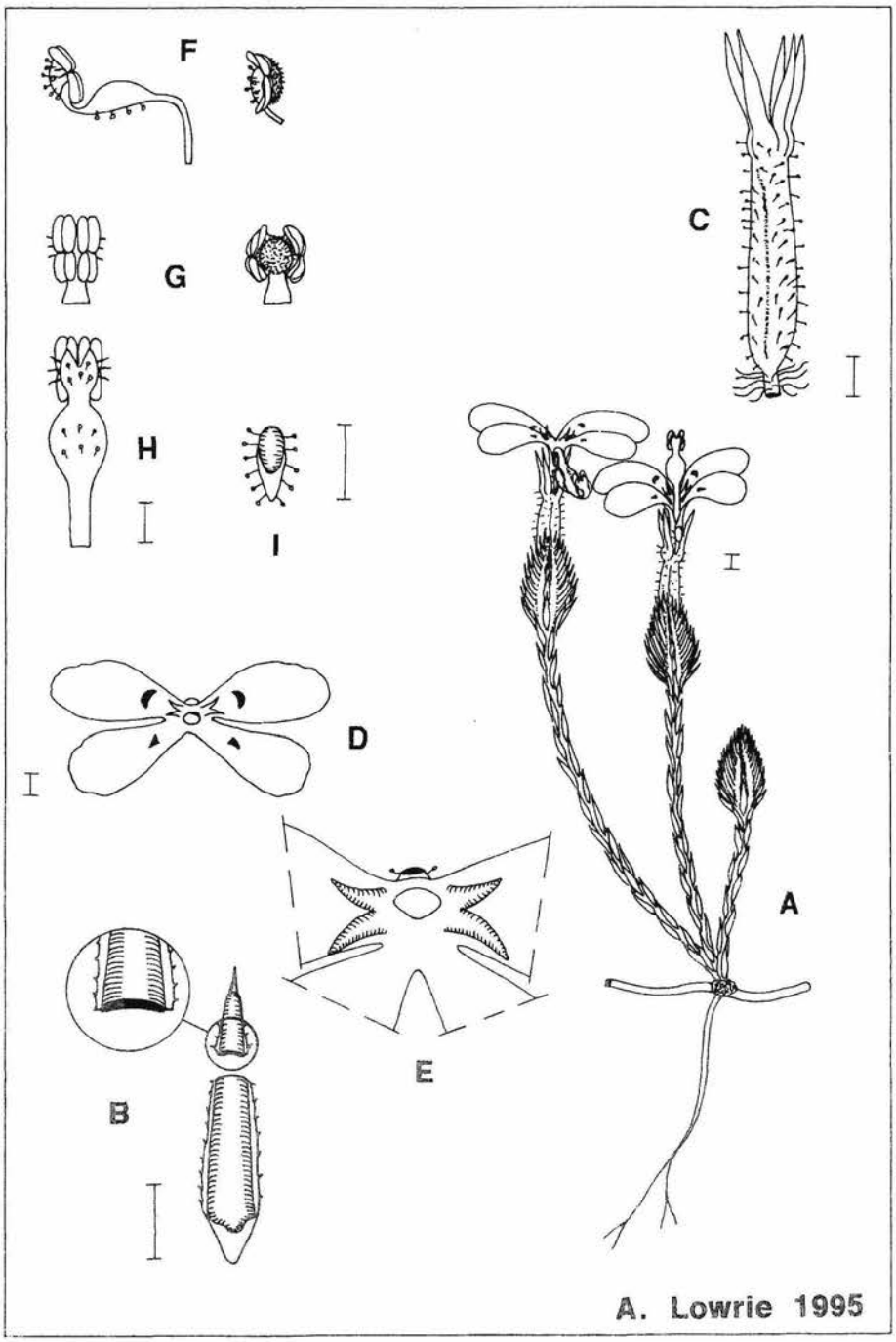

Figure 20. *Stylidium sacculatum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium column (and gynostemium tip with stigma at right); G – face view of gynostemium tip (with stigma grown out right); H – abaxial view of gynostemium column showing the dilated cunabulum below the anthers; I – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie* 141 (PERTH).

Distribution. Known from scattered locations in the region bordered by Bolgart in the south; *c.* 60 km north-west to Gillingarra; *c.* 40 km north-east to Piawaning; *c.* 35 km east to Wongan Hills; and *c.* 45 km south-west back to Bolgart.

Habitat. Grows in white sand.

Flowering period. October, November.

Chromosome number. Unknown.

Conservation status. Locally abundant and currently not under threat.

Etymology. The epithet *sacculatum* from the diminutive of the Latin *saccatum* – pouched in reference to the cunabulum immediately below the hinged portion at the base of anthers.

Affinities. Its closest relative is *Stylidium pseudosacculatum* which differs in having peduncles extending beyond the terminal leafy rosette, 6 throat appendages, a labellum with basal appendages, and the abaxial surface of the gynostemium glabrous.

21. Stylidium choreanthum R. Erickson & J.H. Willis (Erickson & Willis 1956: 171). *Type:* by the roadside along Great Eastern Highway, east of Southern Cross and probably between Boorabbin and No. 7 Pumping Station, Western Australia, October 1955, *Mrs J.A. Wollard s.n.* (*holo:* MEL; *iso:* K, PERTH).

Illustrations. Carlquist (1969) page 33, figure 35 [black & white photograph]. Erickson (1958) page 78, plate 19, figures 1–9. Grieve & Blackall (1982) page 760, n. 88; photograph, colour plate XI, top left.

Creeping perennial *herb*; elevated above the soil on short stilt roots and irregularly branched to form a tangled matted network up to 30 cm diam. *Stems* between the rosette nodes leafless, flowering stems 1–6 cm long arising from the internode junctions, bearing persistent appressed leaves along their length in the upper portions and terminating in compact apical leafy rosette. *Leaves* lanceolate, 2–3 mm long, 0.5–0.7 mm wide near the base, 0.3–0.4 mm wide near the apex, apical mucro translucent white, 0.2–0.3 mm long, sharp, basal spur translucent white 0.5–0.7 m long, hyaline margins white with irregular spike-like teeth gradually reducing in length from the base towards the apex. *Inflorescence* 2–5-flowered, 10–15 mm long, densely glandular; pedicels 1–2 mm long; floral bracts lanceolate, 1.5–2.5 mm long; bracteoles lanceolate, 1–1.5 mm long. *Hypanthium* obovoid at anthesis, 2–3 mm long, 0.9–1.3 mm wide, densely glandular. *Sepals* 5, all free to the base, ovate, margins and apex irregularly serrate, 3 sepals 1.5–2.5 mm long, 2 sepals 1–1.7 mm long, sparsely glandular. *Corolla* pale pink fading to white with reddish marks near the base of the lobes, abaxial surface pinkish and a little glandular along the middle, vertically paired; anterior lobes oblong-falcate, slightly tapering, *c.* 5 mm long, *c.* 1 mm wide, posterior lobes spathulate-flabellate, *c.* 5 mm long, *c.* 4.5 mm wide, flabellate portion *c.* 2.5 mm long, apex crenate. *Throat* appendages green, ridge-like on petal base folds. *Labellum* boss narrowly ovate, yellow, *c.* 0.5 mm long, *c.* 0.3 mm wide; apical point reddish, subulate in outline, *c.* 0.6 mm long. *Gynostemium* linear-tapering, 4.5–6 mm long, anthers grey, diagonally-paired, abaxial surface of anthers bearing minute transparent white moniliform hairs, pollen grey; stigma pale green, cushion-shaped. *Capsule* unknown. *Seeds* unknown. (Figure 21)

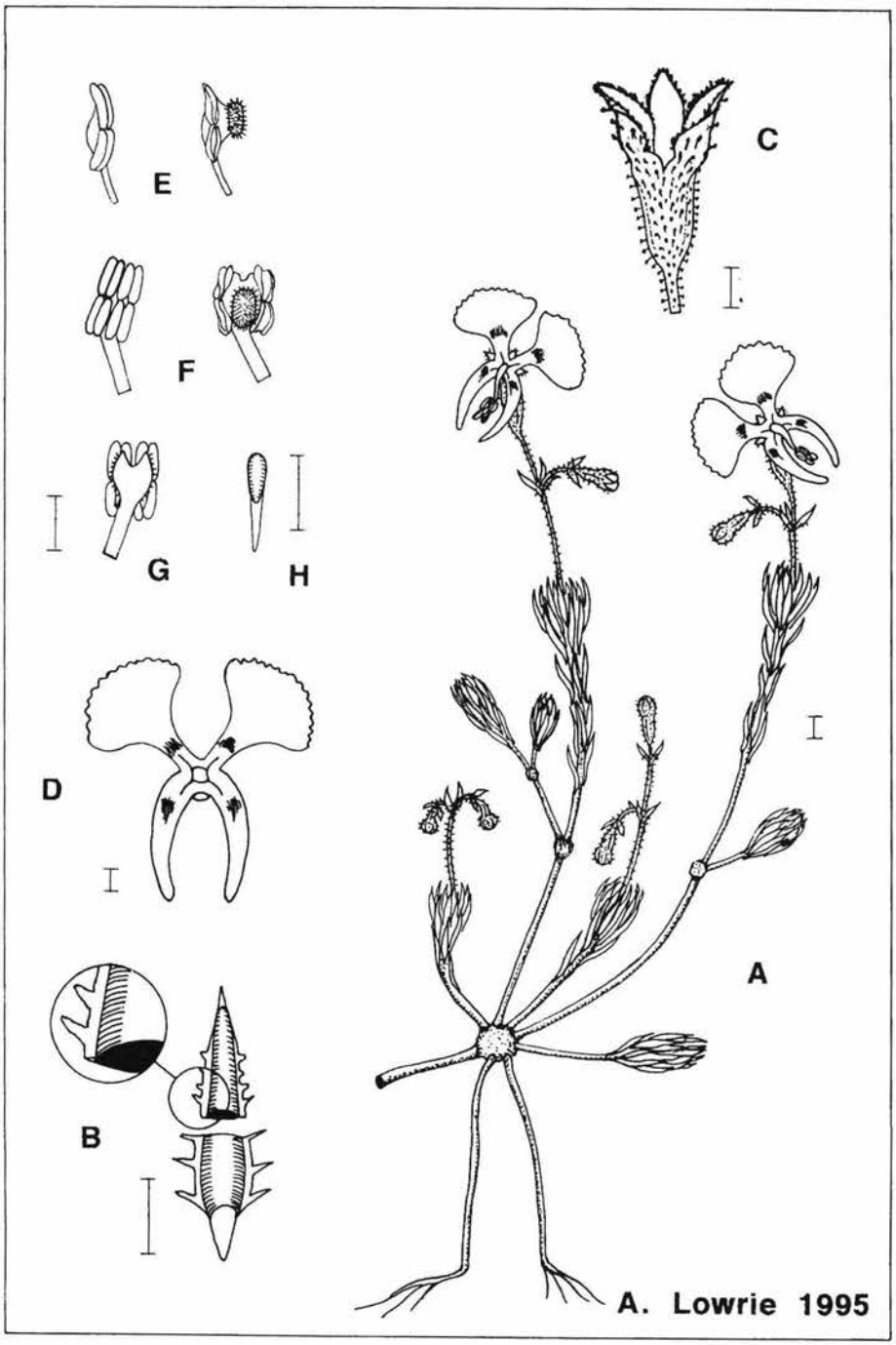

Figure 21. *Stylidium choreanthum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie s.n.* 1 Oct. 1989 (PERTH).

Other specimens examined. WESTERN AUSTRALIA: near Southern Cross, Sep. 1929, *W.E. Blackall s.n.* (PERTH); 9.7 km N of Southern Cross, 16 July 1975, *A.H. Burbidge* 1958 (PERTH); 2 km S of Queen Victoria Rock, 2 Sep. 1975, *A.H. Burbidge* 2048 (PERTH); 9.7 km N of Southern Cross, 6 Oct. 1977, *A.H. Burbidge* 2524 (2 sheets) (PERTH); 1/4 mile [0.4 km] E of Ghooli (E of Southern Cross), 7 Oct. 1967, *S. Carlquist* 3670 (PERTH, NSW [B & W photo of flowers attached to second sheet]); 27 miles [43.2 km] S of Coolgardie, 3 Oct. 1961, *J.H. Willis s.n.* (PERTH); 16.5 km NE of Bungalbin Hill, 2 Oct. 1991, *R.J. Cranfield* 8142 (PERTH); 10 km NNE of access track to hill E of Bungalbin Hill, 8 Sep. 1989, *R.J. Cranfield & P.J. Spencer* 7775 (PERTH); 54 km W of turn off from Norseman–Esperance Rd on track to Hyden, 11 Nov. 1994, *D.J. Edinger* 931 (PERTH); 49 miles [78.4 km] S of Bullfinch on road to Jackson, Oct. 1972, *S.H. James* 72.10/13 (PERTH); Yellowdine, Great Eastern Hwy, at turnoff to Marvel Loch, Oct. 1972, *S.H. James* 72.10/11 (2 sheets) (PERTH); 10 km N of Southern Cross on Southern Cross–Bullfinch road, 1 Oct. 1989, *A. Lowrie s.n.* (PERTH); Helena and Aurora Range, Hunt Range track 10.97–12.95 km NE of Y-junction located 6 km NE of Bungalbin Hill trig, 20 Oct. 1990, *F.H. & M.P. Mollemans* 3762 (PERTH); Condarnin Rock Nature Reserve, Yellowdine–Neroma road, 1.9 km S of the Great Eastern Highway and 20 km E of the road, 16 Oct. 1990, *F.H. & M.P. Mollemans* 3688 (PERTH);); 2 km W of Yacke Yackine dam *c.* 70 km NNW of Bullfinch, 3 Oct. 1981, *K. Newbey* 9287 (PERTH); 10 miles [16 km] S of Moorine Rock, 20 Oct. 1974, *L. Pitt* (PERTH); NE of Bungalbin on dogger's track 30° 17' 47" S, 119° 44' 31" E, 18 Sep. 1991, *B.H. Smith* 1531 (PERTH); 10 km N of Southern Cross along road to Bullfinch, 3 Oct. 1979, *J. Taylor* 1092, *M.D. Crisp & R. Jackson* (PERTH); Eyre Highway, 27 miles [43.2 km] S of Coolgardie, 3 Oct. 1961, *J.H. Willis s.n.* [note in Willis' hand 'The 2nd known locality for species (TYPE was from near Boorabin)'] (NSW).

Distribution. Known from scattered locations along a line from Bungalbin Hill in the north; *c.* 80 km south-west to Southern Cross; *c.* 180 km east to *c.* 30 km south of Coolgardie near Queen Victoria Rocks; and *c.* 150 km south to *c.* 30 km north-west of Peak Charles.

Habitat. Grows in yellow sand in dry shrublands.

Flowering period. September to November.

Chromosome number. n = 15 [18.5 km E of Southern Cross] (Burbidge & James 1991).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two.

Etymology. The epithet *choreanthum* from the Greek *choreia* – a choral dance and *anthos* – flower in reference to this species common name of Dancing Triggerplant.

Affinities. Stylidium choreanthum is distinguished from all other creeping triggerplants by having vertically paired corolla lobes.

Notes. Stylidium choreanthum commonly coexists with *S. arenicola* Carlquist, *S. limbatum* F. Muell. and *S. yilgarnense* E. Pritz. in the Southern Cross region.

22. Stylidium tepperianum (F. Muell.) Mildbr. (Mildbraed 1908: 69). – *Candollea tepperiana* F. Muell. (Mueller 1887: 15). *Type:* on Mount Taylor, Kangaroo Island, [South Australia], 12 November 1886, *O. Tepper* (*lecto:* MEL 716062, here designated; *isolecto: leg. Tepper* 15.11.1886, Herb. GOET).

Creeping perennial *herb*; elevated above the soil on stilt roots 1–1.5 cm long, leafy basal rosettes compact, with erect and branching stems bearing additional compact leafy rosettes arising from the preceding leafy rosettes, 4–8 cm tall, stems between rosettes sparsely leaved or leafless, 1–2 cm long. *Leaves* linear-lanceolate, 4.5–10 mm long, 0.4–0.6 mm wide, apical mucro sharp, translucent white, 0.3–0.5 mm long, margins with ciliate spines, 0.1–0.3 mm long. *Inflorescence* 3–14 cm long including the peduncle, forming a 1-sided raceme, 1–6-flowered, sparsely covered with short glandular hairs; pedicels 2–4 mm long; floral bracts 1.2–3.5 mm long; bracteoles 0.8–1.5 mm long. *Hypanthium* obovate at anthesis, 2.4–4.5 mm long, 0.9–1.5 mm wide, densely glandular. *Sepals* 5, ovate, 3 free to the base, 1.2–1.8 mm long, 2 joined to within *c.* 0.5 mm of the apex, 1.7–2.3 mm long, densely glandular. *Corolla* white or pink with magenta marks near the base of the lobes, abaxial surface with magenta stripe, glandular, laterally paired, anterior lobes elliptic, *c.* 5 mm long, *c.* 2 mm wide, posterior lobes elliptic, *c.* 4 mm long, *c.* 2 mm wide. *Throat* white, appendages 8, white, finger-like and irregularly dilated, papillose, outer opposite pairs *c.* 1.5 mm long, central opposite pairs *c.* 2 mm long. *Labellum* boss obovate-apex cuspidate, *c.* 1.4 mm long, *c.* 0.7 mm wide; apical point and margins of smooth boss winged, oblong in outline, papillose; labellum twisted and positioned over 1 sepal. *Gynostemium* 6–7 mm long; anthers maroon, laterally paired, abaxial surface bearing a few short transparent white moniliform hairs, pollen white; stigma cushion-shaped. *Capsule* obovoid 4.5–6.5 mm long, 2–2.5 mm wide. *Seeds* light brown, ovoid-ellipsoid, longitudinally ridged and spirally twisted, 0.6–0.7 mm long, 0.4–0.45 mm diam, minutely papillose. (Figure 22)

Other specimens examined. SOUTH AUSTRALIA: W side of Mt Taylor, Kangaroo Island, 29 Dec. 1974, *A.H. Burbidge* 1827 (PERTH); Mt Taylor *c.* 10 km NW of Vivonne Bay on south coast, (Kangaroo Island), 13 Jan. 1962, *T.R.N. Lothian* 834 (K); 1 km from corner of Black Rock Rd, Kangaroo Island, 35° 54' S, 137° 37' E, 10 Nov. 1991, *D.E. Murfet, B.M. Overton & R. Taplin* 1397 (AD); Point Reynolds, Kangaroo Island, 35° 52' S, 137° 44' E, 10 Nov. 1991, *D.E. Murfet, B.M. Overton & R. Taplin* 1397 (AD); W of Pennington Bay, E of Point Reynolds, south coast Kangaroo Island, 35° 52' S, 137° 44' E, 18 Nov. 1988, *B.M. Overton* 924 (AD).

Distribution. Endemic to Kangaroo Island in South Australia.

Habitat. Grows in skeletal soils over limestone, amongst limestone rubble or deeper sandy soil over limestone in coastal shrub with *Eucalyptus diversifolia* Bonpl. Has also been observed growing 50 metres down a cliff face within the ocean sea-spray zone (B.M. Overton pers. comm. 1998).

Flowering period. November, December.

Chromosome number. Unknown.

Conservation status. Known from a number of populations, two of which – both exceptionally small populations – occur on Flinder's Chase and Mt Taylor Reserves (B.M. Overton pers. comm. 1998). The conservation status rating is currently recorded as RARE, to be investigated with the view to upgrading to VULNERABLE (Overton 1996).

Etymology. The epithet *tepperianum*, honours Gottlieb Otto Tepper (1841–1923), entomologist at the South Australian Museum who collected in South Australia.

Affinities. Stylidium tepperianum is the only creeping triggerplant in South Australia. Its unusual seed morphology, with the surface sculpture longitudinally ridged and spirally twisted as well as minutely papillose, may separate *S. tepperianum* from all other known creeping triggerplants.

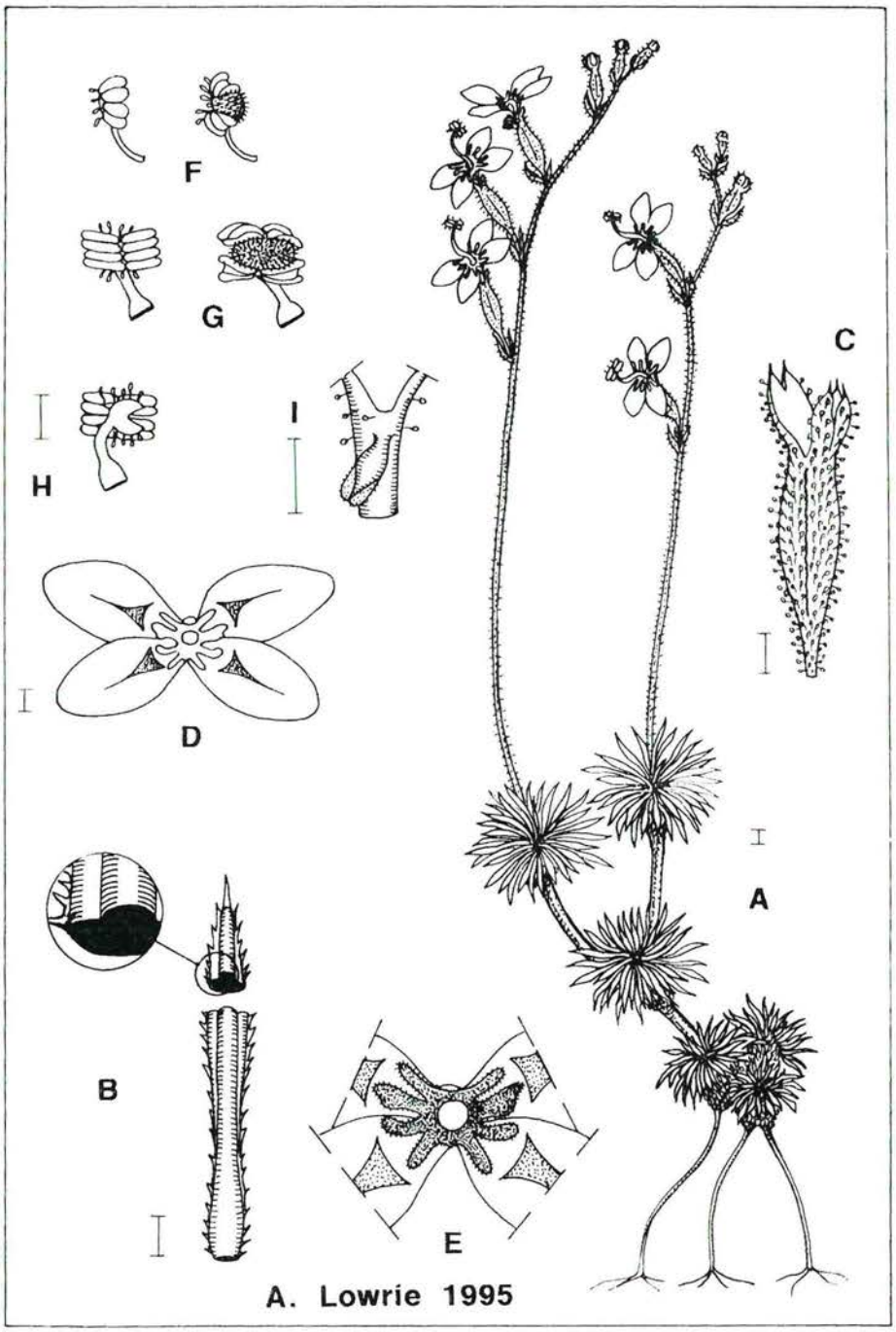

Figure 22. *Stylidium tepperianum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – throat appendages, enlarged; F – lateral view of gynostemium tip (with stigma at right); G – face view of gynostemium tip (with stigma grown out, right); H – back of gynostemium; I – labellum showing attachment to the corolla tube below the sinus and the sideways twist to clasp a sepal. Scale bar = 1 mm. Drawn from *D. E. Murfet, B. M. Overton & R. Taplin* 1397 (AD).

Notes. Mildbraed (1908) erroneously recorded the year of publication for *Candollea tepperiana* F. Muell. as 1881. A misreading has apparently been made between the English figure 7 and its counterpart, the German figure 1. *C. tepperiana* was described in Jan. 1887 from material collected Nov. 1886. The hand-written label (probably Tepper's original collection slip) immediately below the specimen on the lectotype sheet at MEL records the following details 'Summit & declivities of Mt Taylor, 12.11.86., flowers rose-colour, 22. *Stylidium* '. The collection date is incorrectly recorded on the typed label of the isolectotype sheet for *Candollea tepperiana* at GOET as 15 November 1886.

Stylidium tepperianum is an early colonizer following fire and limited soil disturbances (Overton 1996).

23. Stylidium uniflorum Sond. (Sonder 1845: 381). *Type:* in glareosis sterilibus districtus Hay, [Western Australia], 6 November 1840, *Preiss* 2253 (*holo:* LD).

Illustrations. Erickson (1958) page 149, figure 44, 1–8. Grieve & Blackall (1982) page 745, n. 50.

Creeping caespitose perennial *herb*; forming compact colonies up to 60 cm diam., bases of leafy tufts and connecting stems buried just below the soil surface, each individual leafy tuft producing additional tufts from their bases to form larger leafy tufts, connected to other crowded leafy tufts by stolon-like stems. *Stems* between the the bases of the compact leafy clumps mostly leafless, 2.5–30 mm long. *Leaves* linear, 5–7 cm long, 0.5–0.8 mm wide, apical mucro blunt, translucent white, 0.2–0.3 mm long, hyaline margins white, irregularly erose-serrate. *Inflorescence* mostly uni-flowered, rarely 2-flowered, mostly positioned a little above the leaves, peduncles 1–3, reddish, pilose, arising from the base of each leafy tuft; floral bracts and bracteoles, similar to the leaves, 2.5–5.5 mm long. *Hypanthium* oblong-falcate at anthesis, 6.5–15 mm long, 1.2–1.5 mm wide, pilose. *Sepals* 5, all free to the base, oblanceolate, 3.5–4.5 mm long, margins translucent white, irregularly erose-serrate, 2 lobes wider than the remaining 3, pilose. *Corolla* very pale pink to apricot with pinkish red marks near the base of the lobes, abaxial surface pinkish, sparsely pilose, laterally paired; anterior lobes obovate-elliptic, *c.* 6 mm long, *c.* 3 mm wide, posterior lobes oblanceolate-falcate, *c.* 9 mm long, *c.* 2.5 mm wide. *Throat* green, without appendages. *Labellum* boss pale green, broadly ovate, *c.* 0.5 mm long, *c.* 0.5 mm wide; basal appendages subulate-falcate, *c.* 0.5 mm long, *c.* 0.25 mm wide. *Gynostemium* linear-tapering 7–10 mm long, anthers green, laterally paired, abaxial surface glabrous, pollen greyish green; stigma pale green, elliptic, *c.* 0.7 mm long, *c.* 0.5 mm wide, cushion-shaped. *Capsule* oblanceolate-falcate, 12–15.5 mm long, 1.7–2.5 mm wide. *Seeds* brown, ovoid-ellipsoid, 0.6–0.7 mm long, 0.4–0.5 mm diam., smooth. (Figure 23)

Other specimens examined. WESTERN AUSTRALIA: between the 86 and 87 mile [137.6 and 139.2 km] pegs of the Albany Highway, N of Williams, 20 Oct. 1974, *S. Carlquist* 6097 (PERTH); 1 km along Guru Rd in Dryandra Forest, 8 Nov. 1993, *K.H. Coate* 319 (PERTH); Pallinup River bridge, riverside W, Hassell Highway, 28 Oct. 1983, *E.J. Croxford* 2864 (PERTH); Cranbrook Water Reserve, Cranbrook, 22 Oct. 1993, *D.J. Edinger* 863 (PERTH); Kendenup, 15 Oct. 1951, *R. Erickson s.n.* (PERTH); Broome Hill (no date) *R. Erickson s.n.* (PERTH); between Bannister and Williams Rivers, Oct. 1928, *Gardner & Blackall s.n.*, 29 Sep. 1928, *C.A. Gardner s.n.* (PERTH); Blackwood River bridge W of Dinninup on road to Boyup Brook, 13 Nov. 1175, *S. D. Hopper* 2270 (PERTH); 70 km E of Perth on Brookton Highway, Aug. 1966, *S.H. James* 66.8/18 UWA 1333 [voucher for chromosome count of 2n = 28] (PERTH); Boxwood Hill, 17 Oct.1987, *A. Lowrie s.n.* (PERTH); 3 km E of Cranbrook, 19 Nov 1989, *A. Lowrie s.n.* (PERTH); Dale West Rd, *c.* 2 km E of Brookton Highway, 3 Nov 1990, *A. Lowrie* 147 (PERTH); Albany Highway, 20.7 km N of Williams, 8 Oct.1991, *A. Lowrie* 374 (PERTH); Robin's Rd near Boddington, 14 Oct.1993, *A. Lowrie* 809 (PERTH); 85 km N of Albany, Sep. 1902,

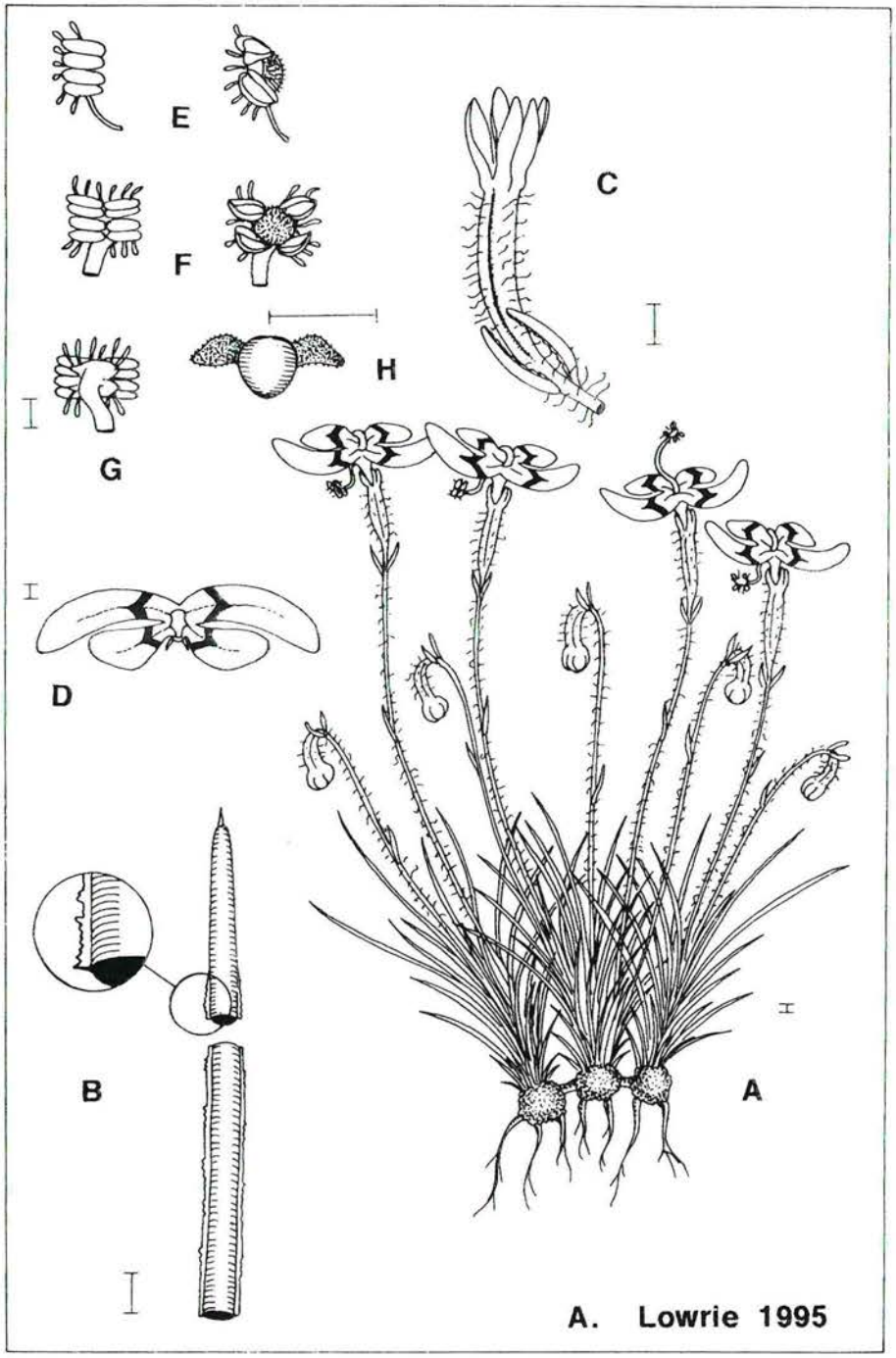

Figure 23. *Stylidium uniflorum* A – habit of flowering plant; B – leaf; C – hypanthium; D – corolla; E – lateral view of gynostemium tip (with stigma at right); F – face view of gynostemium tip (with stigma grown out, right); G – back of gynostemium; H – labellum. Scale bar = 1 mm. Drawn from *A. Lowrie s.n.* 17 Oct. 1987 (PERTH).

A. Morrison s.n. (PERTH); R. N. Stockwell (near Chillinup) 22 Oct. 1974, *K.R. Newbey* 4534 (PERTH); *c.* 19 km N of Lake Muir *c.* 7 km SW of Tone Bridge, 11 Dec. 1974, *R. Pullen* 9968 (PERTH); Darradup, 16 miles [25.6 km] W of Nannup, 31 Oct. 1948, *R.D. Royce* 3033 (PERTH); Tunney, S of Kojonup, 4 Oct. 1963, *R.D. Royce* 8051 (PERTH).

Distribution. Known from the region bordered by Dale west of Brookton in the north; *c.* 200 km south-east to Nannup; east *c.* 300 km to Boxwood Hill *via* Lake Muir and Kendenup; and north-west *c.* 300 km back to Dale.

Habitat. Grows in sandy loam near or mixed with laterite soils.

Flowering period. October, November.

Chromosome number. n = 28 [Cranbrook] and 2n = 28 [Brookton Highway] (James 1979). Northern populations are believed to be diploid and southern populations tetraploid.

Affinities. Its nearest relative is *Stylidium megacarpum* which differs in having rosette nodes above the soil surface and leaves positioned along erect and spreading flowering stems.

Conservation status. Common and currently not under threat.

Etymology. The epithet *uniflorum* is from the Latin *unus* – one and *florus* – flower in reference to the mostly uni-flowered peduncles.

Acknowledgements

We thank the late Associate Professor Sid James, former head of the Botany Department, University of Western Australia for the published and unpublished chromosome counts and his encouragement, support and informed and stimulating discussions concerning the nature and evolution of this fascinating group of plants; Greg Keighery for assistance with chromosome counts; Beverley Overton, Denzel Murfet and Rosemary Taplin for their Kangaroo Island pressed and spirit collections of *Stylidium tepperianum* and personal communications regarding this species; Dr Sherwin Carlquist and Dr Kingsley Dixon for advice with growth habit terminologies; Paul Wilson for his assistance with the Latin diagnoses; Barbara Rye and Terry Macfarlane for their comments and revision of the manuscript; the directors and staff of the Western Australian Herbarium (PERTH), the National Herbarium of Victoria (MEL), the National Herbarium of New South Wales (NSW), the Herbarium of the Northern Territory (DNA) and the Queensland Herbarium (BRI) – particularly Dr Phillip Short, Dr Jim Ross, Dr Gordon Guymer and Clyde Dunlop who assisted AHB and KFK with both specimen loans and advice during visits.

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Alphabetical index of current names and synonyms

Full treatment of species page numbers in **bold**.

An updated revision of *Pimelea* sect. *Heterolaena* (Thymelaeaceae), including two new taxa

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Abstract

Rye, B.L. An updated revision of *Pimelea* sect. *Heterolaena* (Thymelaeaceae), including two new taxa. *Nuytsia* 13 (1): 159–192 (1999). The taxonomy of *Pimelea* sect. *Heterolaena* (Endl.) Benth. (Thymelaeaceae) is updated to include data that have accumulated during the last decade. Two new taxa, *Pimelea neokyrea* Rye and *P. rosea* subsp. *annelsii* Rye, are named, bringing the total number recognized in the section to 15 species and five non-typical subspecies. Both of the new taxa and also *Pimelea ciliata* subsp. *longituba* Rye are included on the official list of Western Australian taxa with conservation priority, as they are either very geographically restricted or known from very few collections. These three taxa are illustrated. Descriptions and a key are provided for all named members of sect. *Heterolaena*, and the authorship of the section is discussed.

Introduction

Since the revision of Western Australian Thymelaeaceae (Rye 1988) was published eleven years ago, many new collections have been made and well over a thousand specimens of the family have been incorporated at PERTH. These additional specimens have increased the known geographical ranges of many of the taxa and provided a more detailed picture of many other aspects of their biology. About two years after the Western Australian revision, a flora treatment for all Australian members of the Thymelaeaceae was published (Rye 1990), presenting selected data from the revision but adding very little new information on the Western Australian taxa.

Among the recent collections of *Pimelea* Banks & Sol. ex Gaertn., are some specimens of two new taxa in section *Heterolaena*, a species group endemic to the south-west of Western Australia. This paper updates the taxonomic revision of this plant group to include the two new taxa and incorporate other new data, as well as correcting errors in earlier treatments. In particular, both the revision (Rye 1988) and the "Flora of Australia" account (Rye 1990) have significant defects in their keys in relation to the species of sect. *Heterolaena*. In addition to providing a more reliable key to all taxa of the section, the current paper cites a selection of new specimens, gives revised geographical distributions and habitat descriptions, and indicates both flowering and fruiting times. It also gives brief descriptions, omitting some of the less important characters covered previously, but including some significant new characters.

Methods

All measurements of morphological characters were made from dried specimens. Only the larger leaves and stamens on each specimen were measured. Where possible, anther colour and seed characters have been added to the descriptions of each taxon, but these characters should be treated with caution as there are often few specimens with mature seeds and anther colour is sometimes based on very few records. Conservation status has only been included for taxa warranting inclusion as Declared Rare or Priority Flora or known from few localities. All other taxa are known from at least 15 localities, usually including nature reserves, and do not appear to be at risk at present. An explanation of the conservation codes applied to the Western Australian flora is given at the end of each *Nuytsia* issue.

A few PERTH specimens were selected for citation under each taxon. These are mainly recent collections, mostly from new localities, or older specimens that have only recently been incorporated or reidentified. Distribution maps have been updated, with each symbol representing the occurrence of the taxon in a quarter degree latitude by a quarter degree longitude area.

Section description

Pimelea sect. **Heterolaena** (Endl.) Benth. (Bentham 1873: 8). – *Pimelea* b. *Heterolaena* Endl. (Endlicher 1837: 331). – *Pimelea* sect. *Pimelea* [as *Eupimelea nom. inval.*] § *Heterolaena* (Endl.) Meisn. (Meisner 1857: 497). – *Banksia* sect. *Heterolaena* [as *Heteroclaena*] (Endl.) O. Kuntze (Post & Kuntze (1903: 59). *Type: Pimelea rosea* R. Br., lectotype, *fide* Rye (1988: 227).

Heterolaena C.A. Mey. (Fischer, Meyer & Ave-Lallemant 1845: 47–48). *Type: Heterolaena spectabilis* (Lindl.) Fisch. & C.A. Mey. [= *Pimelea spectabilis* Lindl.].

Very small to tall *shrubs* or rarely small *trees*, often with a lignotuber 3–15 mm diam.; stems largely glabrous but with small tufts of white to ferruginous or reddish hairs associated with the axillary buds in at least the uppermost axils below each inflorescence. *Leaves* opposite-decussate, very shortly petiolate to sessile. *Inflorescence* erect or sometimes pendulous, usually globular, head-like, the short pedicels being concealed; involucral bracts usually 4, sessile, glabrous outside or rarely with a few hairs towards base; pedicels densely covered by long hairs, together with the receptacle forming a flat disc-like to narrowly conic structure that persists after the involucral bracts and fruits have been shed. *Flowers* large or medium-sized, bisexual or rarely female, protandrous, white to deep pink or pale yellow, hairy outside, glabrous inside or with hairs restricted to the throat and sepals. *Floral tube* with long hairs (usually mixed with much shorter hairs) occurring above or on upper part of the swollen base, glabrous at extreme base, the whole tube and attached floral parts persistent in fruit in most taxa, but the upper half shed in two taxa. *Ovary* glabrous. *Fruit* dry, shed enclosed in the base of the floral tube, the wall usually green and flexible at first, sometimes becoming hard. *Seed* narrowly to broadly ovoid and very slightly to distinctly compressed, somewhat lop-sided as the apex is recurved towards abaxial surface; exocarp and endocarp membranous, reticulate-patterned, white to golden brown and often translucent or becoming transparent, the exocarp usually golden brown along abaxial line; mesocarp hard and brittle, very finely reticulate, black. *Cotyledons* (where known) narrow.

Notes. Currently 15 species are recognized in sect. *Heterolaena*, all from the south-west of Western Australia. Most plants are single-stemmed at the base but mature plants are generally capable of resprouting from a lignotuber after fire or other damage to the main stem, resulting in a multi-stemmed

shrub. Stems are usually glabrous except near each inflorescence where the uppermost axils usually have hairs associated with the axillary bud. Very rarely there are also hairs on the internodes, occurring in a strip extending vertically above each of the axils of the node but not in the intermediate areas.

Most of the taxa could be regarded as gynodioecious or gynomonoecious or a combination of both states, but female plants or flowers are rare in comparison with the bisexual ones. All descriptions below of flowers or floral organs refer only to bisexual flowers. Female flowers differ from the bisexual ones in having small abortive anthers on shorter filaments, the staminodes invariably being shorter than the sepals. They also tend to have a shorter floral tube and more prominently exserted style, with the stigma often broader.

All flowers have a long slender tube and basal nectar that is accessible to insects with a long slender proboscis. They appear to be pollinated primarily by butterflies, although moths might also be of importance. Keighery (1975) recorded a total of six species of butterflies feeding from flowers of three members of sect. *Heterolaena*. Three species of butterflies were recorded visiting a population of *Pimelea ciliata* [as *P. rosea*], four species visiting a population of *P. ferruginea* and one species visiting two populations of *P. spectabilis*, which has particularly large flowers and may therefore be specialized for the larger butterflies.

Involucral bracts are usually in two pairs, occasionally in three pairs but then with the outermost pair of bracts usually more leaf-like than the others and not included in the descriptions given for the bracts below, or rarely in a single pair and then with two broad, somewhat bract-like leaves directly below. Descriptions of flower colour refer only to the predominant colour visible from the top of the open flowers, i.e. the upper surface of the sepals. Predominantly white-flowered taxa are often pink or yellowish in bud and partially coloured so in flower. Many of the taxa have orange anthers, which often become brown in dried material, but a few taxa have yellow or cream anthers.

Young seedlings have not been examined in this study but cotyledon shape may be significant and should be studied further. Meyer (1845) indicated that the species he placed in *Heterolaena* have narrow cotyledons while some other species groups have broad cotyledons, and Bentham (1873) reported narrow cotyledons in *P. ferruginea* and *P. spectabilis*, the only two taxa for which he had examined mature seeds.

Seed and fruit characters cannot be used as primary key characters because there are seldom mature fertile fruits present on the specimens, but they often differ significantly from species to species. These characters were omitted from the revision (Rye 1988) mainly because of the acute shortage of mature fruiting material at that time.

The following characters are relatively uncommon in sect. *Heterolaena* and so are useful in distinguishing the few taxa possessing them: leaf margins incurved; involucral bracts almost fully hairy inside; flowers circumscissile; floral tube with all hairs appressed to antrorse, or with the large hairs more or less restricted to the swollen base, or with retrorse to reflexed hairs on the swollen base; anthers subsessile and introrse.

Key to species and subspecies

Drawing up a reliable key for this species group is difficult because of the great variability of the more useful characters within some of the taxa. There may be occasional atypical specimens which will not key successfully on all characters for a particular lead.

Excluding the newly discovered *Pimelea neokyrea*, all species belonging to *Pimelea* sect. *Heterolaena* are keyed under couplets 11–26 in Rye (1988: 144–145). Couplet 12 of this key is misleading, as *Pimelea brevistyla* is incorrectly keyed under the second alternative and three of the species keyed only under the first alternative of having leaf margins "flat to incurved" actually have recurved leaf margins, although not as prominently recurved as most of the taxa keyed only under the second alternative of leaf margins "recurved to revolute". The new key given below overcomes this shortcoming and other more minor inaccuracies in the previous key, and also differs from the earlier key in its inclusion of infraspecific taxa.

