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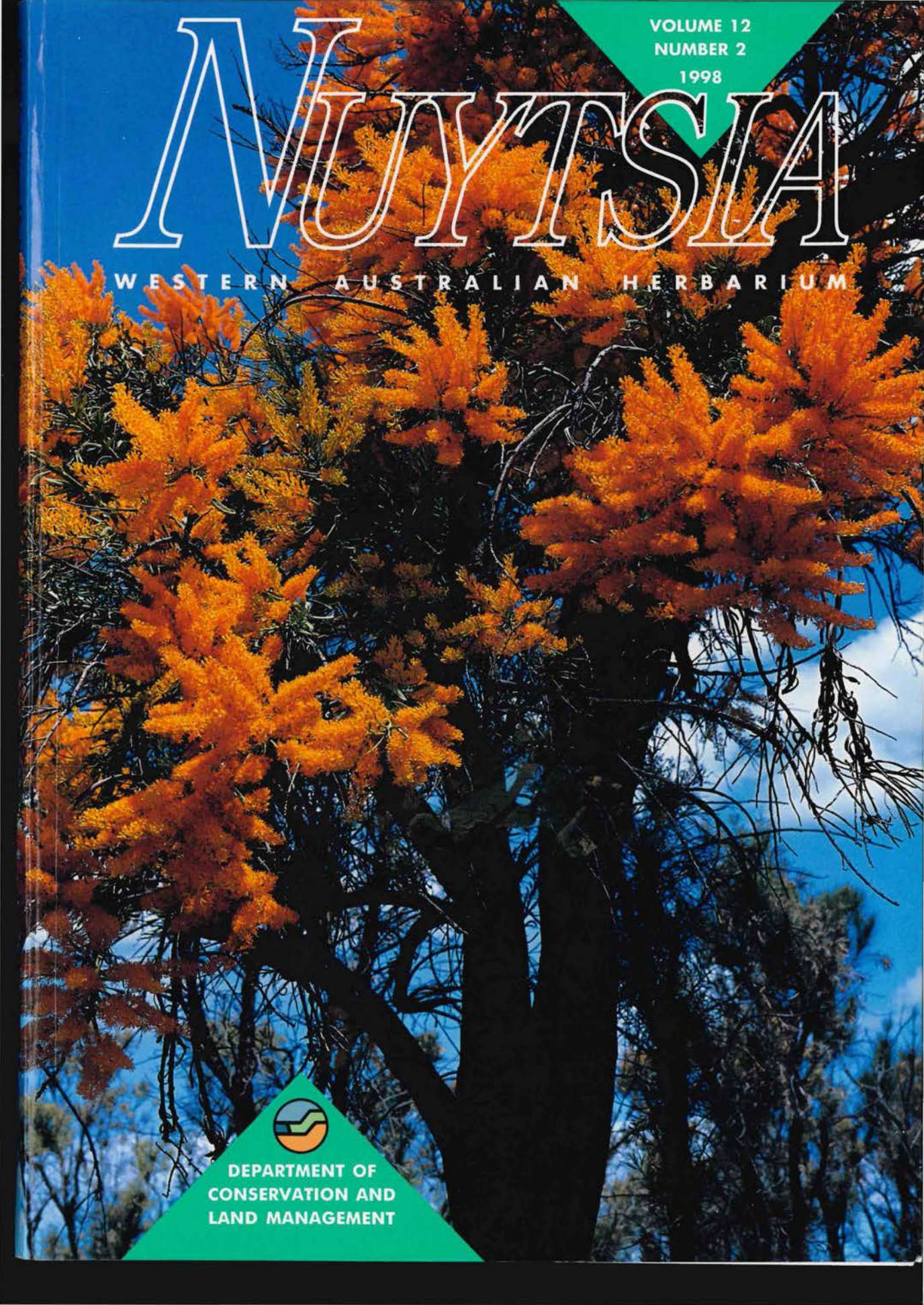

DEPARTMENT OF
CONSERVATION AND
LAND MANAGEMENT

CONTENTS

DEDICATED TO PAUL G. WILSON

(Contents continued inside back cover)

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NUYTSIA

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Department of Conservation and Land Management, Western Australia