1. Leaves sessile, the base slightly stem-clasping. Involucral bracts more or less circular. (Shark Bay to Mingenew) ..... **P. sessilis**

1. Leaves all or mostly with a petiole 0.2–2 mm long, not stem-clasping. Involucral bracts usually narrowly to broadly ovate, sometimes more or less elliptic or obovate

2. Stamens much shorter than sepals, subsessile (filament 0.1–0.4 mm long); anther 0.5–0.7 mm wide. Leaves with the margins distinctly incurved or inrolled, often tending to become linear

3. Involucral bracts 12–20 mm long. Floral tube 11–15 mm long. Sepals 4.5–6 mm long. (Darling Range) ..... **P. brevistyla** subsp. **brevistyla**

3. Involucral bracts 7–11 mm long. Floral tube 8–11 mm long. Sepals 3–4 mm long. (Wubin to Lake Carmody) ..... **P. brevistyla** subsp. **minor**

2. Stamens much shorter than to greatly exceeding sepals, usually with a filament 0.7–8 mm long but occasionally subsessile in *P. brevifolia*, which has the anther 0.2–0.4 mm wide. Leaves with the margins incurved to revolute but never inrolled, if tending to become linear then the margins revolute

4. Swollen base of floral tube with the lowest hairs reflexed to retrorse, these retrorse hairs usually extending higher but sometimes becoming more or less patent towards summit of floral tube, sometimes mixed with some larger patent to antrorse hairs in distal half of tube

5. Inner involucral bracts glabrous or with very few hairs inside. (Darling Range) ..... **P. rara**

5. Inner involucral bracts appressed-hairy inside (but often with a narrow glabrous margin)

6. Involucral bracts with distinct pink to reddish margins or margins indistinct in colour. Flowers not circumscissile. (Geographe Bay to Mt Manypeaks) .... **P. hispida**

6. One or both pairs of involucral bracts with distinct yellow margins. Flowers circumscissile. (Perth to Albany) ..... **P. lanata**

4. Swollen base of floral tube glabrous or with appressed to widely antrorse or more or less patent hairs throughout, often with a mixture of large and minute hairs especially towards the summit of tube

7. Flowers with hairs at throat and on base of each sepal
   8. Flowers with a ring of long retrorse hairs in the throat and also antrorse hairs on base of each sepal. Floral tube either circumscissile or glabrous on swollen base
      9. Floral tube circumscissile; swollen base of floral tube with minute hairs 0.1–0.4 mm long and often a few larger hairs towards summit. (Mount Barker to East Mt Barren) ..... **P. lehmanniana** subsp. **lehmanniana**
      9. Floral tube persistent; swollen base glabrous. (Darling Range to Mount Barker) ..... **P. lehmanniana** subsp. **nervosa**
   8. Flowers with antrorse to patent hairs in the throat and inside of sepals. Floral tube persistent; swollen base of floral tube with fine minute hairs 0.1–0.3 mm long and sometimes a few large hairs towards summit. (Darling Range to Fitzgerald River National Park) ..... **P. spectabilis**
7. Flowers glabrous inside
   10. Leaves with upper surface convex, the margins incurved
      11. Floral tube with long hairs on swollen base only or mainly there but also extending for a short distance onto slender portion of tube. (Lake Grace to Albany, Norseman and Israelite Bay) ..... **P. brevifolia** subsp. **brevifolia**
      11. Floral tube with long hairs all or mainly on slender portion, sometimes also on summit of swollen base of tube. (Wubin to Lake Grace and Coolgardie) ..... **P. brevifolia** subsp. **modesta**
   10. Leaves with upper surface concave, the margins recurved or revolute
      12. Floral tube with the longer hairs widespread or at least extending through distal half of swollen base to half way up the slender portion of tube; hairs of upper part of tube mostly more or less patent
         13. Leaves 3–11 mm long, with a distinct mucro. Flowers with the slender portion of tube 1.5–4.5 mm long, the largest hairs 0.4–2.5 mm long, and anthers 0.3–0.6 mm long. (Wagin to Israelite Bay) ..... **P. brachyphylla**
         13. Leaves 5–24 mm long, scarcely mucronate. Flowers with the slender portion of tube 4–9 mm long, the largest hairs 1.5–3 mm long, and anthers 0.5–1.1 mm long. (Wilroy to Moorine Rock) ..... **P. avonensis**
      12. Floral tube with a belt of long spreading or antrorse hairs restricted to less than half of the swollen base and/or less than half of the slender portion of tube; hairs of the upper part of floral tube mostly antrorse or appressed
         14. Leaf apex acute at 75–105 degrees or obtuse, not mucronate or with a short broad mucro
            15. Inner bracts 6–12 mm long. Flowers usually distinctly pink; slender portion of floral tube 4–8 mm long. Seed rather dull, commonly 2.3–2.6 x 1.1–1.3 mm. (South-west coast and islands) ..... **P. ferruginea**
            15. Inner bracts 13–20 mm long. Flowers white to yellow; slender portion of floral tube 9–14 mm long. Seed shiny, commonly 2.3–2.8 x 0.7–1.1 mm. (Shark Bay to Pinjarra) ..... **P. leucantha**

14. Leaf apex tapered at 30–60 degrees, usually with a rather narrow mucro or slender point
    16. Outer bracts ciliate. Floral tube with long hairs absent from swollen base or only present on summit. Stamens slightly to greatly exceeding sepals; filament 2.5–4.5 mm long
        17. Slender portion of floral tube 4.5–8(9) mm long. Sepals white or pale pink on upper surface. (Wongan Hills to Scott River to Porongurup Range) ..... **P. ciliata** subsp. **ciliata**
        17. Slender portion of floral tube 8–11 mm long. Sepals medium pink on upper surface. (Yallingup to Margaret River) ..... **P. ciliata** subsp. **longituba**
    16. Outer bracts glabrous and/or floral tube with long hairs extending onto distal half of swollen base. Stamens usually distinctly shorter than sepals; filament 0.7–2.5 mm long, possibly sometimes longer in *P. neokyrea*
        18. Large hairs of floral tube extending from summit of swollen portion to about half way up the slender portion. Sepals white to pale yellow on upper surface. (Dongolocking to Cranbrook) ..... **P. neokyrea**
        18. Large hairs of floral tube extending from near the middle of swollen portion onto basal part of slender portion. Sepals usually pale to deep pink on upper surface
            19. Largest hairs of floral tube mostly occurring on swollen base, 1–1.5 mm long. (Mount Barker to Hay River) ..... **P. rosea** subsp. **annelsii**
            19. Largest hairs of floral tube about equally common on swollen base and lowest part of slender portion of tube, 2–3 mm long. (Swan Coastal Plain to Mt Manypeaks area) ..... **P. rosea** subsp. **rosea**

Species descriptions

Pimelea avonensis Rye (Rye 1988: 239–240). *Type:* Fowlers Gully, 2 km south of Wongan Hills – Piawaning road on Wilding Rd, western side of Wongan Hills, Western Australia, 14 September 1983, *K.F. Kenneally* 8808 (*holo:* PERTH 01603469; *iso:* CANB, K, MEL, PERTH 01603477, 01603485).

Illustration. Rye (1988: Figure 54).

Shrub 0.3–1.2 m high; stems with dense axillary hair tufts present throughout but tending to become less conspicuous in lower axils. *Leaf blades* linear or narrowly ovate to narrowly obovate, 5–24 x 0.5–3.5 mm; margins recurved or revolute; apex narrowly obtuse, without a mucro. *Inflorescence* erect. *Involucral bracts* ovate or broadly ovate, often pink- or red-tinged; outer bracts usually glabrous, rarely ciliate and partially appressed-hairy inside; inner bracts 6–12 mm long, often appressed-hairy inside, sometimes ciliate. *Flowers* white or pink-tinged, glabrous inside, persistent in fruit; swollen base of floral tube with more or less patent hairs 0.2–0.4 mm long, mixed with long hairs almost throughout or in distal half; slender portion of floral tube 4–9 mm long, with more or less patent hairs

1.5–3 mm long mixed with much smaller hairs in basal half and usually extending to near summit of tube, with widely antrorse or tangled hairs mostly 0.5–1 mm long in distal half. *Stamens* shorter than to slightly exceeding sepals; filament 1.5–3 mm long; anther orange, 0.5–1.1 mm long. *Seed* almost ovoid, 3.0–3.3 x *c.* 1.4 mm, rather dull greyish black, the exocarp impressed in a reticulate pattern onto the black mesocarp.

Selected specimens examined. WESTERN AUSTRALIA: S side Raywood Homestead, off Lampard Rd, Coorow Shire, 4 Sep. 1995, *F. Falconer* 41; 7 km N of Perenjori, 19 Aug. 1994, *E.D. Kabay* 374; Koolanooka Hills, 18 km E of Morawa, 15 Aug. 1990, *G.J. Keighery & J.J. Alford* 2019; 25 km NW of Mt Woodward, 30 Sep. 1982, *K.R. Newbey* 9538; Mollerin Rock, Reserve No. 769, 30 July 1988, *B.H. Smith* 1053.

Distribution and habitat. Extends from Wilroy south-east to near Moorine Rock in the South West Botanical Province. Occurs mainly in sandy soils, often in open woodlands or shrublands. (Figure 1A)

Phenology. Flowers: July to October. Fruits: August to November. Mature seeds were examined on *R.J. Cranfield* 4806.

Breeding system. Female specimen examined: *J. Taylor* 2190 *& P. Ollerenshaw.*

Notes. Very closely related to *Pimelea brachyphylla*, which has the same type of indumentum on the floral tube but differs in its distinctly mucronate leaves and usually has distinctly shorter leaves and flowers. *P. avonensis* has also been confused with *P. ciliata* and *P. leucantha* but tends to have the hairs on the floral tube more silky, and the small hairs of the upper tube are spreading, not appressed or closely antrorse as in the other two species. In *P. avonensis* the long hairs usually continue higher up the slender portion of the floral tube, although not on the type specimen illustrated in Rye (1987: Figure 54), and always extend well down onto the swollen base of the floral tube.

Two isolated records from "near York" and Dongolocking Reserve reported in Rye (1987) are no longer included in the species' distribution; the former record was based on an old collection with a vague and perhaps misleading locality, while the latter is now regarded as belonging to the newly named species *P. neokyrea*. The entire distribution map given in Rye (1987: Figure 57) for *P. avonensis* was accidently reproduced one degree too far north.

Pimelea brachyphylla Benth. (Bentham 1873: 11). – *Banksia brachyphylla* (Benth.) Kuntze (Kuntze 1891: 583). *Type:* South-west of Western Australia, 1848, *J. Drummond* 5: 429 (*lecto:* K, *fide* Rye (1988: 259); *isolecto:* MEL).

Illustration. Rye (1988: Figure 71).

Shrub or undershrub 0.1–1 m high; stems with dense axillary hair tufts sometimes tending to become less conspicuous in lower axils. *Leaf blades* elliptic-oblong to linear, 3–11 x 1–3 mm; margins revolute; apex recurved, mucronate. *Inflorescence* erect. *Involucral bracts* ovate to obovate or broadly so, with a reddish margin or more widespread reddish colouration; inner bracts 4–9 mm long, often partially appressed-hairy inside, often ciliate. *Flowers* white or rarely pale yellow, glabrous inside, persistent in fruit, the floral tube usually rather uniformly hairy, its largest hairs 0.4–2.5 mm long; swollen base of floral tube with antrorse to patent hairs 0.1–0.3 mm long, mixed with longer hairs at least in distal half; slender portion of floral tube 1.5–4.5 mm long, with widely antrorse to patent hairs throughout, the largest hairs occurring throughout or extending most of the length of floral tube.

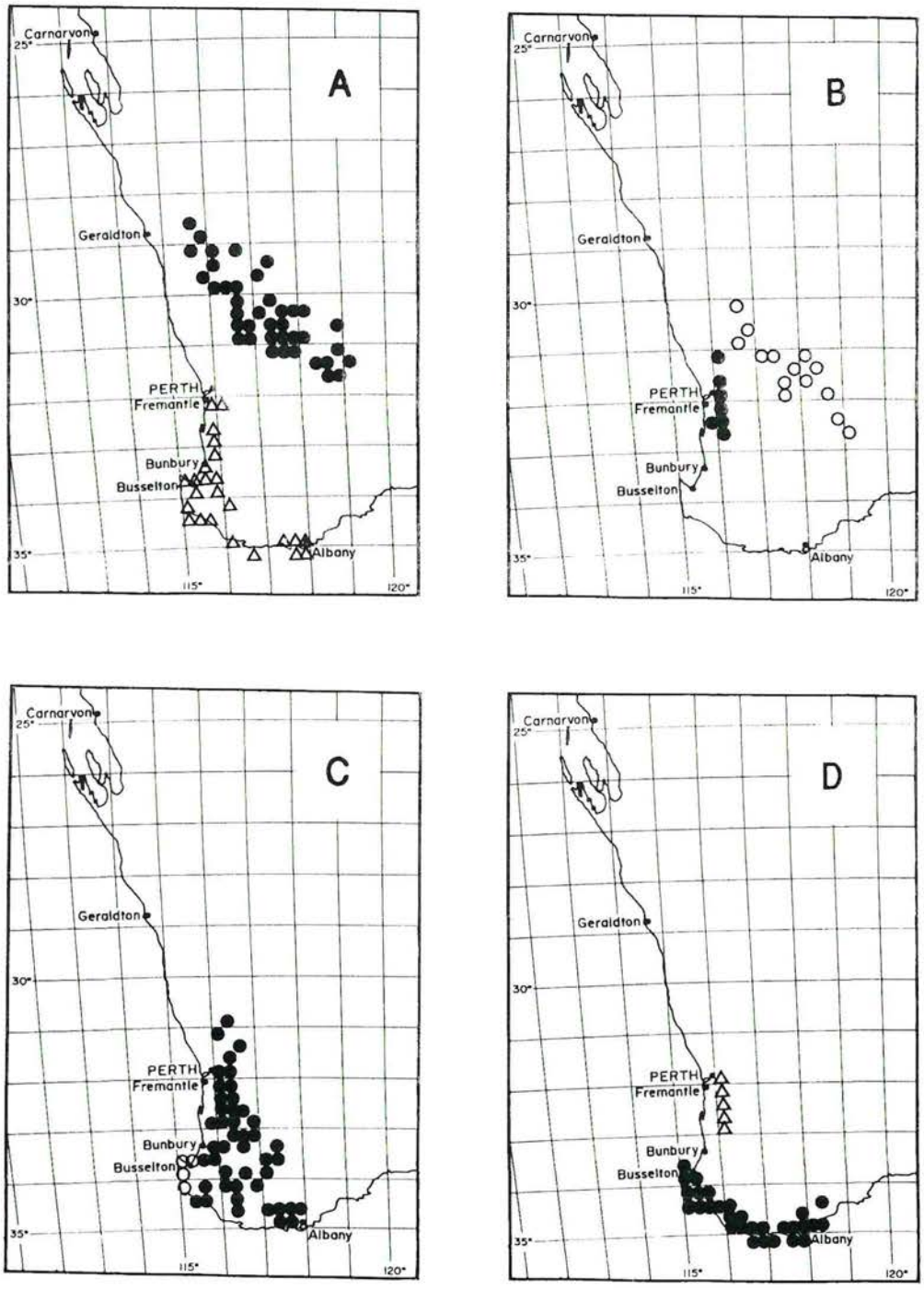

Figure 1. Geographical distributions. A – *Pimelea avonensis* ● and *P. lanata* △ ; B – *Pimelea brevistyla* subsp. *brevistyla* ● and *P. brevistyla* subsp. *minor* O ; C – *Pimelea ciliata* subsp. *ciliata* ● and *P. ciliata* subsp. *longituba* O ; D – *Pimelea hispida* ● and *P. rara* △.

Stamens about as long as or exceeding sepals; filament 1–3.5 mm long; anther orange, 0.3–0.6 mm long. *Seed* almost ovoid, 1.7–2.8 x 0.7–1.3 mm, whitish or golden brown over shiny black.

Selected specimens examined (typical variant). WESTERN AUSTRALIA: 117.5 km S of Balladonia, 19 Aug. 1995, *R.J. Cranfield* 10146; Woogenellup Rd Reserve near Chester Pass Rd, 30 Sep. 1990, *E.J. Croxford* 6358; West Hill, 14 May 1996, *R. Davis* 751; Gnarming, 12 Sep. 1994, *D. Quicke* KKQ7.

Selected specimens examined (large variant). WESTERN AUSTRALIA: Hellfire Bay, Cape Le Grand National Park, 24 Sep. 1985, *M. Carter* 229; 6.2 km SE of Mt Drummond, Fitzgerald River National Park, 12 Nov. 1986, *K.R. Newbey* 11403; 32 miles [54 km] from Ravensthorpe, 27 Aug. 1965, *E. Wittwer* 413.

Distribution and habitat. Extends from near Wagin east to Israelite Bay and from Gnarming (near Kulin) south to the South Stirlings area in the South West Botanical Province. Occurs in a variety of soils, in mallee woodlands or shrublands. (Figure 2A)

Phenology. Flowers: mainly July to early October. Fruits: mainly August to November. Mature seeds of the typical variant were seen on *W.E. Blackall* 1012, *E.M. Bennett* 3013, *H. Eichler* 20380, *A.S. George* 6864 & 9854, *E.D. Kabay* 824 and *B.L. Rye* 82030. Mature seeds of the large variant were seen on *A.E. Orchard* 1672 and *K.R. Newbey* 11403 & 11417.

Breeding system. Female specimen examined: *K.R.Newbey* 11417. Some specimens (e.g. *M.A. Burgman* 2520 & *S. McNee*), have inflorescences with the outermost flowers female and the rest bisexual.

Notes. Closely related to *Pimelea avonensis*, differing as noted under that species and also apparently in its smaller, more shiny seeds. Seed differences need confirmation, however, as only one specimen with mature seeds has been examined in *P. avonensis*. *Pimelea brachyphylla* appears to show much better seed set than *P. avonensis*.

Pimelea brachyphylla has two main variants, which intergrade. In the typical variant the leaves are mostly very small and are closely clustered below each inflorescence although sometimes longer and more distant elsewhere on the plant, the flowers are small and the seeds (where known) are 1.7–2.3 x 0.7–1.0 mm. A variant with larger and more distant leaves, larger flowers tending to have longer hairs on the floral tube, and seeds 2.3–2.8 x 1.1–1.3 mm, is much less common but is scattered across most of the southern part of the species distribution. Only this large variant could be confused with *P. avonensis*.

Pimelea brevifolia R. Br. (Brown 1810: 359). – *Calyptrostegia brevifolia* (R. Br.) C.A. Mey. (Meyer 1845: 74). – *Banksia brevifolia* (R. Br.) Kuntze (Kuntze 1891: 583). *Type:* King George Sound, Western Australia, December 1801, *R. Brown* (*holo:* BM).

Shrub 0.1–1 m high; stems with inconspicuous hairs in uppermost axils below each inflorescence, becoming glabrous in lower axils. *Leaf blades* narrowly elliptic to obovate, 4–16 x 1–6 mm; margins incurved; apex acute or obtuse, often mucronate. *Inflorescence* erect. *Involucral bracts* narrowly to broadly ovate or obovate to broadly elliptic, sometimes reddish at base or apex, glabrous or rarely ciliate towards base; inner bracts 5–12 mm long. *Flowers* white or cream, glabrous inside, persistent in fruit; slender portion of floral tube 2–7 mm long. *Stamens* shorter than sepals; filament 0.3–1.5 mm long; anther orange, 0.4–1.1 mm long. *Seed* almost ovoid or narrowly ovoid, whitish to golden brown over shiny black.

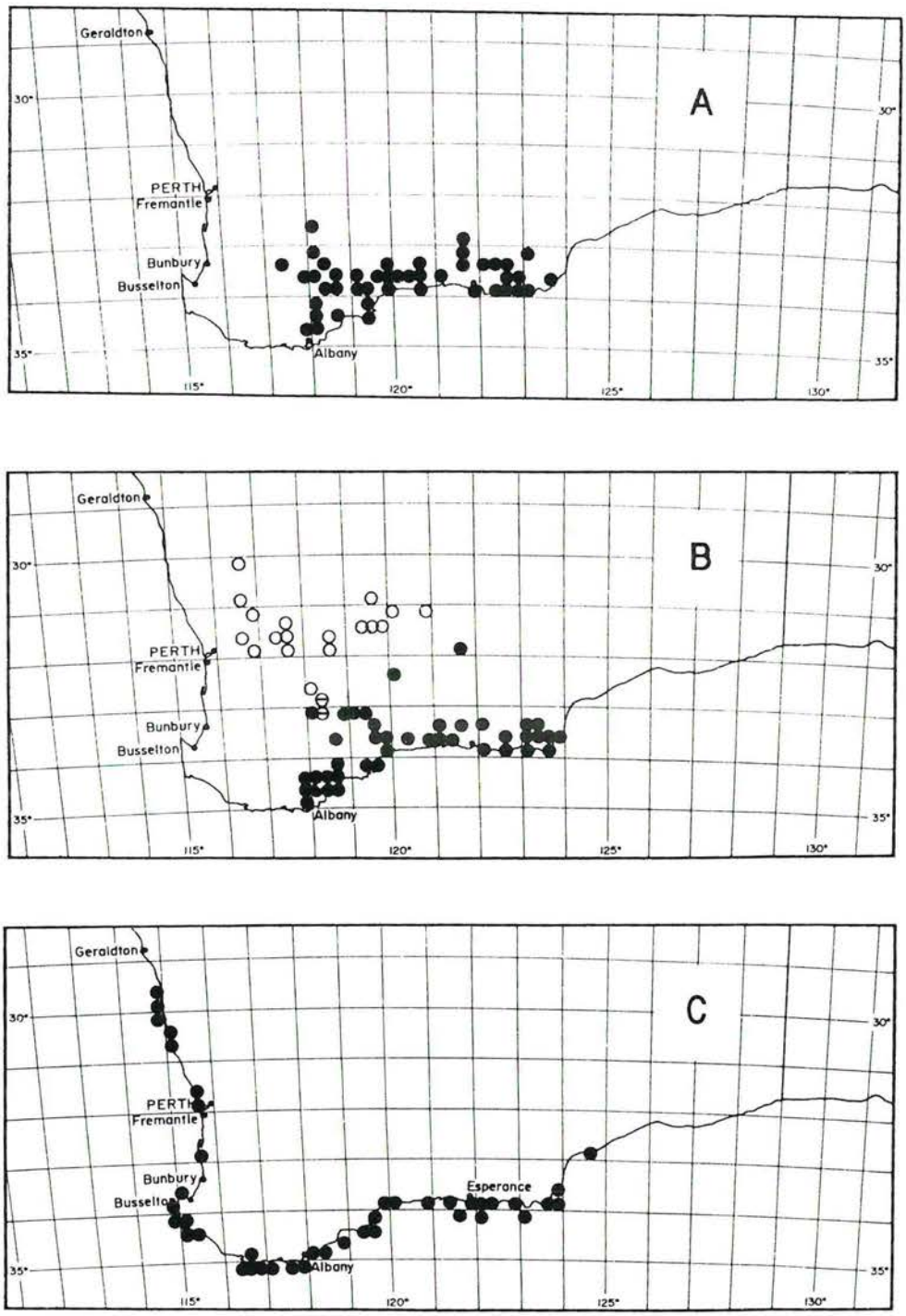

Figure 2. Geographical distributions. A – *Pimelea brachyphylla*; B – *Pimelea brevifolia* subsp. *brevifolia* ●, *P. brevifolia* subsp. *modesta* O and both subspecies or intermediates Θ ; C – *Pimelea ferruginea*.

Distribution and habitat. Distributed in the South West Botanical Province and South-western Interzone, extending from near Wubin south to Albany, south-east to Israelite Bay and east to Coolgardie. (Figure 2B)

Notes. Two subspecies are recognized in *Pimelea brevifolia*, the main differences between them relating to the shape of the bracts and the density, position and orientation of the long and short hairs on the floral tube. They appear to be almost parapatric, with one intermediate specimen (*B.G. Muir* 361) collected from North Tarin Rock Reserve, where their known ranges slightly overlap. The distribution of the typical subspecies is now known to be more extensive than was indicated in Rye (1988, 1990).

The type subspecies is sometimes very similar to *Pimelea rosea* subsp. *annelsii* in its floral tube indumentum and short stamens, but the latter taxon tends to have longer leaves and flowers and can be readily distinguished by its recurved leaf margins and pink flower colour. Subsp. *modesta* is more likely to be confused with *Pimelea brachyphylla*, which can be readily distinguished by its recurved to revolute leaf margins. Both subspecies of *P. brevifolia* resemble *P. brevistyla* in their incurved leaf margins, and subsp. *brevifolia* sometimes also in having subsessile introrse anthers, but there are significant differences as discussed under *P. brevistyla*.

Of all the species currently placed in sect. *Heterolaena*, *Pimelea brevifolia* possibly shows the greatest approach to sect. *Calyptrostegia*. In the southern part of its range, *Pimelea brevifolia* can be confused with an extreme variant of one of the species in the latter section, *P. angustifolia* R. Br. This variant of *P. angustifolia* is similar to subsp. *brevifolia* in having small leaves and flowers and its floral tube only moderately densely hairy, but still has more densely hairy flowers than subsp. *brevifolia* and has a more uniform indumentum of large hairs on the swollen base of the floral tube. Also, the inner involucral bracts are glabrous inside in subsp. *brevifolia* but hairy inside at least towards the base in *P. angustifolia*. In the Albany–Stirling Range area, the two taxa can be distinguished by the leaf apex, which has a distinct subterminal thickening terminating in a point in subsp. *brevifolia* but not in *P. angustifolia*, and in all areas *P. angustifolia* tends to have inflorescences less erect (i.e. more horizontal or nodding) than those of subsp. *brevifolia*, and leaves larger and more elongate.

The clearest difference between *P. angustifolia* and *P. brevifolia* is that the flowers are circumscissile in the former and not circumscissile in the latter, a very obvious difference once the fruiting stage is reached. If the current placement of the two species in different sections is correct, then some of the morphological similarities must be superficial or convergent. If instead it results from a very close relationship between these two taxa, then the separation of the two sections is called into doubt.

a. Pimelea brevifolia R. Br. subsp. **brevifolia**

Illustration. Rye (1988: Figure 69).

Inner involucral bracts ovate or broadly ovate. *Floral tube* with the larger hairs restricted to swollen base of tube or occurring on distal half of swollen base and on base of slender portion, the largest hairs antrorse to patent and 0.4–2.5 mm long, almost completely glabrous to moderately densely hairy on the slender portion, sometimes also with short hairs on the swollen base; hairs of the distal third of tube appressed to antrorse or rarely patent, mostly 0.2–0.4 mm long. *Stamens*: filament 0.3–1.1 mm long; anther 0.6–1.1 mm long. *Seed* 2.5–3.0 x 0.8–1 mm.

Selected specimens examined. WESTERN AUSTRALIA: Mt Ragged, 25 Sep. 1995, *S. Barrett* 489; Rest area beyond Washpool Rd, near Kamballup, 24 Oct. 1991, *E.J. Croxford* 1509; Bremer Bay Rd, E of Dillon Rd, 11 Oct. 1992, *E.J. Croxford* 6593.

Distribution and habitat. Extends along the south coast from the Albany area east to Israelite Bay and inland to Lake Grace and to north of Norseman. Occurs in sandy soils or sometimes clay, often with laterite or granite, recorded in a variety of shrublands, often dominated by mallees or other *Eucalyptus* species.

Phenology. Flowers: July to October. Fruits: August to November. Mature seeds were observed on *N.N. Donner* 3043.

Breeding system. A few specimens, such as *C.A. Gardner* 14100, have a few of the outermost flowers of each inflorescence female and the rest bisexual.

Notes. Pimelea brevifolia subsp. *brevifolia* is very variable, with eastern specimens from Esperance east to Cape Arid tending to have a less hairy upper portion to the floral tube than western specimens and with the long hairs completely or almost completely restricted to the swollen base and sometimes occurring almost throughout the base. Western specimens, especially in the north-west, tend to have the long hairs beginning higher on the swollen base and extending onto the base of the slender portion of tube. The stamens always have a short filament (0.3–0.5 mm long) on the eastern specimens, some of which reach the extent of having subsessile, almost fully introrse anthers, while on the western specimens the stamens vary more, with the filament (0.3)0.5–1.1 mm long.

A few specimens, notably *N. Hoyle* 1059, have very little differentiation between the largest and shortest hairs of the floral tube.

b. Pimelea brevifolia subsp. **modesta** (Meisn.) Rye (Rye 1988: 258–259). – *Pimelea modesta* Meisn. (Meisner 1848: 268–269). *Type:* South-west, Western Australia, 1843–1844, *J. Drummond* 3: 238 (*iso:* K, MEL, NY).

Illustration. Rye (1988: Figure 70).

Inner involucral bracts usually obovate to broadly elliptic. *Floral tube* moderately densely hairy on slender portion with widely antrorse to patent hairs 0.8–1.5 mm long usually mixed with shorter hairs on the basal part of slender portion, usually also extending onto the summit of the swollen base but fewer there than on slender portion, also with short antrorse hairs on the swollen base; hairs of the distal third of tube patent or rarely antrorse and mostly 0.3–0.5 mm long. *Stamens*: filament 0.7–1.5 mm long; anther 0.4–0.7 mm long. *Seed c.* 2.6 x 1.3 mm.

Selected specimen examined. WESTERN AUSTRALIA: Muntadgin, Aug. 1947, *T.W. Stone & E.T. Bailey* 447.

Distribution and habitat. Extends from near Wubin south to York, south-east tc near Kulin and east to Coolgardie. Occurs in shrublands on sand, sometimes with laterite.

Phenology. Flowers: August to October. Fruits: September to October. Mature seeds were examined on *H. Demarz* 5251.

Breeding system. Female specimens examined: *R.J. Cranfield* 2439, *H. Demarz* 5251 (also a bisexual specimen on same sheet) and *P. Roberts* 193.

Conservation status. This taxon is probably not at risk at present since it has been recorded from a fairly large range, but needs to be monitored because its range is mainly in the wheatbelt and most populations may have been cleared. It does not appear to have been collected since 1983 and is not known from any nature reserves.

Notes. The old specimen cited above was included in Rye (1987) but with the first of the collectors' names omitted. Specimens from the north-western areas tend to have broader leaves and bracts, more hairy floral tubes and anthers with a narrower connective than south-eastern specimens, which become more similar to subsp. *brevifolia*. Subsp. *modesta* is distinguished from subsp. *brevifolia* primarily by having the large hairs of the floral tube located mainly above the swollen base, also in its usually obovate to broadly elliptic (rather than ovate or broadly ovate) inner bracts.

Pimelea brevistyla Rye (Rye 1984: 1–4). *Type:* Glenburn Rd, *c.* 0.8 km west of Moola Rd, Glen Forrest, Western Australia, 6 October 1983, *N. Cohen* 1002 (*holo:* PERTH 01603507; *iso:* CANB, K, MEL, NSW).

Shrub usually 0.3–1.3 m high; stems with axillary hair tufts absent except for inconspicuous ones in the uppermost axils below each inflorescence. *Leaf blades* linear to narrowly ovate; margins incurved or inrolled; apex narrowly obtuse, occasionally slightly mucronate. *Inflorescence* erect. *Involucral bracts* ovate or broadly ovate, paler than leaves and usually yellowish; outer bracts glabrous outside, sometimes ciliate, occasionally hairy inside; inner bracts glabrous outside or occasionally hairy on the apical point, appressed-hairy inside at least towards apex, densely ciliate. *Flowers* white or cream, sometimes hairy along the midvein on the inside of each outer sepal, persistent in fruit; swollen base of floral tube largely glabrous to largely covered with patent to retrorse hairs 0.1–0.2 mm long; slender portion of floral tube 6–12 mm long, the proximal half with a belt of more or less patent hairs 2–5 mm long (the longest hairs at least 2.5 mm long) mixed with minute hairs 0.1–0.3 mm long, the distal half with hairs 0.2–1 mm long, the longer hairs antrorse. *Stamens* much shorter than sepals; filament 0.1–0.4 mm long; anther orange, 0.8–1.8 x 0.5–0.7 mm, introrse.

Distribution and habitat. Extends from Wubin south to North Dandalup River and south-east to near Lake Carmody in the South West Botanical Province. Occurs in lateritic or granitic habitats. (Figure 1B)

Phenology. Flowers: August to October. Fruits: September to November. Mature seeds were examined on *D.J.E. Whibley* 4726.

Breeding system. All specimens examined are bisexual.

Notes. Pimelea brevistyla is a very distinctive species and can be recognized readily from all other members of sect. *Heterolaena* except *P. brevifolia* by its subsessile strictly introrse anthers. Most specimens of *P. brevifolia* have longer filaments and semi-latrorse anthers, but those with subsessile introrse anthers can still be readily distinguished from *P. brevistyla* by the glabrous or subglabrous inner surface of their bracts and by the antrorse hairs on the swollen base of their floral tube. *Pimelea brevifolia* usually has distinctly smaller leaves and flowers than *P. brevistyla* and its leaves are usually obovate to elliptic rather than narrowly ovate, never becoming linear by the inrolling of the margins.

From the few mature seeds that have been examined in this species, *P. brevistyla* appears to be similar to *Pimelea spectabilis* in having a relatively thick and shiny brown exocarp. Most members of sect. *Heterolaena* have a very thin membranous exocarp, which is sometimes impressed onto the mesocarp.

Previously the known ranges of the two subspecies of *P. brevistyla* were separated by a fairly large disjunction (see Rye 1987: Figure 58). A recent collection from about midway across the disjunction (*J.R. Wheeler* 2316) has bridged the gap in distribution, but not in morphology, between the two subspecies.

a. Pimelea brevistyla Rye subsp. **brevistyla**

Illustration. Rye (1984: Figure 1).

Shrub (0.3)0.5–1.3 m high. *Leaf blades* 15–28 x 1.5–4(5) mm. *Involucral bracts* 12–20 mm long. *Floral tube* 11–15 mm long. *Sepals* 4.5–6 mm long. *Seed* not seen at maturity.

Selected specimens examined. WESTERN AUSTRALIA: Walk track above falls, S side of river, Serpentine National Park, 9 Aug. 1990, *B. Evans* 45; 85 km N of Midland, Perry Rd, 2 km E of Great Eastern Highway, 3 Sep. 1984, *J.R. Wheeler* 2316.

Conservation status. Although only recorded from about nine localities, this taxon does not appear to be at risk at present. If surveys were to be carried out for it, the subspecies would almost certainly be found from many additional localities on the Darling Range.

Distribution and habitat. Apparently restricted to Darling Range, extending from north of Bindoon south to Serpentine Falls.

b. Pimelea brevistyla subsp. **minor** Rye (Rye 1988: 242–244). *Type:* Great Eastern Highway, 4.1 km west of Hines Hill, Western Australia, 27 August 1983, *N. Cohen* 1025 (*holo:* PERTH 01603515; *iso:* CANB, K, MEL, NSW).

Illustrations. Rye (1988: Figure 59) and Rye (1990: Figure 79D,E).

Shrub (0.2)0.3–0.9 m high. *Leaf blades* 8–18 x 1.5–3(4) mm. *Involucral bracts* 7–11 mm long. *Floral tube* 8–11 mm long. *Sepals* 3–4 mm long. *Seed* almost ovoid, 3.0–3.3 x *c.* 1.4 mm, shiny brown over black.

Selected specimens examined. WESTERN AUSTRALIA: 45 km SE of Hyden along road to Lake King, 13 Oct. 1991, *W. Greuter* 22764; Off Goldfields Rd, Merredin, 13 Aug. 1997, *A. Gundry* 121; 9 km E of Wyalkatchem, 10 Oct. 1989, *B. Nordenstam & A. Anderberg* 508; Wongan Hills Experimental Farm, Reserve 18672, Craig Rd, *c.* 6.5 km N of Wongan Hills, 10 Oct. 1985, *C.M. Parker & P.J. Poli.*

Distribution and habitat. Occurs in the central wheatbelt, extending from Wubin south-east to near Lake Carmody (east of Hyden).

Pimelea ciliata Rye (Rye 1984: 6–9). *Type:* Glenburn Rd, *c.* 0.8 km west of Moola Rd, Glen Forrest, Western Australia, 6 October 1983, *N. Cohen* 1001 (*holo:* PERTH 01603965; *iso:* CANB, K, MEL, NSW, PERTH 01603566).

Shrub usually 0.5–1 m high; stems with axillary hair tufts present throughout but tending to become less conspicuous in lower axils. *Leaf blades* ovate to almost linear, 8–22 x 1–5(7) mm; margins recurved to revolute; apex acute, usually distinctly mucronate. *Inflorescence* erect. *Involucral bracts* ovate or broadly ovate, usually with a pinkish base, sometimes largely reddish, ciliate, rarely partially hairy inside; inner bracts 8–13 mm long. *Flowers* white or pink, glabrous inside, persistent in fruit; swollen base of floral tube with more or less patent hairs 0.1–0.4 mm long, occasionally with a few long hairs at summit; slender portion of floral tube 4.5–11 mm long, with widely antrorse to patent hairs 2–5 mm long in basal half, usually mixed with minute hairs, and with antrorse hairs mostly 0.3–1 mm long in distal half. *Stamens* slightly to much longer than sepals; filament 2.5–4.5 mm long; anther orange (0.5)0.7–1.2(1.4) mm long.

Distribution and habitat. Occurs in the South West Botanical Province, extending from Wongan Hills to the south-west corner of the State and south-east to Porongurup Range. Occurs mainly on relatively elevated areas such as Darling Range, in heavy soils often in lateritic and granitic habitats. (Figure 1C)

Notes. The common name White Banjine has sometimes been applied to this species, but possibly also sometimes to related species, and is somewhat misleading as the species often has pink flowers. It is closely related to *Pimelea neokyrea* and *P. rosea*; see notes under those species for a discussion of the differences between them. It has also often been confused with *P. avonensis* and *P. leucantha*, both of which differ in their more obtuse leaves.

Two subspecies are recognized. These are geographically distinct but show habitat similarities especially in respect to soil type and typography.

a. Pimelea ciliata Rye subsp. **ciliata**

Illustration. Rye (1988: Figure 60).

Flowers white or pale pink; slender portion of floral tube 4.5–8(9) mm long. *Seed* almost ovoid, 3–3.5 x 1.1–1.4 mm, dull greyish black, the exocarp impressed in a reticulate pattern onto the black mesocarp. (Figure 3A,B)

Selected specimens examined (typical variant). WESTERN AUSTRALIA: Off Yarra Rd, 4.8 km NW of Mt Yetar, 5 Nov. 1996, *M.G. Allen* 45; Fowlers Gully, Wongan Hills, 14 Sep. 1983, *N. Cohen* 1028; 29 km W of Woodanilling on Robinson Rd, 5 Oct. 1988, *J.M. Fox* 88/188 (ex CANB).

Selected specimens examined (southern variant). WESTERN AUSTRALIA: 14.5 km WSW of Tenterden, near Lake Nunijup, 10 Aug. 1993, *A.R. Annels* 3491; Sheepwash Nature Reserve, SE of Mount Barker, 16 Aug. 1993, *B.G. Hammersley* 900; Scott National Park, 30 Oct. 1990, *C.J. Robinson* 338.

Distribution. Extends from Wongan Hills south-south-west to Scott River National Park, south to near Lake Muir, and south-east to Porongurup Range.

Phenology. Flowers: August to November. Fruits: September to January. Mature seeds were observed on *H.J. Anderson* 28, *R. Davis* 4556, *H. Demarz* 398 and *S. Patrick* 86.

Breeding system. Female specimens examined: *A.R. Annels* 4014, *R. Helms* 11 Sep. 1897 and *M. Koch* 2455 (also a bisexual specimen on same sheet). A few specimens (e.g. *J. Seabrook* 182), have inflorescences with some of the outermost flowers female and the rest bisexual.

Notes. This subspecies is much more widespread and variable than the other subspecies. Most specimens from near Perth and northwards have flowers white at maturity, but white-flowered specimens become gradually less common and pale pink-flowered ones more common towards the south and east of the subspecies' range, with all specimens from the far south-east apparently having pale pink flowers. There is also a tendency for specimens in the southern part of the range to differ from those in the northern part of the range in having shorter and more elliptic leaves, and longer hairs on the swollen base of the floral tube. Some of the specimens occurring furthest inland have the smallest flowers found in this subspecies.

Throughout the subspecies' distribution some specimens have few or no minute hairs occurring in the central part of the band of long hairs on the floral tube, although most specimens do have minute hairs throughout the band.

A specimen from Sampsons Brook (*G.F. Berthoud* 25 Oct. 1902) has particularly large leaves and flowers, the largest leaf 7 mm wide and the largest flowers with the slender portion of the floral tube 9 mm long.

b. **Pimelea ciliata** subsp. **longituba** Rye (Rye 1988: 246–247). *Type:* Jindong, south of Busselton, Western Australia, 20 October 1950, *R.D. Royce* 3402 (*holo:* PERTH 01603973; *iso:* CANB, MEL).

Flowers medium pink; slender portion of floral tube 8–11 mm long. *Seed* not seen at maturity. (Figure 3C–E)

Selected specimens examined. WESTERN AUSTRALIA: Yelverton Forest, 23 km NW of Margaret River, 7 Nov. 1989, *G.J. Keighery* 10984; Forest Grove Block, SE of Witchcliffe, 30 Oct. 1996, *G.J. Keighery* 14616.

Distribution. Occurs in a small area extending from Yallingup south to near Witchcliffe and east to Ambergate.

Phenology. Flowers: September to November. Fruits: October to December.

Breeding system. One specimen, *J.E. Whibley* 5044, has inflorescences with the outermost flowers female and the rest bisexual.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. This subspecies has been collected from at least six localities and while not known from any nature reserves, is found in areas managed for conservation. Its known range is *c.* 50 km long.

Pimelea ferruginea Labill. (Labillardiere 1805: 10, t. 5). – *Banksia ferruginea* (Labill.) Kuntze (Kuntze 1891: 583). *Type:* "Van-Leuwin" [Actually collected at Esperance], Western Australia, 11–18 December 1792, *J.J.H. de Labillardière* (*iso:* MEL).

Pimelea decussata R.Br. *nom. illeg.* (Brown 1810: 360). – *Heterolaena decussata* (R. Br.) C.A. Mey. *nom. illeg.* (Meyer 1845: 73). *Type:* King George Sound, Western Australia, December 1801, *R. Brown* (*holo:* BM).

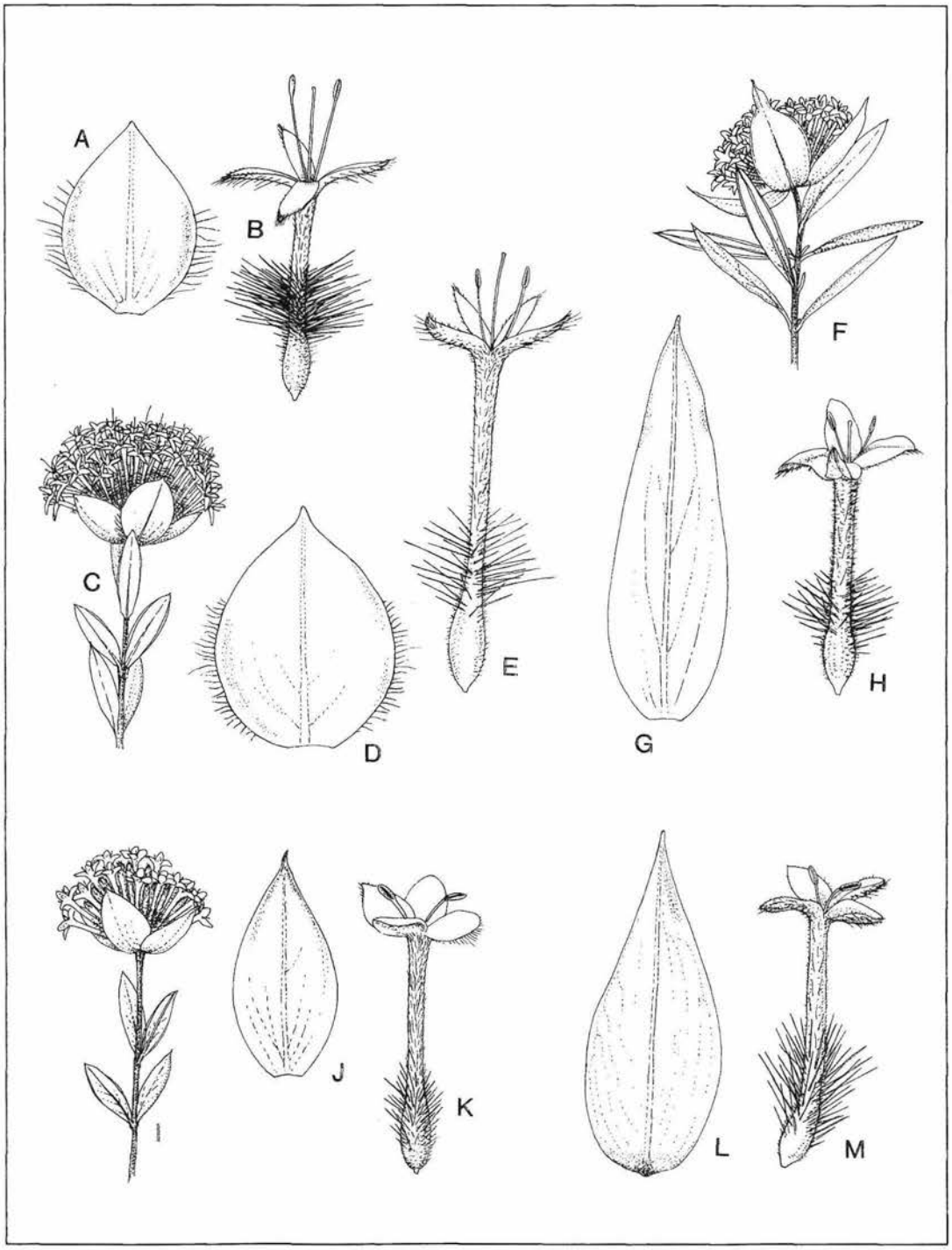

Figure 3. A,B. *Pimelea ciliata* subsp. *ciliata*. A – bract (x3), B – flower (x3.5); C–E. *Pimelea ciliata* subsp. *longituba*. C – flowering branch (x1), D – bract (x3), E – flower (x3.5); F–H. *Pimelea neokyrea*. F – flowering branch (x1), G – bract (x3), H – flower (x3.5); I–K. *Pimelea rosea* subsp. *annelsii*. I – flowering branch (x1), J – bract (x3), K – flower (x3.5); L, M. *Pimelea rosea* subsp. *rosea*. L – bract (x3), M – flower (x3.5). Drawn from *W. Greuter* 22685 (A, B), *R.D. Royce* 2484 (C–E), *G.J. Keighery* 6336 (F–H), *A. Strid* 20396 (I–K) and *B.J. Keighery & N. Gibson* 394 (L, M).

Illustration. Rye (1988: Figure 62).