CONTENTS

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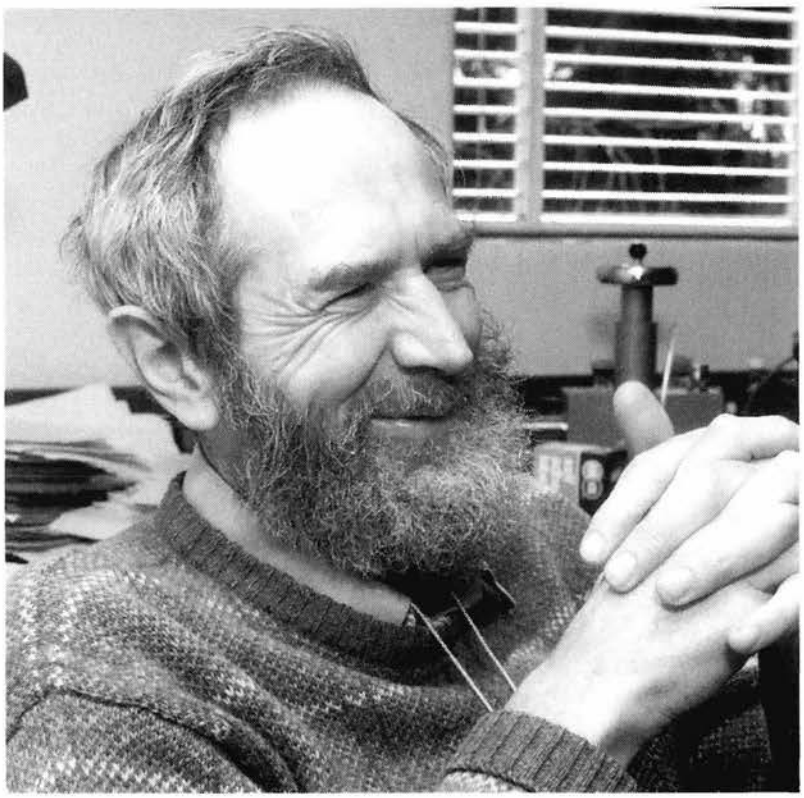
Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) – the Western Australian Christmas Tree is one of the few arborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn 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

DEDICATION TO PAUL GRAHAM WILSON



This issue of *Nuytsia* is dedicated to Paul Graham Wilson to recognize the enormous contribution he has made to Australian plant taxonomy and to celebrate his 70th birthday in 1998.

Although Paul retired from the Western Australian Herbarium on January 2, 1993 he has continued to maintain his high productivity, dedicating most of his time to taxonomic research on the Western Australian flora. In addition to his systematic studies he has made a major contribution to the Herbarium effort towards maintaining a comprehensive census of the State flora, extending well beyond his expertise in Asteraceae, Chenopodiaceae and Rutaceae.

Paul has been the most prolific contributor to *Nuytsia* since the inaugural issue published on December 1, 1970 and it is fitting that this issue is dedicated to his productivity. The very first paper in *Nuytsia* Volume 1 was on the systematics of three genera of Rutaceae. Paul has continued to publish his taxonomic revisions of genera in this family as well as in Asteraceae in the present volume.

Dr Neville G. Marchant, Director, Western Australian Herbarium

Beaufortia aestiva (Myrtaceae): a new species from the northern kwongan of the South-West Botanical Province, Australia

K.J. Brooks[1], A.A. Burbidge[2] and A.S. George[1]

[1]Biological Sciences, Murdoch University, Western Australia 6150
[2] Department of Conservation and Land Management, Wildlife Research Centre, PO Box 51, Wanneroo, Western Australia 6065

Abstract

Beaufortia aestiva (Myrtaceae), a new species from the northern kwongan of the South-West Botanical Province, Australia. *Nuytsia* 12 (2):163–169 (1998). *Beaufortia aestiva* K.J. Brooks is described and illustrated. It is closely allied to *B. squarrosa* Schauer and was previously determined as this species. Extending south from Eurardy Station to Eneabba and south-east to Tammin, it prefers shallow sand on a lateritic substrate. It is cultivated in the Perth metropolitan region and flowers abundantly from October to February.

Introduction

The species described here as *Beaufortia aestiva* occurs in the northern kwongan of the South-West Botanical Province of Western Australia. The genus *Beaufortia* R. Br. is endemic in Western Australia (Lamont *et al.* 1984) and is confined to the South-West Botanical Province, except *B. dampieri* A. Cunn. which extends into the Eremean Botanical Province in the Shark Bay area. Brown (1812) described the genus, naming it in honour of Mary Somerset, Duchess of Beaufort and owner of two botanic gardens (Wrigley & Fagg 1993).

A member of the Myrtaceae, the genus *Beaufortia* is in the subfamily Leptospermoideae and is placed in the *Melaleuca* suballiance within the *Leptospermum* alliance. This is an informal classification proposed by Briggs & Johnson (1979) which is likely to undergo revision with increasing knowledge (Johnson & Briggs 1984; Gadek *et al.* 1996).

The genus is closely allied to *Regelia* Schauer. The two differ in that members of *Regelia* have four ovules per locule, and anthers that open outwards in longitudinal slits. *Beaufortia* has one ovule per locule, and there are transverse slits at the apex of the anther (Marchant *et al.* 1987; Wrigley & Fagg 1993). Members of *Beaufortia* share the characteristics of Johnson & Briggs's (1984) *Beaufortia* infra-alliance: five petals and five staminal bundles attached at the rim of a hypanthium, each staminal bundle and petal being opposite one of the five sepals; a pubescent perigynous ovary and filiform style with a small stigma; and filaments with basifixed anthers.

Until now, collections of *B. aestiva* have been included in the species *B. squarrosa* Schauer, both species having ciliate anthers, petals and sepals, glabrous staminal claws and filaments, and squarrose foliage. *Beaufortia squarrosa* was described by Schauer in 1844. Ludwig Preiss collected the type specimen from the Canning River in 1841, recording 'Buno' as the aboriginal name (Schauer 1845). The species extends as far north as Eneabba and south to the Whicher Range. Examination of material previously considered to be *B. squarrosa* has resulted in the recognition of a new species *B. aestiva* which is described in this paper. Andrew Burbidge first recognized *B. aestiva* informally as *B.* sp. aff. *squarrosa*.

Methods

Wherever possible, measurements were taken from fresh material or material preserved in formalin-acetic-alcohol (FAA), but some measurements were obtained from dried and detergent-softened herbarium specimens. There was no discernible difference between the measurements taken from differently treated specimens. Where length and width are recorded, these refer to the longest and widest section of the organ in question. Plants were observed in the field to determine habit and some ecological aspects.

Material housed at the Western Australian Herbarium (PERTH) was examined as was Andrew Burbidge's collection currently housed at the Wildlife Research Centre, Department of Conservation and Land Management. The holotype specimen of *B. squarrosa* was located (at LD) and a photograph will be lodged in the Western Australian Herbarium (PERTH).

The distributions of both *B. squarrosa* and *B. aestiva* were mapped using latitudinal and longitudinal data provided with the collections. Collections with a general locality were not mapped but fall within the range indicated by the other collections.

The Latin description was prepared using Stearn (1992) as a reference.

Description

Beaufortia aestiva K.J. Brooks

Frutex 0.7–2 m alta. *Ramuli* pubescentes cum maturitate glabrescentes. *Folia* opposita, decussata, subsessilia, ad basin introrsa, supra recurva, late obovata; lamina 4–11 mm longa, 3–7 mm lata, includens marginem quinquenervia. *Hypanthium* 2.5–4 mm longum, glabrum vel sparsim puberulum. *Sepala* late triangularia, trinervia, ciliata, glabra. *Petala* anguste elliptica, 4.3–5.5 mm longa, 1.4–2.6 lata, membranacea, glabra, alutacea ad armeniaca, marginibus involutis, ciliatis. *Fasciculus staminalis* 18–33 mm longus, ad dimidium divisus staminibus 5–7, glaber, luteolus ad flammeus; filamentum longissimum 18–34 mm longum, brevissimum 14–16 mm longum; antherarum margo apicalis ciliatus. *Stylus* ruber, 21–29 mm longus, stamina aequans vel excedens. *Fructus* persistens, 7–9 mm longus, 6–8 mm latus, 2–16-fasciculatus, saepe circa 8, rasilis, glaber, fuscus. *Semina* alata, 5–6 mm longa, 1–1.5 mm lata.

Typus: 4 km north of Binnu on old section of highway to the west of North West Coastal Highway, Western Australia, latitude 28°01'S, longitude 114°40'E, 25 December 1996, *K.J. Brooks* 96004 (*holo:* PERTH 04951719; *iso:* CANB, K, NSW).