Shrub 0.3–1.5 m high; stems with reddish hair tufts in uppermost axils but hairs often absent from lower axils, often also hairy on the internodes especially the uppermost ones below each inflorescence, the internode hairs extending above each axil to the next internode but absent from the strips in between. *Leaf blades* more or less elliptic or narrowly elliptic, 5–17 x 1.5–6.5 mm; margins recurved; apex often minutely mucronate. *Inflorescence* erect. *Involucral bracts* broadly ovate or rarely ovate, usually partially pink to deep pink throughout, sometimes with a few hairs at extreme base inside, usually ciliate on lower margins; inner bracts 6–12 mm long. *Flowers* white to deep pink-purple, usually pale to medium pink, glabrous inside, persistent in fruit; swollen base of floral tube with more or less patent hairs 0.1–0.5 mm long mixed with long hairs in distal half; slender portion of floral tube 4–8 mm long, with widely antrorse to patent hairs 1.5–3 mm long mixed with minute hairs in basal half and with antrorse hairs mostly 0.4–0.8 mm long in distal part. *Stamens* usually longer than sepals; filament 1.5–3.5 mm long; anther with orange cells and a pink connective, 0.6–1.4 mm long. *Seed* almost ovoid, 2.3–2.6 x 1.1–1.3 mm, rather dull greyish black, the exocarp tending to be impressed in a reticulate pattern onto the black mesocarp. **Coastal Banjine**

Selected specimens examined. WESTERN AUSTRALIA: 3 km S of Grey on track to Wedge Island, 30 Aug. 1988, *K. Hill* 2952 (ex NSW); Shire View Hill Reserve 11930, Nowergup, 21 Oct. 1993, *B.L. Keighery & N. Gibson* 554; Tagon Bay, Cape Arid National Park, 16 Oct. 1991, *W. Greuter* 22883; Between Point Irwin and The Gap, Walpole–Nornalup National Park, 9 Aug. 1992, *J.R. Wheeler* 3078; Walking trail on Martins Tank Lake, Yalgorup National Park, 20 Oct. 1994, *A. Worz* 04.10.20.06.

Distribution and habitat. Extends around the coast from Cliff Head to near Point Culver in the South West Botanical Province. Occurs close to the coast in very low to medium-height shrublands, on hills or slopes with a rocky substrate usually of limestone or granite, or on sand dunes. (Figure 2C)

Phenology. Flowers: July to February, especially September to November. Fruits: September to March. Mature seeds were observed on *T.E.H. Aplin* 2543, *D. Churchill* 39, *R.J. Cranfield* 1146, *J. Everett* 1473, *C.A. Gardner* 13800 and *J.R. Knox* 661201.

Breeding system. Some specimens (e.g. *D. Edinger* 158 and *E.D. Kabay* 604), have inflorescences with the outermost flowers female and the rest bisexual.

Notes. This attractive species is one of the most common *Pimelea* species in cultivation, favoured because of its dense domed growth habit, with very close patent leaves in an obvious opposite-decussate arrangement, and prolific pink flowers. It can generally be distinguished from other species by its distinctive growth form but occasionally in the wild produces more straggly growth with longer internodes and with the leaves often antrorse. The normal domed habit is evidently well suited to its coastal habitat in low windswept shrublands.

As listed among the doubtful names in Rye (1990: 209), three varieties based on cultivated material have been named under the illegitimate synonym *Pimelea decussata*. These varieties are probably all variants of *P. ferruginea* but there is insufficient information to be certain. The species has a considerable range around the coast, with specimens from the south-west corner and south coast tending to have leaves either longer or broader than those from the west coast, and with specimens from the far south-west near Augusta tending to have the longest stamens. Specimens from both ends of the range nearly always have both pairs of bracts ciliate whereas those from some other parts of the range fairly often have the outer pair or both pairs glabrous.

Nearly all specimens on the west coast from Yalgorup northwards have hairs on several to many internodes below each inflorescence. While members of sect. *Heterolaena* commonly have axillary tufts of hairs and occasionally are sparsely hairy on the peduncle, an extension of these hairs up along the stems often for several internodes below each inflorescence is unique to *P. ferruginea*. This character is uncommon in specimens from the far south-west and south coast however.

Pimelea hispida R. Br. (Brown 1810: 360). – *Heterolaena hispida* (R. Br.) C.A. Mey. (Meyer 1845: 73). – *Banksia hispida* (R. Br.) Kuntze (Kuntze 1891: 583). *Type:* King George Sound, Western Australia, December 1801, *R. Brown* (*holo:* BM).

Illustrations. Rye (1988: Figure 67) and Rye (1990: Figure 79F).

Shrub 0.4–1.5 m high; stems with axillary hairs present throughout but tending to become less conspicuous in lower axils. *Leaf blades* more or less elliptic, 9–34 x 2–9 mm; margins recurved or sometimes incurved; apex obtuse to mucronate. *Inflorescence* erect. *Involucral bracts* usually ovate or broadly ovate, usually with a deep pink apex or margin to deep pink throughout, sometimes green throughout, glabrous outside; outer bracts partially appressed-hairy inside; inner bracts 6–16 mm long, appressed-hairy inside, usually ciliate. *Flowers* very pale to deep pink, possibly very rarely white, glabrous inside, persistent in fruit; swollen base of floral tube with retrorse hairs 0.2–0.6 mm long usually throughout but rarely becoming patent in distal half, mixed with large patent or retrorse hairs towards summit; slender portion of floral tube 7.5–12 mm long, with widely antrorse to patent hairs 2.5–5 mm long mixed with minute hairs in basal half, the distal half with medium-sized antrorse or somewhat tangled hairs usually mixed with a few larger hairs 1.5–3 mm long. *Stamens* longer or sometimes shorter than sepals; filament 1.5–3 mm long; anther with orange cells and a pink conective, 0.6–1.4 mm long. *Seed* almost ovoid or broadly ovoid, 2.0–2.6 x 1.3–1.6 mm, whitish over shiny black.

Selected specimens examined. WESTERN AUSTRALIA: E end of ridge, Mt Manypeaks, 22 Nov. 1994, *S. Barrett* 167; 33°44'45"S, 115°03'59"E, 4 Dec. 1996, *N. Casson & A. Annels* SC 36.4; Wye Flats, South Coast Highway, 15 Nov. 1980, *E.J. Croxford* 1322; North Marbellup, W of Albany, 25 Nov. 1980, *D. Davidson s.n.*; 1.3 km S of Schroeder Rd and Great North Rd intersection, 12 Dec. 1996, *C. Godden & D. Bright* SC 83.4.

Distribution and habitat. Extends from Geographe Bay around the coast to Mt Manypeaks and inland to Stirling Range in the South West Botanical Province. Occurs on seasonally waterlogged flats and on coastal sand dunes. (Figure 1D)

Phenology. Flowers: September to January, especially October to December. Fruits: October to February. Mature seeds were observed on *A.R. Annels* 651, *N. Casson & B. Evans* SC139.6, *C. McChesney & C. Day* W10.3, *P. Ellery & C. Day* P155.7, *L. Graham* 615, *E.D. Kabay* 1405, *R.D. Royce* 8114 and *J.R. Wheeler* 3628 *& S.J. Patrick.*

Breeding system. Female specimen examined: *S.W. Jackson* Dec. 1912 (also bisexual specimens on same sheet).

Notes. Pimelea hispida seems to have a less variable flowering period than its closest relative *P. lanata*, with its main flowering time earlier, and tends to have larger flowers with shorter anthers. The two taxa can be readily distinguished by the bracts, which have a distinct yellow border in *P. lanata* but not in *P. hispida*, and also by the circumscissile flowers of *P. lanata* having the floral tube more slender

below and rather suddenly expanded above the circumscission point whereas the non-circumscissile flowers of *P. hispida* show a more gradual expansion from the base to the summit of the floral tube. In comparison with *P. hispida*, *P. lanata* has a harder fruit wall and its seed is significantly shorter although of a similar width.

Pimelea hispida shows great variablility in its leaf margins, which range from distinctly incurved to distinctly recurved. The swollen base of the floral tube is very densely covered at first by hairs mostly 0.2–0.5 mm long and some larger hairs, the smaller hairs usually reflexed to retrorse but occasionally only the lowest ones reflexed as in *J.R. Wheeler* 3390 and the rest more patent. Retrorse to reflexed hairs often extend onto the lower half of the slender portion of the floral tube as well but commonly the hairs become patent to antrorse in this area.

Pimelea lanata R. Br. (Brown 1810: 360). – *Calyptrostegia lanata* (R. Br.) Endl. (Endlicher 1848: 61). – *Pimelea hispida* var. *lanata* (R. Br.) Diels & E. Pritz. (Diels & Pritzel 1904: 394). *Type:* King George Sound, Western Australia, December 1801, *R. Brown* (*holo:* BM).

Illustrations. Rye (1988: Figure 68) and Rye (1990: Figure 79G–I).

Shrub or small *tree* 0.7–4 m high; stems with axillary hairs present and sometimes dense throughout but sometimes tending to become less conspicuous in lower axils. *Leaf blades* ovate to narrowly obovate, 9–25 x 2–9(11) mm; margins incurved; apex minutely apiculate or mucronate. *Inflorescence* erect. *Involucral bracts* ovate or broadly ovate, green with a distinctive yellow marginal border 0.5–1.5 mm wide (the border obvious on at least two of the four bracts) and sometimes tinged deep pink towards apex, glabrous outside; outer bracts partially appressed-hairy inside; inner bracts 5–14 mm long, appressed-hairy inside, ciliate on at least part of the margin. *Flowers* white or pale pink, possibly rarely medium pink, glabrous inside, tardily circumscissile 1–3 mm above the swollen base of tube in fruit; swollen base of floral tube densely covered by retrorse hairs 0.2–0.4 mm long, mixed towards the summit with some large hairs; slender portion of floral tube 4.5–8 mm long, with widely antrorse to patent hairs 2–4 mm long concentrated in basal half and mixed with minute hairs, the distal half less densely hairy with medium-sized antrorse hairs, often mixed with a few larger hairs. *Stamens* longer than sepals; filament 2.5–4.5 mm long; anther with a pink connective, 1.0–1.6 mm long. *Seed* almost ovoid, 3.3–4.0 x 1.3–1.6 mm, whitish to golden brown over shiny black.

Selected specimens examined. WESTERN AUSTRALIA: 550 m N of Sabina Rd on Jalbaragup Rd, 80 m W of Jalbaragup Rd, 8 Jan. 1997, *N. Casson & B. Evans* SC147.1; Youngs Siding, W of Albany, 15 Jan. 1977, *E.J. Croxford* 23; 3 km N along Linfarne Rd from intersection with Gibellini Rd [W of Palgarup], 19 Feb. 1997, *C. Day & A. Annels s.n.*; 21 km along Windy Harbour Rd, S of Northcliffe, 12 Jan. 1995, *E.D. Kabay* 1361; Anstey Rd, Forrestdale, 9 Nov. 1990, *G.J. Keighery* 11816.

Distribution and habitat. Extends around the coast from Perth to Albany and inland to near Manjimup in the South West Botanical Province. Occurs in swampy areas on coastal plains. (Figure 1A)

Phenology. Flowers and fruits: all year, especially December to February. Mature seeds were observed on *D. Churchill* 27/12/1957, *E.D. Kabay* 1361, *K.R. Newbey* 1240, *C.J. Robinson* 420 and *R.D. Royce* 6799.

Breeding system. All specimens examined are bisexual.

Notes. Atypical of sect. *Heterolaena* in having circumscissile flowers. Some specimens with immature fruits appear to have non-circumscissile flowers but the circumscission is always evident in mature fruits. At full maturity the ovary wall often forms a particularly hard case about the seed in this species.

Pimelea lanata has commonly been confused with *P. hispida*, but differs as indicated under that species. It also shows some similarities to *P. lehmanniana*, *P. sessilis* and *P. rara* but is readily distinguished from all these species.

Northern specimens, occurring from Perth to Harvey, have narrower leaves and bracts than those from elsewhere in the species' distribution, with specimens from near the south coast tending to have the largest and broadest leaves.

Pimelea lehmanniana Meisn. (Meisner 1845: 603). – *Calyptrostegia lehmanniana* (Meisn.) Endl. (Endlicher 1848: 61). – *Banksia lehmanniana* (Meisn.) Kuntze (Kuntze 1891: 583). *Type:* "Mt Wuljenup" [Willyung Hill], Western Australia, 14 October 1840, *L. Preiss* 1271 (*lecto:* LD, *fide* Rye (1988: 228); *isolecto:* MEL, NY).

Shrub 0.2–1.2 m high; stems with axillary hairs present in uppermost axils but absent or few and inconspicuous in lower axils. *Leaf blades* with margins slightly to prominently recurved; apex acute, mucronate. *Involucral bracts* ovate or broadly ovate, often yellowish or reddish; outer bracts often partially hairy inside; inner bracts (8)10–22 mm long, partially or almost fully hairy inside, sometimes ciliate. *Flowers* with a ring of long reflexed hairs in the throat and with somewhat shorter antrorse to patent hairs on the base of each sepal and sometimes extending along midvein to about the centre of each sepal. *Stamens* longer than sepals, usually much longer; anther probably pale yellow. *Seed* not seen at maturity.

Distribution. Distributed in the South West Botanical Province, extending from the part of Darling Range closest to Perth south-south-west to Yelverton, south-east to near Albany and from there inland to Stirling Range and east to East Mt Barren. (Figure 4A)

Notes. Although numerous specimens are in mature fruit, no mature seeds were observed. Bentham (1873) similarly failed to find mature seeds in this species. The closest relative is probably *Pimelea spectabilis*, which commonly produces fertile fruits.

The distribution data given in Rye (1988, 1990) for the two subspecies of *P. lehmanniana* are misleading. Recent collections have extended the known ranges of the two taxa, which now appear to be parapatric or have a slight area of overlap in range rather than being allopatric. A single specimen of somewhat intermediate morphology is *A.R. Annels* 4189 from near Mount Barker, which has a few small hairs towards the summit of the swollen base of the flower but otherwise appears to match subsp. *nervosa*.

a. **Pimelea lehmanniana** Meisn. subsp. **lehmanniana**

Illustrations. Rye (1988: Figure 49) and Rye (1990: Figure 79A).

Leaf blades narrowly ovate to narrowly obovate or ovate to obovate, 10–26 x 2–7 mm. *Inflorescence* pendulous. *Flowers* white to pale yellow, tardily circumscissile 1.5–3 mm above the swollen base of tube in fruit; swollen base of floral tube with coarse, more or less patent hairs

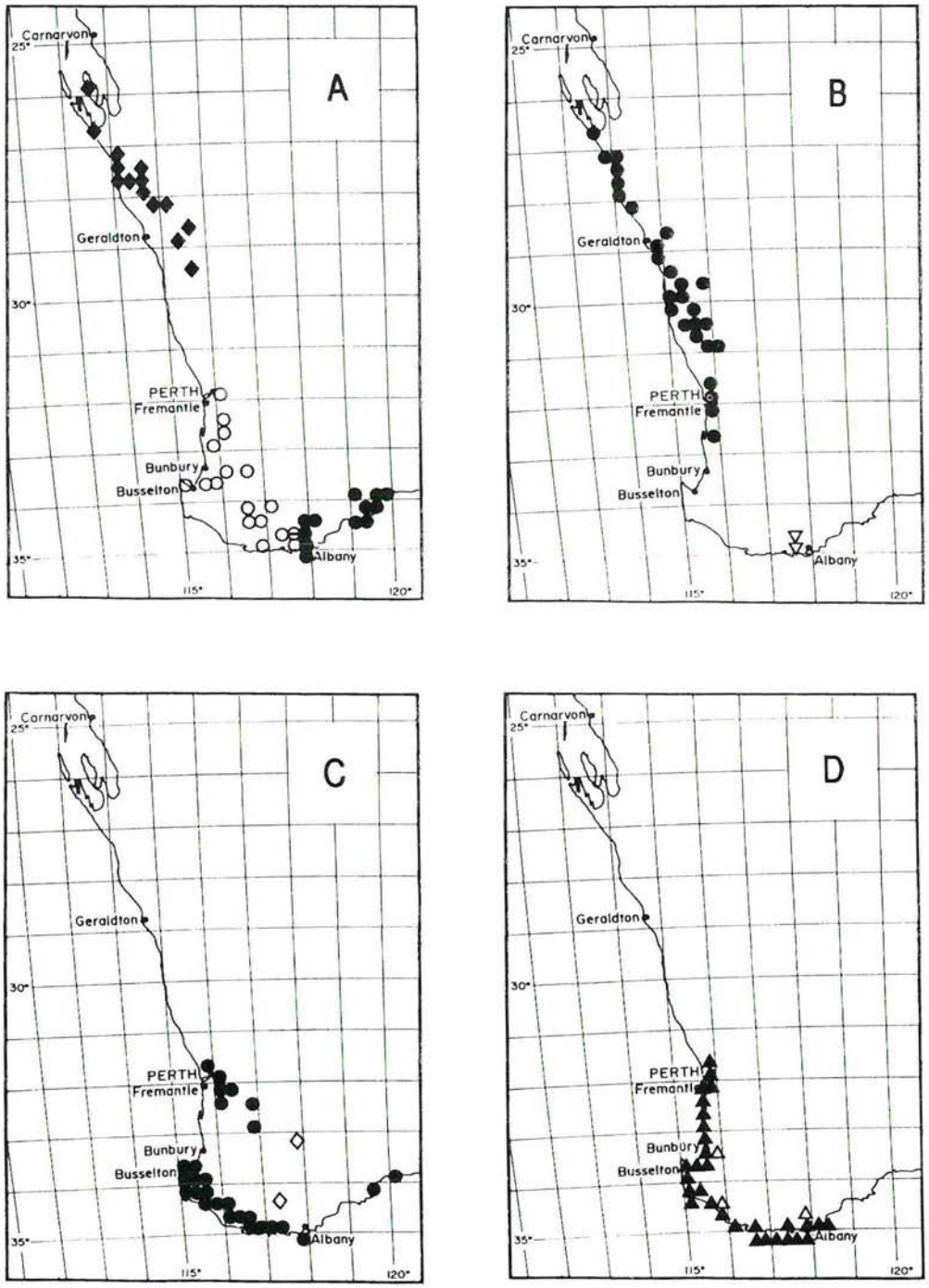

Figure 4. Geographical distributions. A – *Pimelea lehmanniana* subsp. *lehmanniana* ●, intermediate ⊖, subsp. *nervosa* ○ and *P. sessilis* ◆ ; B – *Pimelea leucantha* ◍ and *P. rosea* subsp. *annelsii* ▽ ; C – *Pimelea neokyrea* ◇ and *P. spectabilis* ● ; D – *Pimelea rosea* subsp. *rosea*, coastal populations ▲ and inland populations △ .

0.1–0.4 mm long and often a few much larger hairs towards summit; slender portion of floral tube 4.5–9 mm long, with widely antrorse to patent hairs 2–5.5 mm long on basal half and smaller antrorse hairs on distal half. *Stamens* with a filament 4–7 mm long; anther 0.7–1.2 mm long.

Selected specimens examined. WESTERN AUSTRALIA: South Stirlings rubbish reserve, Chillinup Rd, 28 Aug. 1985, *E.J. Croxford* 4204; Stirling Range Drive, *c.* 16 km from E junction, 1 Nov. 1994, *A. Worz s.n.*

Distribution and habitat. Extends from near Mount Barker and Albany east to East Mt Barren. Occurs mostly on rocky hillsides or ridges, often with quartzite or laterite.

Phenology. Flowers: August to October. Fruits: September to November.

Breeding system. Female specimens examined: *A.M. Ashby* 578 and *W. Rogerson* 262 (also a bisexual specimen on same sheet).

b. Pimelea lehmanniana subsp. **nervosa** (Meisn.) Rye (Rye 1988: 232). – *Pimelea lehmanniana* var. *nervosa* Meisn. (Meisner 1848: 270). *Type:* South-west, [Western Australia], 1843–1844, *J. Drummond* 3: 284 *ex parte* (*iso:* NY).

Illustration. Rye (1988: Figure 50).

Leaf blades narrowly ovate to narrowly obovate or rarely ovate, 15–34 x 2.5–10 mm. *Inflorescence* erect or pendulous. *Flowers* white or creamy white, persistent in fruit; swollen base of floral tube glabrous; slender portion of floral tube 6.5–11 mm long, with widely antrorse to patent hairs 3–6 mm long towards (but usually not quite reaching) base and smaller antrorse hairs on distal half. *Stamens* with a filament 4.5–8 mm long; anther 1.2–1.5 mm long.

Selected specimens examined. WESTERN AUSTRALIA: Walpole, 5 Dec. 1989, *A.R. Annels* 950; Reserve 22492, 5 km SE of Mount Barker, 16 Nov. 1993, *A.R. Annels* 4189; Spencer Road Reserve, 12 km W of Narrikup, 15 Nov. 1986, *E.J. Croxford* 5470; Carbanup River townsite, 2 Nov. 1993, *G.J. Keighery* 11766.

Distribution and habitat. Extends from Gooseberry Hill (an eastern suburb of Perth) south-south-west to Yelverton and south-east to Walpole and the Mount Barker area. Occurs on Darling Range and in other hilly areas, commonly recorded with laterite or gravel, often in vegetation dominated by Jarrah (*Eucalyptus marginata*) and/or Marri (*Corymbia calocephala*).

Phenology. Flowers and fruits: September to December.

Breeding system. All specimens examined are bisexual.

Notes. Differs from subsp. *lehmanniana* in its fully persistent rather than circumscissile flowers, glabrous swollen base of floral tube and larger anthers. It tends to have larger flowers and longer leaves while subsp. *lehmanniana* tends to have more yellowish flowers and the inflorescences are consistently pendulous, but these characters show too much overlap to be of use in keying the two taxa.

Pimelea leucantha Diels (Diels & Pritzel 1904: 393). *Type:* Lower Greenough River, north of "Bukara" [Bookara], Western Australia, 10 September 1901, *L. Diels* 4238 (*holo:* B destroyed; *iso:* PERTH (ex B) 01604090).

Pimelea rosea var. *calocephala* Meisn. (Meisner 1845: 602–603). *Type:* near "Lake Keiermulu" [Leederville area], Western Australia, 4 October 1839, *L. Preiss* 1267 (*lecto:* LD, *fide* Rye (1988: 238); *isolecto:* MEL, NY).

Illustration. Rye (1988: Figure 53).

Shrub 0.4–2 m high; stems with axillary hair tufts absent except for uppermost axils below each inflorescence. *Leaf blades* usually linear to narrowly ovate or narrowly elliptic, 12–28 x 1–5 mm; margins recurved, often becoming revolute; apex narrowly obtuse, not or scarcely mucronate. *Inflorescence* erect or somewhat pendulous. *Involucral bracts* ovate or broadly ovate, sometimes yellowish and often pink-tinged; outer bracts glabrous or ciliate; inner bracts 13–20 mm long, often ciliate, sometimes slightly hairy inside. *Flowers* white to yellow, usually pale yellow, glabrous inside, persistent in fruit; swollen base of floral tube with patent to antrorse hairs 0.1–0.3 mm long, mixed with long hairs in distal half or towards summit; slender portion of floral tube 9–14 mm long, with a mixture of widely antrorse to patent hairs 2.5–5.5 mm long and minute hairs in basal half and with antrorse hairs mostly 0.5–1 mm long in distal half. *Stamens* usually shorter than sepals; filament 1–2.5 mm long; anther 0.7–1.3 mm long. *Seed* almost narrowly ovoid or ovoid, 2.3–2.8 x 0.7–1.1 mm, whitish over shiny black.

Selected specimens examined. WESTERN AUSTRALIA: Erindale Rd, Warwick, Nov. 1979, *P. Bridgewater*; 50 km E of Eneabba on Eneabba–Winchester road, 22 Aug. 1983, *I.R. Dixon*; Barberton West Rd, W of Moora, 2 Oct. 1988, *E.A. Griffin* 5421; 4.5 km from New Norcia, 1 Nov. 1990, *E.A. Griffin* 5969; 29 km SW of Cooloomia Homestead, 23 Aug. 1983, *S.D. Hopper* 3318; Nine Mile Lake Nature Reserve, SW of Pinjarra, 20 Sep. 1995, *G.J. Keighery* 13639.

Distribution and habitat. Distributed in the South West Botanical Province, extending along the west coast from Tamala Station south to Nine Mile Lake Nature Reserve (south-west of Pinjarra) and extending inland to Three Springs and near New Norcia. Occurs in deep sand or in sand over rock, the rock usually sandstone or limestone but sometimes laterite. Recorded in Jarrah (*Eucalyptus marginata*) and/or *Banksia* woodlands in the southern part of its range; further north recorded in *Eucalyptus todtiana* woodlands or in vegetation dominated by other eucalypts or various tall shrub or small tree species. (Figure 4B)

Phenology. Flowers: August to early November. Fruits: September to November. Mature seeds were observed on *J.S. Beard* 6882 and *W.E. Blackall* 2775.

Breeding system. Some specimens (e.g. *E.A. Griffin* 3374), have inflorescences with the outermost flowers female and the rest bisexual or produce occasional female inflorescences as well as bisexual inflorescences, while *G.J. Keighery* 13693 appears to be almost entirely female.

Notes. Recent collections have extended the known range of the species both northwards and southwards. One of the specimens cited here (*P. Bridgewater* Nov. 1979) was previously misidentified as *P. rosea*, with which it overlaps in range on the coastal plain between Lake Pinjar and Pinjarra. *P. rosea* can be readily distinguished from *P. leucantha* by its more pointed leaves and pink flower colour.

More commonly, *P. leucantha* has been confused with *P. avonensis* and *P. ciliata.* Apart from the differences already described in the notes under those two species, *P. avonensis* has shorter flowers than *P. leucantha* and *P. ciliata* generally has more prominently ciliate bracts and longer stamens than *P. leucantha.*

Specimens from Perth southwards tend to have relatively large flowers with short anthers on a relatively long filament compared with northern specimens. Specimens from north of Geraldton tend to have a deeper yellow colour to the flowers and shorter broader leaves than those further south. One of the specimens from Kalbarri (*R.C. Wemm* 2100) has particularly broad leaves, with bract-like leaves directly below the inflorescences up to 6.5 mm wide.

Pimelea neokyrea Rye, *sp. nov.*

Differt a *Pimelea ciliata* bracteis exterioribus plus elongatis eciliatis, a *Pimelea rosea* colore florum et positione elatiore pilorum longorum supra tubum florale.

Typus: near Dongolocking [precise locality withheld], Western Australia, 25 August 1983, *G.J. Keighery* 6336 (*holo:* PERTH 03407373).

Shrub 0.3–0.9 m high; stems glabrous except for very inconspicuous hair tufts in axils immediately below inflorescences. *Petioles* 0.5–1 mm long. *Leaf blades* narrowly ovate to very narrowly elliptic, 12–23 x 2–6 mm; margins recurved; apex acute, mucronate. *Involucral bracts* narrowly ovate or ovate, often with a yellowish to reddish base; outer bracts glabrous; inner bracts 15–18 mm long, glabrous inside, sometimes ciliate. *Inflorescence* erect. *Flowers* white or possibly sometimes pale yellow, glabrous inside, persistent in fruit; swollen base of floral tube with more or less patent hairs 0.2–0.3 mm long, with a few long hairs at summit; slender portion of floral tube 7–8 mm long, with widely antrorse to patent hairs 2–3 mm long mixed with minute hairs in basal portion and with antrorse to patent hairs mostly 0.3–1 mm long in distal portion. *Sepals c.* 3 mm long. *Stamens* shorter than sepals; filament 1.8–2.5 mm long; anther 0.6–0.7 mm long. *Seed* not seen at maturity. (Figure 3F–H)

Other specimens examined. WESTERN AUSTRALIA: W of Cranbrook [precise locality withheld], 23 Sep. 1993, *A.R. Annels* 3856; W of Cranbrook [precise locality withheld], 15 Sep. 1984, *E.J. Croxford* 3670.

Distribution and habitat. Recorded from near Dongolocking and from west of Cranbrook in the South West Botanical Province. At the former locality the species was recorded growing under trees in mallee heath on a flat site with "white sandy loam clay". At the latter locality it was recorded on the upper slope of a hill with quartzite and gravel, and the vegetation was apparently dominated by *Eucalyptus marginata.* (Figure 4C)

Phenology. Flowers: August to October. Fruits: September to October.

Breeding system. All specimens examined are bisexual.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Known from only three specimens, two collected very close to one another and possibly at the same locality, and the other specimen from a reserve *c.* 130 km away.

Etymology. From the Greek words *neos* – recent and *kyreo* – light upon, referring to the recent discovery that this taxon was a distinct species. A single specimen (*G.J. Keighery* 6336) was available at the time the genus was revised in Western Australia (Rye 1988) and this was incorrectly placed under *P. avonensis*.

Notes. Closely related to *Pimelea ciliata* and *P. rosea*, being somewhat intermediate in morphology, for example in having stamens shorter than the sepals as in *P. rosea* but with a longer filament and shorter anther more akin to the sizes found in *P. ciliata*. Its distribution of long hairs on the floral tube is also intermediate but closer to that of *P. ciliata*. *P. neokyrea* is also distinguished from *P. rosea* by its inland rather than coastal distribution and its white or yellowish rather than pink flowers. According to the label on *E.J. Croxford* 3670 this specimen of *Pimelea neokyrea* has yellow flowers, but it is only in bud so the open flowers may still be white.

In *P. ciliata* there are two or occasionally three pairs of ciliate bracts whereas the new species has at most one pair of ciliate bracts, and the outer bracts of *P. neokyrea* are longer and narrower than the second pair of bracts in *P. ciliata*. In the area where the two species overlap in range, *P. neokyrea* can also be distinguished from *P. ciliata* by its longer leaves and white or yellowish flowers, but these differences are not reliable elsewhere.

Pimelea rara Rye (Rye 1984: 9–10). – *Pimelea lehmanniana* var. *?ligustrinoides* Benth. (Bentham 1873: 9). *Type:* Swan River, Western Australia, *J. Drummond* 1: *s.n.* (*lecto:* K, *fide* Rye (1984: 9); *isolecto:* K, NY).

Illustrations. Rye (1984: Figure 4). A close-up photograph of the inflorescence is reproduced in Hopper *et al.* (1990: 93).

Shrub commonly 0.2–0.35 m high, with decumbent stems often longer than this; stems with axillary hairs absent or few and inconspicuous in lower axils. *Leaf blades* usually narrowly obovate, 15–37 x 4–8 mm; margins recurved; apex usually obtuse with a short thick mucro. *Inflorescence* erect but often at an angle to an almost horizontal stem. *Involucral bracts* ovate or broadly ovate, usually the same colour as the leaves; outer bracts glabrous; inner bracts 11–17 mm long, ciliate at least at centre of each margin, sometimes sparsely hairy towards base inside. *Flowers* white, sometimes with a ring of short hairs inside at the throat, persistent in fruit; swollen base of floral tube densely covered by retrorse to reflexed hairs mostly 0.3–0.5 mm long; slender portion of floral tube 3.5–7 mm long, usually with retrorse to reflexed hairs on basal part, with widely antrorse to patent hairs 1.3–3 mm long, often mixed with much shorter relexed to patent hairs, on central portion or reaching either to the base or to the summit, sometimes with somewhat smaller and more antrorse hairs towards summit. *Stamens* much longer than sepals; filament 4–6 mm long; anther orange, 0.9–1.4 mm long. *Seed* almost ovoid, 2.6–3.3 x 1.5–1.6 mm, whitish to golden brown over shiny black. **Summer Pimelea**

Selected specimens examined. WESTERN AUSTRALIA: Ellis Brook Valley Reserve, 8 Feb. 1997, *H. Bowler* 478; Lockwood Rd, N of Perth Observatory, 15 Jan. 1987, *L. Graham s.n.*; Nanga Rd, 0.45 km S of Nanga Brook Rd, E of Waroona, 13 Feb. 1998, *F. & J. Hort* 124; Douglas Rd, W of junction of Old Canning Rd, 22 Jan. 1991, *J.L. Robson* 6.

Distribution and habitat. Restricted to Darling Range, recorded from Parkerville south to near Nanga (east of Waroona) in the South West Botanical Province. Occurs in lateritic soil in Jarrah forest. (Figure 1D)

Phenology. Flowers: December to January. Fruits: January to February. Mature seeds were observed on *H. Bowler* 478 and *F. & J. Hort* 124.

Breeding system. All specimens examined are bisexual.

Conservation status. CALM Conservation Codes for Western Australian Flora: Declared Rare. Over 1000 plants are known from more than ten main sites extending about 100 km along the Darling Range. Before recent surveys of this species commenced in 1987, *P. rara* had not been collected for over 65 years, probably because of its summer flowering time as well as its restricted range and its tendency to be largely hidden by the dense shrubs with which it occurs. It may also flower less regularly than other *Pimelea* species, with flowering probably enhanced by disturbance (*F. Hort* pers. comm.).

Notes. This distinctive species has an unusual growth habit with decumbent straggling branches interwoven with shrubs of other species. Perhaps its closest relative is *P. lehmanniana*, which lacks the retrorse hairs on the base of the floral tube and never has small hairs mixed with the large patent hairs of the floral tube.

Pimelea rosea R. Br. (Brown 1810: 360). – *Heterolaena rosea* (R. Br.) C.A. Mey. (Meyer 1845: 73). – *Banksia rosea* (R. Br.) Kuntze (Kuntze 1891: 583). *Type:* King George Sound, Western Australia, December 1801, *R. Brown* (*holo:* BM).

Shrub 0.3–1 m high; stems with axillary hairs not prominent, absent or becoming few and inconspicuous in lower axils. *Leaf blades* narrowly ovate to narrowly obovate; margins recurved or revolute; apex acute to slender-pointed. *Inflorescence* erect. *Involucral bracts* usually narrowly ovate or ovate, rarely broadly ovate, with a yellowish to reddish base; outer bracts usually glabrous, rarely with a few cilia, which are generally concentrated towards base; inner bracts often ciliate, glabrous inside or with a few hairs usually restricted to near the base. *Flowers* usually medium pink to deep red-purple, occasionally pale pink and possibly rarely white, glabrous inside, persistent in fruit; swollen base of floral tube with minute hairs, which are mixed with longer hairs in distal half; slender portion of floral tube 6–10 mm long, with relatively large antrorse to patent hairs near the base and antrorse hairs usually 0.3–1 mm long on remainder. *Stamens* usually distinctly shorter than sepals, rarely about as long as or slightly exceeding sepals; filament 0.7–2 mm long; anther with gold (yellow-orange) cells and a yellow connective, 0.7–1.4 mm long. **Rose Banjine**

Distribution and habitat. Occurs in the South West Botanical Province, extending around the coast from west of Lake Pinjar to Cheyne Beach and inland to Mount Barker. (Figure 4B,D)

Notes. One of the specimens previously cited for this species (*P. Bridgewater* Nov. 1979) has now been redetermined as *Pimelea leucantha*. The newly cited specimens include a few that extend the known range of the species inland to near Dardanup and to east of Lake Jasper.

The closest relative appears to be *Pimelea neokyrea*, and another close relative is *P. ciliata*. Differences between *P. rosea* and the former species are described under that species. *Pimelea rosea* differs from *P. ciliata* in usually having longer, more yellowish anthers on shorter filaments, having the long hairs of the floral tube borne in a lower position on the floral tube and in its shiny black seed. The two taxa generally occur in different areas, *P. rosea* being more coastal and generally in more sandy soils than *P. ciliata*, but there is some overlap in their known ranges between Bunbury and Porongurup Range.

Seed set is particularly good in *Pimelea rosea* and seems to far outdo any other species in section *Heterolaena*. Together with the attractive bright pink flowers, this high fertility may have contributed to making the species one of the earliest Pimeleas to have been cultivated.

Two varietal names have been published under *Pimelea rosea*. One of these, *Pimelea rosea* var. *calocephala* Meisn., is a synonym of *Pimelea leucantha*. The other, *Pimelea rosea* var. *hendersonii* (Graham) Meisn. (Meisner 1857: 503), appears from its description to be a variant of *P. rosea* but cannot be definitely identified as there does not appear to be any type material. It was based on cultivated specimens, with no type cited, and there was no illustration.

Two subspecies are now recognized. Near Albany, they appear to slightly overlap in range but not in habitat.

a. Pimelea rosea subsp. **annelsii** Rye, *subsp. nov.*

Differt a subsp. *rosea* floribus minus dense pilosis, pilis majoribis tubum florale brevioribus et ad basim floris multo proxime positis.

Typus: Reserve 25638, 2 km south-west of Narrikup, Western Australia, 29 September 1993, *A.R. Annels* 3961 (*holo:* PERTH 04297768; *iso:* CANB, MJP *n.v.*).

Shrub 0.3–0.8 m high. *Leaf blades* 6.5–15 x 1–3.5 mm; margins recurved or revolute; apex acute or slightly mucronate. *Inflorescence* erect. *Involucral bracts* often yellowish towards the base or deep purplish to red-tinged at apex; outer bracts usually glabrous, rarely with a few cilia or partially hairy inside; inner bracts 7–13 mm long, sometimes ciliate towards base and partially to sparsely hairy inside. *Floral tube*: swollen base with a few antrorse hairs mostly 0.2–0.4 mm long towards base, becoming replaced by antrorse hairs 1–1.5 mm long in distal half; slender portion 6–8 mm long, with a few antrorse hairs 1–1.5 mm long at extreme base. *Seed* not seen at maturity, 2.5–2.7 mm long when still immature. (Figure 3I–K)

Other specimens examined. WESTERN AUSTRALIA: 400 m W of Mount Barker on Blue Lakes Rd, 27 Sep. 1991, *A.R. Annels* 1751a; Near NE corner of Hay Location 6634, 14 Nov. 1991, *A.R. Annels* 1948; Reserve 22492, 7.5 km SE of Mount Barker, 21 Sep. 1993, *A.R. Annels* 3754; 17.5 km W of Narrikup, 29 Sep. 1993, *A.R. Annels* 3986; Carbarup Rd, near railway, Mount Barker, 9 Sep. 1983, *E.J. Croxford* 2552; Albany–Pemberton road, Sep./Oct. 1963, *D.M. Dorrien-Smith s.n.*; 3 km W of Mount Barker on road to Denmark, 22 Sep. 1982, *A. Strid* 20396.

Distribution and habitat. Restricted to a small area from Mount Barker south-south-west to near the junction of Hay and Mitchell Rivers and south-south-east to Narrikup. Occurs in sandy soils often with laterite or lateritic gravel, in woodlands usually dominated by both Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata*). (Figure 4B)

Phenology. Flowers: September to November. Fruits: recorded November.

Breeding system. One specimen, *A.R. Annels* 1948, has inflorescences with the outermost flowers female and the rest bisexual.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Known from seven collections, at least two of which are on reserves, with a distributional range of over 30 km.

Etymology. Named after Tony Annels, a CALM officer based at Manjimup, who has made extensive collections in south-western Australia, including a majority of the cited specimens of subsp. *annelsii*.

Notes. This subspecies and *Pimelea brevifolia* subsp. *brevifolia* have been confused because their leaves can be of a similar size and shape, and also the type and distribution of hairs on the floral tube of the two taxa can be similar, but *P. rosea* subsp. *annelsii* can be readily distinguished by its recurved leaf margins and larger pink flowers with a usually more densely hairy floral tube.

Subsp. *annelsii* can be distinguished from subsp. *rosea* by its less densely hairy flowers with the large hairs of the floral tube occurring lower on the tube and forming a pure band, not mixed with small hairs except towards the base of the band, these long hairs also being shorter and more appressed than in subsp. *rosea*. It has a more inland distribution than subsp. *rosea*, whose only reported record inland from the south coast is a single unconfirmed record from Porongurup Range, and differs in habitat, although there are a few occurrences of subsp. *rosea* on a similar habitat in other areas.

Subsp. *rosea* tends to have longer more spreading leaves than subsp. *annelsii*, the apex often prominently recurved and generally with a prominent terminal point, and longer involucral bracts, which usually lack the reddish apical margins common in subsp. *annelsii*. There is too much overlap in these characters, however, for them to be useful in keying the two taxa.

b. Pimelea rosea R. Br. subsp. **rosea**

Illustration. Rye (1988: Figure 61).

Shrub 0.3–1 m high. *Leaf blades* 9–30 x 1.5–5 mm; apex often prominently recurved, usually distinctly mucronate or with a slender point 0.3–0.6 mm long. *Involucral bracts* narrowly ovate or ovate, with a yellowish to reddish base; outer bracts usually glabrous, rarely with a few cilia, which are generally concentrated towards base; inner bracts 9–16 mm long, often ciliate, glabrous inside or with a few hairs towards base. *Floral tube*: swollen base with more or less patent hairs mostly 0.2–0.3 mm long mixed with long widely antrorse to patent hairs in distal half; slender portion 6–10 mm long, with widely antrorse to patent hairs 2–3 mm long mixed with usually numerous minute hairs in basal half. *Seed* almost ovoid, 2.1–3.0 x 1.1–1.5 mm, shiny golden brown over shiny black. (Figure 3L,M)

Selected specimens examined (coastal or near-coastal localities). WESTERN AUSTRALIA: 10.35 km W along Lake Jasper track from Vasse Highway, 2 Feb. 1997, *E. Bennett & C. Day* P19.3; 4 km WSW of Nanarup Beach, 12 Dec. 1996, *R. Davis* 1824; Cheyne Beach, 19 Sep. 1985, *H.A. Froebe & R. Classen* 850.

Specimens examined (inland localities). WESTERN AUSTRALIA: Porongurup Range, 14 Sep. 1939, *A.B. Cashmore* 67; Lake Jasper track, 2 Nov. 1997, *R.J. Cranfield* 11589; 10 km W of Donnybrook, *P.A. Jurjevich* 1733; Banksia Rd, Dardanup, 24 Oct. 1985, *L. Nunn* 466.

Distribution and habitat. Extends around the coast from west of Lake Pinjar to Cheyne Beach (*c.* 10 km east of Mt Manypeaks). Occurs mainly on sand dunes, deep sand or sandy clay on coastal plains or on limestone or granite close to the coast. There are also a few inland records, all cited above, three from sandy soil with laterite in the extreme south-west and one record, presumably on granite, from Porongurup Range. The subspecies often occurs in Tuart (*Eucalyptus gomphocephala*) woodlands

near the west coast from Geographe Bay northwards, and it is sometimes associated with watercourses or seasonally waterlogged depressions along the south coast. (Figure 4D)

Phenology. Flowers: July to December, especially September to November. Fruits: recorded September to January. Mature seeds were observed on numerous specimens from throughout the geographical range.

Breeding system. One specimen, *B.J. Keighery & N. Gibson* 437, has inflorescences with the outermost flowers female and the rest bisexual.

Notes. There is a slight tendency for specimens from the west coast to have larger flowers than those from the south coast but there is considerable variability in this character in both areas. The overall stamen length does not vary greatly throughout the geographical range as specimens with long anthers tend to have short filaments and those with short anthers tend to have long filaments.

A few specimens (e.g. *D. Churchill* 16) occasionally produce rather elongate inflorescences with the receptacle and attached pedicels up to 21 mm long.

Pimelea sessilis Rye (Rye 1988: 232–234). *Type:* 0.7 km south of Kalbarri–Ajana road on track to Meanarra Hill, Kalbarri National Park, Western Australia, 28 September 1985, *N. Hoyle* 527 (*holo:* PERTH 01604546; *iso:* CANB, MEL).

Illustrations. Rye (1988: Figure 51) and Rye (1990: Figure 79B).

Shrub 0.15–0.4 m high; stems with dense axillary hair tufts throughout. *Leaves* usually narrowly ovate to broadly elliptic, 6–19 x 3–9 mm; margins recurved or revolute; apex usually broadly obtuse and with a short thick mucro. *Inflorescence* usually horizontal to pendulous. *Involucral bracts* more or less circular (broadly elliptic to depressed ovate or circular), often yellowish, not ciliate; inner bracts 8–12 mm long, appressed-hairy inside. *Flowers* white to pale yellow, glabrous inside, persistent in fruit; swollen base of floral tube with patent or reflexed hairs mostly 0.2–0.4 mm long and also some larger more or less patent hairs in upper half; slender portion of floral tube 6–8.5 mm long, with widely antrorse to patent hairs 2–3.5 mm long on basal half and often extending higher, and usually with a few smaller antrorse hairs towards summit. *Stamens* longer than sepals; filament 2–4 mm long; anther bright yellow, 0.7–1.2 mm long. *Seed* almost narrowly ovoid, *c.* 3.3 x 1 mm, shiny black.

Selected specimens examined. WESTERN AUSTRALIA: Murchison House Station, N side of State Barrier Fence, 47.3 km W of North West Coastal Highway, 27 Aug. 1991, *A.H. Burbidge* 4404; No. 1 Tank [just N of Murchison River on North West Coastal Highway], *C.A. Gardner s.n.*; NE of Yandanooka, 21 Oct. 1992, *E.A. Griffin* 7328; 0.8 km along the road from Denham to Monkey Mia, Peron Peninsula, 4 Nov. 1989, *M.E. Trudgen* 7175.

Distribution and habitat. Distributed mainly in the far north of the South West Botanical Province, with one record from the Eremean Botanical Province. Extends from Peron Peninsula (Shark Bay area) south-east to Yandanooka (Mingenew area). Occurs in sand in shrublands, the sand commonly yellow or red, the dominant species sometimes including *Actinostrobus*. (Figure 4A)

Phenology. Flowers and fruits: August to October. Mature seeds were observed on *M.E. Phillips* 68 1242.

Breeding system. Female specimen examined: *A.S. George* 1503.

Notes. Readily distinguished from other *Pimelea* species by its somewhat stem-clasping leaves. It shows the closest approach to *P. lanata* in its leaves, axillary hairs and bract indumentum, and the closest approach to *P. rara* in its floral indumentum.