Dense rounded or spreading *shrub* 0.7–2 m tall and to 2 m across. New *branchlets* pubescent, glabrescent with maturity. *Leaves* opposite, decussate, adjacent pairs overlapping, shortly petiolate; blade introrse at base becoming recurved, obovate to broadly obovate, 4–11 mm long, 3–7 mm wide, having an obtuse to slightly cuspidate apex, distinctly 5(–9)-veined including margin, glabrous; abaxial surface prominently punctate. *Inflorescence* terminal, subglobular, 35–45 mm across; flowers *c.* 12–25, all male, all bisexual, or both together. *Hypanthium* turbinate, 2.5–4 mm long, glabrous to sparsely puberulous with glossy colourless to white hairs. *Sepals* broadly triangular, 1.25–3.3 mm long, 1–3.5 mm wide, coriaceous, 3-veined, ciliate (most pronounced towards base); external surface of the lobes glabrous, smooth, green to pale yellowish-green, the internal surface with an indumentum of sparse, appressed, soft, glossy, simple trichomes. *Petals* narrowly elliptic, 4.3–5.5 mm long, 1.4–2.6 mm wide, membranous, glabrous, cream to pale orange-red, deeper colouring confined to central area of petals; margins involute on fresh specimens, ciliate. *Staminal bundles* 18–34 mm long, divided halfway into slender claw and free filaments, glabrous, yellow with red band on claw to deep red throughout; bundles consisting of 5–7(10) filaments of unequal length, the longest filament (including claw) 18–34 mm long, the shortest 14–16 mm long; number of filaments per bundle variable within the same flower; apical margin of anthers ciliate. *Style* red, 21–29 mm long, level with or exceeding longest stamen by up to 4 mm. *Fruits* persistent, 7–9 mm long, 6–8 mm wide, in clusters of 2–16, frequently *c.* 8, smooth, glabrous, silvery brown. *Seeds* one per locule, winged, 5–6 mm long, 1–1.5 mm wide. (Figure 1)

Selected specimens examined (all at PERTH). WESTERN AUSTRALIA: 7 km SSE of Junga Dam, Kalbarri Natl Park, *S.D. Hopper* 1260; 37 km W of North West Coastal Highway on Kalbarri road, *R.J. Hnatiuk* 780358; 25 km E of Binnu, *C.A. Gardner* 12314; East Yuna [Nature] Reserve, *B.G. Muir* 429 (3.10); 8.8 km S on Moore Road from turnoff on Geraldton–Mullewa road, *K.F. Kenneally* 11132; 25 km E of Yandanooka, *A. Carr* 165; 8 km SW of Mt Campbell (between Three Springs and Morawa), *L.A. Craven* 7006; 3 km W of Lake Indoon, *E.A. Griffin* 3029 & *M. Blackwell*; [Reynoldson] Reserve, SE of Kondut, *A.S. George* 508; Tammin, *C.A. Gardner* 1111.

Distribution. Beaufortia aestiva is distributed throughout the north-western region of the extra-dry mediterranean bioclimatic zone (Beard 1984). Relatively small populations are found in clusters extending north from Tammin to the vicinity of Kalbarri National Park (between latitudes 27°20'S and 31°30'S). A large number of populations have been recorded between Kalbarri, Binnu, Yuna and Mullewa. A cluster of populations has been recorded from Mingenew and another around Three Springs. Several populations occur from approximately 35 km north to 25 km south of Eneabba. Four collections have been recorded from Wongan Hills. Several collections were made near Tammin up to 1921 but only one since then, the collector noting a single plant (Livesey, W of Tammin, 8 Nov. 1994, *L. Atkins* HLA181, PERTH). The species is also known from a single collection north of Eurardy Station (latitude 26°58'57"S, longitude 113° 51'47"E). The discontinuity in the clusters of *B. aestiva* from Mingenew to Tammin may be a result of clearing for agriculture, the localities being within the midwest wheatbelt, but ecological aspects have not been studied. (Figure 2)

Habitat. Beaufortia aestiva usually grows on the upper slopes or ridges of undulating sandy plains. These are commonly deep yellow or brown sands formed over a laterite substrate. The species has also been recorded growing in shallow grey sand over a limestone cap. Closed heath to low shrubland predominates on these soils and *B. aestiva* grows amongst species of *Actinostrobus*, *Verticordia*, *Hakea*, *Calothamnus*, *Eremaea*, *Acacia*, *Banksia* and emergent *Grevillea* spp. or *Xylomelum angustifolium*.

Phenology. The peak flowering period is between October and February; but *B. aestiva* flowers from July to late March, and has been collected once at Ajana flowering in May.

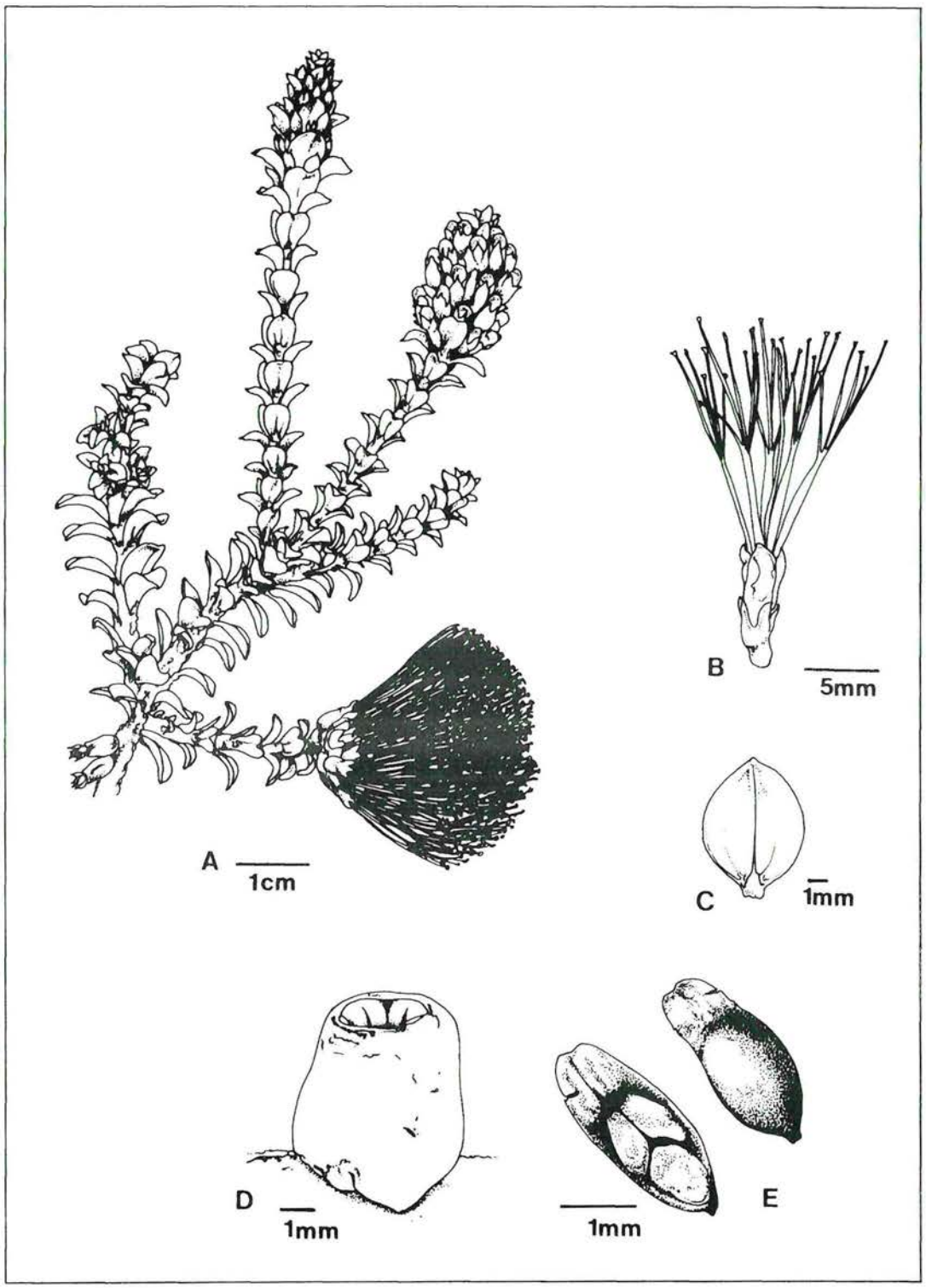


Figure 1. *Beaufortia aestiva*. A – portion of flowering branchlet, B – single flower, C – single leaf showing main venation, D – seed capsule, E – seed. Drawn by Christine McComb from material cultivated at Kings Park and Botanic Garden.