Recent collections have extended the known range of this species northwards into the Eremean Botanical Province as well as southwards. No other members of the sect. *Heterolaena* have been recorded from so far north, although *P. leucantha* is known from Tamala Station just south of the border of the Eremean.

Pimelea spectabilis Lindl. (Lindley 1840: 41). – *Heterolaena spectabilis* (Lindl.) Fisch. & C.A. Mey. (Fischer, Meyer & Ave-Lallemant 1845: 48). – *Banksia spectabilis* (Lindl.) Kuntze (Kuntze 1891: 583). *Type:* South-west, Western Australia, 1839, *J. Drummond* 1: *s.n.* (*lecto:* CGE, *fide* Rye (1988: 236)); South-west, Western Australia, *J. Mangles* (*syn:* CGE).

Illustrations. Rye (1988: Figure 54) and Rye (1990: Figure 79C). A close-up photograph of the inflorescence is reproduced in Figure 49 of "Flora of Australia" Volume 18.

Shrub usually 0.3–2 m high; stems with axillary hairs present throughout but tending to become less conspicuous in lower axils. *Leaf blades* narrowly or very narrowly elliptic, 18–55 x 2.5–7 mm; margins slightly to distinctly recurved; apex acute, with a slender mucro. *Inflorescence* pendulous or sometimes fairly erect. *Involucral bracts* ovate or broadly ovate, often reddish or yellowish, sometimes partially hairy inside; inner bracts 18–30 mm long, sometimes ciliate. *Flowers* usually white, sometimes pale yellow or pink-tinged, densely hairy in the throat with somewhat tangled antrorse to patent hairs, also hairy on the inside of each sepal at least along the midvein, persistent in fruit; swollen base of floral tube with fine more or less patent hairs 0.1–0.3 mm long and often a few much larger hairs towards summit; slender portion of floral tube 10–17 mm long, with widely antrorse to patent hairs 4–7 mm long on basal half, all or the upper long hairs intermixed with minute hairs, and with medium-sized antrorse hairs on distal half. *Stamens* slightly to much longer than sepals; filament 3–8 mm long; anther cream, 1.0–1.8 mm long. *Seed* ovoid but distinctly compressed, 3.4–4.2 x 1.6–2.3 mm, shiny brown over black. **Bunjong**

Selected specimens examined. WESTERN AUSTRALIA: Thumb Peak, 15 Nov. 1995, *S. Barrett* 430; Whicher Rd, 1 km W of intersection with Hill Rd, 7 Jan. 1997, *N. Casson & B. Evans* SC141.2; Boyagin Rock Reserve, 30 Sep. 1994, *E.D. Kabay* 756; Small peak NW of Thumb Peak, 9 Oct. 1974, *K.R. Newbey* 4853; 20 km NE of Denmark, 1 Nov. 1983, *K.R. Newbey* 9811; Dryandra State Forest, 25 Sep. 1987, *D.M. Rose* 311.

Distribution and habitat. There are three areas of occurrence in the South West Botanical Province, the first a northern area from Mundaring south-east to Dryandra State Forest, the second from Cape Naturaliste south-east to Albany and the third in Fitzgerald River National Park. In the first two areas, the species occurs mainly in sand with gravel or lateritic rocks, commonly in Jarrah (*Eucalyptus marginata*) forest, sometimes with other eucalypts also present, or sometimes in Karri (*Eucalyptus diversicolor*) forest. In the eastern area, i.e. Fitzgerald River National Park, the species occurs on the upper rocky slopes and summits of hills, recorded in low shrublands with outcropping quartzite. (Figure 4C)

Phenology. Flowers: mainly September to December, probably also August. Fruits: mainly September to January. Mature seeds were examined on *N. Casson, P. Ellery & C. McChesney* SC70.2 & SC70.4, *D.B. Foreman* 1494, *C.A. Gardner* 13666 and *T.A. Halliday* 283. This species appears to produce viable seeds far more regularly than its close relative *P. lehmanniana*.

Breeding system. Female specimen examined: *A.R. Annels* 2768.

Notes. Distinguished from its closest relative, *Pimelea lehmanniana*, as indicated in the key. *Pimelea spectabilis* can usually also be readily distinguished by having minute hairs intermixed with the long hairs of the floral tube and tends to have larger flowers and more densely hairy sepals than *P. lehmanniana*.

There are several geographical trends in morphological variation in this species. Specimens from the northern area from Mundaring to Dryandra State Forest tend to have the inflorescences more erect, sepals relatively densely hairy inside and relatively short hairs on the floral tube when compared with specimens from the south coast. Specimens from the Margaret River area are usually similar to the northern specimens in most characters but tend to have relatively few minute hairs intermixed with the long hairs of the floral tube, the minute hairs being present in the upper part but often absent in the middle or lower part of the long hair 'belt' on the slender part of the floral tube. Specimens from the eastern area in Fitzgerald River National Park have relatively short leaves and short anthers on long filaments compared with specimens from other areas; they have pendulous inflorescences and tend to have pale yellow flowers, with the sepals sometimes almost glabrous inside. In other areas the flowers are white and sometimes pink-tinged.

Discussion

Pimelea is currently divided into four large sections, sect. *Pimelea*, sect. *Calyptrostegia* (C.A. Mey.) Benth., sect. *Epallage* (Endl.) Benth. and sect. *Heterolaena*, and also several small sections. Of the large sections, *Heterolaena* is the least variable and most restricted, occurring only in temperate south-west of Australia. Each of the other three large sections extends across Australia, occurring in arid and temperate areas as well as alpine and/or tropical areas. Although smaller than these three sections overall, *Heterolaena* is a prominent group in south-western Australia, where it accounts for a third of the *Pimelea* species.

Sect. *Heterolaena* appears to be closest to sect. *Calyptrostegia* but some characters present in all or most members of sect. *Heterolaena* (lack of circumscission, glabrous ovary and recurved leaf margins) suggest a relationship with sect. *Pimelea*, in which these characters are commonly or occasionally present. The boundaries of all sections need to be reassessed, particularly with regard to the placement of the New Zealand species, which are now being studied by Colin Burrows (pers. comm.) at the University of Canterbury, Christchurch, New Zealand. Further study could possibly result in sect. *Heterolaena* being combined with sect. *Calyptrostegia*. However sect. *Heterolaena* is a convenient grouping of very similar species, all of which appear to have their closest relatives within the group.

When first described by Endlicher (1837), *Heterolaena* was an infrageneric category of unspecified rank. Recent publications have disagreed as to the authorship of the recombination to the rank of section as listed below.

1. *Pimelea* sect. *Heterolaena* (Endl.) F. Muell. in Rye (1988, 1990).

2. *Pimelea* sect. *Heterolaena* (Endl.) Benth. in Chapman (1991: 2268). Authorship of the group was also mistakenly given earlier in the same work (Chapman 1991: 1587) as *Pimelea* sect. *Heterolaena* (C.A. Mey.) Meisn.

Although Mueller (1868: 159) was the first to use the name *Heterolaena* as a section of *Pimelea,* he made no reference to a basionym. His recombination is therefore not validly published under the requirements of the Botanical Code up to the Tokyo Congress of 1998. Currently, the first valid publication of sect. *Heterolaena* is considered to be by Bentham (1873) in Volume 6 of "Flora Australiensis", so the second of the choices listed above is adopted here. However, a proposal put forward by Zijlstra & Brummitt (1998) for the 1999 Congress would, if accepted, make Mueller's recombination valid.

Meyer's publication of the generic name *Heterolaena* on 28 March 1845 with the type species specified as *Heterolaena decussata* (Meyer 1845) was apparently preceded shortly after 20 January 1845 (Stafleu & Cowan 1976: 836) by publication of the same generic name but with *Heterolaena spectabilis* the only species mentioned (Fischer, Meyer & Avé-Lallemant 1845). Applying current nomenclatural standards, Meyer's choice of type species in the later publication (which was followed by Chapman 1991: 1587), must now be considered to be incorrect and *Heterolaena spectabilis* must be taken to be the type species for the genus.

Although Meyer (1845) was undoubtedly intending his genus *Heterolaena* to include about half of the species in the *Pimelea* group *Heterolaena* Endl., with the other half of the species placed in his new genus *Calyptrostegia* C.A. Mey., his initial publication of the genus (in Fischer, Meyer & Avé-Lallemant 1845) referred only to a species described by Lindley (1840) and did not list any of the species that Endlicher had included in the group. Also he did not specify that Endlicher's infrageneric name was being used as a basionym for the genus *Heterolaena*, and he used completely different characters to circumscribe it. Therefore the generic name must be treated as being new rather than a recombination of the earlier name, although Meyer clearly did not derive the name *Heterolaena* independently. Authorship of the generic name has often been given incorrectly, for example as *Heterolaena* Fisch. & C.A. Mey. in Domke (1934) and Rye (1988).

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A taxonomic revision of the many-flowered species of *Trachymene* (Apiaceae) in Western Australia

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Abstract

Rye, B.L. A taxonomic revision of the many-flowered species of *Trachymene* (Apiaceae) in Western Australia. *Nuytsia* 13(1):193–232 (1999). A key to all *Trachymene* (Apiaceae) species and infraspecific taxa in Western Australia is presented and the 14 many-flowered species are revised. Two sections are recognized here, both requiring new combinations. *Trachymene* sect. *Didiscus* (Hook.) Rye occurs mainly in southern Australia but extends north to the Kimberley region of Western Australia and comprises annual species with simple, usually glandular hairs and primarily blue petals. *Trachymene* sect. *Hemicarpus* (F. Muell.) Rye occurs in northern Australia and comprises perennial or annual species with non-glandular simple or dendritic hairs and primarily yellowish or pink to red petals. The identity of *T. anisocarpa* (Turcz.) B.L. Burtt is established, the new combinations *T. coerulea* subsp. *leucopetala* (Benth.) Rye and *T. grandis* (Turcz.) Rye are made and the following new Western Australian taxa are described: *Trachymene anisocarpa* var. *trichocarpa* Rye, *T. oleacea* subsp. *sedimenta* Rye, *T. pilbarensis* Rye and *T. pyrophila* Rye. Published illustrations are cited and new illustrations provided where required.

Introduction

Trachymene Rudge (Apiaceae) is a genus of about 60 species, distributed from The Philippines south to Tasmania and east to New Caledonia and Fiji, with the majority of species occurring in Australia. The genus is widespread in Western Australia, with ten species occurring in the south-west and a further nine in the Eremean and Kimberley regions, a total of nine species being endemic to the state. A revision of the genus in Northern Territory (Maconochie 1980) covered most of the *Trachymene* species occurring in northern Western Australia and most of the Eremean species were included in "Flora of Central Australia" (Boyland & Stanley 1981). More recently, the few species occurring in the Perth region were described in a regional flora treatment (Wheeler 1987) and most of the Kimberley taxa were included in a flora treatment for that region (Wheeler 1992). Any new taxa encountered in the flora accounts were treated informally, and the main taxonomic problems for the genus in Western Australia remained unsolved as they involved taxa in regions not covered by the floras.

Wheeler (1987: 515) included one south-western species as *Trachymene* sp. A, correctly distinguishing it from *T. anisocarpa*, under which it had previously been placed. The name *Trachymene anisocarpa* has been widely used (e.g. Blackall & Grieve 1980, Curtis 1963, Eichler 1986, Powell 1992 and Willis 1972) in southern and eastern Australia for various *Trachymene* species that were included under the illegitimate name *Trachymene australis* Benth. in "Flora Australiensis" (Bentham 1867). True *T. anisocarpa* is endemic to south-western Australia. The name has been misapplied to a few other south-western species, which can be readily distinguished when in mature fruit but not so easily from flowering material. One factor that has hindered recognition of the taxa is that most specimens, including the type of *T. anisocarpa*, lack mature fruits.

In eastern Australia, at least two species are currently recognized among the taxa previously combined under Bentham's *Trachymene australis*. One of these, *T. bivestita* (Domin) L.A.S. Johnson, is restricted to Queensland. The other occurs in South Australia, New South Wales, Victoria and Tasmania; it is listed as *Trachymene* sp. in Jacobs & Pickard (1981) but is referred to as *T. anisocarpa* in the most recent floras and checklists. While it is not certain whether the latter taxon is a single species or a complex of species, at least some of the eastern material previously included under the name *T. anisocarpa sens. lat.* should be known as *Trachymene composita* (Domin) B.L. Burtt, a name that has not been used because of confusion over the identity of *T. anisocarpa*. However, Domin (1908) adequately described the differences between this taxon and the Western Australian taxa, which have more narrowly divided leaves and monocarps less compressed on the margin. The western and eastern taxa currently known as *T. anisocarpa* also appear to differ in chromosome number, with true *T. anisocarpa* being diploid (Keighery 1982b) and the eastern material tetraploid (Wanscher 1933) or hexaploid (Constance *et al.* 1971), but more counts of eastern material are needed.

Some additional names not in current use, such as *Trachymene macrophylla* (Domin) B.L. Burtt, have been applied to less widespread members of the species group in eastern Australia. Further work is needed to determine how many species and infraspecific taxa should be recognized in eastern Australia.

This paper gives a key for the 19 species of *Trachymene* occurring in Western Australia and a revision of the 14 species with many-flowered umbels. The remaining species with few-flowered umbels belong to sect. *Dimetopia* (Domin) Keighery & Rye and have been revised separately (Keighery & Rye 1999).

Methods

Specimens cited are all at PERTH except where otherwise indicated. Distribution maps were drawn up with each symbol representing the occurrence of the taxon in a 0.25 degree latitude by 0.25 degree longitude area.

Measurements were all obtained from dried material. The cotyledon measurements were often based on very few specimens as cotyledons are often torn or missing on mature plants, especially in the perennial species. Petal measurements were taken only from particularly well pressed flowers with minimal shrinkage. Petal colour was determined partly from the specimens and partly from field observations by Greg Keighery (pers. comm.); colours recorded for flowers in the notes on herbarium specimens are often inaccurate as they often refer to the fruit colour.

Three main categories of fruits are distinguished here: (1) homomorphic fruits with both monocarps fully developed and of the same type; (2) heteromorphic fruits with both monocarps maturing to full size but differing from one another in ornamentation; (3) asymmetric fruits with one monocarp infertile and reduced in size, therefore lacking the bilateral symmetry of the other types of fruits. Carpophore length is given only for fruits in which both monocarps develop fully and are shed at maturity. For species with asymmetric fruits a measurement is given instead for the infertile monocarp, which remains attached to the carpophore forming a thick fleshy persistent structure.

Key to the Western Australian sections, species and infraspecific taxa

Since fruit measurements, ornamentation and infertility rates are particularly important as key characters, it may not be possible to key specimens with only immature fruits, although it is often possible to determine most of these features from immature specimens. Abbreviations are used for other Australian states as follows: NSW – New South Wales, NT – Northern Territory, Qld – Queensland, SA – South Australia and Vic. – Victoria.

1. Perennials or robust annuals, with non-glandular simple or dendritic hairs occurring on the stems and/or leaves, the involucral bracts glabrous. Sepals conspicuous on the young fruits, at least some of them elongate or prominently clubbed. Petals usually cream to yellow and/or with pink tints. Distributed in the Northern Botanical Province ..... sect. **Hemicarpus**

2. Stems densely and very conspicuously hairy throughout; hairs 5–7 mm long. Monocarp with a broad wing 2–3 mm wide. (Sturt Creek area; NT) ..... **T. villosa**

2. Stems glabrous or with hairs concentrated at or near the nodes; hairs 3–6 mm long. Monocarp(s) not winged or with a narrow wing up to 1.2 mm wide

3. Leaf indumentum with a dense mixture of small and large dendritic hairs; large hairs 2–5 mm long. Petals *c.* 1.5 mm long. Monocarp(s) with a wing 0.7–1.2 mm wide. (Halls Creek area; NT) ..... **T. dusenii**

3. Leaf indumentum either of long unbranched hairs or of shorter dendritic hairs up to 1.2 mm long. Petals 0.8–1.2 mm long. Monocarp(s) scarcely winged or with a wing less than 0.5 mm wide

4. Petioles of all of the divided or toothed leaves with long cilia throughout. Involucral bracts 1.5–4 mm long in fruit (not including connate base), the outermost pedicels 3–6 mm long. (Coulomb Point to Port Warrender and Ord River area; NT) ..... **T. microcephala**

4. Petioles of the divided or toothed leaves (at least the upper ones) with the long cilia restricted to the base. Involucral bracts (3)4–14 mm long in fruit (not including connate base), the outermost pedicels 4–15 mm long

5. Petioles with unbranched hairs (dendritic hairs may be present on the juvenile leaves) 2–6 mm long at base or rarely more widespread. Leaf blades glabrous or with unbranched (rarely inconspicuously dendritic) hairs 1–5 mm long scattered on the main veins. (Cape Leveque and Camballin to far north and Carlton Hill Station; NT) ..... **T. didiscoides**

5. Petioles with a fairly dense indumentum of dendritic hairs mostly *c.* 0.4 mm long but with a few large cilia 1–2.5 mm long. Leaf blades with dendritic hairs 0.4–1.2 mm long widespread (not restricted to the main veins). (Bonaparte Archipelago to Hann River and Pentacost Range) ..... **T. dendrothrix**

1. Tiny ephemeral to robust annuals, most species with simple glandular hairs, which are sometimes restricted to specific areas such as the base of each peduncle or the margins of the involucral bracts; involucral bracts nearly always with at least a few cilia. Sepals inconspicuous. Petals white to deep blue, often white with blue or purple tints. Occurring in the Eremean or South West Botanical Provinces, only one species (*T. oleracea*) extending into the Northern Botanical Province.

6. Tiny to medium-sized annuals, commonly almost prostrate to *c.* 0.05 m but occasionally a few extra-large specimens up to 0.2 m high, with small umbels of 3–21(50) flowers usually borne within or shortly above the vegetative part of the plants. Fruits consistently with both monocarps developed; carpophore compressed ..... sect. **Dimetopia**

7. Carpophore about half as long as commissure. Monocarps with two large terminal projections or wings. (Kennedy Range to York and Laverton area; SA, NSW) ..... **T. ceratocarpa**

7. Carpophore about as long as commissure. Monocarps not winged

8. Monocarps densely hairy and appearing woolly, covered throughout or at least on the outer margin by a very dense tangled indumentum of very long fine hairs. (Lyons River to Stirling Range and Yamarna; SA, NSW) ..... **T. ornata**

8. Monocarps glabrous to densely bristly but not woolly, the bristles radiating or bent but not tangled

9. Monocarps swollen, 0.7–1.1 x 0.5–0.8 mm, with no medial line visible, smooth (but often with shrinkage marks visible when dried). (Cape Cuvier to Murchison River area) ..... **T. elachocarpa**

9. Monocarps very compressed, 2.3–3.4 x 1.4–2.4 mm, with a distinct medial line, usually with a few hair-like bristles to densely bristly or tuberculate, rarely completely smooth

10. Stem hairs (when present) somewhat to distinctly retrorse, often appearing non-glandular. Umbels 3–6(7)-flowered. Fruits homomorphic; monocarps almost truncate at apex (outer margin extending horizontally beyond stylopodium); bristles smooth or with minute patent hairs. (Murchison River area to Stirling Range and Agnew area; SA, NSW, Vic.) ..... **T. cyanopetala**

10. Stems hairs (when present) patent, glandular. Umbels 5–21(50)-flowered. Fruits commonly heteromorphic with one monocarp bristly and the other tuberculate at least at apex; monocarps somewhat narrowed at apex (outer margin usually descending at 10–20 degrees to the stylopodium); bristles (when present) minutely retrorsely barbed. (Widespread in south-western Australia; SA, Vic.) ..... **T. pilosa**

6. Medium-sized to large, usually erect, annuals, 0.1–2.5 m high, with umbels of (15)30–300 flowers prominently displayed above the vegetative part of plant. Fruits inconsistently (few to most fruits per umbel) or consistently with 1 monocarp failing to develop fully; carpophore scarcely compressed ..... sect. **Didiscus**

11. Fruit of 1 fertile monocarp (i.e. asymmetric), slightly dorsiventrally compressed, prominently sculptured, with two ridges or wings on each face and transverse furrows delimiting 4–6 large pits on each surface between the ridges or wings. Plants with non-glandular hairs, from the South West Botanical Province. (Muntadgin to Stirling Range) ..... **T. croniniana**

11. Fruit of 1 or 2 fertile monocarps, greatly bilaterally compressed, smooth to bristly or tuberculate or with shallow irregular ridges, sometimes winged around margin but not on the faces. Plants with glandular hairs and/or occurring in the Northern and Eremean Botanical Provinces.

12. Cotyledons 2.5–10 mm wide. Fruit asymmetric; fertile monocarp with minute or slender glabrous tubercles or sometimes smooth, with 1 or 2 narrow marginal wings 0.1–0.6(0.8) mm wide. Distributed in the Northern and Eremean Botanical Provinces.

13. Uppermost leaves subtending peduncles stem-clasping, broad, often fan-shaped ..... **T. oleracea**

13a. Stems and leaves rather densely glandular-hairy. Monocarp with a broad wing 0.4–0.8 mm wide and elongate tubercles, the largest ones 0.4–0.6 mm long. (Napier Range and near Wyndham) ..... subsp. **sedimenta**

13a. Stems glabrous and leaves sparsely glandular-hairy. Monocarp with a narrow wing 0.1–0.3(0.4) mm wide and short tubercles, the largest ones 0.1–0.25 mm long. (Dampier Archipelago and Barlee Range to Halls Creek.) ..... subsp. **oleracea**

13. Uppermost leaves subtending peduncles either very narrow or with a long petiole.

14. Monocarp with two undulate wings 0.3–0.6 mm wide around margin and along commissure. (Newman to Montague Range and eastwards; NT) ..... **T. bialata**

14. Monocarp with a single entire wing 0.1–0.3 mm wide around margin but not along commissure.

15. Peduncles with small glandular hairs towards the base. Leaves broadly to depressed obovate in outline and deeply divided or lobed. (Wiluna and Laverton to Petermann Ranges; NT, SA, Qld, NSW) ..... **T. glaucifolia**

15. Peduncles glabrous. Leaves broadly to depressed ovate in outline and very deeply divided into narrow lobes. (Onslow to Mt Narryer Station to Great Northern Highway) ..... **T. pilbarensis**

12. Cotyledons 0.7–2.5 mm wide. Fruit asymmetric, homomorphic or heteromorphic, not consistently asymmetric throughout the umbel except in *T. grandis*; fertile monocarp(s) bristly, irregularly ridged, rugose, tuberculate or rarely smooth, not winged; tubercles (when present) either large and broad or with a terminal glandular hair. Distributed in the South West Botanical Province and South-western Interzone.

16. Pedicels glandular-hairy. Young fruit glandular-hairy or glandular-bristly. Distributed from Kalbarri south to Augusta and near Nannup, with an isolated record near Albany ..... **T. coerulea**

16a. Large stem hairs slender throughout, 0.7–1.5 mm long. Monocarp(s) tuberculate; tubercles 0.1–0.2 mm long, terminating in a simple glandular hair. (Jurien Bay to Augusta and near Albany) ..... subsp. **coerulea**

16a. Large stem hairs with a broad base, 1–5 mm long. Monocarp(s) bristly, rarely one bristly and one tuberculate; bristles *c.* 0.5 mm long, with minute side branches. (Kalbarri to Lake Indoon) ..... subsp. **leucopetala**

16. Pedicels glabrous. Young fruit glabrous or with non-glandular hairs or bristles. Distributed from near Jarrahwood inland to the Cundeelee-Zanthus area.

17. Umbels with all fruits asymmetric. Monocarp 3.3–5 mm long, usually either bristly (minute side branches present) or with discrete tubercles, rarely smooth. Extends from Pemberton east to Stirling Range ..... **T. grandis**

17. Umbels with the central fruits homomorphic and the outer fruits either homomorphic or asymmetric. Monocarp(s) 2.2–2.8 mm long, either irregularly rugose-tuberculate or with hair-like bristles. Distributed from near Stirling Range north-east to Cundeelee.

18. Stems usually partially glabrous; bracts glabrous or with few cilia. Outermost fruiting peduncles 7–11 mm long. Monocarp(s) tuberculate- rugose or with bristles 0.2–0.4 mm long; style 1.2–1.7 mm long. (Stirling Range to Forrestania and Mt Ragged) ..... **T. anisocarpa**

18a. Monocarp(s) rugose-tuberculate (with tubercles united into irregular ridges or an irregularly furrowed surface). (Stirling Range to Forrestania and Kumarl) ..... var. **anisocarpa**

18a. Monocarp(s) with hair-like bristles 0.2–0.4 mm long. (Esperance-Mt Ragged area) ..... var. **trichocarpa**

18. Stems and bracts usually glandular-hairy throughout. Outermost fruiting peduncles 11–16 mm long. Monocarp(s) with slender bristles, the largest ones 0.7–1 mm long; style 1.5–2.5 mm long. (Cundeelee–Zanthus area) ..... **T. pyrophila**

Descriptions of the many-flowered species

Implicit characters

Rather than repeat the characters found universally among the Western Australian members of the genus in each of the descriptions below, these characters are listed here. Note that the juvenile leaves and the leaves subtending the uppermost branches of the plants are not included in the descriptions given below unless specifically mentioned.

Cotyledons entire. *Leaves* concentrated towards base of plant, the basal few juvenile leaves often entire to slightly lobed and grading into larger distinctly lobed or divided leaves, the uppermost leaves

tending to be shorter and more scattered, those leaves or bracts subtending the upper branches being smallest. *Petioles* prominent on the basal leaves, shorter on the intermediate leaves but with a more expanded base, the uppermost leaves or bracts almost sessile. *Leaf blades* often cuneate at base, the primary division into three shallow to very deep lobes, which are either further divided or shallowly lobed to toothed; lower surface more prominently veined than upper surface. *Inflorescence* of an umbel terminating the main axis and usually several to many more umbels terminating lateral branches; umbels with central flowers usually maturing before outermost ones. *Involucral bracts* united at base into an open obconic structure; free portion subulate to ovate. *Fruit* with inner (adaxial) monocarp fully developed, shed from carpophore at maturity; outer (abaxial) monocarp sometimes failing to develop fully, if failing early then narrowly or very narrowly obconic and remaining united to the carpophore.

Distributions, breeding systems and chromosome numbers

The genus *Trachymene* is found throughout Western Australia. Distributions of all the many-flowered species are shown in Figures 1–3. It is notable that among the south-western species there is no known overlap in geographic range, except for an overlap in the ranges of *T. coerulea* subsp. *coerulea* and *T. grandis* (which usually differ in chromosome number), but adjacent species ranges generally appear to more-or-less meet so the species may be parapatric. This general pattern of each taxon taking over in distribution where another ends can be seen to a lesser extent in some other pairs of closely related species, such as *T. glaucifolia* and *T. pilbarensis*. It greatly reduces the likelihood of hybridization since only the more distantly related species are likely to coexist. There are no known cases of hybridization among the members of *Trachymene* sect. *Didiscus* in Western Australia, but the variability of some of the northern taxa and occurrence of occasional intermediate specimens merits further investigation for possible hybrids in sect. *Hemicarpus*.

Some data on breeding systems have been published (Keighery 1982a) for the following four members of sect. *Didiscus: Trachymene anisocarpa* [as *T. croniniana*], both subspecies of *T. coerulea* and *T. grandis* [as *T. anisocarpa*]. The taxon referred to as 'spec. nov.' is the inland variant of the typical subspecies of *T. coerulea*. Members of sect. *Didiscus* often undergo great fluctuations in population size, producing large populations after fires but few or no plants in years when there has been no disturbance. Flowers are protandrous, produce plentiful nectar and are displayed prominently above the foliage. They attract a large variety of small to medium-sized insect pollinators. The natural pollinators recorded by Keighery (1982a) were native bees, beetles, wasps, muscid and bombylid flies, butterflies and moths. Introduced honey bees are also attracted to the flowers. Plants are almost fully self-compatible so are able to produce high seed set even when cross-pollination fails.

All chromosome counts so far for the many-flowered species of Western Australia have been n=11 except for the tetraploid *T. grandis* with n=22 and one tetraploid count in the predominantly diploid species *T. coerulea*.

1. Trachymene sect. **Didiscus** (Hook.) Rye, *comb. nov.*

Didiscus Hook. (Hooker 1828: t. 2875). – *Didiscus* B. *Polyanthon* Domin *nom. illeg.* (Domin 1908: 27). – *Didiscus* sect. *Polyanthon* (Domin) C.A. Gardner *nom. illeg.* (Gardner 1931: 100) [= sect. *Didiscus*]. – *Didiscus* sect. *Teleiocarpus* F. Muell. *nom. illeg.* (Mueller 1859: 236) [= sect. *Didiscus*]. *Type: Didiscus coeruleus* (Graham) Hook. [= *Trachymene coeruleus* Graham].

Dimetopia sect. *Anisocarpaea* Turcz. *nom. inval.* (Turczaninow 1849: 29).

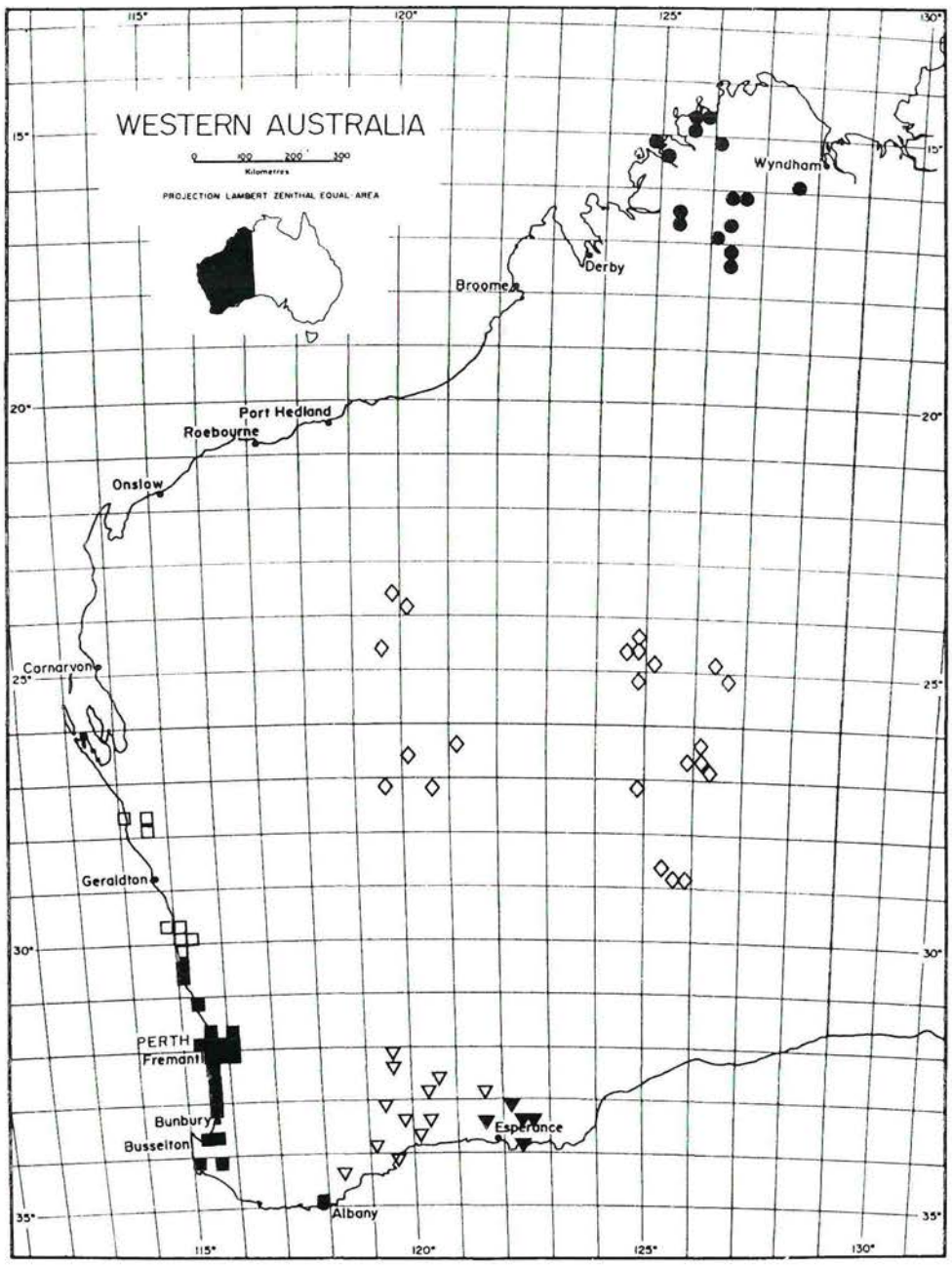

Figure 1. Full distribution of *Trachymene anisocarpa* var. *anisocarpa* ▽, *T. anisocarpa* var. *trichocarpa* ▼, *T. coerulea* subsp. *coerulea* ■, *T. coerulea* subsp. *leucopetala* □ and Western Australian distribution of *T. bialata* ◇ and *T. dendrothrix* ●.

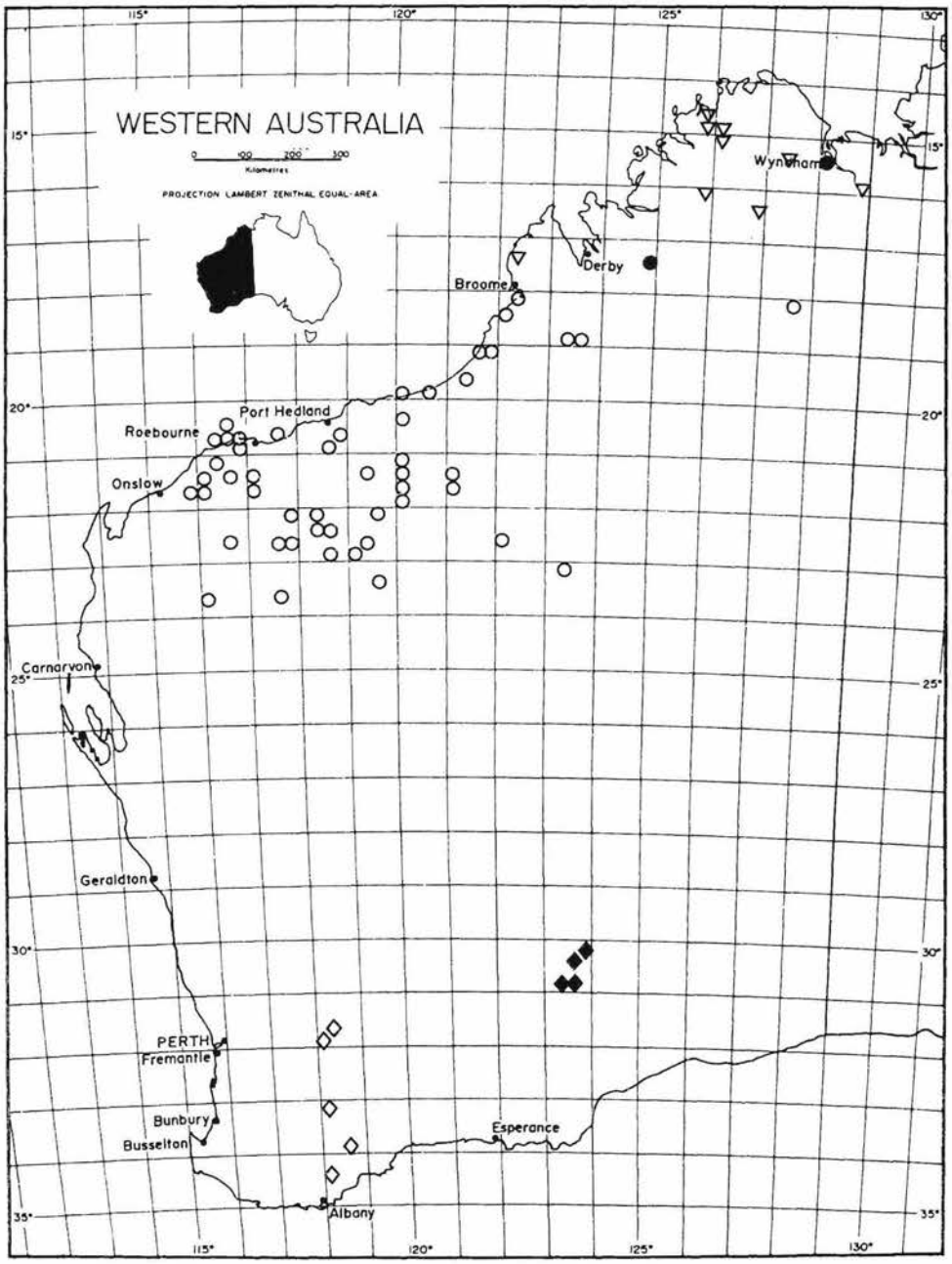

Figure 2. Full distribution *Trachymene croniniana* ◇, *T. oleracea* subsp. *oleracea* ○ and *T. oleracea* subsp. *sedimenta* ◍ and *T. pyrophila* ◆ and Western Australian distribution of *T. microcephala* ▽.

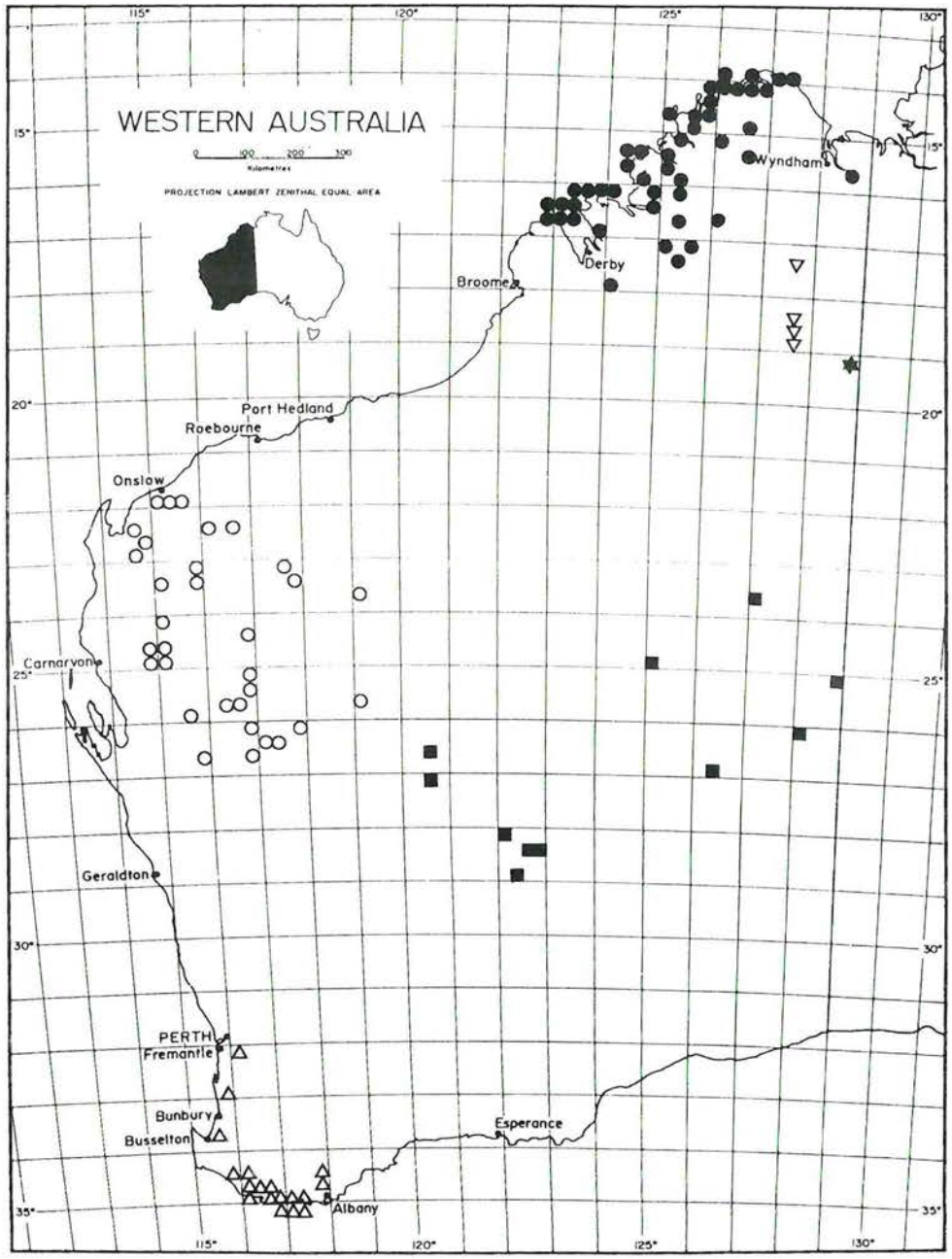

Figure 3. Western Australian distribution of *T. didiscoides* ●, *T. dusenii* ▽, *T. glaucifolia* ■, and *T. villosa* ✱ and full distribution of *T. grandis* △ and *T. pilbarensis* ○.

Annual herbs with glandular hairs (except *T. croniniana*). *Petioles* expanded at the base, sometimes prominently expanded but often varying between specimens in this character. *Flowers* often dimorphic, the outermost flowers with the outer petal distinctly enlarged, both types of flowers white to deep blue, or with a white corolla suffused with blue to purple on the outside, sometimes with a deep blue to violet centre (stylopodium and styles). *Sepals* 5 but of varied lengths and some usually so small as to appear absent, the largest sepal not very prominent. *Petals* large or medium-sized, the outer petal of the outermost flowers often extra large. *Fruit* usually of 1 fertile monocarp.

Etymology. Derived from the Greek *dis* – double and *discos* – disk, referring to the shape of the fruits found on the type species *Trachymeme coerulea*, as most fruits have both monocarps fully developed.

Notes. A section of at least 14 species, distributed in all states of Australia.

The name *Didiscus* is not a very suitable name for this section as a whole because most species produce only one fertile monocarp on all or most of their fruits. A later name that would have been more appropriate for the group in its meaning, as it refers to the presence of such fruits, is *Anisocarpaea*. Turczaninow (1849) placed the two species now known as *Trachymene anisocarpa* and *T. grandis* in sect. *Anisocarpaea* but did not validly publish the name.

Trachymene anisocarpa (Turcz.) B.L. Burtt (Burtt 1941: 44). – *Dimetopia anisocarpa* Turcz. (Turczaninow 1849: 29). – *Didiscus anisocarpus* (Turcz.) F. Muell. (Mueller 1859: 238). *Type:* Swan River Colony [Western Australia], 1847?, *J. Drummond* coll. 4, n. 132 (*holo:* KW *n.v.*, photograph PERTH; *iso:* PERTH 03579123).

Annual herb 0.2–1.5 m high, sometimes slightly viscid; indumentum (where present) of patent glandular hairs, sometimes losing glandular apex with age. *Stems* usually largely glabrous but with hairs fairly densely distributed for some distance above each node, and often also for a shorter distance below each node, sometimes sparsely hairy throughout; hairs 0.2–1.5 mm long, usually slender, rarely robust. *Cotyledons* 5–8 x 1–1.5 mm; lamina narrowly or very narrowly ovate. *Petioles* 10–50 mm long; expanded base 2–5 mm long, with cilia up to 2 mm long. *Leaf blades* broadly to depressed obovate in outline and deeply divided or lobed, 11–50 x 14–85 mm, often cuneate at base, the 3 primary lobes usually further trisected or bisected or dentate, both surfaces usually with a few hairs scattered along the veins. *Peduncles* 15–140 mm long, either glabrous or sparsely hairy for most of length but densely glandular-hairy at the base or fairly densely hairy throughout. *Involucral bracts* (10)17–26; base 1–2.5 mm long; free portion 4.5–10 mm long, usually glabrous or with 1 or 2 glandular cilia or teeth, rarely sparsely glandular-ciliate, the cilia or teeth 0.2–0.7 mm long. *Umbels* mostly 15–30 mm diam., approximately (20)40–120-flowered, the outer flowers sometimes all producing asymmetric fruits but at least some of the inner flowers producing homomorphic fruits. *Pedicels* 3–11 mm long; outermost ones 8–11 mm long in fruit, glabrous. *Petals* 1.5–2.5 mm long, white to deep purple or bluish on undersurface, very pale blue or white on upper surface. *Anthers* 0.3–0.4 mm long. *Fruit* highly bilaterally compressed, with both monocarps maturing or with the outer monocarp reduced usually to 0.6–1.4 mm long; carpophore 0.4–1.3 mm long; styles 0.8–1.7 mm long. *Fertile monocarp(s)* 2.2–2.8 x 1.6–2.1 mm, up to *c.* 0.6 mm thick, either with hair-like bristles or tubercles in merging rows forming a shallowly ridged or indented surface at maturity.

Distribution. Endemic to the South West Botanical Province of Western Australia. Extends from Forrestania (east of Hyden) southwards and from Chillinup Rd (south-east of Stirling Range) east to Cape Arid National Park.

Phenology. Flowering and fruiting period: Mainly October to November, also recorded January, March to June and August. Common after burns.

Notes. Previously, the south-western species *Trachymene grandis* and *T. croniniana* were often confused with this species, as well as a number of eastern and northern Australian species, as described in the introduction to this paper.

The locality of the type specimen of *T. anisocarpa* is unknown but evidently was from the western half of the species range as Drummond's fourth collection extended only as far east as West Mt Barren (Erickson 1969).

One specimen (an unmounted duplicate of *G.J. Keighery* 409) has one cotyledon with a deeply bifid lamina and the other cotyledon broken too close to the base to establish the shape of its lamina. This is the only known case among the Western Australian species examined in which the cotyledons are not entire. As in most other species, few of the *T. anisocarpa* specimens have intact cotyledons.

The species is fairly variable in leaf shape, some specimens having narrowly divided leaves similar to those of *T. grandis* and others having less divided leaves more like those of *T. pyrophila*. Two varieties are recognized.

a. Trachymene anisocarpa var. **anisocarpa**

Didiscus benthamii Domin *nom. illeg.* var. *benthamii* [as var. *typica nom. illeg.*] f. *benthamii* [as f. *muricatus nom. illeg.*] (Domin 1908: 40). *Type:* between Hamersley River and West River, Western Australia, 1901, *L. Diels* 4798 (*n.v.*).

Didiscus benthamii f. *microcarpus* Domin (Domin 1908: 40). *Type:* Swan River Colony [Western Australia], 1847?, *J. Drummond* coll. 4, n. 132 (*iso:* KW *n.v.*, photograph PERTH; PERTH 03579123).

Peduncles up to 95 mm long. *Fertile monocarp(s)* with the tubercles in merging rows forming a shallowly ridged or indented surface at maturity. (Figure 4A–D)

Other specimens examined. WESTERN AUSTRALIA: 13 km N of Ravensthorpe, 29 Oct. 1963, *T.E.H. Aplin* 2735; near Bounty Mine access road, near Mt Holland, 23 Nov. 1994, *G. Barrett*; 41 km E of Coujinup Hill, 25 June 1983, *M.A. Burgman* 1510 *& S. McNee*; 14.25 km due E of Muckinwobert Rock, 14 Aug. 1983, *M.A. Burgman* 2075 *& S. McNee*; Chillinup road, Gnowellen, 22 Mar. 1974, *A.E. Dixon*; Kumarl, Oct. 1938, *L.A. Horbury* 129; 266.7 miles [429 km] S of Perth on Lake King to Newdegate road, 5 Jan. 1975, *G.J. Keighery* 358; 100 km E of Lake King on Norseman road, 25 Oct. 1975, *G.J. Keighery* 409; 7 km W of crossroads at Forrestania, 6 May 1978, *G.J. Keighery* 1661; 20 km E of Jerramungup, 20 Nov. 1984, *K.R. Newbey* 10858; 2 km NW of Woolbernup Hill, Fitzgerald River National Park, 23 Nov. 1985, *K.R. Newbey* 11052; Hill 49, 22 Nov. 1990, *I. Solomon* 453; 6.1 miles [10 km] E of Ravensthorpe hotel on main road to Esperance, 12 Nov. 1973, *A.S. Weston* 8651; Peak Charles–Lake King road, vicinity of Frank Hann National Park, 28 Nov. 1973, *A.S. Weston* 9022.

Distribution. Extends from Forrestania (east of Hyden) southwards and from Chillinup Rd (south-east of Stirling Range) east to near Cape le Grand National Park. (Figure 1)

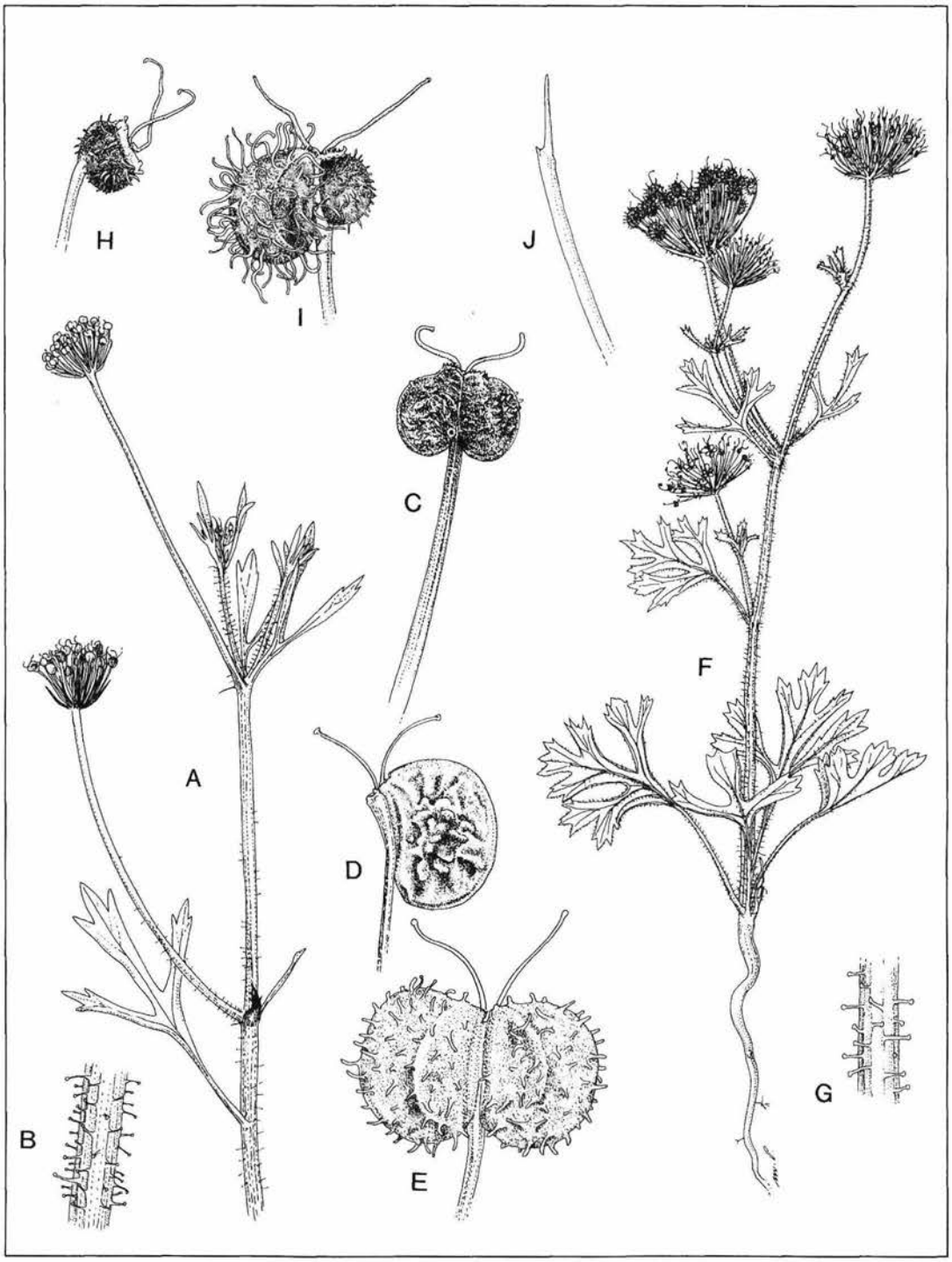

Figure 4. A–D. *Trachymene anisocarpa* var. *anisocarpa*. A – portion of plant (x1), B – base of peduncle with glandular hairs (x9), C – immature homomorphic fruit (x12), D – asymmetric fruit (x9); E – *T. anisocarpa* var. *trichocarpa* homomorphic fruit (x9); F–J. *T. pyrophila*. F – whole plant (x1), G – portion of stem with glandular hairs (x5), H – immature fruit with two slightly unequal monocarps (x7.5), I – asymmetric fruit (x7.5), J – carpophore and pedicel (x7.5). Drawn from *G.J. Keighery* 1661 (A,B,D), *A.S. Weston* 9022 (C), *R.J. Cranfield* 1370 (E), and *D.W. Goodall* 2417 (F–J).

Habitat. Occurs mainly in recently disturbed or burnt habitats, in clay or sandy clay, often in shrublands or woodlands dominated by *Eucalyptus* species with a mallee habit.

Chromosome number. n=11 (Keighery 1982b). Voucher specimens: *G.J. Keighery* 358, 409, 1661; possibly also *G.J. Keighery* 435, *n.v.* [all as *Trachymene croniniana*].

Conservation status. Not considered to be at risk.

Notes. The phrase name *Trachymene* sp. Ravensthorpe (*T.E.H. Aplin* 2735) has been used for this variety at PERTH. Most specimens are 0.2–0.7 m high but var. *anisocarpa* might occasionally grow much taller as suggested for the other variety.

Judging from the description, illustration and type locality given by Domin (1908) for *Didiscus benthamii*, this taxon is a synonym of the typical subspecies of *Trachymene anisocarpa*. The type was originally cited under var. *typica* [= var. *benthamii*] as *Diels* 4798, collected in 1901 during the voyage on behalf of the Humboldt Foundation, with the locality "inter Hammersley et West-River" added under the description of form *muricatus* [= f. *benthamii*].

Domin named a second variety from Queensland as *Didiscus benthamii* var. *bivestitus* Domin; this has since been raised to specific rank as *Trachymene bivestita* (Domin) L.A.S. Johnson. Domin also named two new forms of the type subspecies, one based on the type of *T. anisocarpa* and the other based on the type of *T. grandis* (see under those taxa). Hence his circumscription of *D. benthamii* included two closely related Western Australian species and a distantly related species from Queensland.

b. Trachymene anisocarpa var. **trichocarpa** Rye, *var. nov.*

Differt a *Trachymene anisocarpa* var. *anisocarpa* fructo setoso et habito plus arenaceo.

Typus: base of Hill 49, Cape Le Grand National Park, Western Australia, 19 November 1979, *R.J. Cranfield* 1370 (*holo:* PERTH 03579506).

Peduncles up to 140 mm long. *Fertile monocarp(s)* with hair-like bristles; larger bristles 0.2–0.4 mm long, sometimes with minute side branches towards the base. (Figure 4E)

Distribution. Extends from north of Esperance east to near Mt Ragged in Cape Arid National Park. (Figure 1)

Habitat. Occurs mainly in recently disturbed or burnt habitats, in rather sandy soils, often in woodlands dominated by *Eucalyptus* species with a mallee habit.

Other specimens examined. WESTERN AUSTRALIA: 1 mile [1.6 km] E of Kau Rock, 16 Oct. 1970, *T.E.H. Aplin* 4091; 540 mile peg between Esperance and Salmon Gums [c. 18 km S of Grass Patch], 5 Nov. 1962, *J.S. Beard* 2346; 10 km N of Mt Ridley, 26 Oct. 1976, *G.J. Keighery* 417; 45 km NNE of Condingup, 8 Nov. 1980, *K.R. Newbey* 8238.

Chromosome number. n=11 (Keighery 1982b). Voucher specimens: *G.J. Keighery* 417 [as *Trachymene croniniana*]; probably also *G.J. Keighery* 1719, *n.v.* [as *Trachymene* aff. *croniniana*].

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Var. *trichocarpa* is known from five localities, including one in a national park. It is common after fires, apparently surviving in unburnt vegetation mainly in the form of dormant seeds. Populations may therefore be effectively invisible except after fires.

Etymology. From the Greek *trichos* – hair or bristle and *karpos* – fruit, the hair-like bristles on the fruits being the distinguishing feature of this variety.

Notes. This variety was previously known by the phrase name *Trachymene* sp. Esperance (*R.J. Cranfield* 1370). It probably tends to be a larger plant, with longer peduncles, than the type variety. The only consistent morphological difference between the two varieties, however, is in fruit ornamentation, with var. *anisocarpa* having an irregularly ridged-tuberculate surface to the fertile monocarps. The two varieties overlap slightly in known geographical range, with both variants recorded from Hill 49, but var. *trichocarpa* is restricted to the eastern part of the species distribution while the typical variant occurs mainly in the western and central parts. They appear to differ in habitat, with var. *trichocarpa* occurring in more sandy soils than var. *anisocarpa*.

Three other many-flowered south-western *Trachymene* species have fruits that are always or sometimes bristly. In these species the bristles are usually longer and with larger, more numerous side branches.

Trachymene bialata (Domin) B.L. Burtt (Burtt 1941: 45). – *Didiscus bialatus* Domin (Domin 1908: 51–52). *Type:* "N." Barrow Range, [Western Australia], 17 August 1891, *R. Helms* (K, NSW, *n.v.*).

Annual herb usually 0.2–1.0 m high; indumentum (where present) of patent glandular hairs. *Stems* largely glabrous but with hairs fairly densely distributed for a short distance at the base of each peduncle, the lower stems either completely glabrous or with fewer hairs above each node; hairs 0.1–0.6 mm long. *Cotyledons* 11–24 x 3.5–6 mm; lamina ovate to obovate or narrowly so. *Petioles* 35–115 mm long, largely glabrous to fairly densely hairy; expanded base 2–12 mm long, with cilia up to 1.5 mm long. *Leaf blades* very broadly to depressed ovate to obovate in outline, palmisect, 15–33 x 25–50 mm, cuneate at base, the 3 primary lobes usually further trisected or bisected or dentate, almost glabrous to fairly densely hairy, with few to numerous minute hairs and also a few large robust hairs scattered along the veins, the large hairs 0.4–0.6 mm long. *Peduncles* 35–140 mm long, glandular-hairy at base and glabrous above. *Involucral bracts* usually 12–20; base 0.8–1.6 mm long; free portion 3.5–7 mm long, glandular-ciliate and sometimes with a few glandular teeth, also with a few hairs on the surface especially along midvein; cilia or teeth 0.1–0.5 mm long. *Umbels* mostly 14–30 mm diam., approximately (30)40–140-flowered. *Pedicels* 1.5–11 mm long; outermost ones 6.5–11 mm long in fruit, glabrous. *Petals* usually 2–3 mm long, usually pale blue to purple on undersurface, white on upper surface. *Anthers* 0.3–0.5 mm long. *Fruit* highly bilaterally compressed, with the outer monocarp very reduced and 2–2.8 mm long; styles 1.7–2.8 mm long. *Fertile monocarp* with a body 3.5–4.3 x 2.6–3.5 mm, up to *c.* 1 mm thick, usually shortly tuberculate, with two divergent wings fully encircling the body of the monocarp; wings crenulate, 0.3–0.6 mm wide, becoming thickened; tubercles up to 0.3 mm long. (Figure 5A).

Selected specimens examined. WESTERN AUSTRALIA: 26 km S of Newman turnoff Great Northern Highway, 11 Sep. 1978, *A.C. Beauglehole* 59350 & *E.G. Errey* 3050; Eagle Bore Study Site, Gibson Desert Nature Reserve, 1 Sep. 1991, *A. Chapman & S. Fraser* 34; 10 miles [16 km] W of Wiluna, 16 Oct. 1945, *C.A. Gardner* 7903; 34 miles [55 km] W of Warburton, 24 Aug. 1962, *A.S. George* 3968;

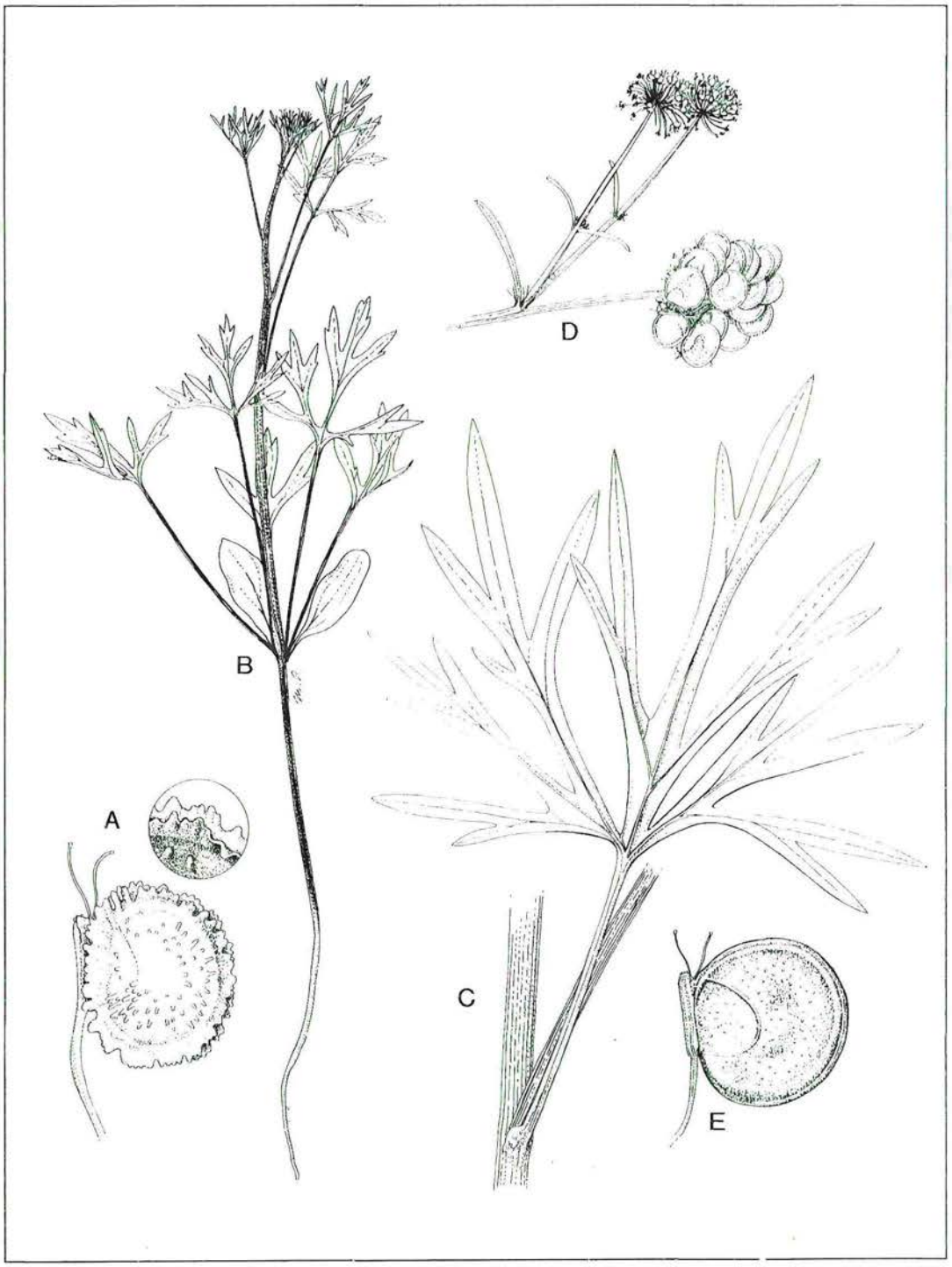

Figure 5. A – *Trachymene bialata* asymmetric fruit (x5), with close-up view of double wing (x10); B–E. *Trachymene pilbarensis*. B – young plant with cotyledons still attached (x1), C – stem and young leaf from mature plant (x1), D – flowering and fruiting inflorescences (x1), E – asymmetric fruit (x4.5). Drawn from *H. Demarz* 7230 (A), *S. van Leeuwin* 1349 (B), Hamersley Iron Herbarium 1507 (C) and *H. George* 1146 (D,E).

Miss Gibson Hill, 26 Aug. 1962, *A.S. George* 4072; Young Range, 22 Jan. 1964, *M. Gillett* 61; 40 km SSE of E end of Clutterbuck Hills, 14 June 1983, *S.D. Hopper* 2900; 151.5 miles [244 km] N of Seemore Downs Station Homestead, Connie Sue Highway, 20 Sep. 1975, *G.J. Keighery* 552; 65 miles [105 km] N of Sandstone on Wiluna road, 15 Oct. 1972, *R.D. Royce* 10439; 12 miles [19 km] NE of Millrose, 8 Sep. 1958, *N.H. Speck* 1382.

Distribution. Occurs in the Eremean Botanical Province of Western Australia, extending from near Newman south to near Montague Range (south-east of Wiluna), south-east to between Neale Junction and Plumridge Lakes and east towards the Northern Territory border. Also occurs in Northern Territory. (Figure 1)

Habitat. Commonly occurs on red sandy soil with spinifex (*Triodia*), usually on sandplains but also recorded in gravelly soils and on lateritic soils above gorges or breakaways, sometimes in *Acacia* shrublands, with one record from *Eucalyptus gongylocarpa* savannah. The species is probably favoured by fires although only one habitat record mentions that the area had recently been burnt.

Phenology. Flowering and fruiting period: mainly June to October, also recorded January.

Chromosome number. n=11 (Keighery 1982b). Voucher specimen: *G.J. Keighery* 552.

Conservation status. Not considered to be at risk.

Notes. Readily distinguished from all other Western Australian species by the crenulate double wings encircling the body of the monocarp including the portion along the commissure. The other taxa described in this paper either lack wings or have a single wing extending around the margin of the monocarp but not along the commissure.

In *T. bialata* the flowers have blue or purple tints on the undersurface of the petals, with the styles often bluish and the stylopodium often deep blue-purple. The umbels have up to about 20 bracts and 140 flowers, but a depauperate specimen from Young Range (*M. Gillett* 61) has some umbels with only *c.* 10 bracts and *c.* 30 flowers.

Trachymene coerulea Graham (Graham 1828: 380–381). – *Didiscus coeruleus* (Graham) Hook. (Hooker 1828: t. 2875). – *Didiscus cyaneus* DC. *nom. illeg.* (de Candolle 1829: 28, t. 4). – *Huegelia coerulea* (Graham) Reichb. (Reichenbach 1830: 1–2, t. 201). – *Trachymene cyanea* A. Cunn. ex DC. *nom. inval.* (de Candolle 1830: 72). *Type:* cultivated at Edinburgh Royal Botanic Garden from seeds sent from New Holland [Western Australia] by Mr Fraser (*lecto:* illustration t. 2875 from Hooker (1828), here chosen).

Annual herb 0.2–1.2 m high, viscid; indumentum of patent glandular hairs. *Stems* with a usually dense indumentum of hairs of very variable size; largest hairs 0.6–5 mm long, slender or robust. *Cotyledons* 5.5–10 x 0.7–2.3 mm; lamina narrowly or very narrowly ovate. *Petioles* commonly less than 10 mm long but up to 50 mm long on lower leaves; expanded base often not distinguishable, commonly *c.* 2 mm long, with cilia up to 2 mm long. *Leaf blades* usually broadly to depressed obovate in outline and deeply divided, 10–70 x 11–60 mm, the 3 primary lobes usually further trisected or bisected, both surfaces usually rather densely hairy. *Peduncles* 15–200 mm long, densely hairy. *Involucral bracts* 14–32; base 3–6 mm long; free portion 11–20 mm long, densely glandular-ciliate and with scattered glandular hairs over the outer surface; larger cilia 0.4–1 mm long. *Umbels*

20–60 mm diam., approximately 130–300-flowered, usually with most flowers producing homomorphic or heteromorphic fruits but some of the flowers producing asymmetric fruits. *Pedicels* 2–25 mm long, rather densely glandular-hairy throughout or less densely so towards base, the largest hairs 0.4–1 mm long and sometimes concentrated towards the summit, occasionally blue; outermost ones 13–25 mm long in fruit. *Petals* commonly 2–2.5 mm long, white to deep blue. *Anthers* 0.3–0.5 mm long. *Fruit* highly bilaterally compressed, with both monocarps maturing or with the outer monocarp very to somewhat reduced in size, when very reduced 1.3–2.5 mm long; carpophore 1.2–2.5 mm long; styles 1.0–1.5 mm long. *Fertile monocarp(s)* 1.8–4.8 x 1.5–3.1 mm, up to *c.* 0.6 mm thick not including the ornamentation, either bristly or tuberculate, each tubercle terminating in a hair.

Distribution. Endemic to the South West Botanical Province of Western Australia. Extends from Kalbarri National Park south to near Augusta, with an isolated record from Wilyung Hill (near Albany).

Chromosome number. n=11 (Constance & Bell 1960, Wanscher 1933). Additional records are cited for each subspecies.

Notes. Of the species described in this paper, *Trachymene coerulea* is the only one for which heteromorphic fruits have been recorded, although these fruits are apparently very rare and are known in only one of its two subspecies. Heteromorphic fruits are common in one other Western Australian species, *T. pilosa*, as described in Keighery & Rye (1999).

a. Trachymene coerulea Graham subsp. **coerulea**. – *Trachymene coerulea* Graham var. *coerulea.*

Illustrations. These include Bennett (1988: Figure 252), Hooker (1828, t. 2875) and Rippey & Rowland (1995: 240–241).

Annual herb 0.2–1.2 m high. *Peduncles* usually with all hairs fine; large hairs up to 1.5 mm long, with a slender base usually *c.* 0.1 mm wide. *Involucral bracts* 20–32, often deeply blue in distal quarter to half of free portion, sometimes paler blue or with blue extending most of length, usually with all hairs fine. *Petals* usually pale to deep blue, rarely white. *Fruit* homomorphic or asymmetric; fertile monocarp(s) 2.5–4.8 x 1.6–3.1 mm, tuberculate, with a short unbranched hair at the centre of each tubercle; tubercles 0.1–0.2 mm long. **Blue Lace Flower** or **Rottnest Island Daisy**

Selected specimens examined (limestone variant). WESTERN AUSTRALIA: 6 km NE of Cervantes, 11 Dec. 1985, *J.J. Alford* 80; Yanchep, 21 Oct. 1965, *E.M. Bennett* 181; Rottnest Island, 21 Nov. 1972, *R.A. Congdon*; Cottesloe, Jan. 1923, *L. Glauert*; Yanchep National Park, 2 Jan. 1992, *A. Greig* 32; Wongonderrah Rd, Nambung National Park, 22 Nov. 1992, *E.A. Griffin* 7921; North Fremantle, 19 Dec. 1897, *R. Helms*; Yanchep National Park, 29 Jan. 1964, *A.M. James* 188; 11 miles [18 km] S of Mandurah, 19 Oct. 1973, *G.J. Keighery* 2198; Raebold Hill, City Beach, 5 Dec. 1985, *G.J. Keighery* 6330; 20 km W of Harvey, 15 Jan. 1984, *G.J. Keighery* 6543; 5 km S of Lancelin, 1 Dec. 1985, *G.J. Keighery* 7931; Trigg townsite, 14 km N of Perth, 1 Dec. 1987, *G.J. Keighery* 9608; SW of Ludlow, 1 Feb. 1996, *G.J. Keighery* 14354; Rockingham, Dec. 1959, *H. Kretchman* 12282; S of Rockingham, 24 Jan. 1964, *R.A. Saffrey* 101.

Selected specimens examined (non-limestone variant). WESTERN AUSTRALIA: Swan View, Dec. 1900, *Diels & Pritzel* 327; Quarry Rd, Avon Valley National Park, 23 Dec. 1989, *B. Evans* 197; Wongong Gorge, 26 Dec. 1959, *A.S. George* 459; 4.1 km E of Stewart Rd on Brockman Highway, 4 Jan. 1975, *G.J. Keighery* 346; Wilyung Hill, 10 Nov. 1982, *G.J. Keighery* 5624; Darlington, 28 Nov. 1903, *A. Morrison*; Helena Valley, 20 Nov. 1977, *J. Seabrook* 491.

Distribution. Extends along the coast and on off-shore islands from near Cervantes southwards and from the Darling Range near Perth south to near Augusta, with an isolated record from Wilyung Hill near Albany. (Figure 1)

Habitat. Occurs on limestone or dunes along the coast, in deep sand on the western side of the Swan Coastal Plain, on sandy or clayey soils on the eastern side of the Swan Coastal Plain and often associated with granite in the Darling Range and the southern parts of the species' distribution.

Phenology. Flowering and fruiting period: mainly October to January. On the mainland the species occurs in great numbers following fires but is rarely seen otherwise. On Rottnest and Garden Islands, where fires were extremely rare prior to settlement, the species has overcome the fire-dormancy requirement, germinating each year without any need for fire (G.J. Keighery pers. comm.).

Chromosome number. n=11 for limestone variant and n=?11,22 for non-limestone variant (Keighery 1982b). Voucher specimens for limestone variant: *G.J. Keighery* 2198; probably also three unnumbered collections of *G.J. Keighery*, all *n.v.* Voucher specimens for non-limestone variant: *G.J. Keighery* 346 [as *T. anisocarpa*] with n=22; probably also *G.J. Keighery* 600, *s.n.*, both *n.v.* [as *Trachymene* sp. II] with n=11.

Conservation status. Not considered to be at risk.

Notes. Monocarps are 2.5–3.5 mm long in most areas but approximately 4–5 mm long on Garden Island specimens, with short glandular hairs at first, becoming rugose with pyramid-shaped tubercles, each with a short terminal glandular hair.

There are two main variants. The typical variant occurs mainly on limestone or dunes near the coast, but is also recorded from Booragoon and Cannington in sandy soils, extending from near Cervantes south to near Lake Preston, and usually has deeply coloured blue flowers in umbels 25–60 mm diam. with a peduncle 30–200 mm long. The other variant occurs usually in soils with a greater proportion of clay, often associated with granite, extending from the Darling Range near Perth south to near Augusta, with an isolated record from Wilyung Hill near Albany, and usually has white or pale blue flowers in umbels 20–35 mm diam. with a peduncle 15–140 mm long.

Both of the common names cited above apply to the coastal variant of this subspecies. The name Blue Lace Flower was favoured by Bennett (1988) and Wheeler (1987), but both names were listed by Rippey & Rowland (1995).

b. Trachymene coerulea subsp. **leucopetala** (F. Muell. ex Benth.) Rye, *stat. nov.*

Trachymene coerulea var. *leucopetala* F. Muell. ex Benth. (Bentham 1867: 349). – *Didiscus coeruleus* var. *leucocephalus* (F. Muell. ex Benth.) Domin (Domin 1908: 44–45). *Type:* Murchison River, [Western Australia], *Oldfield* (*n.v.*).

Annual herb 0.2–0.5 m high. *Peduncles* with a mixture of coarse and fine hairs; large hairs up to 5 mm long, with a broad base usually 0.2–0.3 mm wide. *Involucral bracts* 14–28, green throughout, with a mixture of coarse and fine hairs. *Pedicels* with glandular hairs up to 1 mm long in distal half and with a shorter, less dense indumentum or almost glabrous in basal half. *Petals* usually white, sometimes very pale blue. *Fruit* homomorphic, heteromorphic or asymmetric; fertile monocarp(s)

1.8–3.0 x 1.5–2.0 mm, bristly or (in heteromorphic fruits) the outer one bristly and the inner one tuberculate-rugose; bristles commonly 0.6–0.8 mm long, coarse, the apex glandular, with minute retrorse to patent side branches. (Figure 6A–C)

Other specimens examined. WESTERN AUSTRALIA: Red Bluff, 25 Nov. 1980, *D.R. Bellairs* 1063; Cliff Head, 29 Oct. 1967, *A.C. Burns* 126; 390–394 mile pegs on North West Coastal Highway, 23 Oct. 1966, *A.C. Burns* 1047; Kalbarri, 18 Dec. 1968, *H. Demarz* 913; Lesueur National Park, 16 Dec. 1993, *B. Evans* 774; Rocky Springs Reserve, 10 km S of Eneabba, 13 Nov. 1978, *E.A. Griffin* 1654; railway line, N of Arrowsmith siding, 3 Feb. 1992, *E.A. Griffin* 6745A; 7 km W of Lake Indoon, 7 Feb. 1977, *R. Hnatiuk* 770010; Ajana, Sep. 1958, *D.H. Perry*; 20 miles [32 km] N of Ajana, 15 Nov. 1959, *L. Steenbohm & F. Lullfitz.*

Distribution. Extends along the coast from Kalbarri National Park south to near Lake Indoon and inland to Ajana and near Eneabba. (Figure 1)

Habitat. Occurs in sand, often over sandstone, limestone or ironstone.

Phenology. Flowering and fruiting period: late October to early February.

Chromosome number. n=11 (Keighery 1982b). Voucher specimen: *Young* 485 *n.v.*

Conservation status. Not considered to be at risk.

Notes. On the coast this taxon is replaced south of Eneabba, in a quite sudden transition, by the bright blue-flowered typical variant of the species; inland on granite and laterite it is replaced by the white- or pale blue-flowered hills variant of subsp. *coerulea*. Subsp. *leucopetala* has medium-sized umbels 20–45 mm diam. on a peduncle 30–120 mm long. It can be distinguished vegetatively from the other subspecies by its coarser glandular hairs on the peduncles and bracts and the larger hairs on the base of the flowers, and tends to be a smaller plant. It also tends to have smaller numbers of bracts and flower per umbel and probably the pedicels less densely hairy towards the base than subsp. *coerulea* but there is considerable overlap for these characters.

There are too few mature fruiting specimens to accurately determine fruit size in subsp. *leucopetala* but it appears to have smaller fruits generally than subsp. *coerulea*. One specimen (*B. Evans* 774) from Lesueur National Park has heteromorphic fruits (Figure 5C) and also asymmetric fruits in each umbel, the inner monocarp tuberculate-rugose and the outer one either full-sized and bristly or much reduced. Possibly some of the other specimens would also exhibit heteromorphy if they were in mature fruit, but it appears that most plants in this subspecies produce homomorphic fruits. The tuberculate-rugose monocarps tend to have a row of large tubercles along the medial line, more compressed tubercles around the margin and often a group or tubercles towards the base or a few scattered ones, with the remainder of the surface somewhat rugose. The tuberculate monocarps of subsp. *coerulea* differ in having numerous smaller tubercles more uniformly distributed across the surface.

Trachymene croniniana (F. Muell.) T. Durand & B.D. Jacks. (Durand & Jackson 1902: 136). – *Didiscus croninianus* F. Muell. (Mueller 1895: 144). *Type:* towards Coolgardie, [Western Australia], *Cronin* (MEL 98616).

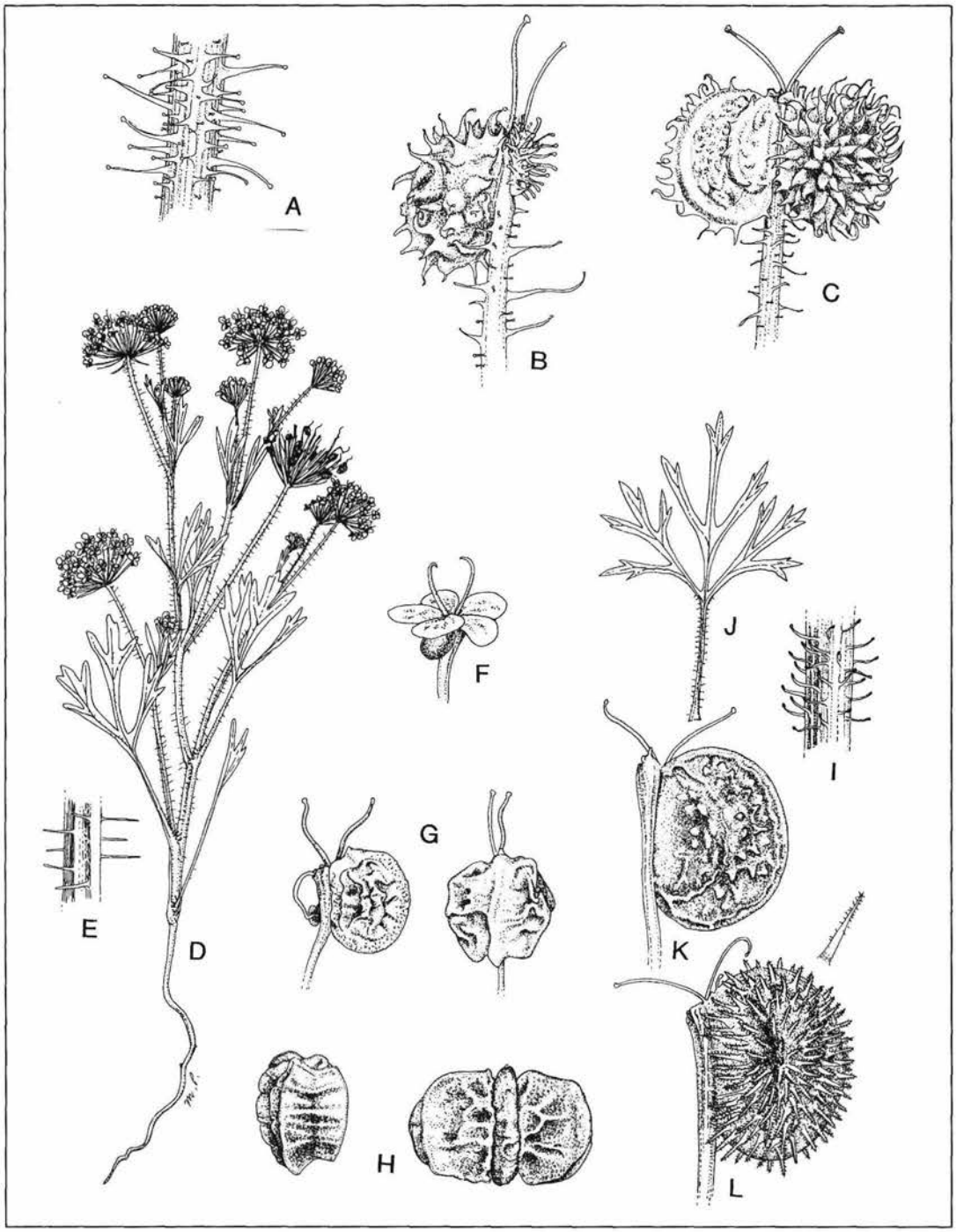

Figure 6. A–C. *Trachymene coerulea* var. *leucopetala*. A – portion of peduncle with glandular hairs (x6), B – asymmetric fruit (x10), C – heteromorphic fruit (x8); D–H. *Trachymene croniniana*. D – whole plant (x1), E – portion of stem with non-glandular hairs (x5), F – very immature fruit (x9), G – lateral and adaxial views of asymmetric fruit of northern variant (x9), H – lateral and adaxial views of asymmetric fruit of southern variant (x11); I–L. *T. grandis*. I – base of peduncle with glandular hairs (x9), J – leaf (x1), K – tuberculate asymmetric fruit (x8), L – bristly asymmetric fruit (x8), with enlarged bristle. Drawn from *D.R. Bellairs* 1063 (A,B), *B. Evans* 774 (C), *E.T. Bailey* 560 (D–G), *Wittwer* 1510 (H), *G.J. Keighery* 2154 (I–K) and *G.J. Keighery* 6528 (L).

Annual herb 0.1–0.2 m high; indumentum of patent non-glandular hairs. *Stems* fairly uniformly but rather sparsely hairy; hairs 0.4–1.4 mm long, robust. *Cotyledons c.* 6 x 1 mm; lamina narrowly elliptic. *Petioles* 17–55 mm long; expanded base 2.5–14 mm long, with non-glandular cilia mostly 0.5–2.5 mm long. *Leaf blades* broadly to depressed obovate, deeply lobed, 14–35 x 8–54 mm, cuneate at base, the 3 primary lobes usually further trisected or bisected or dentate, the ultimate teeth mucronate, both surfaces usually with a few non-glandular hairs scattered along the veins, the lower surface much more prominently veined than upper surface. *Peduncles* 16–72 mm long. *Involucral bracts* 11–18; base 0.6–1.4 mm long; free portion 4–6 mm long, glabrous or with a few (usually 1 or 2) cilia or teeth 0.1–0.4 mm long. *Inflorescence* 11–22 mm diam., approximately 40–80-flowered. *Pedicels* 2–9 mm long; outermost ones 5–9 mm long in fruit. *Petals* 1.3–1.8 mm long, often pale to deep violet-purple on undersurface, white on upper surface. *Anthers c.* 0.3 mm long. *Fruit* bilaterally compressed at first but not at maturity, with the outer monocarp very reduced and 0.8–1.3 mm long; styles 1.2–1.4 mm long. *Fertile monocarp* 1.8–2.0 x 1.3–1.5 mm, 1.5–2.5 mm thick, highly sculptured, with 2 prominent longitudinal projections or wings on each face and transverse furrows delimiting 4–6 large pits on each surface of each projection, the outer margin thickened or produced into a narrow but definite wing. (Figure 6D–H)

Other specimens examined. Bruce Rock district, *E.T. Bailey*; Muntadgin, Sep. 1945, *E.T. Bailey* 560; 6 km W of Formby South Rd on Salt River Rd towards Cranbrook, Stirling Range, 14 Nov. 1982, *G.J. Keighery* 5790; 21 km NE of Ongerup, 31 Oct. 1974, *K.R. Newbey* 4550; 14 miles [23 km] W of North Lake Grace, 29 Nov. 1974, *Wittwer* 1510.

Distribution. Endemic to the South West Botanical Province of Western Australia. Extends from Muntadgin south to Stirling Range National Park. (Figure 2)

Habitat. Recorded from "lateritic sand", from "well drained shallow loamy sand" and from "coarse gritty sand over clay", the last locality described as a creek bed with a woodland of *Eucalyptus occidentalis*.

Phenology. Flowering and fruiting period: September to December. The species is favoured by fires, apparently producing very large populations after fires and becoming very rare in intervening periods.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Known from few specimens. As in related species, population size fluctuates widely in *T. croniniana* because of its fire-dependence. Assessment of its conservation status is therefore difficult.

Notes. A very distinctive species, immediately recognizable from other south-western species by its non-glandular indumentum and odd fruit. The description of the species is based on few specimens and very few with relatively mature fruits, although all have immature fruits. The fruit always has one fertile monocarp and the other monocarp very reduced. Although appearing typical when immature, the fruit is quite atypical of the genus at maturity, being slightly to distinctly dorsiventrally compressed (rather than bilaterally compressed) and highly sculptured with protruding ridges or wings and large pits. The only other member of the genus observed to have monocarps with significant dorsiventral breadth is a species from Northern Territory, *Trachymene inflata* Maconochie, which has a prominent longitudinal ridge on each face, the whole fruit covered with long bristles.

There appear to be two variants of *Trachymene croniniana*, the atypical one recorded from the Lake Grace area south to Stirling Range National Park, with stem hairs 0.4–0.65 mm long and the fertile

monocarp with prominent wings exceeding the margin (Figure 6H). The type variant, recorded in the Bruce Rock–Muntadgin area, has stem hairs 1–1.4 mm long and the fertile monocarp is apparently less dorsiventrally compressed but probably not fully mature, with a more prominent marginal wing (Figure 6G). More material with mature fruits is needed to determine whether there really are two distinct kinds of fruits, as each kind is currently known from only one specimen in PERTH.

Trachymene glaucifolia (F. Muell.) Benth. (Bentham 1867: 350). – *Didiscus glaucifolius* F. Muell. (Mueller 1853: 395). *Type:* Elders Range, [South Australia], October 1851, *F. Mueller* (K, MEL, *n.v.*).

Illustrations. Boyland & Stanley (1981: Figure 354,4), Eichler (1986: Figure 500D).

Annual herb 0.1–0.5 m high, often glaucous; indumentum (where present) of patent glandular hairs. *Stems* largely glabrous but with hairs distributed for a short distance on base of each peduncle and sometimes above each of the upper nodes; hairs mostly 0.1–0.3 mm long but up to 0.6 mm. *Cotyledons* 14–16 x 2.5–4 mm; lamina narrowly or very narrowly oblong-elliptic (slightly ovate to slightly obovate). *Petioles* 15–105 mm long; expanded base 3–6 mm long, with cilia up to 2 mm long. *Leaf blades* broadly to depressed obovate in outline and deeply divided or lobed, 15–40 x 15–60 mm, cuneate at base, the 3 primary lobes usually further trisected or bisected or dentate, glabrous or with a few hairs scattered along the veins. *Peduncles* commonly 60–90 mm long but not seen in mature fruiting stage, glabrous for most of length but fairly densely glandular-hairy at the base. *Involucral bracts* 15–26; base usually 1–1.5 mm long; free portion commonly 5–7 mm long, glandular-ciliate, sometimes with a few glandular-ciliate teeth, often also with a few glandular hairs on the outer surface; cilia mostly 0.1–0.4 mm long, the teeth up to 2 mm long. *Umbels* commonly 15–30 mm diam. and 80–150-flowered. *Pedicels* commonly 3–10 mm long, glabrous. *Petals c.* 2 mm long, often deeply blue or purple on undersurface, white or pale blue to mauve on upper surface. *Anthers* 0.4–0.6 mm long. *Fruit* highly bilaterally compressed, with the outer monocarp very reduced and probably 1.5–2.5 mm long; styles probably 1.5–2.5 mm long. *Fertile monocarp* not seen at maturity.

Selected specimens examined. WESTERN AUSTRALIA: 99 km N of Agnew, 19 Aug. 1963, *T.E.H. Aplin* 2401; 27 km by road NE of Beria, 30 km NE of Laverton–Warburton road, 16 Sep. 1978, *A.C. Beauglehole* 59859 & *E.G. Errey* 3559; 179 km E of Warburton Mission on Docker Mission road, 20 Sep. 1978, *A.C. Beauglehole* 60297 & *E.G. Errey* 3997; S side of Petermann Ranges, 22 Sep. 1978, *A.C. Beauglehole* 60670 & *E.G. Errey* 4370; Lake Violet Station, July 1941, *F.M. Bennett* 57; 33 miles [53 km] SE of Windulda, Warburton road, 25 Aug. 1962, *A.S. George* 4003; 27.7 miles [44 km] E of Laverton, 18 Sep. 1975, *G.J. Keighery* 523; 32 km NNW of Mt Windarra, 29 Sep. 1992, *G.J. Keighery* 13901; 45 km N of Everard Junction, Gibson Desert Nature Reserve, 13 Aug. 1987, *D.J. Pearson* 245. NORTHERN TERRITORY: 9.8 miles [16 km] SW of Lucy Creek Homestead, 11 July 1957, *G. Chippendale* 3517; 55 miles [89 km] SW of Alice Springs, 16 Mar. 1953, 11672, *C.A. Gardner* 11672; Palm Creek campground, 2 Aug. 1981, *A.S. Weston* 12515; 70 miles [113 km] SE of Ringwood, 6 Oct. 1954, *R.E. Winkworth* 657.

Distribution. Occurs in the eastern Eremean Botanical Province of Western Australia, from near Mt Keith (south of Wiluna) and Mt Weld Station (south of Laverton) north-east to Petermann Ranges. Also occurs in Northern Territory, South Australia, Queensland and New South Wales. (Figure 3)

Habitat. Occurs on red sandy soils, often with spinifex (*Triodia*). Apparently favoured by fire.

Phenology. Flowering and fruiting period: July to October. In far inland areas of Western Australia, the species probably has a longer flowering period than currently recorded for the State, varying greatly

from year to year depending upon when sufficient rainfall comes. Its flowering period in other states includes March.

Chromosome number. n=11 (Keighery 1982b). Voucher specimens: *G.J. Keighery* 507, 523.

Conservation status. Not considered to be at risk.