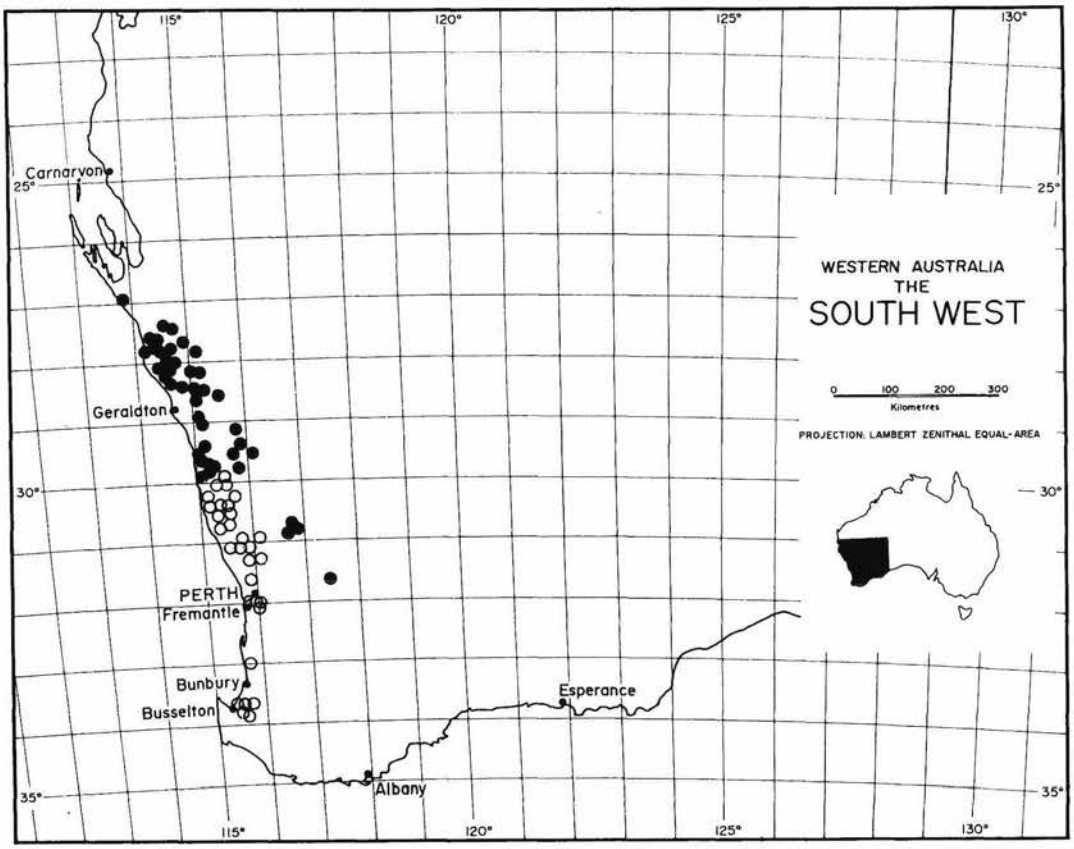


Figure 2. Distribution of *Beaufortia aestiva* ● and *B. squarrosa* ○.

Conservation status. *Beaufortia aestiva* is not considered rare or threatened.

Etymology. The name is derived from the Latin adjective *aestivus* (of summer), in reference to its abundant flowering over the summer period.

Biology. Much of the biology of *B. aestiva* is unknown. The species is bradysporous, retaining its fruits for at least three years, possibly longer. Field observations have shown no dehiscence of the capsule while it is retained on the plant. Not surprisingly, the number of fruits in a cluster tends to be indicative of the ratio of bisexual to male flowers; thus, specimens from the Eneabba area generally have fewer male flowers per inflorescence and larger clusters of fruits. However, the ratio of male to bisexual flowers is variable throughout the species distribution. Both wasps and bees (unidentified) have been observed feeding from the flowers in the field. The plants are non-lignotuberous, being killed by fire and regenerating from seed.

Cultivation. Already cultivated in the Perth metropolitan region, the species makes a good ornamental shrub due to its dense, rounded, habit and large showy flowers throughout much of the year.

Variation. Within *B. aestiva* stamen colour varies from a biscuit-yellow to deep red throughout its range. The yellow form is most common in northern populations. Variation is also seen in the number of filaments per staminal bundle. In some specimens collected from north of Yuna to north-north-east of Eurardy Station (*F.W. Went* 54; *B.G. Muir* 429), the number of stamens increases from 5–7 per bundle to 7–9 per bundle, although occasionally 6 or 10 occur. This variation is most easily seen in specimens in A.A. Burbidge's collection (*D.J. Mell* 2, 7, 8, 9, 10 and 11).

Specimens from the Eneabba area have a tendency towards broadly obovate and slightly larger, more recurved leaves than those found in other populations. In addition, the leaves are commonly distinctly 7-veined (*C. Chapman* 1975; *H. Demarz* D3386), including the margin, as opposed to the more usual 5 veins. In some specimens 9 veins are present on some leaves, in others there appears to be a seasonal change between 5- and 7-veined leaves (*E.A. Griffin* 3029; *R.J. Hnatiuk* 770008). The Eneabba populations also show a tendency towards larger fruit clusters, commonly having 13 to 16 fruits in a cluster. It is possible that further work on the species would yield subspecies or at least variants of *B. aestiva*.