Notes. Judging from flora accounts from other states (cited below), *T. glaucifolia* is up to 1 m high and can be perennial, although Western Australian specimens appear to be uniformly annual and the species is recorded as annual in the only available revision (Maconochie 1980: 174). Glandular hairs are present on the bracts and bases of peduncles and sometimes on the leaves in all Western Australian specimens, as indicated also for South Australian specimens (Eichler 1986: 1007) and all regions covered in the central Australian flora (Boyland & Stanley 1981: 270). According to Holland (1991: 401) the species has completely glabrous stems in Queensland, but presumably this is excluding the hairs on the peduncles, and also has completely glabrous leaves.

There are no mature fruits on the Western Australian specimens but the immature fruits are glabrous, lacking the small marginal glandular hairs present on both immature and mature fruits in most Northern Territory specimens. In addition to the minute glandular cilia, immature fruits of Northern Territory specimens have small glandular hairs scattered over the body which develop into tubercles as the fruit matures. Mature monocarps are mostly 4.5–6 x 4–4.8 mm, with a marginal wing 0.1–0.3 mm wide.

Trachymene pilbarensis has been included under this species and there are possibly other taxa still included in eastern material that need to be recognized at some level. *T. glaucifolia* certainly needs further study.

Trachymene grandis (Turcz.) Rye, *comb. nov.*

Dimetopia grandis Turcz., (Turczaninow 1849: 29). – *Didiscus grandis* (Turcz.) F. Muell. (Mueller 1859: 238). – *Didiscus benthamii* f. *tuberculatus* Domin (Domin 1908: 40). *Type:* Swan River Colony [Western Australia], 1847?, *J. Drummond* coll. 4, n. 133 (*holo:* KW *n.v.*, photograph PERTH; *iso:* MEL).

Trachymene sp. A in Wheeler (1987: 515).

Annual herb 0.2–2.5 m high, sometimes slightly viscid; indumentum (where present) of patent glandular hairs, but glandular apex sometimes lost with age. Stems usually largely glabrous but with hairs fairly densely distributed for some distance above each node, and often also for a shorter distance below each node, sometimes with scattered hairs on the usually glabrous portion; hairs 0.3–0.6(1.2) mm long, slender. *Cotyledons c.* 10 x 1.5–2.5 mm; blade narrowly ovate. *Petioles* 4–60 mm long; expanded base 1–5 mm long, with cilia up to 2 mm long. *Leaf blades* very broadly to depressed obovate in outline and 13–70 x 17–85 mm, deeply divided into narrow lobes, with a short base divided into 3 primary lobes, which are trisected or bisected with the secondary lobes further divided, most lobes more or less linear to filiform, usually with some hairs along the main veins. *Involucral bracts* 13–26; base 0.6–1.7 mm long; free portion 4–10(12) mm long, sparsely glandular-ciliate, the cilia mostly 0.1–0.4 mm long. *Peduncles* 25–95 mm long, usually glabrous for most of length but densely glandular-hairy at the base. *Umbels* mostly 15–30 mm diam. but up to 40 mm, 40–150(200)-flowered. *Pedicels* 1.5–16 mm long, the outermost ones 7–16 mm long in fruit. *Petals* 1.8–3.3 mm long, white to deep blue on both surfaces, the blue colour often mainly towards base.

Anthers 0.3–0.5 mm long. *Fruit* highly bilaterally compressed, with the outer monocarp very reduced and 2–3 mm long; styles 1.4–1.8 mm long. *Fertile monocarp* 3.0–4.0(5.0) x 2.0–2.8(3.6) mm, up to *c.* 0.8 mm thick, either bristly or tuberculate to almost smooth; bristles (0.3)0.4–0.6 mm long, retrorsely barbed; tubercles discrete, usually 0.1–0.2 mm long. (Figure 5I–L)

Specimens examined (bristly-fruited variant). WESTERN AUSTRALIA: Walpole–Nornalup National Park, 16 Dec. 1988, *A.R. Annels* 621; Mt Chudalup, 12 Dec. 1961, *T.E.H. Aplin* 1427; Porongorup Range, 15 Nov. 1994, *S. Barrett* 323; Ellis Brook Valley Reserve, 22 Dec. 1996, *H. Bowler* 476; Mt Chudalup, 26 Nov. 1961, *A.S. George* 3205; Crowea Rd, N of Northcliffe, 10 Jan. 1995, *E.D. Kabay* 1347; 2 km NNE of the intersection of Williamson Rd and Claymore Rd, 18 km E of Busselton, 15 Oct. 1992, *B.J. Keighery & N. Gibson* 729; 7 miles [13 km] W of Denmark, 27 Dec. 1973, *G.J. Keighery* 1412, 1414; 7 miles [13 km] W of Denmark, 12 Jan. 1974, *G.J. Keighery* 2152; 15 km NE of Denmark to Mount Barker, 13 Jan. 1984, *G.J. Keighery* 6528; Mt Chudalup, 19 Jan. 1966, *F. Lullfitz* 4714; William Bay National Park, Jan. 1984, *C.V. Malcolm* 77; 5 km E of Walpole, 19 Dec. 1982, *A. Strid* 21805; E of Waroona, Jan. 1964, *W.A. Ross*.

Specimens examined (with both variants or intermediate). WESTERN AUSTRALIA: Porongurup Range, Jan. 1941, *F.M. Bennett* (same sheet); 25 km N of Walpole Rd, Walpole, 3 Jan. 1986, *E.J. Croxford* 4750 (same sheet); Nornalup, Dec. 1929, *W.E. Blackall* (separate sheets); N part of Porongurup National Park, 1.5 km W of ranger's residence, 21 Oct. 1991, *W. Greuter* 23055.

Specimens examined (typical variant). WESTERN AUSTRALIA: Isle Rd, Walpole, 2 July 1997, *A.R. Annels* 5949; *c.* 3 km N of Crystal Springs, NW of Walpole, 13 Jan. 1978, *A.S. George* 15063; John Rate Lookout, near Walpole, 27 Dec. 1973, *G.J. Keighery* 1413; Nornalup townsite, 12 Jan. 1974, *G.J. Keighery* 2153; 9.5 miles [15 km] N of Pemberton, 12 Jan. 1974, *G.J. Keighery* 2154; Bow River, Dec. 1912, *S.W. Jackson*; William Bay National Park, Jan. 1984, *C.V. Malcolm s.n.*; Walpole–Nornalup National Park, Delta Rd, 2.8 km W from Isle Rd, 27 Jan. 1993, *J.R. Wheeler* 3793 *& S.J. Patrick.*

Distribution. Endemic to the South West Botanical Province of Western Australia. Extends along ranges near the west coast from Ellis Brook Valley Reserve, in the Darling Range near Perth, south to near Jarrahwood and also extends along the south coast and nearby from Pemberton and Mt Chudalup east to the Porongurup and Stirling Ranges. (Figure 3)

Habitat. Apparently occurs in seasonally wet habitats in the western part of the species range, recorded from a creek bank in Jarrah (*Eucalyptus marginata*) forest and from slopes over granite or ironstone. In the southern part of its range, *T. grandis* occurs mainly in heavy soils in Karri (*Eucalyptus diversicolor*) forest or over granite.

Phenology. Flowering and fruiting period: October to early February, especially December to January. The species is favoured by fires and clearance.

Chromosome number. n=22 (Keighery 1982b). Voucher specimens: *G.J. Keighery* 1412–1414, 2152–2154 [all as *Trachymene anisocarpa*].

Conservation status. Not considered to be at risk.

Notes. The phrase name *Trachymene* sp. Walpole (*A.S. George* 15063) has been applied to this species. *Trachymene grandis* differs in chromosome number from its closest relative *T. anisocarpa* and has

larger fruits, invariably with one monocarp very reduced. The fertile monocarp also differs in ornamentation, being either smooth to tuberculate (the tubercles quite distinct, not combined into ridges as in *T. anisocarpa* var. *anisocarpa*) or bristly with numerous side branches especially towards the apex (not with side branches absent or mainly towards the base as in *T. anisocarpa* var. *trichocarpa*).

Trachymene grandis shows a great deal of variation in fruit ornamentation. A variant with bristly fruits occurs throughout the species distribution. Smooth-fruited plants are rarest and apparently restricted to the extreme south coast, while tuberculate-fruited plants, which include the type of the species, have been recorded mainly on the south coast but also further inland near Pemberton and on Porongurup Range. Specimens with tuberculate or smooth fruits appear to completely intergrade and are combined under the title 'typical variant' in the above lists of specimens examined. A few specimens (e.g. *G.J. Keighery* 1413 from near Walpole) have fruits that are intermediate between the bristly and tuberculate variants, these having long tubercles minutely barbed towards the apex. Two collections, *E.J. Croxford* 4750 from near Walpole and *F.M. Bennett s.n.* from Porongurup Range, are mixed, both with one plant of each fruit type. Presumably, these specimens come from mixed populations, as there are no morphological differences evident except for the terminally barbed tuberculate protrusions of one being replaced by the much longer bristles of the other.

Drummond's fourth collection was mainly from the region extending from Stirling Range south to King George Sound and east to West Mt Barren (Erickson 1969). The type collection was therefore probably from the easternmost part of the species range, perhaps from Porongurup Range. As its name suggests, *T. grandis* is usually a large plant; in Karri forests, where it commonly occurs, it reaches up to 2.5 m high. Where it grows on granite, however, it is a much smaller plant commonly *c.* 0.4 m high as in the Porongurup Range specimen *W. Greuter* 23055.

Trachymene oleracea (Domin) B.L. Burtt (Burtt 1941: 46). – *Didiscus oleraceus* Domin (Domin 1928: 1044–1045). *Type:* between Ashburton and De Grey Rivers, Western Australia, *E. Clement* (*syn: n.v.*); Mons Cupri, Whim Creek, Western Australia, *W.A. Mitchell* (*syn: n.v.*).

Annual herb usually 0.2–1.3 m high; indumentum (where present) of patent glandular hairs. *Cotyledons* 7–13 x 2.5–6 mm; lamina obovate. *Petioles* 20–60 mm long; expanded base 2.5–4.5 mm long, with cilia up to 3 mm long. *Leaf blades* broadly to depressed ovate in outline and shallowly to very deeply lobed, 15–40 x 22–55 mm, often with 3 primary lobes, all or the two lateral lobes often shallowly to deeply 2-lobed, prominently dentate, often with a few minute marginal hairs and a few larger hairs scattered along the veins; base generally with margins incurved into an open cone shape. *Peduncles* usually 20–170 mm long, subtended by stem-clasping, somewhat fan-shaped bracts. *Involucral bracts* 11–16; base 0.5–1.5 mm long; free portion 2.5–8 mm long, with few to many glandular cilia 0.1–0.5 mm long. *Umbels* mostly 10–30 mm diam., approximately 50–110-flowered. *Pedicels* 1–12 mm long; outermost ones 4–12 mm long in fruit, glabrous. *Petals* commonly 1.4–1.7 mm long, usually tinged deep blue to purple on undersurface, white or rarely very pale blue on upper surface. *Fruit* highly bilaterally compressed, the outer monocarp very reduced and 2.2–2.8 mm long; styles 1.5–2.5 mm long. *Fertile monocarp* with a very narrow to moderately broad wing around free margin; body 4.3–7.5 x 3.8–5.5 mm, up to *c.* 0.5 mm thick, tuberculate or papillate; wing 0.1–0.8 mm wide.

Distribution. Apparently endemic to Western Australia, extending from near Wyndham in the Northern Botanical Province south-west to Barlee Range in the Eremean Botanical Province. This is the only species to occur in more than one botanical province in Western Australia.

Notes. This species can generally be distinguished readily from other Western Australian species by its rather stem-clasping fan-shaped leaves. A species from Northern Territory, *T. inflata* Maconochie, has similar leaves but very different flowers and fruits.

Two subspecies are recognized in *Trachymene oleracea*. The subspecies appear to be geographically distinct, with subsp. *sedimenta* occurring further north than subsp. *oleracea*.

a. Trachymene oleracea (Domin) B.L. Burtt subsp. **oleracea**

Illustration. Wheeler (1992: Figure 211G).

Annual herb usually 0.2–1.3 m high, appearing glabrous. *Stems* glabrous. *Leaf blades* usually with a few large glandular hairs 0.3–2.2 mm long towards base and some minute glandular hairs towards apex of each tooth. *Involucral bracts* with a few glandular cilia 0.1–0.2(0.3) mm long. *Anthers* 0.35–0.5 mm long. *Fertile monocarp* with a body 4.3–6.7 x 4.0–5.5 mm, with thick tubercles, the largest tubercles 0.1–0.25 mm long; wing 0.1–0.3(0.4) mm wide.

Selected specimens examined. WESTERN AUSTRALIA. Northern Botanical Province: Wallal Downs Station, Eighty Mile Beach, 20 July, *N.T. Burbidge* 1497; 10 km NE of Nita Downs Station, 8 Oct. 1984, *P.R. Foulkes* 24; Mt Barrett, 11 May 1951, *C.A. Gardner* 10194; 9 km S of Ardjorie Homestead ruins, Edgar Ranges, 27 June 1984, *K.F. Kenneally* 9159.
Eremean Botanical Province: 7 km E of Wittenoom on the Roy Hill road, 11 Sep. 1982, *L.A. Craven* 7544; Bam Hill, Thangoo Station, 26 June 1991, *T. Handasyde* 13; Python Pool, Chichester Range National Park, 22 May 1976, *G.J. Keighery* 772; *c.* 30 km S of Munjina Roadhouse on Newman road, 3 Sep. 1995, *A.A. Mitchell* PRP620; Barlee Range, Henry River, 17 Aug. 1961, *R.D. Royce* 6512; West Lewis Island, Dampier Archipelago, 14 June 1962, *R.D. Royce* 7432; Rosemary Island, Dampier Archipelago, Aug. 1961, *B. Wilson* 9; Rudall River area, 12 Aug. 1971, *P.G. Wilson* 10457.

Distribution. Apart from an isolated record from Mt Barrett, near Halls Creek (Fitzgerald District), the known range is from near Broome and Edgar Ranges (Dampier District) in the Northern Botanical Province south-east to Dampier Archipelago and Barlee Range and south to Well 24 of Canning Stock Route in the Eremean Botanical Province of Western Australia. (Figure 2)

Habitat. Occurs mainly in rocky or stony habitats, the rock type often ironstone, sometimes on the slopes and summits of hills or along watercourses, often in red soil with spinifex (*Triodia*).

Phenology. Flowering and fruiting period: May to October, also one record from early March.

Chromosome number. n=11 (Keighery 1982b). Voucher specimen: *G.J. Keighery* 772.

Conservation status. Widespread and common.

Notes. The leaves are usually glandular-hairy but a few specimens, especially some from islands of Dampier Archipelago and from the Kimberley region, have glabrous or subglabrous leaves.

b. Trachymene oleracea subsp. **sedimenta** Rye, *subsp. nov.*

Differt a *Trachymene oleracea* subsp. *oleracea* indumento densiore et plus generali, ala fructi latiore et tuberculis fructi longioribus insidens.

Typus: Napier Range, Western Australia, 24 May 1971, *D.E. Symon* 7015 (*holo:* PERTH (ex ADW) 03582515; *iso:* ADW, CANB, K all *n.v.*).

Annual herb commonly 0.3–0.6 m high, with an indumentum of short glandular hairs on the young stems, leaves and bracts. *Stems* rather densely hairy, the larger hairs 0.4–0.9 mm long. *Leaf blades* moderately densely hairy throughout, the larger hairs mostly 0.3–0.5 mm long. *Involucral bracts* with many glandular hairs, the larger ones 0.3–0.5 mm long. *Anthers* 0.5–0.6 mm long. *Fertile monocarp* with a body 4.5–7.5 x 3.8–5.5 mm, with long tubercles towards apex and/or inner margin and shorter tubercles elsewhere; wing 0.5–0.8 mm wide at apex of fruit body and 0.4–0.5 mm wide around remainder of body; larger tubercles slender, 0.4–0.6 mm long. (Figure 7A–D)

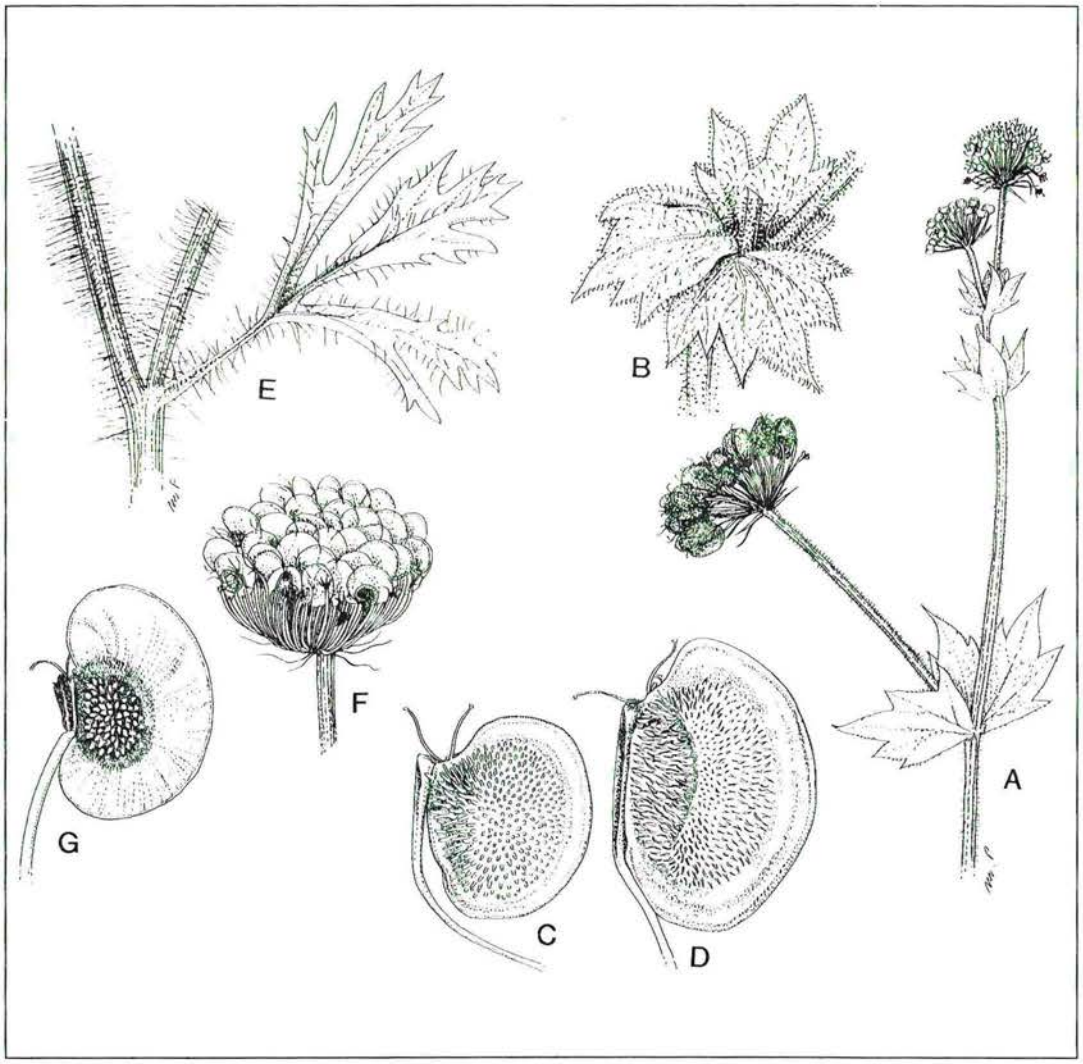

Figure 7. A–D. *Trachymene oleracea* subsp. *sedimenta*. A – flowering and fruiting branch (x1), B – young stem and leaf (x3.5), C – asymmetric fruit from Napier Range (x4.5), D – asymmetric fruit from Wyndham (x4.5); E–G. *T. villosa*. E – stem and leaf (x1), F – fruiting inflorescence (x1), G – asymmetric fruit (x3.5). Drawn from *C.A. Gardner* 7255 (A,D), *D.E. Symon* 7015 (B,C) and *R.A. Perry* (E–G).

Other specimen examined. WESTERN AUSTRALIA: The Bastion Range, near Wyndham, 24 May 1944, *C.A. Gardner* 7255.

Distribution. Recorded from Napier Range (Dampier District near border with Fitzgerald District) and The Bastion Range, near Wyndham (eastern Gardner District) in the Northern Botanical Province of Western Australia. (Figure 2)

Habitat. Occurs on limestone or sandstone on inland ranges, the limestone on Napier Range being of Devonian reef origin.

Phenology. Flowering and fruiting period: May to June.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. Known from two collections made in two ranges of hills over 400 km apart.

Etymology. The epithet refers to the sedimentary rocks on which the taxon has been found.

Notes. Attention was first drawn to the existence of distinctly glandular-hairy specimens in a note under the description of *Trachymene oleracea* in "Flora of the Kimberley Region" (Wheeler 1992: 685) and the taxon was later added to the Priority Flora List under the phrase name *Trachymene* sp. Napier (*D.E. Symon* 7015).

Subspecies *oleacea* differs from subsp. *sedimenta* in its glabrous stems, less densely hairy leaves, fewer and shorter cilia on the bracts, shorter papillae and narrower wing on the fruit, and possibly shorter anthers. In subsp. *sedimenta*, the hairs on the leaves are more uniform in size than in subsp. *oleracea*, which tends to have both minute hairs and much larger hairs.

Trachymene pilbarensis Rye, *sp. nov.*

?*Didiscus setulosus* var. *fililoba* F. Muell. (Mueller 1883: 14). *Type:* none cited but the immature material described apparently came from the Gascoyne River area or nearby in Western Australia.

Trachymene glaucifoliae affinis sed divisionibus foliorum angustioribus, pedunculis glabris et alis fructorum latioribus differt.

Typus: 3 km north of Mt Narryer, Western Australia, 2 September 1970, *R.A. Saffrey* 1160 (*holo:* PERTH 03581896; *iso:* CANB, K, MEL).

Annual herb usually 0.1–0.7 m high, often purplish on base of stem and undersurface of cotyledons; indumentum (where present) of antrorse to patent glandular hairs, sometimes losing glandular apex with age. *Stems* glabrous. *Cotyledons* 12–26 x 3.5–10 mm; lamina obovate to broadly ovate. *Petioles* 15–80 mm long; expanded base usually 2–5 mm long, with cilia up to 4 mm but usually 1–3 mm long. *Leaf blades* broadly to depressed ovate in outline and very deeply divided into very narrow lobes, 12–70 x 10–90 mm, the 3 primary lobes usually further trisected or bisected, often with secondary lobes also divided, usually with a few hairs scattered along the veins. *Peduncles* 10–90 mm long, glabrous. *Involucral bracts* 12–20; base 0.5–1.3 mm long; free portion 2–9 mm long, glandular-ciliate, the longer cilia 0.5–1.3 mm long. *Umbels* 12–27(35) mm diam., approximately (15)20–100-flowered. *Pedicels* 3–13 mm long, the inner and outer ones not greatly differing in length, glabrous. *Flowers* with blue

and/or purple tints, the stylopodium and styles often deep blue to violet. *Petals* 2–3 mm long, usually white or pale blue on upper surface and blue to violet on undersurface. *Anthers* 0.4–0.6 mm long. *Fruit* highly bilaterally compressed, with the outer monocarp very reduced and 1.7–2.5 mm long; styles 2–2.5 mm long. *Fertile monocarp* with a body 4.8–5.7 x 4.2–5.3 mm and very narrow wing around margin, up to *c.* 0.6 mm thick, smooth or tuberculate; wing 0.1–0.2 mm wide, entire, yellow-brown, translucent. (Figure 5B–E)

Selected specimens examined. WESTERN AUSTRALIA: Yanrey West, 8 Aug. 1963, *W.H. Butler;* Towera Station, 5 Aug. 1981, *R.J. Cranfield* 1772; 1.1 km SW of Murdabool Well, Belele Station, 26 Aug. 1986, *R.J. Cranfield* 5919; E side of Mt Augustus, 29 July 1989, *A.E. De Jong*; Pharoh Well, 19 Aug. 1972, *H. Demarz* 3841; Old Mooka Homestead, 2 Sep. 1983, *H. Demarz* 9649; Kennedy Range, 23 Sep. 1941, *C.A. Gardner* 6081; 10 miles [16 km] S of Onslow, 28 Aug. 1960, *A.S. George* 1146; 45 miles [72 km] E of Bullara Homestead, 29 Aug. 1960, *A.S. George* 1192; 28 km W of Erabiddy Homestead, 13 Sep. 1987, *J.W. Green* 5382; W side of Doolgunna Station, 1973, *J.G. Morrissey* 161; Barley Range Nature Reserve, 9.7 km W of Mt Palgrave, 5 Aug. 1993, *S. van Leeuwin* 1349; 7 km NW of Quarry Hill, 4 Aug. 1984, *K.R. Newbey* 10653; 17.5 km N of Barradale, 3 Oct. 1989, *B. Nordenstam & A. Anderberg* 289; near Ejah breakaway, Mileura Station, 30 Aug. 1970, *R.A. Saffrey* 1117; 10 miles [16 km] S of Berringarra, 15 July 1958, *N.H. Speck* 975; Landor Station, Sep. 1969, *D.G. Wilcox* 83.

Distribution. Occurs in the Pilbara–Gascoyne area in the Eremean Botanical Province of Western Australia. Extends from near Onslow south to Mt Narryer Station and inland to near Great Northern Highway. (Figure 3)

Habitat. Occurs on rocky hillsides, granite outcrops and other rocky sites, often in *Acacia* shrublands, commonly in reddish soils with spinifex (*Triodia*).

Phenology. Flowering and fruiting period: July to October.

Chromosome number. n=11 (Keighery 1982b). Voucher specimens: *H. Demarz* 3841 [as *Trachymene* sp. I], possibly also Dell 74886 *n.v.*

Conservation status. An apparently common species with a wide distribution.

Etymology. The epithet refers to the Pilbara area of Western Australia, where the species is widespread.

Notes. This species has been known by the phrase names *Trachymene* sp. Kennedy Range (*G.J. Keighery & N. Gibson* 719) and *Trachymene* sp. Pilbara (*R.A. Saffrey* 1117) and was previously referred to as *T.* sp. *aff. glaucifolia* in PERTH. It appears also to have been included as *Trachymene* sp. in "Flora of Central Australia" (Boyland & Stanley 1981: 270) although no PERTH specimens are from the region covered by that flora.

It is closely related to *Trachymene glaucifolia*, which differs in having small glandular hairs on the base of the peduncles, leaf blades basically obovate rather than ovate and with broader shallower divisions, and monocarps often with glandular hairs. *T. glaucifolia* also tends to have narrower cotyledons, shorter hairs and more numerous bracts and flowers, but these characters overlap too much to be useful for keying the two species.

Trachymene pyrophila Rye, *sp. nov.*

Trachymene anisocarpae affinis sed planta plus glanduloso pilosiore et fructis prominente setosis pedicellis longioribus insidens differt.

Typus: 15 km south-east of Cundeelee Mission, Western Australia, 3 December 1965, *D.W. Goodall* 2417 (*holo:* PERTH 03618277; *iso:* CANB).

Annual herb 0.1–0.5 m high, viscid; indumentum of patent glandular hairs. *Stems* moderately densely hairy; hairs mostly 0.2–1.0 mm long, usually stout. *Cotyledons* 6–7 x 1–1.5 mm; lamina narrowly ovate. *Petioles* mostly 11–35 mm long; expanded base 2.5–4.5 mm long, glandular-ciliate, often with large cilia or narrow marginal divisions 1.5–3 mm long (these usually with a few additional lateral glands or side branches each terminated by a gland) and smaller hairs on the outer surface and margins. *Leaf blades* very broadly to depressed obovate in outline and deeply lobed, 12–30 x 16–34 mm long, cuneate at base, the 3 primary lobes further trisected or bisected and dentate, the ultimate lobes short and 3–7 mm wide; lower surface prominently veined, each vein with glandular hairs; upper surface largely glabrous but with a few glandular hairs on main veins. *Bracts* usually 16–28; free portion 7–12 mm long in fruit. *Peduncles* 15–70 mm long, glandular-hairy throughout or rarely glabrous towards the summit. *Inflorescence* usually 40–120-flowered or larger; the outer flowers sometimes all producing asymmetric fruits but at least some of the inner flowers producing homomorphic fruits. *Pedicels* 2–16 mm long, glabrous; outermost ones 11–16 mm long in fruit. *Petals* 1.3–1.6 mm long, often pale to deep purple on undersurface, white on upper surface. *Anthers* 0.3–0.4 mm long. *Fruit* bilaterally compressed, with outer monocarp very to somewhat reduced or with both monocarps fully developed; carpophore 1.0–1.6 mm long; styles 1.5–2.5 mm long. *Fertile monocarp(s)* 2.3–2.6 x 1.7–1.8 mm, *c.* 0.5 mm thick, with long hair-like bristles, which are simple or slightly branched at base but not towards summit, the largest bristles 0.7–1 mm long. (Figure 4F–J)

Other specimens examined. WESTERN AUSTRALIA: Queen Victoria Springs, 26 Jan. 1959, *W.H. Butler*; Ponton Creek, N of Zanthus, 10 Nov. 1963, *A.S. George*; 7 km SW of Nippon Junction, Queen Victoria Springs Nature Reserve, 26 Nov. 1986, *D.J. Pearson* 93; 50 km NNE of Streich Mound, 24 Mar. 1987, *D.J. Pearson* 1070.

Distribution. Occurs in the South-western Interzone of Western Australia. Extends from near Officer Basin south to Ponton Creek (north of Zanthus). (Figure 2)

Habitat. Recorded in yellow or orange sand on sandplains, one record from mallee (*Eucalyptus*) over spinifex (*Triodia basedownii*).

Phenology. Flowering and fruiting period: November to March. Germinates after fires or other disturbances.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Known from four collections, including one from Queen Victoria Springs wildlife sanctuary. This species rarely germinates in undisturbed vegetation but is reported to be frequent after fire and occasional after disturbance caused by mining. It has been listed as a priority species since 1995 under the phrase name *Trachymene* sp. Cundeelee (*D.W. Goodall* 2417).

Etymology. From the Greek *pyros* – fire and *phileo* – to love. Like related species, this taxon is favoured by fires.

Notes. Closely related to *Trachymene anisocarpa* but can be distinguished both vegetatively and in fruit. It tends to be a smaller plant and is always more hairy than *T. anisocarpa*, with glandular hairs more numerous and more widespread on the stems, bracts and leaves. It tends to have broader, more dentate leaf divisions and its petioles tend to be broader and more prominently divided at the base. Its fruit is very similar to that of *T. anisocarpa* var. *trichocarpa* except that var. *trichocarpa* has shorter bristles 0.2–0.4 mm long. In fruit, the pedicels and styles are generally significantly longer in *T. pyrocarpa* than in both varieties of *T. anisocarpa*.

2. Trachymene sect. **Hemicarpus** (F. Muell.) Rye, *comb. nov.*

Didiscus sect. *Hemicarpus* (F. Muell.) F. Muell. (Mueller 1859: 237). – *Hemicarpus* F. Muell. (Mueller 1857: 18). *Type: Hemicarpus didiscoides* F. Muell. [= *Trachymene didiscoides* (F. Muell.) B.L. Burtt], lectotype here chosen.

Didiscus II. *Pseudocalycina* Domin, rank not specified (Domin 1908: 28). *Type: Didiscus hemicarpus* F. Muell. [= *Trachymene didiscoides* (F. Muell.) B.L. Burtt], lectotype here chosen.

Perennial or *annual herbs* or *subshrubs* medium-sized to large; indumentum (where present) of antrorse to patent non-glandular hairs, which are usually long and often dendritic. *Petioles* with enlarged base tapering to, and scarcely differentiated from, the remainder of petiole. *Flowers* usually yellow to white on the upper surface of the petals, often suffused deep pink on the outside, and deep pink to red in the centre (particularly the stylopodium and styles), occasionally also pink on the pedicel. *Sepals* 5 but usually very unequal, with the apex distinctly capitate-clubbed, the largest sepal prominent on the young fruits and either elongate or strongly clubbed. *Petals* small or medium-sized. *Fruit* usually of 1 monocarp with a wing around the margin.

Etymology. Derived from the Greek *hemi* – half and *carpos* – fruit, members of this section producing mostly half-sized fruits with only one monocarp fertile.

Notes. A section comprising at least seven species in Western Australia and Northern Territory, possibly with further species in the Malesian region or eastern Australia. Three members of this section that are endemic to Northern Territory are *T. hispida* Maconochie, *T. lacerata* Maconochie and *T. rotundifolia* Maconochie, all described and illustrated in Maconochie (1980). A comprehensive treatment of Malesian species of *Trachymene* is given in Buwalda (1949).

In sect. *Hemicarpus* the sepals are more prominent than in sect. *Didiscus*, the largest sepal sometimes about 2 mm long in late flower or early fruit, but shorter by the time the fruit matures, when it is typically 0.3–1.5 mm long. Some plants produce only asymmetric fruits and others, often in the same species, produce both asymmetric and homomorphic fruits.

Trachymene dendrothrix Maconochie (Maconochie 1980: 184–185). *Type:* Gibb River crossing, Western Australia, 28 May 1971, *J.R. Maconochie* 1223 (*holo:* PERTH 01597329; *iso:* BRI, K, NT, isotypes all *n.v.*).

Illustrations. Maconochie (1980: Figure 6); Wheeler (1992: Figure 211C).

Annual or *short-lived perennial herb* 0.5–2.5 m high; indumentum (where present) of dendritic non-glandular hairs. *Stems* sometimes slightly glaucous, glabrous. *Cotyledons c.* 8 x 4 mm; lamina more or less ovate. *Petioles* 30–85 mm long, usually rather densely hairy but sometimes largely glabrous; hairs often mostly *c.* 0.4 mm long but with scattered cilia 1–2.5 mm long especially at base of petiole. *Leaf blades* broadly to depressed ovate or obovate in outline and shallowly to deeply lobed, 30–65 x 25–85 mm, often cuneate at base, the 3 primary lobes broad or sometimes narrow, each usually further trisected or bisected or dentate, fairly densely to sparsely hairy; larger hairs 0.4–1.2 mm long. *Peduncles* 20–80 mm long, glabrous. *Involucral bracts* 13–18; base 0.7–1.7 mm long; free portion 2.5–6 mm long, glabrous. *Umbels* mostly 10–25 mm diam., approximately 50–200-flowered, all flowers or just the outer flowers producing asymmetric fruits or rarely both inner and outer flowers producing homomorphic fruits. *Pedicels* 1–12 mm long; outermost ones 4–12 mm long in fruit, glabrous. *Petals c.* 1.0 mm long, cream or yellow on upper surface, often reddish on undersurface. *Anthers c.* 0.4 mm long. *Fruit* highly bilaterally compressed, either with the outer monocarp very to somewhat reduced and 1.6–3.3 mm long or with both monocarps fully developed; carpophore 1.4–2.3 mm long; largest sepal 0.4–0.6 mm long; styles 0.8–1.5 mm long. *Fertile monocarp(s)* 3.4–4.3 x 2.3–3 mm including a slight to definite wing up to 0.4 mm wide, up to *c.* 0.5 mm thick, tuberculate; tubercles up to 0.25 mm long.

Selected specimens examined. WESTERN AUSTRALIA: Bindoola Creek, El Questro–Gibb River road, 27 May 1976, *A.C. Beauglehole* 51375; near junction of Hann and Barnett Rivers, June 1905, *W.V. Fitzgerald* 1101; just W of Traine River, Mt House–Tableland road, 19 June 1978, *A.S. George* 15175; summit of Mt Trafalgar, 2 May 1996, *G. Graham* 43; King Edward River, *c.* 100 km S of Kalumburu, 4 June 1987, *G.J. Keighery* 8997; Camp Creek, Mitchell Plateau, 13 June 1976, *K.F. Kenneally* 4792; 7.0 km NE of Beverley Springs Homestead, 19 May 1979, *B.G. Muir et al.* 694; Gibb River crossing, *c.* 40 km N of Gibb River Homestead, 28 May 1971, *D.E. Symon* 7077; Bat Island, Bonaparte Archipelago, 26 June 1973, *P.G. Wilson* 10988.

Distribution. Endemic to the Northern Botanical Province of Western Australia. Extends from Mitchell Plateau south to Hann River and from Bonaparte Archipelago east to Bindoola Creek (west of Pentacost Range). (Figure 1)

Habitat. Occurs on sandstone, often in eucalypt woodlands. The species is common after burns.

Phenology. Flowering and fruiting period: April to August.

Conservation status. Not considered to be at risk.

Notes. Closely related to *T. didiscoides* and *T. dusenii*, both of which apparently tend to be more long-lived species. There is some doubt that *T. dendrothrix* is distinct from *T. didiscoides* as discussed under the latter species. The original description of *T. dendrothrix* (Maconochie 1980: 184) suggests that the species is most closely related to *T. dusenii*, but *T. dusenii* is readily distinguished from all the other species in the Kimberley region.

Trachymene didiscoides (F. Muell.) B.L. Burtt (Burtt 1941: 46). – *Hemicarpus didiscoides* F. Muell. (Mueller 1857: 18). – *Didiscus setulosus* F. Muell. *nom. illeg.* (Mueller 1859: 238). – *D. hemicarpus* F. Muell. *nom. illeg.* (Mueller 1863: 226). – *Trachymene hemicarpa* (F. Muell.) Benth. (Bentham 1867: 351). – *Trachymene setulosa* (F. Muell.) Druce (Druce 1917: 650). *Type:* Providence Hill, [Northern Territory], *F. Mueller* (*lecto:* K *n.v.*, *fide* Maconochie (1980: 172)).

Illustration. Wheeler (1992: Figure 211D).

Perennial herb 0.5–2.5 m or more high, often somewhat glaucous; indumentum (where present) of slender spreading non-glandular hairs, the juvenile leaves sometimes with dendritic hairs and the mature leaves with unbranched hairs. *Stems* glabrous. *Cotyledons* 5.5–8 x 3–5 mm; lamina ovate to obovate. *Petioles* 30–160 mm long, usually with a few large cilia at the base, rarely with cilia throughout basal half or even 1 or 2 cilia occurring in distal half; cilia 2–6 mm long. *Leaf blades* broadly to depressed obovate in outline and shallowly to very deeply lobed or divided into 3 or 5 petiolulate leaflets, 35–100 x 40–150 mm, the primary lobes or leaflets usually 2- or 3-lobed or sometimes deeply divided and the secondary lobes or leaflets further divided, toothed, glabrous or with hairs 1–5 mm long scattered along the veins; petiolules up to 35 mm long. *Peduncles* 10–90 mm long, glabrous. *Involucral bracts* 12–21; base 0.8–1.7 mm long; free portion 2.5–14 mm long, very slender, glabrous. *Umbels* mostly 10–25 mm diam., approximately 40–170-flowered, all flowers producing asymmetric fruits or some to most producing homomorphic fruits, the inner flowers producing homomorphic fruits more frequently than the outer flowers. *Pedicels* 1–15 mm long; outermost ones 4–15 mm long in fruit, glabrous. *Petals* 0.8–1.2 mm long, white to yellow on upper surface, often flushed deep pink on undersurface. *Anthers* 0.35–0.45 mm long. *Fruit* highly bilaterally compressed, either with the outer monocarp very to somewhat reduced and 1–2.7 mm long or with both monocarps maturing; carpophore 0.8–2.4 mm long; largest sepal usually 0.2–0.8 mm long but up to 1.7 mm long on young fruits; styles 1.3–1.6 mm long. *Fertile monocarp(s)* 2.6–4.8 x 2.3–3.6 mm, up to *c.* 0.4 mm thick, slightly to prominently tuberculate; wing usually 0.1–0.2 mm but up to 0.4 mm wide; tubercles up to 0.2 mm long.

Selected specimens examined (typical variant). WESTERN AUSTRALIA: Bougainville Peninsula, 22 May 1993, *I. Cowie* 4210 *& Stewart*; Koolan Island, 2 May 1983, *P.A. Fryxell & L.A. Craven* 3915; Prince Regent River, 4 June 1920, *C.A. Gardner* 1350; Cape Bernier, 5 June 1988, *G.J. Keighery* 10102; Bathurst Island, Buccaneer Archipelago, 24 June 1982, *K.F. Kenneally* 8505; Boomerang Bay, Bigge Island, 3 June 1972, *N.G. Marchant* 72/113; rocky crossing at Theda Station Homestead, 29 May 1971, *D.E. Symon* 7116.

Selected specimens examined (inland variant). WESTERN AUSTRALIA: Donkey Creek, Beverley Springs Station, 19 Jan. 1992, *R.L. Barrett* 122; road to Carlton Hill Station, *c.* 50 km NW or NNW of Kununurra, 27 Apr. 1977, *H. Eichler* 22522; Gauging Station, Camp Creek, *c.* 12 km SW of mining camp, Mitchell Plateau, 7 Dec. 1982, *K.F. Kenneally* 8672; just N of Eva Creek Gorge, King Leopold Ranges, 12 June 1992, *M.J.S. Sands* 4618.

Selected specimens examined (narrow-leaved variant). WESTERN AUSTRALIA: 6 km WNW of One Arm Point, 13 June 1987, *B.J. Carter* 41; 7.6 km W of Deep Water Point, 24 June 1981, *K.F. Kenneally* 7657; Sir Frederick Island, Buccaneer Archipelago, 27 June 1982, *L.J. Pen* 33.

Distribution. Occurs in the Northern Botanical Province of Western Australia, extending along the north-west coast and offshore islands from near Cape Leveque north-east to Cape Bernier and inland to Camballin, the King Leopold Ranges and Carlton Hill Station. Also occurs in Northern Territory. (Figure 3)

Habitat. Often occurs on sandstone outcrops and other sandstone habitats, also on other types of rocky habitats such as lateritic plateaus, with a variety of dominant species including eucalypts and *Acacia* species. Mostly recorded on islands and close to the coast of the mainland but with scattered records inland.

Phenology. Flowering and fruiting period: most or all of the year but particularly May to July.

Conservation status. Not considered to be at risk.

Notes. This appears to be the largest of the *Trachymene* species in Western Australia, sometimes equalled in height by one or two other species but rarely in bulk. A few of the smaller specimens of *T. didiscoides* appear to be annual rather than perennial but these may just be young plants, many of which probably do not succeed in becoming established as mature plants. The juvenile leaves sometimes (e.g. in *P.A. Fryxell et al.* 4687) have dendritic hairs like those of *T. dendrothrix* on the petiole but are not as densely hairy and have only scattered long hairs on the blade. In all cases the mature basal leaves have a few long unbranched hairs on the base of the petiole and sometimes scattered on the veins, with the upper leaves mostly completely glabrous. Apart from the difference in leaf indumentum, no absolute differences have been found between *T. didiscoides* and *T. dendrothrix*. The two taxa often cannot be distinguished from herbarium specimens that lack the basal parts of the plants as there appear to be no reliable differences in their flowers and fruits.

As presently delimited, *Trachymene didiscoides* is extremely variable, having three main variants. The typical variant is found mainly close to the coast and on off-shore islands from Buccaneer Archipelago around the north of the Kimberley and in the north of Northern Territory. It is a large plant with deeply dissected leaves, the larger leaves usually with petiolulate leaflets, and has large umbels and fruits. A narrow-leaved variant, which extends from near Cape Leveque north-east to Sir Frederick Island, appears to be a smaller plant that might be more short-lived. Another small variant extends inland to the King Leopold Ranges but does not reach the coast and has less deeply divided leaves with the leaflets not petiolulate. This inland variant shows the greatest similarity to two other predominantly inland taxa, *T. dendrothrix* and *T. microcephala*. All these taxa are in need of further study, particularly of the different stages from the seedling to full-sized plant, to reassess the formal taxonomy of this group. They also need to be compared with the variants and related species occurring in Northern Territory.

Trachymene dusenii (Domin) F.M. Bailey (Bailey 1913: 228). – *Didiscus dusenii* Domin (Domin 1908: 64–65). *Type:* near Cambridge Gulf, [Western Australia], *Johnston* 1885 (*iso:* K, MEL, both *n.v.*).

Didiscus setosus O. Schwarz (Schwarz 1927: 92) – *Trachymene setosus* (O. Schwarz) B.L. Burtt (Burtt 1941: 46). *Type:* Port Darwin, Northern Territory, *Bleeser* 347 (*holo:* B, ? destroyed).

Illustration. Wheeler (1992: Figure 211E).

Perennial herb 0.5–1 m or more high, forming clumps; indumentum (where present) of patent non-glandular dendritic hairs. *Stems* glabrous. *Cotyledons* not seen. *Petioles* 25–60 mm long, with a very dense indumentum of mixed hairs of very varied lengths, the largest hairs 2–8.5 mm long. *Leaf blades* broadly or very broadly obtriangular to obovate in outline and slightly to deeply 3-lobed, 14–55 x 23–45 mm, cuneate at base, each lobe shallowly to deeply toothed but not divided into secondary lobes, with an indumentum similar to that of the petiole but tending to be shorter and less dense, the largest hairs 2–4.5 mm long. *Peduncles* 15–95 mm long. *Involucral bracts* usually 14–21; base 1–2.5 mm long; free portion 5–13 mm long, glabrous. *Umbels* mostly 12–35 mm diam., usually approximately 40–200-flowered, the outer flowers all producing asymmetric fruits but the inner flowers sometimes producing homomorphic fruits. *Pedicels* 3–10 mm long; outermost ones 8–10 mm long in fruit, glabrous. *Petals c.* 1.5 mm long, yellow or white. *Anthers* 0.4–0.6 mm long. *Fruit* highly bilaterally

compressed, with the outer monocarp usually very reduced and 2–2.5 mm long; largest sepal 0.4–1.5 mm long; styles 1.6–2.3 mm long. *Fertile monocarp(s)* with a body 3.5–4.5 x 2.8–3.3 mm, up to *c.* 1 mm thick, minutely tuberculate, with a fairly broad wing around free margin; wing 0.7–1.2 mm wide, entire; tubercles up to 0.2 mm long.

Specimens examined. WESTERN AUSTRALIA: 13 miles [18 km] S from turnoff Halls Creek to Billiluna, 19 July 1968, *J.S. Beard* 5534; 43 km N of Ruby Plains Homestead, 15 July 1974, *A.C. Beauglehole & G.W. Carr* 3727; 95 km S of Halls Creek on the Tanami track, 26 May 1985, *P.A. Fryxell, L.A. Craven & J. McD. Stewart* 4542; 28 miles [45 km] N of Springvale Station, 20 July 1959, *M. Lazarides* 6373.
NORTHERN TERRITORY: Negri River, 3.5 km E of Duncan Highway, 7 July 1976, *A.C. Beauglehole* 54406; 22 miles [35 km] SSE of Waterloo Station, 2 July 1949, *R.A. Perry* 2319.

Distribution. Occurs in the Halls Creek area in the south-east of the Northern Botanical Province, extending from the north end of Springvale Station south to Ruby Plains Station. Also occurs in Northern Territory. (Figure 3)

Habitat. One record from *Eucalyptus brevifolia* "steppe woodland" and another from "coarse-textured skeletal soil on hill". In Northern Territory the species has been recorded from alluvial flats near small watercourses.

Phenology. Flowering and fruiting period: May to July.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Known from only four specimens in Western Australia and a small number of specimens from the adjacent part of Northern Territory.

Notes. Readily identified by its distinctive leaf indumentum from all other *Trachymene* species in Western Australia.

Trachymene microcephala (Domin) B.L. Burtt (Burtt 1941: 45). – *Didiscus microcephalus* Domin (Domin 1908: 56). *Type*: North Coast [probably Arnhem South Bay, Middle Point, Northern Territory], 1803, *R. Brown* (probable *holo:* K, *n.v.*; *iso:* W).

Didiscus pilosus Benth. *nom. illeg.* (Bentham 1837: 54), *non D. pilosus* (Sm.) Domin. *Type:* in Bauer Herbarium (*holo:* W).

Illustration. Wheeler (1992: Figure 211F).

Perennial herb 0.4–1 m high; indumentum (where present) of very fine spreading non-glandular hairs up to 6 mm long, occasionally pink. *Stems* glabrous or with a long hairs at or extending below or above the nodes. *Cotyledons* not seen. *Petioles* 20–70 mm long, with long hairs scattered along full length; hairs 2–5 mm long. *Leaf blades* broadly to depressed obovate in outline and usually slightly to deeply 3-lobed, 15–45 x 15–40 mm, cuneate at base, the primary lobes often further divided into 2 or 3 secondary lobes, all lobes dentate, with long hairs scattered along the veins. *Peduncles* 10–50 mm long. *Involucral bracts* 10–16; base up to 1 mm long; free portion 1.5–4 mm long, glabrous. *Umbels* mostly 8–16 mm diam., approximately 20–75-flowered, all flowers producing highly asymmetric fruits or rarely a few inner flowers producing homomorphic or only slightly asymmetric fruits. *Pedicels*

1.5–6 mm long; outermost ones 3–6 mm long in fruit, glabrous. *Petals* 0.9–1.2 mm long, yellow or white on upper surface, deep pink to reddish on undersurface. *Anthers* 0.3–0.4 mm long. *Fruit* highly bilaterally compressed, usually with the outer monocarp very reduced and 1.3–2.5 mm long; largest sepal 0.3–0.6 mm long; styles 0.7–1.4 mm long. *Fertile monocarp(s)* 3.3–4 x 2.4–2.6 mm, up to *c.* 0.6 mm thick, often with a narrow wing around free margin, usually minutely tuberculate; wing absent or up to 0.4 mm wide, entire; tubercles up to 0.2 mm long.

Selected specimens examined. WESTERN AUSTRALIA: 14.4 miles [23 km] NW of Mt Elizabeth Station, 30 June 1973, *T.E.H. Aplin* 5615; Chapman River, 55 km by road WSW of Kurungi Station turnoff Gibb River–El Questro road, 25 May 1976, *A.C. Beauglehole* 51557; Kununurra–Timber Creek road, 1.5 km W of Lake Argyle turnoff, *G.W. Carr* 3054 *& A.C. Beauglehole* 46833; Camp Creek, near Camp Amax, Mitchell Plateau, 29 May 1993, *I.D. Cowie* 4336 *& C. Brubaker*; 19 km ESE of Coulomb Point, Wonganut Spring Creek, 18 June 1984, *S.J. Forbes* 2379; King Edward River, *c.* 100 km S of Kalumburu, 5 June 1987, *G.J. Keighery* 9076; *c.* 13 km S of Paradise Pool on Ernest River, 20 Mar. 1978, *M. Lazarides* 8640; 13 miles [21 km] W of Durack River, 20 May 1967, *E.M. Scrymgeour* 1830. NORTHERN TERRITORY: 16 miles [26 km] E of Borroloola Station, 28 July 1948, *R.A. Perry* 1801.

Distribution. Occurs mainly in the north-western part of the Northern Botanical Province, extending from near Coulomb Point (north of Broome) north-east to near Port Warrender and east-north-east to Victoria Highway east of Ord River. Also occurs in Northern Territory. (Figure 2)

Habitat. Commonly occurs along watercourses, often in alluvial soils, or near swamps, often associated with *Corymbia polycarpa* or *Melaleuca viridiflora*. Also recorded in *Eucalyptus miniata* woodlands on sandstone or laterite.

Phenology. Flowering and fruiting period: March to October.

Chromosome number. The chromosome number of this species is unknown. Although (Wanscher 1933) recorded 2n=44 for *Didiscus pilosus* Benth., this name was then applied to many species that were lumped under the illegitimate name *T. australis*, as explained below. Wanscher's chromosome number determination almost undoubtedly came from material of a non-Western Australian member of that species group.

Conservation status. Not considered to be at risk at present.

Notes. Maconochie placed a determinavit dated 2 June 1977 on the holotype of *Didiscus pilosus* Benth., identifying the specimen as *Trachymene microcephala*, but did not mention this in his revision (Maconochie 1980). The name *D. pilosus* had generally been assumed to apply to one of the taxa occurring in the south-west of Australia, with both Bentham (1867) and Domin (1908) citing it under their illegitimate names of *T. australis* Benth. and *T. benthamii* Domin respectively.

As noted by Burtt (1941), Bentham (1867) cited the types of two previously named species, *Dimetopia anisocarpa* and *D. grandis* under *Trachymene australis*, and could have used one of these existing epithets rather than creating a superfluous new epithet. Interestingly, Bentham did not cite the type specimen of *Didiscus pilosus*, which he listed as a synonym and evidently was intending to replace by his new name, perhaps omitting the type because it was a poor specimen. Bentham could not make the new combination *Trachymene pilosa* (Benth.) Benth. because the name *T. pilosa* Sm. had already been published for another member of the genus. Bentham had based his description of

D. pilosus on a single vegetative specimen of the species now known as *Trachymene microcephala* and, since the specimen lacked a locality, he was evidently unaware that this was a species from northern Australia. Indeed he clearly regarded the northern taxon as a different species because be cited a specimen later used as the type of *T. microcephala* under the name *T. incisa* var. *pilosa* Benth. (Bentham 1867: 350).

Trachymene microcephala can usually be easily distinguished from its closest relative in the Kimberley region, *T. didiscoides*, but there is one somewhat intermediate specimen from Drysdale River National Park (*A.S. George* 13182) currently housed under the latter name. This specimen resembles *T. microcephala* in its involucral bract size and overall appearance but has less hairy petioles than other specimens, the upper leaves with cilia only towards the base as in *T. didiscoides*.

Trachymene villosa (F. Muell.) Benth. (Bentham 1867: 349). – *Hemicarpus villosus* F. Muell. (Mueller 1857: 18). – *Didiscus villosus* (F. Muell.) F. Muell. (Mueller 1859: 238). *Type:* Sturts Creek, [Northern Territory or possibly Western Australia], *F. Mueller* (K, *n.v.*).

Annual herb 0.2–1 m high; indumentum of long patent non-glandular hairs. *Stems* rather densely hairy throughout except for peduncles; hairs 4–7 mm long, slender. *Cotyledons* not seen intact. *Petioles* commonly 15–100 mm long, the longer hairs usually 3–4 mm long; expanded base not well differentiated. *Leaf blades* usually broadly to depressed obovate in outline and deeply divided or lobed, commonly 30–55 x 25–75 mm, the 3 primary lobes usually further trisected or bisected or dentate, hairy mainly along the main veins, the hairs shorter than on the stems. *Peduncles* commonly 50–150 mm long, rather densely hairy towards base but glabrous in distal half. *Involucral bracts* commonly 25–35; base *c.* 2 mm long; free portion commonly 8–11 mm long, glabrous. *Umbels* mostly 25–40 mm diam., usually over 100-flowered. *Pedicels* commonly 3–15 mm long; outermost ones usually 12–15 mm long in fruit, glabrous. *Petals c.* 1.3 mm long, pale to deep pink on undersurface, white or pale pink on upper surface. *Anthers c.* 0.4 mm long. *Fruit* highly bilaterally compressed, with the outer monocarp very reduced and commonly 1.3–1.7 mm long; largest sepal commonly 1–1.7 mm long; styles usually 2–2.5 mm long. *Fertile monocarp* broadly winged; body *c.* 3.5 x 2.5 mm, *c.* 0.5 mm thick, tuberculate; wing 2–3 mm wide, entire. (Figure 7E–G)

Specimens examined [precise localities withheld]. WESTERN AUSTRALIA: SE of Gordon Downs Station, 14 July 1949, *R.A. Perry* 2491.
NORTHERN TERRITORY: SW of Hookers Creek, 18 May 1971, *J.R. Maconochie* 1114.

Distribution. Occurs in the south-eastern part of the Northern Botanical Province. The only definite record for Western Australia is from south-east of Gordon Downs Station but the type specimen from Sturts Creek might also have been collected in this State. Also occurs in Northern Territory. (Figure 3)

Habitat. Recorded on skeletal soil over quartzite, with *Eucalyptus brevifolia* and *Triodia*.

Phenology. Flowering and fruiting period: May to July.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. There is only one definite record for Western Australia from about 50 years ago. *Trachymene villosa* is much more abundant in Northern Territory.

Notes. This species was omitted from "Flora of the Kimberley Region". In the key given in that flora (Wheeler 1992: 683), *T. villosa* would come out with *T. didiscoides* and *T. microcephala*, from which it can be distinguished by its conspicuous stem indumentum 5–7 mm long and its broadly winged monocarps.

T. villosa is not a typical member of sect. *Hemicarpus*, perhaps being the only strictly annual species included here, with petals larger than most and tending to be pink rather than yellow on the upper surface. Its affinities may lie more with species of other groups in Northern Territory or elsewhere. More work is required for the genus in the remainder of Australia and also overseas before the species groups can be determined reliably and a complete formal infrageneric taxonomy drawn up.

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Keraudrenia exastia and *Keraudrenia katatona* (Malvaceae: Byttnerioideae), new species from the Kimberley region of Western Australia

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Abstract

Wilkins, C.F. *Keraudrenia exastia* and *Keraudrenia katatona* (Malvaceae: Byttnerioideae), new species from the Kimberley region of Western Australia. *Nuytsia* 13(1): 233–242(1999). *Keraudrenia exastia* C.F. Wilkins and *K. katatona* C.F. Wilkins are two new species endemic to the Kimberley region of Western Australia. They are described and illustrated, and their distributions are mapped. *K. exastia* is considered to be critically endangered, due to its restricted distribution in Dampier Peninsula where its survival is threatened by industrial expansion. A chromosome number for *K. exastia* of n=10 is presented as the first published count for the genus and a key is provided for distinguishing the three species of *Keraudrenia* in the Kimberley region.

Introduction

Keraudrenia Gay belongs to subfamily Byttnerioideae (*sensu* Bayer *et al.* 1999) of the broadly circumscribed Malvaceae (including Sterculiaceae, Bombacaceae and Tiliaceae) *sensu* Judd & Manchester (1997) and accepted by The Angiosperm Phylogeny Group (1998). It is an endemic Australian genus that has not been revised since Bentham's (1863) treatment in "Flora Australiensis". Eleven species of *Keraudrenia* were recognized in a recent census of Australian plants (Hnatiuk 1990). There are also some unnamed species including two that were referred to as species A and B in a book of plants from the Broome area of the Kimberley region, Western Australia (Kenneally *et al.* 1996).

In preparation for a treatment in "Flora of Australia", a cladistic analysis and taxonomic revision of the genus are in progress. As one of the unnamed Kimberley species appears to be endangered, it is described here before the revision is completed. The opportunity is taken to address other problems involving the Kimberley taxa, including naming a second new species which was treated as *K. velutina* Steetz in "Flora of the Kimberley Region" (Wilson 1992). This paper also provides a key to the three species now recognized in the Kimberley region.

Keraudrenia sp. A "Flora of the Kimberley Region" (*T.E.H. Aplin et al.* 333) is known from three small populations in the Dampier Peninsula, Gordon Downs Station and Wolf Creek in the Kimberley region and also near Soudan and Mt Isa in Queensland. It differs from typical *K. nephrosperma* in having carpels that are almost glabrous laterally, with a dorsal ridge of stellate hairs. In the current

revision, sp. A has been combined with *K. nephrosperma* as the amount of stellate indumentum on the sides of the carpels is variable between populations and not considered positively indicative of a distinct taxon.

The presence of twisted styles was used as a key distinguishing feature of *Keraudrenia velutina* (Wilson 1992), however, twisting of styles is initially present in all species of *Keraudrenia*. The styles later become separate and straight.

Methods

Taxon status. Morphological characters of *K. exastia, K. katatona* and closely related species of *Keraudrenia* were examined from fresh material and rehydrated material from herbarium specimens. These included type specimens and were obtained from the following herbaria: AD, BM, BRI, CANB, DNA, HO, K, MEL, NSW, P, PERTH and W. Characters were scored and entered into a MacClade 3.05 database as part of research into phylogeny of the genera of tribe Lasiopetaleae (Wilkins & Chappill in prep.).

Measurement of characters. Hair density was quantified as follows: sparse refers to hairs well spaced; medium density refers to hairs just touching laterally; dense refers to hairs overlapping laterally, with the epidermis still visible; tomentum or tomentose refers to hairs overlapping to the extent that the epidermis is no longer visible.

Calyx tube length was measured from the centre of the flower to the junction of the lobes.

Chromosome count. Fresh anthers from field collections were fixed in 4: 3: 1 chloroform: absolute ethanol: glacial acetic acid for 24 hours, rinsed in 70% ethanol and stained in alcoholic hydrochloric acid carmine for 2–10 days. Meiosis was examined in pollen mother cells of anthers squashed in 45% glacial acetic acid. Chromosomes were micrographed x100 using a Zeiss Axiophot microscope and 6 ASA Imagelink film.

Taxonomy

Key to *Keraudrenia* in the Kimberley region

1. Calyx lobes broadly ovate, broader than long, apex rounded or sub-acute, margin entire, mature calyx lobe venation thickened-reticulate, veins on inner surface not prominent. 9–17 flowers per inflorescence. Stamen filament fused to ventral surface of anther. Carpels free or fused laterally
   2. Carpels free. Staminodes to 1 mm long, generally with erect apex. (Dampier Peninsula to Gordon Downs Station, also NT, SA, NSW and Qld) ..... **K. nephrosperma**
   2. Carpels free centrally, but fused laterally at base. Staminodes 1–2 mm long, apex often recurved or with sterile anthers or swollen apex. (Broome, Edgar Range and NE of Port Hedland) ..... **K. katatona**

1. Calyx lobes ovate, longer than or as long as broad, apex acuminate, margin roughly fringed, mature calyx lobe venation not obviously reticulate, fresh flowers with mid and lateral veins prominent on inner surface, only mid vein prominent on dried flowers. 7–9 flowers per inflorescence. Stamen filament not fused to ventral surface of anther. Carpels free centrally, but fused laterally at base. (Broome) ..... **K. exastia**

Keraudrenia exastia C.F. Wilkins, *sp. nov.*

Species insignis costa et venis lateralibus calyce tumidis, margo calyce apicali valde fimbriato ut acuminato, lobis longioribus quam latioribus, speciebus mihi notis bene distincta.

Typus: Dampier Peninsula, West Kimberley [precise locality withheld], Western Australia, 25 May 1995, *C.F. Wilkins* CW 828, *K. Shepherd, R. Orifici, P. Foulkes & T. Willing* (*holo:* PERTH 05232031; *iso:* CANB, MEL, K).

Shrub, erect, compact, multistemmed, 70–90 cm high, asexual reproduction by rhizomes not investigated. *Stems* terete; apical branchlets with a tomentum of pale tan and white stellate hairs to 0.2 mm diameter (*c.* 24 cells per hair). *Stipules* narrowly ovate or ovate, 1.5–4 x 0.3–0.5 mm; adaxial surface with medium density, stellate hairs and scattered, stipitate, clavate glands *c.* 0.1 mm long, abaxial surface with stellate-tomentum. *Leaves* alternate, spreading; petiole 3–6 mm long; base obtuse, blade flat or conduplicate, narrowly ovate, elliptic or oblong, (6)15–20 (28) x 5–10 mm, margin entire; both surfaces with a pale grey-green tomentum of stellate hairs; abaxial surface with prominent veins and occasional, red, stipitate, capitate glands *c.* 0.25 mm in diameter; apex obtuse, rarely retuse; young growth leaves not observed. *Inflorescence* a dichasial cyme, 7–9-flowered, 15–22 mm long, flowers 5- rarely 4-merous. *Peduncle* 2–3 mm long, stellate-tomentose. *Pedicel* 4–7 mm long, faintly articulate, stellate-tomentose. *Bract* caducous, purple, petaloid, attached on pedicel below articulation, elliptic, 3.5–9.5 x 0.5–4 mm, margin fringed; adaxial surface with scattered, fine, white, stellate indumentum; abaxial surface with dense, pale-tan-centred stellate hairs; apex apiculate. *Calyx* purple, petaloid, with base of inner rib a yellow-green, tube and lobes initially deflexed from staminal tube, ovate, 9–12 mm long, longer than wide, lobes comprise 65–80% of calyx length; adaxial surface of lobe with prominent midrib and lateral veins prominent when fresh, margin of adaxial surface with few simple hairs, tube and centre of lobe with stipitate, white, clavate glands, 0.15 mm long, rarely stellate hairs at base; abaxial surface of calyx with medium density, stellate hairs, 0.2–1.0 mm diameter, denser at the base of the calyx, capitate glands absent; margin minutely denticulate with apical stellate hairs on the teeth; lobe apex acuminate; fruiting calyx not observed. *Corolla* usually absent (one petal observed on one flower, obovate, *c.* 1.0 x 1.2 mm, outer surface stellate-hairy). *Stamens* shortly fused at the base; *staminal tube c.* 0.8 mm long; *staminodes* narrowly triangular, yellow, *c.* 1.3 x 0.15 mm, frequently with recurved apex and rarely with minute sterile anther affixed; *filaments* yellow, *c.* 0.15 mm long; *anthers* extrorse, ventrifixed, curved, 1–1.3 x 0.6–0.7 mm, yellow when young, becoming faded purple with age, stellate hairs rarely present on anther margins, pollen yellow. *Ovary c.* 1 x 1 mm, 5-celled rarely 4-celled, carpels free centrally, fused laterally at lower centre, ovary outer surface with papillae, developing post anthesis into stellate hairy setae (bristles with stellate hairs along length and apex); ovules 5 or 6 per cell. *Styles* 5(4), 3.3–4 mm long, glabrous. *Stigma* simple. *Fruit* not observed. (Figure 1)

Chromosome number. n=10. (Figure 2)

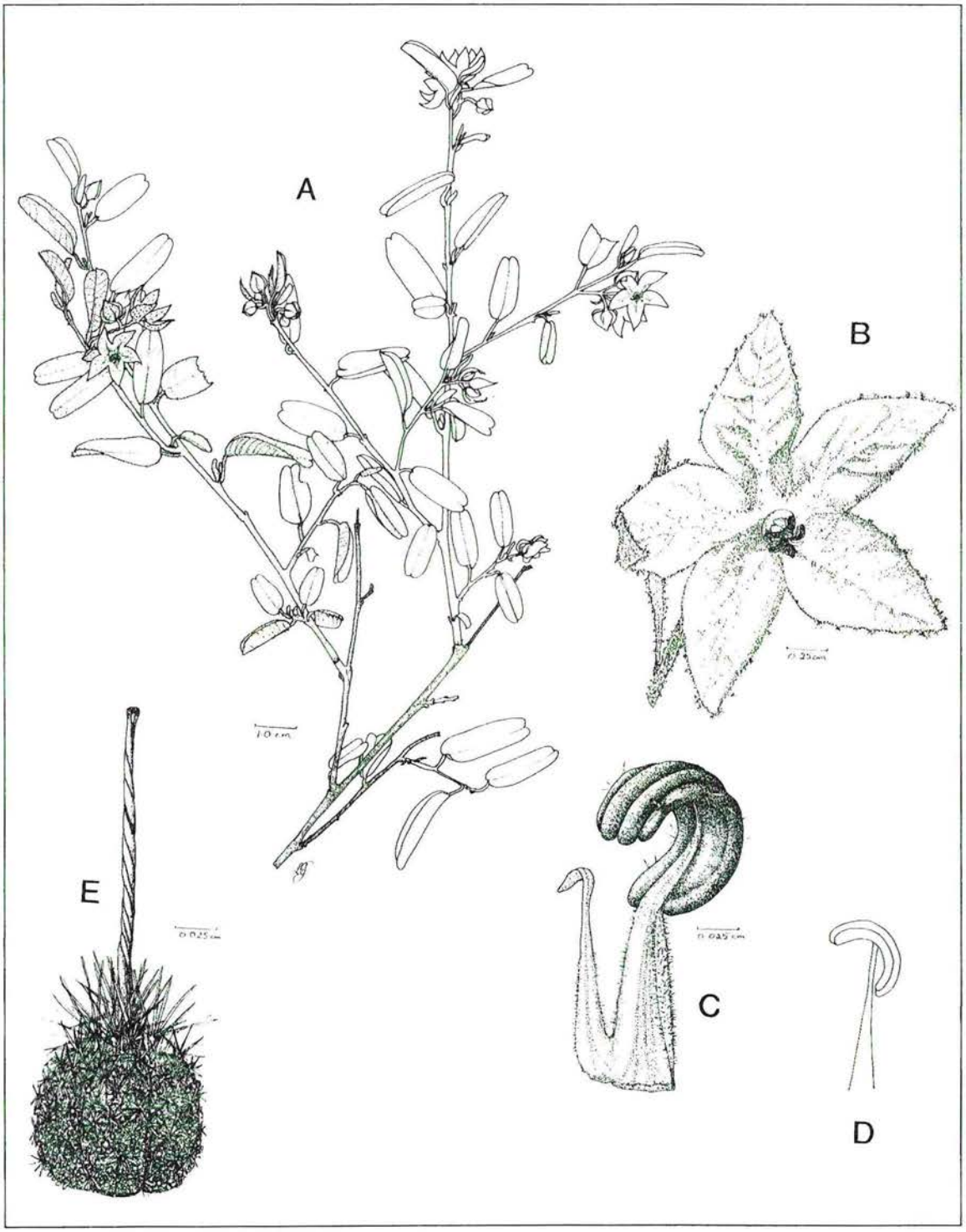

Figure 1. *Keraudrenia exastia* A – habit, B – flower, C – stamen and staminode, D – ventrifixed anther, E – gynoecium.

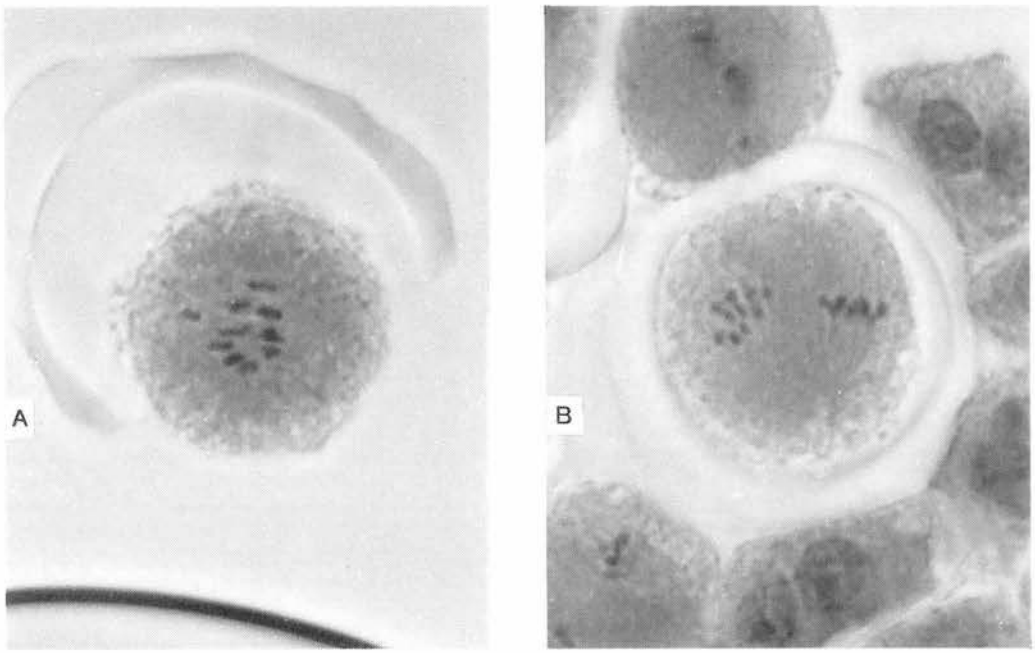

Figure 2. Meiosis in *Keraudrenia exastia* (voucher *C.F. Wilkins* CW 825), n=10; A – first metaphase; B – second metaphase.

Selected specimens examined. WESTERN AUSTRALIA: Broome, Dampier Peninsula, 2 Nov. 1991, *B.J. Carter* 501 (PERTH); E of wharf, Broome townsite, Dampier Peninsula, 13 Aug. 1985, *K.F. Kenneally* 9429 (PERTH); Broome, Dampier Peninsula, 29 Apr. 1987, *K.F. Kenneally* 9866 (PERTH); WNW of Broome, 22 Aug. 1993, *A.A. Mitchell* 3282 (PERTH); Broome, Dampier Peninsula, 25 May 1995, *C.F. Wilkins* CW 825–829, *K.A. Shepherd, R. Orifici, P. Foulkes & T. Willing* (CANB, K, MEL, PERTH, UWA); Broome, Dampier Peninsula, 25 May 1995, *C.F. Wilkins* CW 831–837, *K.A. Shepherd & R. Orifici* (PERTH, UWA).

Distribution. Restricted to coastal populations on the Dampier Peninsula, near Broome Western Australia. (Figure 3)

Habitat. This species occurs in relict desert dune swale in red sand (pindan), in *Acacia* shrubland (to 3 m) with *Gyrostemon, Triodia, Hakea* and *Eucalyptus*. One population occurs down the slope from an area of deciduous vine thicket.

Phenology. Flowering period April to December. Fruit not observed (P. Foulkes †, K. Kenneally & T. Willing, pers. comm.).

Conservation status. This species currently has CALM Conservation Codes for Western Australia Flora: Priority One. However, it has been proposed as declared rare-extant with conservation status of Critically Endangered. Only seven populations are known in close proximity on Dampier Peninsula and are under threat from encroachment by the port industrial area. This species has been recognized for some time and occurs in an area of diverse coastal pindan, which, given the rarity of this plant, should be given some protection.

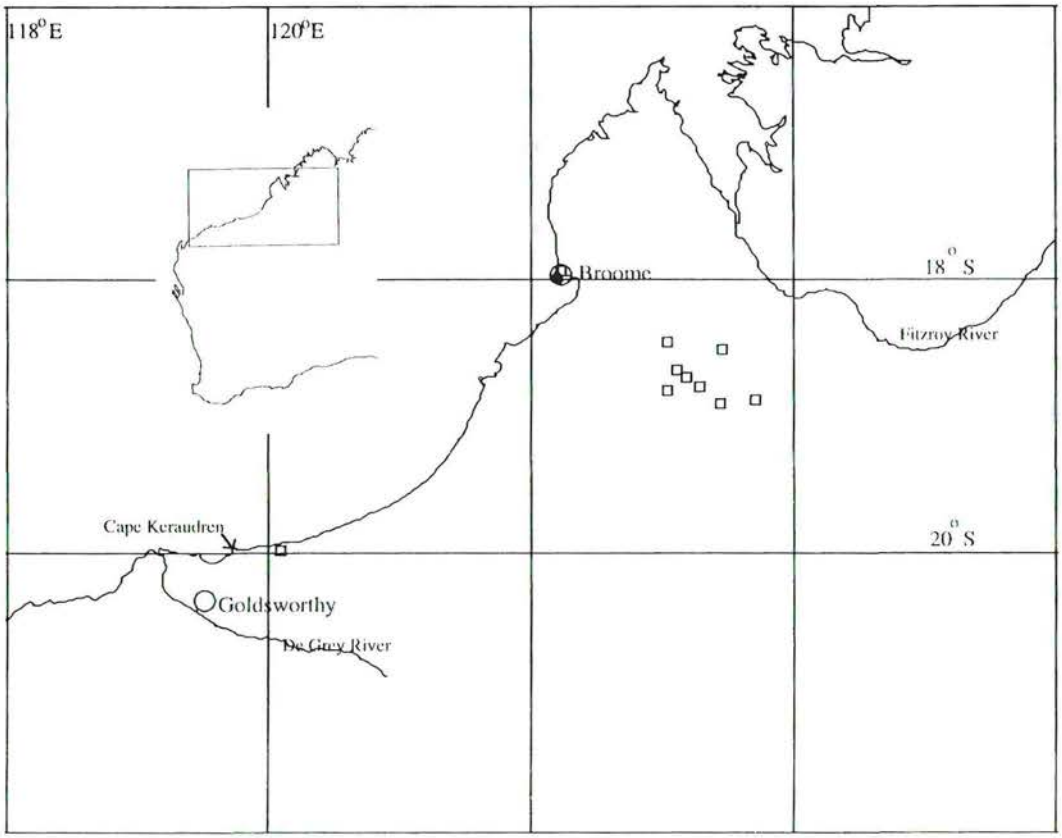

Figure 3. Distribution of *Keraudrenia exastia* ● and *K. katatona* □, West Kimberley region of Western Australia.

No fruit has been observed in our field collection or by other researchers over the past ten years. Closely related species of *Keraudrenia* have vegetative propagation from rhizomes and investigation of this form of reproduction in *K. exastia* is suggested.

Etymology. The specific epithet – *exastia* is from the Greek – *exastis* meaning rough edge or fringe (Brown 1956), in reference to the strongly fringed margin of the mature calyx and bract.

Affinities. The grey, tomentose, entire, elliptic or oblong leaves and purple calyx lobes with acute apices suggest this species is closest to *K. velutina* Steetz. subsp. *elliptica* C.F. Wilkins ms. *K. exastia* differs in having shorter mature pedicels (4–7(9) mm long compared with 5–15 mm); anthers that remain curved after dehiscence rather than becoming straight; anthers that are separate rather than laterally adherent to form a tube, and are ventrifixed not ventri-adnate (filament fused to anther ventral surface); and inflorescences that tend to have fewer (7–9, not 6–13) flowers. Fresh material of the *K. exastia* calyx has swollen lateral veins, not just a swollen mid rib, the apex of each calyx lobe is acuminate and the apical margin is strongly fringed rather than acute and entire. Calyx lobes also differ in being longer than wide, rather than slightly wider than long or nearly the same width as length. *K. velutina* subsp. *elliptica* ms. has not been collected in the Kimberley area but is widely distributed in Western Australia from Nanutarra and Karajini National Park to north of Paynes Find and in the south-west of the Northern Territory and the north-west of South Australia.

Notes. In "Flora of the Kimberley Region" Wilson (1992) refers to this species in a note following *K. velutina.* It is reported as having collections from the Broome area with almost concolorous grey leaves that may be referable to *K. velutina* but not appearing to set fruit and therefore difficult to identify.

The purple recurved calyx and yellow stamens give the flowers of *K. exastia* a superficial resemblance to *Solanum* species, however, the calyx in *Solanum* is green beneath the purple recurved petals.

Keraudrenia katatona C.F. Wilkins, *sp. nov.*

[*Keraudrenia velutina auct. non* Steetz Wilson (1992:191).]

Keraudrenio nephrospermo F. Muell. affine sed carpellis ad centrum libris, ad basim lateraliter conjunctis; staminodiis 1–2 mm longis subulatis saepe ad apicem recurvis, interdum antheris parvis sterilibus praeditis differt.

Typus: 300 metres south of south boundary of "Airport, One Mile Aboriginal Community", Broome, Western Australia, 17° 56' 37"S, 122° 14' 09"E, 24th May 1995, *C.F. Wilkins* CW 807, *K.A. Shepherd, R. Orifici, T. Willing, P. Foulkes, J. Martin & D. Duncan* (*holo:* PERTH 05232058; *iso:* CANB, MEL, K, BRI).

Shrub, erect, compact, multistemmed, to 1 m high, with asexual reproduction by rhizomes. *Stems* terete; apical branchlets tan tomentose, with stellate hairs to *c.* 0.4 mm diameter, (*c.* 24 cells per hair). *Stipules* narrowly ovate, 2–4.5 x 0.6–1 mm; adaxial surface with scattered, clavate, glands *c.* 0.1 mm long; abaxial surface tomentose with tan-centred, white, stellate hairs. *Leaves* alternate, spreading; petiole 2.5–6 mm long (young growth plants *c.* 8 mm), stellate-tomentose; blade flat, base obtuse, young growth leaves trilobed then ovate, *c.* 35 x 18 mm, becoming oblong-elliptic, 12–28 x 6–10 mm; adaxial surface with whitish-green stellate tomentum or dense stellate hairs; abaxial surface with prominent veins, and a tan or whitish-green tomentum with occasional, stalked, capitate, red glands *c.* 0.25 mm diameter; margin entire; apex obtuse or retuse. *Inflorescence* a dichasial cyme, 9–17 flowered, 20–30 mm long, flowers 3–5-merous. *Peduncle* 3–7 mm long, stellate-tomentose. *Pedicel* 7–11 mm long, articulate, stellate-tomentose. *Bracts* caducous, purple, petaloid, attached on pedicel below articulation; broadly ovate or elliptic, 3.5–6 x 1–2.5 mm; adaxial surface with scattered to medium density, fine, white, stellate hair; abaxial surface with medium density, tan-centred, stellate hair; margin fringed; apex acute. *Calyx* purple, petaloid, with inner rib-base yellow-green, tube and lobes initially deflexed, broadly-ovate, 7–9(10) mm long, same width as length or wider than long, tube 50% of calyx length; lobe adaxial surface margin and apex with few simple hairs, tube and centre of lobe with midrib prominent and scattered, stalked, clavate, white glands *c.* 0.15 mm long; abaxial surface of calyx with medium density stellate hairs, a mix of 0.2–1 mm diameter stellate hairs, denser at base of calyx with occasional, stalked, capitate, red glands; fruiting calyx with reticulate venation; lobe margin entire; lobe apex rounded or sub-acute. *Corolla* absent. *Stamens* shortly fused at base; *staminal tube c.* 0.5 mm long; *staminodes* subulate, yellow, *c.* 1–2 x 0.2 mm, apex usually recurved, often thickened or with minute sterile anthers affixed; *filaments* yellow, 1.5–1.8 x 0.4 mm; *anthers* extrorse, ventri-adnate (apex of filament fused to ventral surface of anther), curved, *c.* 1 x 0.5–0.7 mm, blackish purple, glabrous, pollen orange. *Ovary c.* 1 x 1 mm, 3–5 celled, carpels free centrally, fused laterally near base, ovary outer surface with papillae, which post anthesis develop into setae; ovules 3 or 4 per cell. *Styles* 3–5, 1.5–3.2 mm long, glabrous. *Stigma* sub-capitate while receptive. *Fruit* 4–5 x 5–6 mm, outer surface with setae to *c.* 1.5 mm long (only immature fruit seen). *Seed* reniform (only immature seed seen). (Figure 4)

Selected specimens examined. WESTERN AUSTRALIA: Manguel Creek to Mowla Bluff Road, 7 km N of Dampier Downs turn-off, 16 June 1976, *A.C. Beauglehole* ACB53079 (PERTH); R1. Edgar Range Site, Edgar Range, SE of Broome, 6 Aug. 1976, *K.F. Kenneally* 5479 (CANB, PERTH); R2. Red Dune

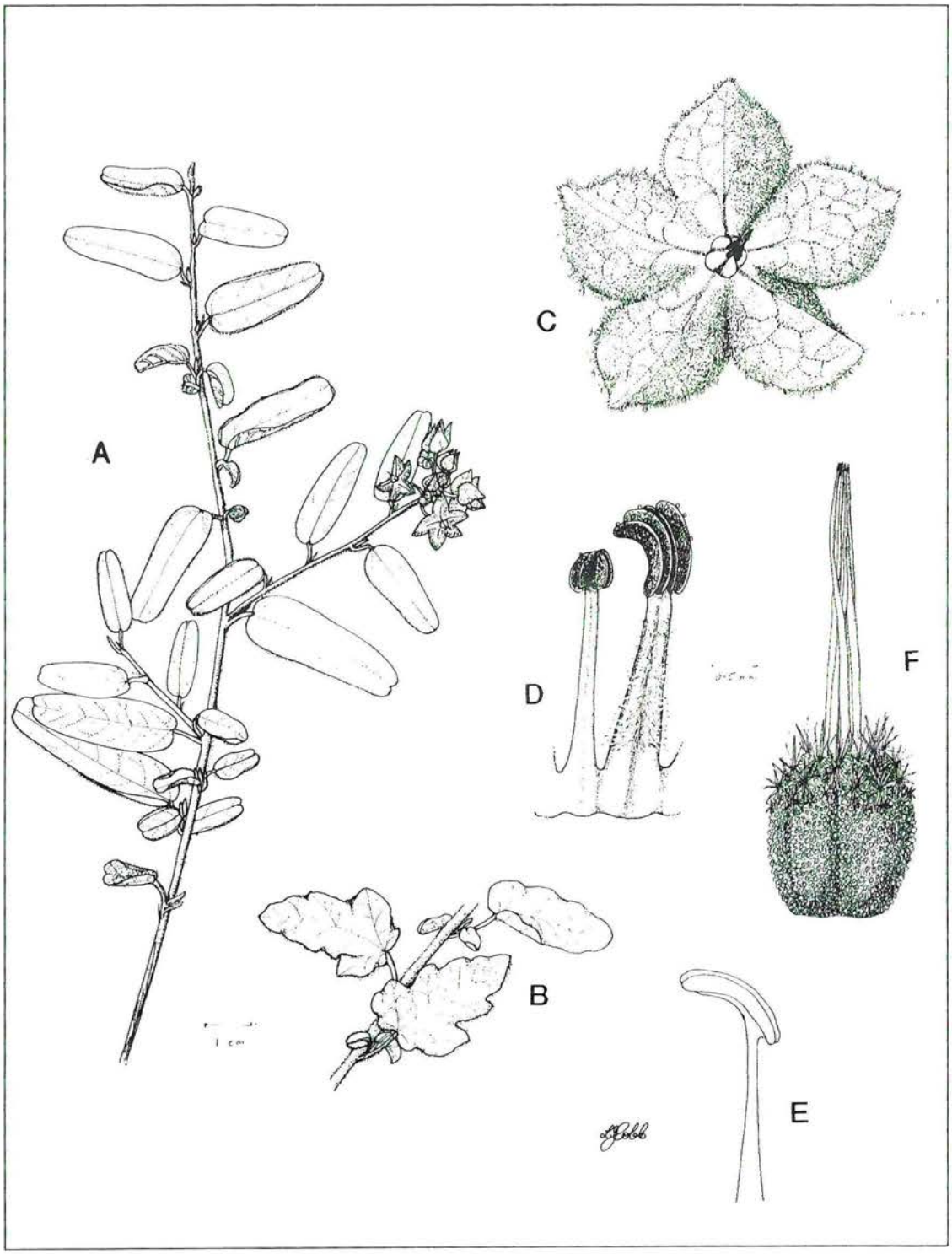

Figure 4. *Keraudrenia katatona* A – habit, B – juvenile leaves, C – flower, D – stamen & staminode, E – ventri-adnate anther, F – gynoecium.

Site, near Edgar Range, SE of Broome, 8 Aug. 1976, *K.F. Kenneally* 5514 (CANB, PERTH); D1. Red Dune Site, near Edgar Range, SE of Broome, 13 Aug. 1976, *K.F. Kenneally* 5636 (CANB); P1. Near Edgar Range, SE of Broome, 18 Aug. 1976, *K.F. Kenneally* 5749 (PERTH); 300 metres S of S boundary of Airport 'One mile Aboriginal Community, Broome, *C.F. Wilkins* CW 799–810, *K.A. Shepherd, R. Orifici, P. Foulkes, T. Willing, J. Martin & D. Duncan* (PERTH, UWA); 187.4 km NE of Port Hedland on Great Northern Highway, *C.F. Wilkins* CW 83 (PERTH, UWA); SE of Broome, Dampier Downs Station, track from McLeods well to Edgar Range south gorges, 24 May 1995, *C.F. Wilkins* CW 860–865 (PERTH, UWA).

Distribution. Restricted in distribution to Broome, the Edgar Range (SE of Broome) and north-east of Port Hedland in Western Australia. (Figure 3)

Habitat. Red sand, desert dunes in pindan with *Acacia, Triodia* and *Eucalyptus* open shrubland to 3 m high.

Phenology. Flowering period March to August.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. *K. katatona* is known from a population in a disturbed fire-break area near Broome, several large populations in the Edgar Range within Dampier Downs Station and one road verge plant, north-east of Port Hedland.

Etymology. Derivation of the specific epithet, is from the Greek word – *katatonus* meaning "broader than high" (Brown 1956) in reference to the broader than long calyx lobes of this species.

Affinities. K. katatona is similar to *K. nephrosperma* in having tan, tomentose apical branchlets, fruiting calyces with obvious, reticulate venation and broadly ovate lobes that are generally broader than long. It differs, however, in having carpels with some lateral fusion as found in *K. exastia*, instead of distinct carpels as found in *K. nephrosperma*. In the Kimberley, *K. katatona* also differs from *K. nephrosperma* in having staminodes that are 1–2 mm long, subulate, often with recurved apices and occasionally with small, barren anthers, rather than shorter, 0.7–1 mm long, non-recurved, staminodes. The calyx lobe apex is sometimes sub-acute and less rounded than in *K. nephrosperma.*

Notes. K. katatona was included in the "Flora of the Kimberley Region" as *K. velutina* Steetz. It differs from the typical *K. velutina* in having calyx lobes that are broader than long with sub-acute apices, rather than longer than broad with acute apices, and also in having mature leaves that are more elliptic-oblong (L:W 2:1) than linear-oblong (L:W 3:1) in shape, with less ferruginous hairs on the lower surface.

Acknowledgements

Thanks to the Broome Botanical Society, especially Tim Willing, Paul Foulkes †, John Martin and D. Duncan for survey of the Broome area and sharing their knowledge of Broome *Keraudrenia* ecology and distribution. Thanks also to Jenny Chappill, Kevin Kenneally, Barbara Rye and an anonymous reviewer for invaluable comments on the manuscript; to Paul Wilson for translation of diagnoses to Latin; to Australian Biological Resources Study for research funding; to Lorraine Cobb for illustrations; to K. Shepherd and R. Orifici for fieldwork assistance and companionship; and to the directors of herbaria for providing loans of specimens especially the director and staff of PERTH herbarium for additional assistance and provision of facilities.

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SHORT COMMUNICATIONS

A new species of *Typhonium* (Araceae: Areae) from the West Kimberley, Western Australia

Typhonium Schott is a genus of about 40 species of East Asian and Australian geophytic, mostly saproentomophilous aroids, the largest genus of the eastern-hemispheric tribe Areae. *Typhonium* has been revised recently for Australia (Hay 1993) and *in toto* (Sriboonma 1994), with the subsequent addition of three new species in Australia (Hay 1996; Hay & Taylor 1997). Several further new species are also coming to light in Indochina (Dzu & Croat 1997; Hetterscheid, pers. comm.). Here we describe another new Australian species, bringing the total for Australia to 17, of which all but two are endemic. A key to Australian *Typhonium*, including this new species, will appear in the forthcoming treatment for "Flora of Australia" (Hay, in prep.).

Typhonium peltandroides A. Hay, M.D. Barrett & R.L. Barrett, *sp. nov.*

Typhonium alismifolium F. Muell. sens. lat. simulans, sed folii lamina elliptica, nervis numerosissimis striatis, inflorescentiae organis neutris clavulatis differt.

Typus: Grevillea Gorge on Beverley Springs Station, West Kimberley, Western Australia, 16°30'25"S, 125°20'E, 14 January 1996, *R.L. Barrett & M.D. Barrett* 700 (*holo:* PERTH (+ spirit); *iso:* NSW).