Cytological studies on *B. squarrosa* by Rye (1979) included specimens now considered to be *B. aestiva* as well as true *B. squarrosa*. These were found to have a haploid number of 8 or a diploid number of 16 chromosomes – a specimen from Yuna was recorded as *c.* 8. However, the specimens used in the study did not cover all the variation in stamen number or venation mentioned above. The specimens of *B. aestiva* used by Rye (1979) are databased in PERTH as *B.L. Powell* 74075 & 74097 and *B.L. Rye* 76018.

Affinities. Until now, collections of *B. aestiva* have been determined as *B. squarrosa*. With closer examination the new species is clearly different. *Beaufortia aestiva* is most readily distinguished from *B. squarrosa* in the following ways. Leaves tend to be more broadly obovate, brighter green and are introrse only at the base; the hypanthium is glabrous as opposed to pubescent in *B. squarrosa*, and the ratio of tube to sepal length is *c.* 2:1 rather than 1:1; the calyx lobes are broadly triangular rather than triangular; although the staminal bundles of both species are of similar length, the claw to free filament ratio is 1:1 in *B. aestiva* and 2:1 in *B. squarrosa* and there is an increase in stamen number from 3 or 4 stamens per bundle in *B. squarrosa* to 5–7 stamens (occasionally to 10) per bundle; the fruit is larger at 7–9 mm long and 6–8 mm wide, whereas the fruits of *B. squarrosa* is 4–6 mm long and 4–5.5 mm wide; the number of fruits in a cluster is commonly greater in the new species. In the field, *B. aestiva* tends to have a denser habit than *B. squarrosa*.

Acknowledgements

Dr Neville Marchant, director of the Western Australian Herbarium (PERTH), allowed access to the herbarium collection. We are grateful to Christine McComb for preparing the botanical illustration and to Grady Brand, of Kings Park and Botanic Garden, for providing the cultivated material used for illustrative purposes. Associate Professor Jen McComb, Murdoch University, gave enthusiastic assistance.

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Sphaerolobium pubescens and *Sphaerolobium rostratum* (Leguminosae: Mirbelieae), new species from Western Australia

Ryonen Butcher

Department of Botany, The University of Western Australia, Nedlands, Western Australia 6907

Abstract

Butcher, R. *Sphaerolobium pubescens* and *Sphaerolobium rostratum* (Leguminosae: Mirbelieae), new species from Western Australia. *Nuytsia* 12 (2): 171–178 (1998). Two new species of *Sphaerolobium* from the south-west of Western Australia are here described and distinguished from similar species. *Sphaerolobium pubescens* R. Butcher is a yellow-flowered species possessing spreading white hairs on the calyx, bracts, bracteoles and pedicel and *Sphaerolobium rostratum* R. Butcher has a pink and cream corolla and a distinctive rostrate apex to the keel petal.

Introduction

As currently recognized, the genus *Sphaerolobium* Sm. (Leguminosae: Mirbelieae) contains 14 species, 11 of which are endemic to the south-west of Western Australia and occur between Kalbarri in the north and Israelite Bay in the east, with a marked concentration along the south coast between Margaret River and Albany. Of the three species found in the eastern states, only *S. vimineum* Sm. also grows in Western Australia, *S. acanthos* Crisp being restricted to the Grampians in Victoria and *S. minus* Labill. being found in New South Wales, Victoria, Tasmania, Queensland and the Australian Capital Territory (Hnatiuk 1990; Crisp 1993, 1994). Whilst some recent work has been performed by Crisp (1993, 1994) on members of the group from the eastern states, the genus has not been reviewed in full since Bentham's treatment in "Flora Australiensis" (1864) and there are still a number of unresolved problems with the Western Australian taxa.

This paper is presented as the first in a series which will deal with some of the more problematic areas and pressing changes required in the taxonomy of *Sphaerolobium*. It provides descriptions of two new south-western Australian species that were found while preparing a cladistic analysis and revision of the genus.

Methods

All specimens housed at PERTH were examined and photographs of type material borrowed from Dr M.D. Crisp (ANU) were sighted for 22 of the 24 names listed in "Australian Plant Name Index" (Chapman 1991).

Taxonomy

Sphaerolobium pubescens R. Butcher, *sp. nov.*

Species calyce viridi-griseo pilis albis patulis, corolla lutea, stipite ovarii latissimo a congeneribus diversa.