Deciduous *geophyte*; corm depressed globose, to 50 mm wide; foliage leaves 3 or 4 together, arising from parts of each of two modules of a sympodium, the later module subtended by a cataphyll *c.* 7 cm long; petiole 15–50 cm long, distinctly sheathing in lower 1/2 (sheath membranous, to 16 cm); leaf blade ovate to narrowly ovate, always simple, (8–)*14–34 x (3–)7–11.7 cm obtuse at base, apex acute to acuminate; midrib strongly prominent abaxially in the basal half; primary lateral veins *c.* 12 on each side of the midrib diverging at (20–)30–45 degrees, weakly differentiated from the secondary venation, secondary venation in turn rather weakly differentiated from the tertiary; all veins arising from midrib forming a closely striate pattern, ultimately running into a well-defined intramarginal vein 2–3 mm within the margin. *Inflorescence* among the leaves, terminal, preceded by leaves of the module bearing it and followed by more of the next module (this apparently sometimes terminated by a second flower in the same year); bloom smelling of decaying flesh; peduncle (6–)14–24 cm long, *c.* 5 mm diam., elevated *c.* 3–15 cm above soil surface. *Spathe* base green, strongly constricted at apex, broadly oblong, 1.6–2.5 x 1.2–2.7 cm; spathe limb greenish abaxially, entirely deep reddish-purple adaxially (yellowish flesh-coloured at constriction), ovate, (5–)9–12 x (3–)6–8 cm, recurved and spreading at base. *Spadix* slightly shorter than spathe; female zone *c.* 7 x 10 mm; interstice *c.* (12–)21 x 3.5 mm, with sterile organs on lower 4 mm, naked above; male zone *c.* (11–)18 x 7 mm; appendix narrowly conical, sessile, deep reddish-purple, 7.5–9.5 x 1.0–1.2 cm (at widest point), somewhat recurved, base asymmetric, oblique in profile. *Pistils c.* 50, plagioscopic, obovate, *c.* 3 x 1.5 mm, ovary unilocular and uniovulate. *Sterile organs* filiform, slightly clavate at tips, tangled and twisted in all directions, 8–15 mm long. *Male flowers* cream, becoming apricot with pollen. *Fruiting spathe* base persistent and enclosing berries, green, *c.* 2.5 x 2.5 cm. *Seeds* brown, orbicular, slightly laterally compressed with many longitudinal furrows and pits, *c.* 5 x 4.5 mm. (Figure 1)

* all dimensions in parentheses from a cultivated plant (*M.D. Barrett* 599).

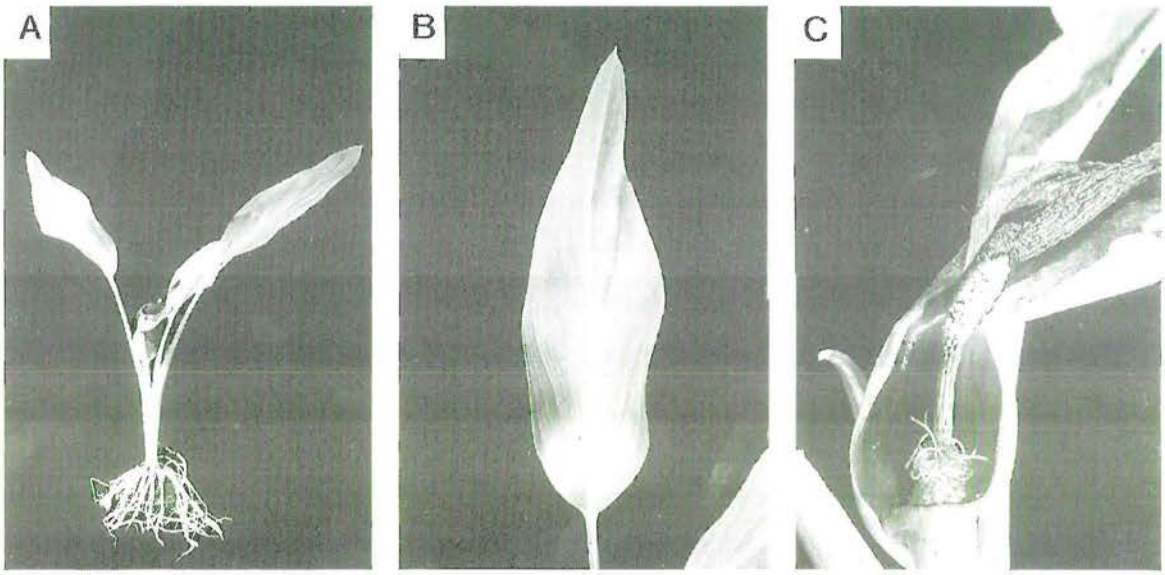

Figure 1. *Typhonium peltandroides* A – whole plant, B – leaf, C – base of spathe and spadix.

Other specimens examined. WESTERN AUSTRALIA: locality as for type, *R.L. Barrett & M.D. Barrett* 340 & 913 (both PERTH); cult. Kings Park & Botanic Garden, ex type locality, *M.D. Barrett* 599 (PERTH).

Distribution. Known only from Grevillea Gorge in the Synnott Range on Beverley Springs Station in the West Kimberley where it is known to occur in small pockets along the gorge. A large group of *c.* 80 plants occurs amongst vine thicket below an ephemeral waterfall, while another large group of *c.* 20 plants grows amongst spinifex on sheltered rock ledges near the top of the gorge; scattered plants occur amongst *Triodia* on sheltered rock ledges on the gorge rim.

Habitat. In shallow sand amongst rough sandstone, either in vine thicket (with *Alstonia linearis* Benth., *Diospyros* sp. and *Geodorum neocaledonicum* Schltr.) or amongst *Triodia* clumps on sides of a gorge.

Flowering period. Late December to January. Fruits mid January to March. The flowering spathe base is usually full of beetles.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. Only one population of less than 200 plants is known. Further searches for this species in likely habitat in the adjacent Salvoni Gorge system failed to produce any further populations.

Etymology. The specific epithet alludes to the resemblance of the leaf venation to that of the North American genus *Peltandra* (Araceae: Peltandreae), in which the venation is also striate with a pronounced intramarginal vein. The choice of epithet is unrelated to Croat's (1998: 66) mistaken assertion that one of us (A.H.) thought another Australian species of *Typhonium*, *T. mirabile* (A. Hay) A. Hay (Tiwi Islands), was actually a species of *Peltandra*.

Affinity. The new species is clearly allied to *T. alismifolium* F. Muell., a species which Hay (1993) treated provisionally as a rather widely circumscribed complex in need of further resolution. *Typhonium alismifolium* has a wide distribution from north-eastern Queensland to Central Australia, and has recently been recorded, as a very robust variant, from near Oodnadatta, South Australia (Hay, in prep.). In spite of the wide circumscription of *T. alismifolium*, the new element combines wide geographical disjunction from that species with differing leaf shape (reduced, though nevertheless distinct posterior lobes are always present in *T. alismifolium*) and, more significantly, highly distinctive striate leaf venation. This venation pattern is unique in the genus (though approached in the north-west Australian *T. liliifolium* F. Muell. which differs qualitatively in its shoot architecture) and it forms the principal basis for recognizing the new element as a discrete species segregated from that complex. Inflorescence structure is similar to that of *T. alismifolium* in the more western parts of its range (sessile appendix), but the neuter organs at the base of the sterile zone are slightly clavate in *T. peltandroides*, and apparently not so in *T. alismifolium*.

Acknowledgements

A.H. thanks PERTH for the loan and donation of cited specimens to NSW.

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Stypandra jamesii (Phormiaceae), a new Western Australian species endemic to granite outcrops

Blindgrass or Nodding Blue Lily, as presently conceived (Henderson 1987), comprises a single variable species in a monotypic genus. *Stypandra glauca* R.Br. occurs in south-western and south-eastern Australia, and possibly in New Caledonia, embracing a considerable diversity of growth forms, from large erect bamboo-like clumps up to 2 m tall, to prostrate sprawling herbs. All have nodding flowers, usually royal blue, but sometimes white along the Darling Range near Perth and near Hyden. Some populations in southern Western Australia are poisonous, causing blindness to livestock if eaten. No such poisonous attributes are known from the south-east.

Chromosome numbers in *Stypandra glauca* were documented by Keighery (1984), Henderson (1987), and Russell (1988), the latter in an honours research project supervised by Associate Professor Sid James of The University of Western Australia. Populations with 8 and 16 pairs of chromosomes occur in south-western Australia, while counts of only 8 pairs have been recorded from plants in south-eastern Queensland and in the Australian Capital Territory near Canberra. This geographical pattern suggests that 8 pairs is the ancestral number of the complex.

Within south-western Australia, there is no clear geographical separation of populations with 8 and 16 pairs of chromosomes. With one possible exception (Sullivan Rock), no case was found where both chromosome numbers occurred together among plants on the same rock. Both chromosome number races extend from granites in the Darling Range near Perth, eastwards through the wheatbelt, and along the south coast on outcrops between Albany and Bremer Bay. Polyploidy may be a recurrent solution to the genetic difficulties posed by inbreeding in small isolated populations of *Stypandra glauca* with the ancestral 8 pairs of chromosomes. Russell (1988) found that substantial levels of pollen sterility occur in the species, possibly due to inbreeding effects. He proposed that polyploidy masks some of the genes causing lethality and restores fertility. A detailed study of population relationships in *Stypandra glauca* using DNA markers would enable a clear understanding of evolutionary processes leading to the complex variation shown by this widespread granite outcrop perennial herb.

The chromosomal variation in south-west populations of *Stypandra glauca* is matched by complex morphological variation. Henderson (1987) summarized the situation succinctly:

> "An extremely variable species which on presently available herbarium material cannot unequivocally be subdivided, though extreme forms are very distinctive. Some have been treated as species but many specimens show intermediate characters or both states of so-called distinctions.
>
> W.A. material (or parts of it) may be subspecifically or specifically distinct from eastern and south-eastern material. ... The names *Stypandra imbricata* and *S. grandiflora* were applied to young or old ± low plants with medium to broad leaf laminas in south-western W.A.; *S. virgata* was applied to older, taller plants with narrow leaf laminas and *S. scoparia* to old tall plants with short filiform leaves in this same region. *S. propinqua*, applied to young plants with comparatively narrow leaves, and *S. latifolia*, to young plants with very broad leaves occurring in eastern Australia, are unquestionably synonyms of *S. glauca*."

My own field studies over the past two decades support Henderson's views on morphological variation in *Stypandra glauca*. Populations tend to be of a uniform morphology, age-related features aside, but substantial variation occurs from rock to rock as one moves across the south-west Australian

landscape. There may be a geographical basis to some of this variation, but rigorous quantitative studies are needed to resolve the situation. However, there is one atypical variant on granite outcrops in the eastern wheatbelt, first collected by Professor Robert Ornduff in 1983 and then by Associate Professor Sid James in 1988. This variant has small white flowers, a sprawling habit, and is sympatric with larger erect blue-flowered specimens, thicker stemmed and smaller leaved, typical of many populations of *Stypandra glauca*. No intermediates have been found where these two taxa are sympatric. Consequently, I regard this white-flowered effuse taxon as a distinct species.

Stypandra jamesii Hopper, *sp. nov.*

A *S. glauca* R. Br. caulia effusia gracilioribus, floribus minoribus cremeis et antherica minoribus, differt.

Typus: Wave Rock [Hyden Rock], Western Australia, 12 October 1991, *W. Greuter* 22709 (*holo:* PERTH 03456668).

Effuse, sprawling rhizomatous *perennial herb*; roots fibrous; tufts to more than 1 m across at base; aerial stems to 30 cm high, thin, to *c.* 1 mm diameter, elongated, leafy throughout. *Leaves* numerous, ascending, soft, linear, 2–15 cm long, to 3 mm wide, base sheathing, cylindrical then equitant above, apex acute. *Upper bracts* linear-subulate, 1–2.5 cm long. *Inflorescence* terminal, open, cymose, few-flowered. *Flowers* actinomorphic, nodding to erect, on slender pedicels 3–18 mm long. *Perianth* creamy white; segments 6, free, subequal, spreading, broadly linear, to 5 x 2 mm, usually 5-nerved. *Stamens* 6, shorter than perianth, 2–3 mm long; filaments slender, becoming kinked below middle, densely hairy distally; anthers slender, yellow, ± tapered upwards, dehiscing longitudinally by slits, recurved or coiled after dehiscence, *c.* 1 long before coiling. *Ovary* superior, *c.* 1 mm long. *Style* filiform, 2–3 mm long; stigma minute, papillose. *Capsule* not seen.

Specimens examined. WESTERN AUSTRALIA: Hyden Rock, 18 Oct. 1989, *S.D. Hopper* 7704 (PERTH); Graham Rock, 17 km E of Hyden, 1 Oct. 1990, *S.D. Hopper* 7861 (PERTH); Graham Rock, late Sep. 1988, *S.H. James for J. Russell* 35 (PERTH); Hyden Rock, 4 Oct. 1983, *R. Ornduff* 9307–74 (PERTH).

Distribution. Known only from Hyden Rock and Graham Rock over a narrow 15 km range in the eastern wheatbelt of south-western Australia.

Habitat. Grows in partial shade on the margins of *Allocasuarina huegeliana* low woodlands and in open low scrub at the base of, or in shallow soil pockets on, large granite inselbergs. Associated species include *Leptospermum erubescens*, *Dodonaea viscosa* subsp. *attenuata*, *Melaleuca elliptica*, *Thryptomene australis*, *Acacia lasiocalyx*, *Eucalyptus loxophleba* subsp. *loxophleba*, *Cheilanthes austrotenuifolia*, *Spartochloa scirpoidea* and *Santalum acuminatum*.

Phenology. Flowers in October, possibly into November.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two.

Etymology. Named for the late Associate Professor Sidney H. James, my respected mentor, Ph.D. supervisor, and friend, for his outstanding research on the evolutionary genetics of the Western

Australian flora, and his fine abilities to inspire generations of students (Hopper 1996). *Stypandra jamesii* was collected by Sid, who most probably recognized it as new, given that he made relatively few herbarium collections and considered this taxon important enough to do so.

Notes. Stypandra jamesii differs from *S. glauca* most noticably in its sprawling low habit, effuse thinner less woody stems, long narrow leaves and its smaller consistently cream flowers. Elsewhere I have seen effuse sprawling long-leaved plants of *S. glauca* only near Cataby in sandy soils beneath *Eucalyptus wandoo* woodland and on the Swan Coastal Plain in *Eucalyptus gomphocephala* woodland (e.g. *J. Russell* 34), but these plants retained the larger blue flowers typical of the species. Usually, *S. glauca* has erect stems, like miniature bamboo, up to 2 m tall. The white-flowered variants of *S. glauca* on the Darling Scarp retain this typical habit, and have larger flowers than those of *S. jamesii*.

The two species are sympatric at Hyden Rock and Graham Rock, where *S. glauca* has typical large blue flowers with perianth segmants to 10 x 3 mm, shorter leaves to 8 cm x 1 mm, and erect robust stems to 4 mm diameter and 2 m tall. No hybrids have been found on these two inselbergs, indicating strong genetic isolation between *S. jamesii* and *S. glauca*. The chromosome number of *S. jamesii* is unknown.

Separate collections of both *Stypandra jamesii* and *S. glauca* were made at Hyden Rock by Professor Robert Ornduff in 1983 (*R. Ornduff* 9307–74 and 9309–32) and by Professor W. Greuter in 1991 (*W. Greuter* 22709 and 22708). This suggests independent recognition of distinct taxa by these botanists, a conclusion I drew and annotated on specimens in October 1989. Undoubtedly, additional taxa are evident in Western Australian *S. glauca* collections. The complex merits further study.

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Stylidium candelabrum (Stylidiaceae), a new species from the Northern Territory, Australia

The new species of triggerplant (Stylidiaceae) described here is endemic to the Northern Territory. It belongs in *Stylidium* subgenus *Andersonia* (R. Br.) Mildbr., which is characterized by having a linear hypanthium, the walls of the mature capsule recurved, the septum erect and persistent, and numerous seeds. This subgenus occurs in regions of tropical northern Australia and extends into south-east Asia (Mildbraed 1908).

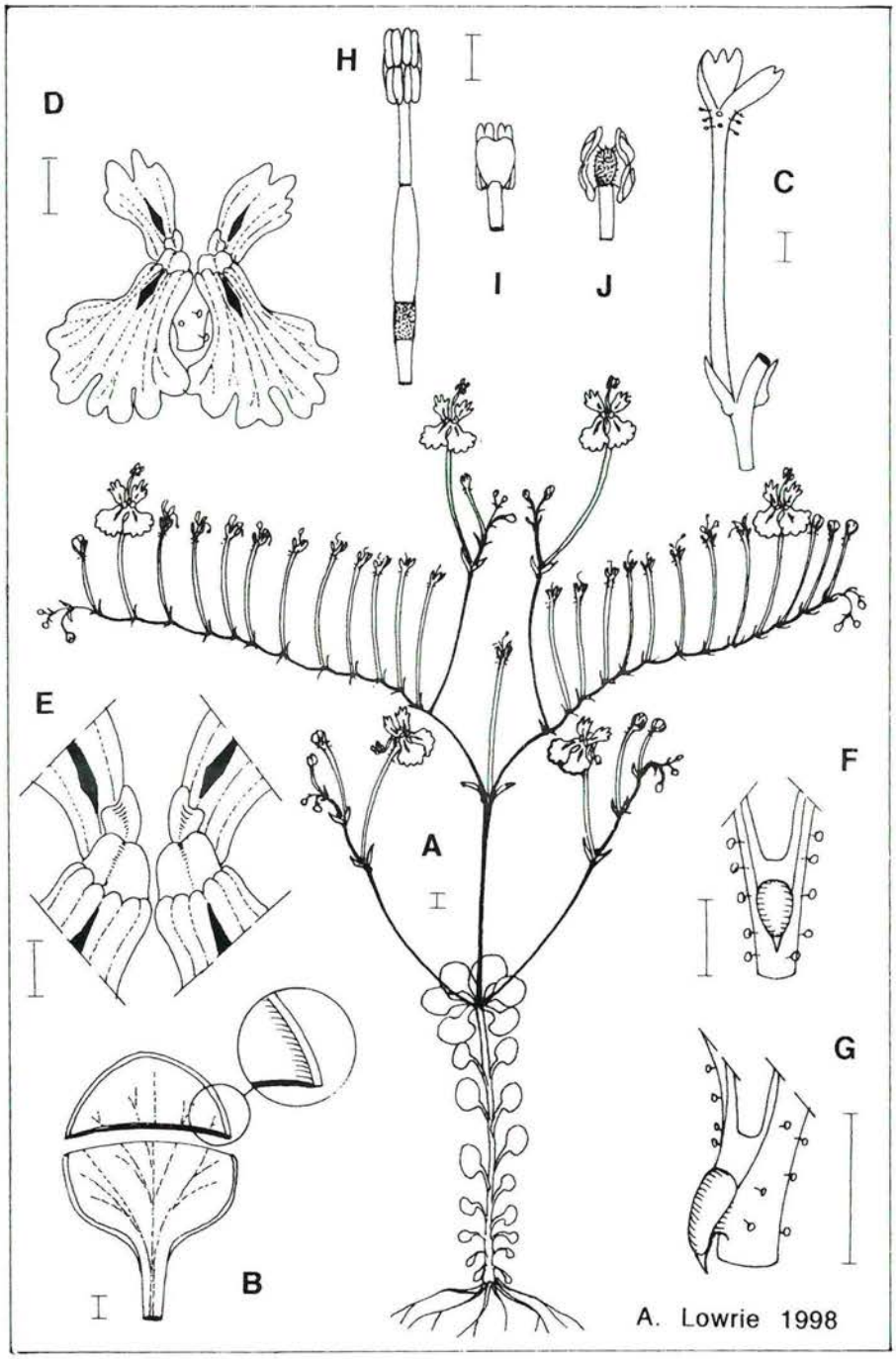
Taxonomy

Stylidium candelabrum Lowrie & Kenneally, *sp. nov.*

A speciebus tropicis bene distincta, foliis obovato-spathulatis, secus caulem erectum dispersis et in rosula terminali positis, inflorescentiis scorpioideis cymosis multifloribus e rosula exorientibus, floribus parvis, lobis corellae verticaliter binatis, apicibus petaliorum multilobis, sepalis in grege duorum et trium fere ad apicem connatis calycem bilobum formantibus.

Typus: Headwaters Katherine River, Arnhemland, 13° 47' 24" S, 133° 05' 18" E, Northern Territory, Australia, 11 July 1996, *C.P. Mangion* 245 & *C. Dunlop* (*holo:* DNA D0130045; *iso:* PERTH).

Erect *annual herb* 8–30 cm (mostly 12–20 cm) high including inflorescence; stem reddish, 2.5–5 cm long, *c.* 1 mm diam., with leaves scattered along an erect stem and in a terminal rosette. *Leaves* green, obovate-spathulate, lamina with marginal hyaline, 6.5–7 mm long, 6–7 mm wide, petioles 0.5–0.8 mm wide at the base, dilated to 1.5–2 mm wide at the base of the lamina, flat in section, glabrous. *Inflorescence* a multi-flowered scorpioid cyme arising from the terminal rosette, 6–20 cm long, sparsely glandular throughout. *Bracts* and *bracteoles* lanceolate, 1–2 mm long, 0.15–0.4 mm wide, sparsely glandular at base. *Pedicels* sessile. *Hypanthium* linear, usually 10–12.5 mm long but up to 20 mm long in some specimens, 0.3–0.4 mm diam. at anthesis, glandular just below the sepals. *Calyx* 1.5–2 mm long, 2-lobed, glabrous; lobe of 3 sepals connate to within *c.* 0.6 mm of the apex; lobe of 2 sepals connate to within *c.* 0.7 mm of the apex. *Corolla* white and pink with red marks near the base of each lobe, abaxial surface bearing a few scattered red capped glands, lobes vertically paired; anterior lobes white, pink near the base, obovate, *c.* 2 mm long, *c.* 1.3 mm wide, with crenate, dentate or irregularly crenate-dentate apices *c.* 4-lobed, posterior lobes pink, broadly obovate, *c.* 3 mm long, *c.* 3 mm wide, with crenate, dentate or irregularly crenate-dentate apices *c.* 8-lobed. *Throat* bearing 4 appendages (2 pairs) at base of the corolla lobes; each anterior appendage joined to a posterior appendage and arranged (when viewed from the adaxial surface) to appear as 2 separate lobes; anterior appendage attached at the base and along part of its side to the inside margin of the anterior corolla lobe, *c.* 0.4 mm long, *c.* 0.3 mm wide; posterior appendage *c.* 0.5 mm long, *c.* 0.5 mm wide, attached to the base of the posterior corolla lobe. *Labellum* positioned *c.* 0.3 mm below the the sinus of the anterior corolla lobes; boss ovate, convex, *c.* 1.7 mm long, *c.* 0.5 mm wide, smooth; apical point short, glabrous. *Gynostemium* 6.5–7 mm long, geniculate *c.* 1.5 mm below the anthers, the sensitive torosus *c.* 0.5 mm long, positioned *c.* 1 mm above the base, glabrous. *Capsule* linear, similar in length to that at anthesis. *Seeds* rusty brown, ± ellipsoid, 0.2–0.25 mm long, 0.1–0.15 diam., ± smooth. (Figure 1)



Stylidium candelabrum A – habit of flowering plant; B – leaf, enlarged section right; C – hypanthium and sepals; D – corolla; E – throat appendages; F – labellum, showing its position on the corolla tube below the sinus; G – oblique view of the labellum on the corolla tube; H – adaxial view of gynostemium; I – abaxial view of gynostemium tip; J – adaxial view of gynostemium tip with stigma grown out centre. Scale bar for all = 1 mm. Drawn from *C.P. Mangion* 245 & *C. Dunlop* (A, B) and *L.A. Craven* 2464 spirit material, CANB (C–J).

Other specimens examined. NORTHERN TERRITORY: Tin Camp Creek, Oenpelli, 15 Apr. 1993, *K. Brennan* 2262 (OSS); Tin Camp Creek, 6 km WSW [of] Myra Falls, Oenpelli, 9 Mar. 1994, *K. Brennan* 2695 (OSS); Little Nourlangie Rock, 19 Feb. 1995, *K. Brennan* 3006 (OSS); Baroalba Creek, Mt Brockman massif, Cahill, 29 Mar. 1995, *K. Brennan* 3093 (OSS); Sandstone plateau, 12° 40' S, 133° 15' E [*c.* 45 km east of Jabiru], 2 March 1973, *L.A. Craven* 2464 (DNA, PERTH, CANB, spirit material CANB only); Kakadu National Park, 7 km NNE of Jabiru, 12° 35' 51" S, 132° 59' 30" E, 25 Apr. 1995, *J.L. Egan* 4795 & *S. Knox*, (DNA); near Little Nourlangie Rock at turn off to Koongarra, Kakadu, 12° 49' 35" S, 132° 47' 57" E, 11 Apr. 1990, *A. Lowrie* 60-B (PERTH); 21 May 1999, *A. Lowrie* 2315 (PERTH, DNA, MEL); W branch of Coopers Creek, Nabarlek, 12° 20' S, 133° 19' E, 20 Apr. 1979, *M.O. Rankin* 2039 (DNA, CANB, BRI, NSW, K).

Distribution. Known from Nourlangie, Mt Brockman, Oenpelli and Nabarlek regions in Kakadu National Park, and from the headwaters of the Katherine River *c.* 120 km south of Mt Brockman south-east of Jabiru.

Habitat. Recorded in grassy woodland on crest of schist hill (*K. Brennan* 2695); in shallow sand deposits on sandstone (*K. Brennan* 3093); in damp sand beside seasonal stream on sandstone outcrop (*K. Brennan* 3006); in rock crevices on sandstone pavement beside creek (*C.P. Mangion* 245 & *C. Dunlop*); in sand above creek (*J.L. Egan* 4795 & *S. Knox*); and in quartz-laterite alluvium (*A. Lowrie* 60–B, *A. Lowrie* 2315).

Phenology. Flowering specimens have been collected from February to July.

Conservation status. Known from a number of locations in Kakadu National Park and currently not under threat.

Etymology. The epithet *candelabrum*, refers to the inflorescence being arranged similarly to that of a candelabrum (large branched candlestick).

Affinities. The closest relative to *Stylidium candelabrum* is considered to be *S. uliginosum* Swartz. Both species have very small flowers with vertically-paired corolla lobes and similarly shaped leaves. *S. candelabrum* differs from *S. uliginosum* by having its leaves scattered along an erect stem terminating in a rosette, with scorpioid cymose inflorescences arising from the terminal rosette, calyx 2-lobed, the lobes of 2 or 3 sepals connate to just below the apex, and throat appendages 4.

Acknowledgements

We would like to thank Kym Brennan for the opportunity to study and determine his Northern Territory Stylidiaceae collections housed at OSS (Office of the Supervising Scientist for the Alligator Rivers Region) and for his many informative personal communications regarding the biology of this species in the field, Clyde Dunlop for arranging for Kevin Kenneally to examine *Stylidium* specimens at DNA and for expediting the loan of relevant material applicable to this species, Brendan Lepschi for facilitating the loan of the spirit material of this species housed at CANB which was used to illustrate this species – especially the finer parts of the corolla, Paul Wilson for his assistance with the Latin diagnosis, Alan Burbidge and Barbara Rye for their comments, and the staff of the Western Australian Herbarium.

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Stylidium chiddarcoopingense (Stylidiaceae), a new species from south-west Western Australia

Stylidium chiddarcoopingense (Stylidiaceae) is a new species of triggerplant endemic to south-west Western Australia. It is a member of the *Stylidium caricifolium* complex, in which seven species are now recognized. The other six species were described and illustrated in Lowrie *et al.* (1998). All members of the *Stylidium caricifolium* complex belong in subgenus *Tolypangium* Endl., section *Squamosae* Benth. (Mildbraed 1908).

Taxonomy

Stylidium chiddarcoopingense Lowrie, Coates & Kenneally, *sp. nov.*

S. nungarinense S. Moore affine sed foliis linearibus, in sectione transversale ellipticis, 0.8–1.2 mm latis, 0.7–0.8 mm crassis.

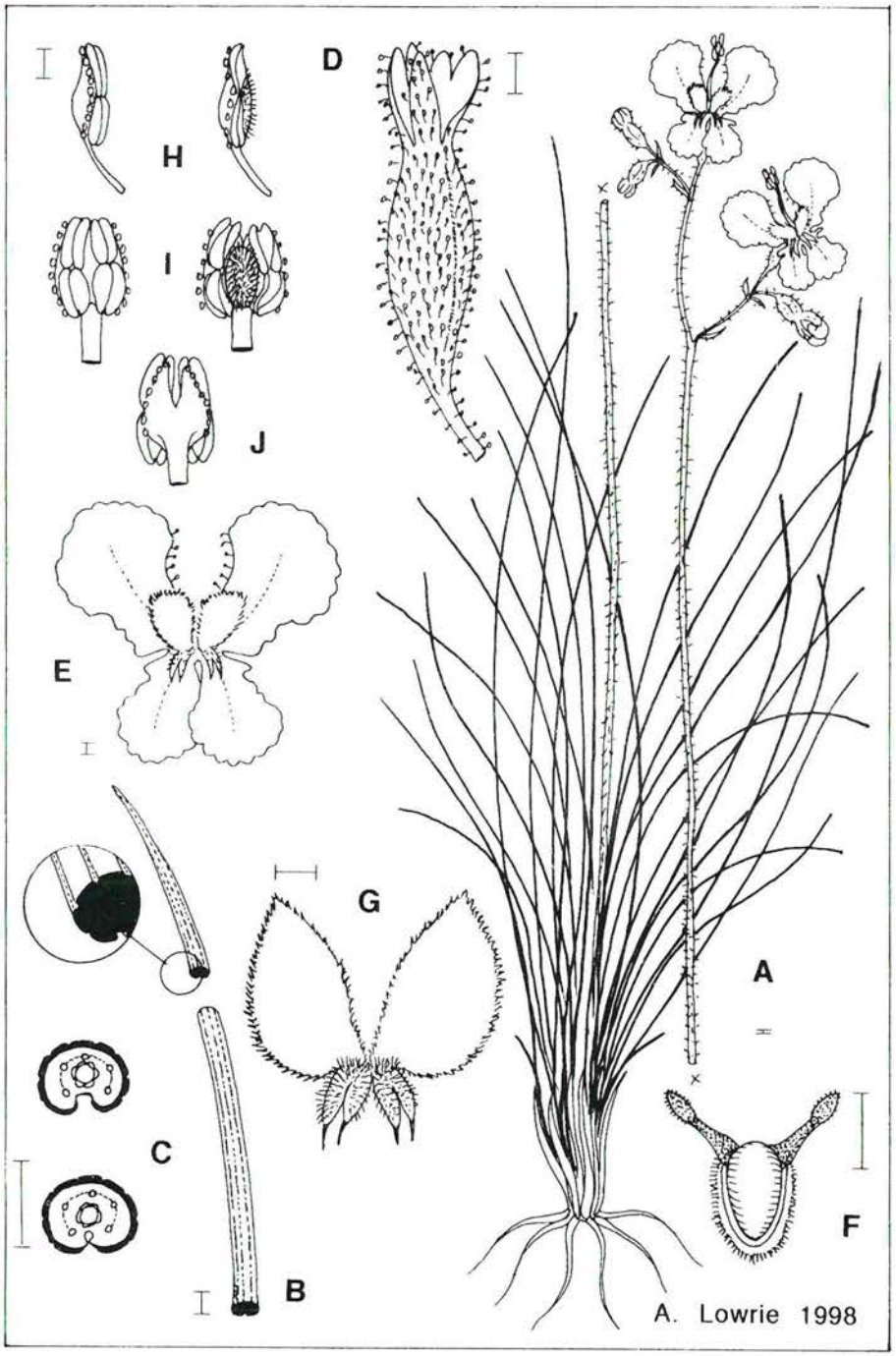
Typus: Chiddarcooping Hill, Chiddarcooping Nature Reserve, Western Australia, 30° 54' S, 118° 41' E, 16 September 1998, *D.J. Coates* 198 (*holo:* PERTH 05335094; *iso:* MEL).

Perennial herb, forming a leafy tuft of long erect or recurved leaves arising singly or in pairs from each basal papery sheath. *Leaves* light green in young leaves, dark green in older leaves, linear, 12–30 cm long, elliptic in section, 0.8–1.2 mm wide, 0.7–0.8 mm thick, midrib visible on the abaxial surface of older leaves, margins revolute, midrib hidden in juvenile and young leaves by the revolute margins, adaxial surface striate, smooth, with glassy epidermis cells in the shallow longitudinal valleys, glabrous. *Inflorescence* paniculate, including scape 30–40 cm long, densely glandular-pubescent; peduncles 1- or 2-flowered, the basal ones 3.5–4.5 cm long, the upper ones shorter; floral bracts linear, 3–5 mm long; bracteoles 2–2.5 mm long. *Hypanthium* narrowly ellipsoid at anthesis, 7–7.5 mm long, 2–2.5 mm wide, densely glandular-pubescent. *Sepals* 5, 2 connate for half their length, 3 free to base, glandular-pubescent. *Corolla* white, lobes vertically paired; anterior lobes 16–17 mm long, 11–12 mm wide; posterior lobes 10–11 mm long, 7–7.5 mm wide. *Labellum* ovate, *c.* 1.5 mm long, *c.* 1 mm wide; margins fringed with long translucent white papillae, apical papillae red; basal appendages 2, white, terete, with red ellipsoid tips, 0.7–1.5 mm long, papillose; boss ovate, pale green, *c.* 1.3 mm long, 0.6 mm wide, smooth. *Throat* appendages 4, upper 2 wing-like, white, 5.5–7.5 mm long, 3–4 mm wide; lower 2 narrowly ovate, bifurcate, white, red-tipped, *c.* 1.3 mm long, papillose. *Gynostemium c.* 15 mm long; anthers olive green, vertically paired; abaxial surface with glassy globose appendages bead-like along the margins; pollen grey; stigma elliptic, *c.* 1.5 mm long, *c.* 0.8 mm wide, cushion-shaped. *Capsule* ellipsoid, *c.* 9 mm long, *c.* 5.5 mm wide. *Seeds* unknown. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: Chiddarcooping Nature Reserve, Sep. 1995, *D.J. Coates* 1395 (PERTH).

Distribution. Known only from two populations *c.* 4 km apart in the Chiddarcooping Nature Reserve *c.* 75 km north-east of Merredin.

Habitat. Grows at the base of breakaways in kaolin sandy soils and rock scree associated with *Allocasuarina* shrubs.



Stylidium chiddarcoopingense A – habit of flowering plant; B – leaf, enlarged section left; C – mature leaf section showing visible mid vein along abaxial surface (top), immature leaf section showing revolute margins completely enclosing the mid vein along abaxial surface (bottom); D – hypanthium and sepals; E – corolla; F – labellum; G – throat appendages; H – lateral view of gynostemium tip (with stigma at right); I – front view of gynostemium tip (with stigma grown out, right; J – back of gynostemium tip. Scale bar for all = 1 mm. Drawn from *D.J. Coates* 198 (PERTH).

Flowering period. September, October.

Chromosome number. n = 8, *D.J. Coates* 1395 (previously unpublished data).

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Only known from the type location which is a nature reserve.

Etymology. The epithet – *chiddarcoopingense* refers to the Chiddarcooping region in south-west Western Australia where this species was discovered and specimens for cytogenic studies were collected.

Affinities. Stylidium chiddarcoopingense is distinguished from all members of the *S. caricifolium* complex by its distinctive linear leaves that are elliptic in section and only 0.8–1.2 mm wide and 0.7–0.8 mm thick. Its closest relative is considered to be *S. nungarinense*, which is similar in having glabrous leaves arising singly from each basal papery sheath and the same chromosome number of n = 8, but shows significant morphological differences such as its lanceolate leaves, narrower upper throat appendages and distinctive corolla outline. *Stylidium wilroyense* Lowrie, Coates & Kenneally also has a chromosome number of n = 8 but shows greater morphological differences including its scabrid leaves and dark pink corolla. Each of the seven species of the *S. caricifolium* complex has its own unique corolla outline.

Acknowledgements

We would like to thank Paul Wilson for his assistance with the Latin diagnosis, Barbara Rye for her comments, and the staff of the Western Australian Herbarium.

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A new record for the fern flora of south-western Australia: a single plant of *Histiopteris incisa* from Mt Lindesay

A single large (rhizome length 0.4 m, leaf length 0.5 m) individual of the cosmopolitan fern *Histiopteris incisa* (Thunb.) J. Sm. (Dennstaedtiaceae) was located on the lower south-western slopes (altitude 110 m) of Mt Lindesay on 3 January 1999. The plant was found growing in a partially shaded, horizontal crevice of a large granite boulder 1.5 m from the ground and 100 metres up a steep slope to the east of the Denmark River. The general area included substantial areas of outcropping in otherwise woodland/forest habitat. This is the first record of this species from south-western Australia, and increases the pteridophyte flora (ferns and fern allies) of the Jarrah Forest Bioregion to 30.

In Australia, *H. incisa* is common along the south-eastern and eastern coasts from south-eastern South Australia and Tasmania to south-eastern Queensland, with scattered populations north to the Atherton Tableland and in the MacDonald Ranges and Kakadu area of the Northern Territory (Brownsey 1998). There is also a single record from the Durrack Range in the Kimberley of Western Australia (Wheeler *et al.* 1992). It is also found widely throughout the tropics and southern temperate regions where it occurs in generally moist open sites (Brownsey 1998).

The as yet undescribed locally endemic *Eucalyptus 'virginia'* ms. (Hopper & Wardell-Johnson unpublished) is the most common overstorey species in the immediate site. Other plant species associated with this site include *Corymbia calophylla, Eucalyptus marginata, Xanthosia rotundifolia, Hypocalymna angustifolium, Loxocarya flexuosa, Agonis hypericifolia, Xanthorrhoea preissii, Leucopogon capitellatus, Hovea elliptica, Agonis marginata, Lepidosperma effusum, Hakea undulata*, and *Dodonaea ceratocarpa.*

Despite the seemingly appropriate habitat for a wide range of ferns and fern allies in the south-west, few species occur there. Thus only 22 species including three introductions, are known from the Warren Bioregion, the most important centre for conservative, relictual high rainfall vascular plant taxa in the State (Hopper *et al.* 1992, Lyons *et al.* in press). No species are confined to the high rainfall south-western forests. Rather, all from the Warren Bioregion are widespread generalists, many of which are outliers in the south-western forests where they are known from few records (e.g. *Hypolepis rugosula* (Labill.) J. Sm., *Asplenium obtusatum* G. Forst., *Christella dentata* (Forssk.) Brownsey & Jermy).

Mt Lindesay lies on the margins of the Warren and the generally drier more seasonal Jarrah Forest Bioregion. This area is notable as a centre for endemism in the region (Wardell-Johnson & Williams 1996, Wardell-Johnson & Horwitz 1996). Only one of the pteridophyte species found in the Jarrah Forest Bioregion is endemic to Western Australia (*Isoetes tripus* A. Braun). Several other species are notable endemics to Western Australia, though all are species from the transitional rather than the high rainfall zone, providing further support to south-western Australia having been through climatic bottlenecks in the past (e.g. Brimhall *et al.* 1988). Westerly weather patterns also prevent south-western Australia having a nearby source for the re-establishment of species (Chinnock pers. comm.).

The *Histiopteris* individual is 15 km from the nearest population centre (Denmark), and over a kilometre from cleared land, and from the picnic area at the base of Mt Lindesay. There is no evidence that the specimen was planted, as it is well established within a narrow ledge and the rhizome is difficult to access. However, the possibility of relatively recent natural establishment (< 20 years) from a cultivated source within the south-west cannot be ruled out, given the prolific spore production of this

species and its general cultivation in greenhouses. It is possible that substantial areas of suitable habitat for this species would exist within the south-western forests. It is also likely that several other fern species might appear and subsequently be lost from time-to-time within the region.

One specimen has been lodged with the Western Australian Herbarium (PERTH 05243912) and one with the Queensland Herbarium (BRI AQ671573).

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Corrections to *Nuytsia* 12(3)

Two misspelt names should be corrected on page 309. The title of the article should read **Dedication to Richard Sumner Cowan**, and a further correction of the middle name to **Sumner** is needed in the first paragraph. The surname given on the fourth line of the second paragraph should read **Stafleu**.

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 searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the 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 animals, 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.

Publication date for *Nuytsia* Volume 12 Number 3: 8 June 1999

Notes for Authors

The aim of *Nuytsia* is to publish original papers on systematic botany with preference given to papers relating to the flora of Western Australia. All papers are refereed and the Editorial Advisory Committee reserves the right to reject papers. Opinions expressed by authors are their own and do not necessarily represent the policies or views of the Department of Conservation and Land Management.

After final acceptance of papers, authors are requested to provide discs readable directly by IBM computer or internet attachments. Wherever possible, the MS-WORD software should be used. Original figures should not be lettered but accompanied by copies indicating lettering. Page proofs will be forwarded to authors for checking. Twenty reprints of each paper will be provided free of charge; no additional copies may be ordered.

Style and layout should follow recent numbers of *Nuytsia*. Within a paragraph two spaces are required between sentences; after colons, semicolons, commas and dashes a single space is required. Italics should be used for formal taxonomic names, from the genus level down to the lowest infraspecific categories, and for collectors' names when citing specimens. Incidental Latin words in the text should be italicized but not the Latin diagnosis.

Title. Should include the family name of the genera or species treated, but not authorities. New taxa should be named if not too numerous. The type of paper (e.g. revision, synopsis) and geographic area of study should be given where appropriate.

Structure of papers. Authors are encouraged to use the conventional structure of scientific papers, especially when a complete study, such as a revision, is being reported.

(1) *Abstract.* Should be indented and commence with bibliographic information. New taxa, combinations and names should be listed with their authorities. The major contents of the paper should be concisely summarized but no additional material given.

(2) *Introduction.* Should give some background information and state the purpose of the paper.

(3) *Methods* or *Materials and methods*. May include the method of drawing up the description from specimens, extent of search for types and discussion of concepts of taxonomic categories.

(4) *Results* or *Taxonomy* or *Taxonomic treatment* or various alternative headings as appropriate to the data being presented in the paper.

(5) *Discussion.* A discussion section should be considered, which would include some or all of the following: a summary of the findings emphasizing the most significant; interpretation of the results in the light of other relevant work; statement of new problems which have arisen; advising of aspects which are to be followed up; suggestion of topics which others might usefully pursue; prediction and speculation.

Short Communications. These are short concise contributions, usually with few or no main headings. They lack an abstract and authors' names and addresses are placed at the end.

Headings. All headings should be mainly in lower case, major headings centred and bold, secondary headings (where required) left-justified and bold, and minor headings left-justified and italicized.

Keys. May be either indented (e.g. *Nuytsia* 11: 94) or bracketed (e.g. *Nuytsia* 11: 55–56). Indented keys involving more than nine levels of indentation should be avoided. Where a key is indented, tabs should be used and not space bars.

Species treatments. Use of certain named paragraphs, or sets of paragraphs, for matter following the descriptions is encouraged. The desired sequence and examples of commonly used headings are shown below. Italicized headings should be followed by text on the same line.

(1) Taxon name (in bold) and authority. For previously published taxa this should be followed by the reference, nomenclatural synonyms (if any) and *Type:* heading with full type details.

(2) Other synonyms with their type details, significant manuscript or phrase names. Recent papers should be consulted for examples of an appropriate format for citing synonyms.

(3) Latin diagnoses (for new taxa – not indented).

(4) *Typus:* (for new taxa – not indented).

(5) English description (indented).

(6) *Other specimens examined* or *Selected specimens examined* as appropriate. The number of specimens cited for each taxon should not exceed 20. Western Australian specimens should be cited first followed by any from other states in the order: Northern Territory, South Australia, Queensland, New South Wales, Victoria, Tasmania. Within each region, the specimens cited should be placed in alphabetical order according to the collectors' surnames. For each specimen the order of the details given should be as follows: locality, date, collector's name (in italics) and number, herbarium (in brackets).

(7) *Distribution.*

(8) *Habitat.*

(9) *Phenology* or *Flowering period.*

(10) *Conservation status.* Department of Conservation and Land Management Conservation Codes for Declared Rare and Priority Flora should be cited for any endangered or rare Western Australian plants.

(11) *Etymology.*

(12) *Typification.*

(13) *Affinities.*

(14) *Notes* or *Discussion* or *Comments.*

Threatened species. The Department of Conservation and Land Management has a policy not to publish precise locality data for threatened species. When describing threatened taxa authors are therefore requested to use generalized localities accompanied by the bracketed statement [precise locality withheld].

Standard abbreviations. When abbreviations are used, the following standards should be followed.

(1) Author abbreviations. Follow Brummitt, R.K. & Powell, C.E. (1992). "Authors of Plant Names." (Royal Botanic Gardens: Kew.).

(2) Book titles. These should not be abbreviated in the references but any literature citations in the text should follow Green, J.W. (1985). "Census of the Vascular Plants of Western Australia." 2nd edn. pp. 20–24. (Department of Agriculture: Perth.). A more complete list of book title abbreviations is given in Stafleu, F.A. & Cowan, R.S. (1976–83). "Taxonomic Literature." 2nd edn. (Bohn, Scheltema & Holkema: Utrecht.), but capital initial letters need to be used in *Nuytsia*.

(3) Journal titles. Follow Lawrence, G.H.M. *et al.* (1968). "B-P-H. Botanico-Periodicum-Huntianum." (Hunt Botanical Library: Pittsburgh.)

(4) Dates and directions. Generally should not be abbreviated except under the *Specimens examined* section. In that section, dates should be written in full only if they have less than five letters (e.g. July), otherwise should be shortened to the first three letters and a stop (e.g. Oct.), while compass directions should be abbreviated to capital letters with no stops (e.g. N and SSW).

(5) Other abbreviations. Standard abbreviations for measurements (e.g. mm), Latin abbreviations (e.g. *c.*, *nom. illeg.*), mountains and roads (e.g. Mt Koscuisko, Brooke Rd) are used in *Nuytsia*. Other abbreviations, especially ones that are ambiguous (e.g. Pt), should be avoided.

Figures. Numbers should follow a single sequence including maps.

References. Citation of references in the text should give the author's surname and date (e.g. Smith 1963) and full details should be given in the reference section. This format is also recommended to replace the traditional abbreviations for references listed under taxonomic names, for example using Benth. (Bentham 1878: 234) rather than Benth., Fl. Austral. 7: 234 (1878).