Typus: Between road and firebreak, 5.1 km south along the Chorkarup–Narrikup road from Chorkarup Rd, Western Australia, 18 November 1996, *R. Butcher, J. Wege & F. Valton* RB 24 (*holo:* PERTH 04896610; *iso:* CANB).

Sub-shrub to 0.45 m, up to 0.3 m wide, erect; stems slender, terete. *Stipules* absent. *Leaves* opposite to more or less whorled, sessile, linear-subulate, *c.* 1.5 mm long, *c.* 0.5 mm wide, acute, caducous before flowering. *Inflorescence* a dense terminal raceme, basipetal flowering, *c.* 50 mm long, 20–31-flowered, 2 flowers per bract. *Pedicels c.* 1.5 mm long. *Bracts* caducous. *Bracteoles* ovate, *c.* 1.6 mm long, *c.* 0.7 mm wide, pubescent, caducous. *Calyx* grey-brown, turbinate, 2.5–4 mm long, with spreading white hairs, the tube much shorter than the upper lip; upper lip fused along *c.* 60% of its length, 2–2.5 mm long, broadly curved; lower lobes lanceolate, 1.5–2 mm long. *Corolla* yellow; standard broadly cordate, 4–6 mm long, 4–6 mm wide, including a broadly triangular claw of 0.3–0.6 mm length, this with flat margins and without callosities, the blade emarginate and auriculate, the eye barely visible with a halo of red-purple; wings broadly spathulate to oblong, 4.5–5.5 mm long, 1.5–2 mm wide, including a claw of *c.* 0.5 mm length, the apex of the blade obtuse, the adaxial spur sharply angled; keel shorter than the wings, 3–4.5 mm long, 2–2.5 mm wide, including a narrow claw of *c.* 1 mm length, the whole not pouched, the apex truncate to obtuse, the adaxial edge straight, oblique, the spur small, the abaxial edge gently arcuate. *Stamens* with filaments 2–3 mm long; anthers rotund, versatile, dorsifixed, 0.35–0.45 mm long. *Gynoecium* 6–7 mm long including the distinct broad stipe (*c.* 1 mm long, *c.* 0.5 mm wide) and the style (3–4 mm long); ovary glabrous, uniformly pale yellowish green; style geniculate, curving adaxially towards ovary, with an undulate, more or less semicircular (0.6–0.8 mm long, 0.4–0.6 mm wide), fringed subapical wing; stigma shortly tufted. *Pod* at first yellow, brown at maturity, orbicular, broader than long, 2.5–3 mm long, 3 mm wide, obliquely angled towards style. *Seed* black at maturity, more or less oval, *c.* 1.2 mm long, 1.5 mm wide, without an aril, testa smooth. (Figure 1A-H)

Other specimens examined. WESTERN AUSTRALIA: 5.1 km S along Gull Rock Rd from Lower King–Nannarup road, 10 Oct. 1997, *R. Butcher & J. Chappill* JC 5892 (PERTH); Nutcracker Rd, 600 m W of Denmark-Mount Barker road, 19 Nov. 1996, *R. Butcher, J. Wege & F. Valton* RB 30 (PERTH); 16 km N of Albany on Hassel Hwy, 21 Oct. 1983, *M.G. Corrick* 8879 (MEL); Lake Rd, NW Lake William, West Cape Howe, 3 Nov. 1990, *G. J. Keighery* 11978 (PERTH); 6 km E of Warriup Hill, 23 Oct. 1975, *K.R. Newbey* 4886 (PERTH); Walpole–Nornalup National Park, Nut Rd, *c.* 0.5 km N of junction with Ficifolia Rd, 16 Oct. 1991, *J.R. Wheeler* 2786 (PERTH).

Distribution. S. pubescens has been found in the Walpole–Nornalup National Park, near Mt Lindesay and Narrikup, in West Cape Howe National Park and east of Albany near Ledge Beach and Warriup Hill in the Green Range. (Figure 2A)

Habitat. S. pubescens has been collected from gently undulating areas with well drained sand over clay and relatively high moisture availability, as well as seasonally wet swamp flats. Habitats include low heath communities and sparse, mixed *Casuarina*/*Eucalyptus* woodland, sometimes with scattered *Nuytsia floribunda* and *Banksia coccinea*. Associated vegetation includes *Pimelea* spp., *Xanthorrhoea preissii, X. gracilis, Dasypogon bromeliifolius*, mixed sedges and myrtaceous shrubs.

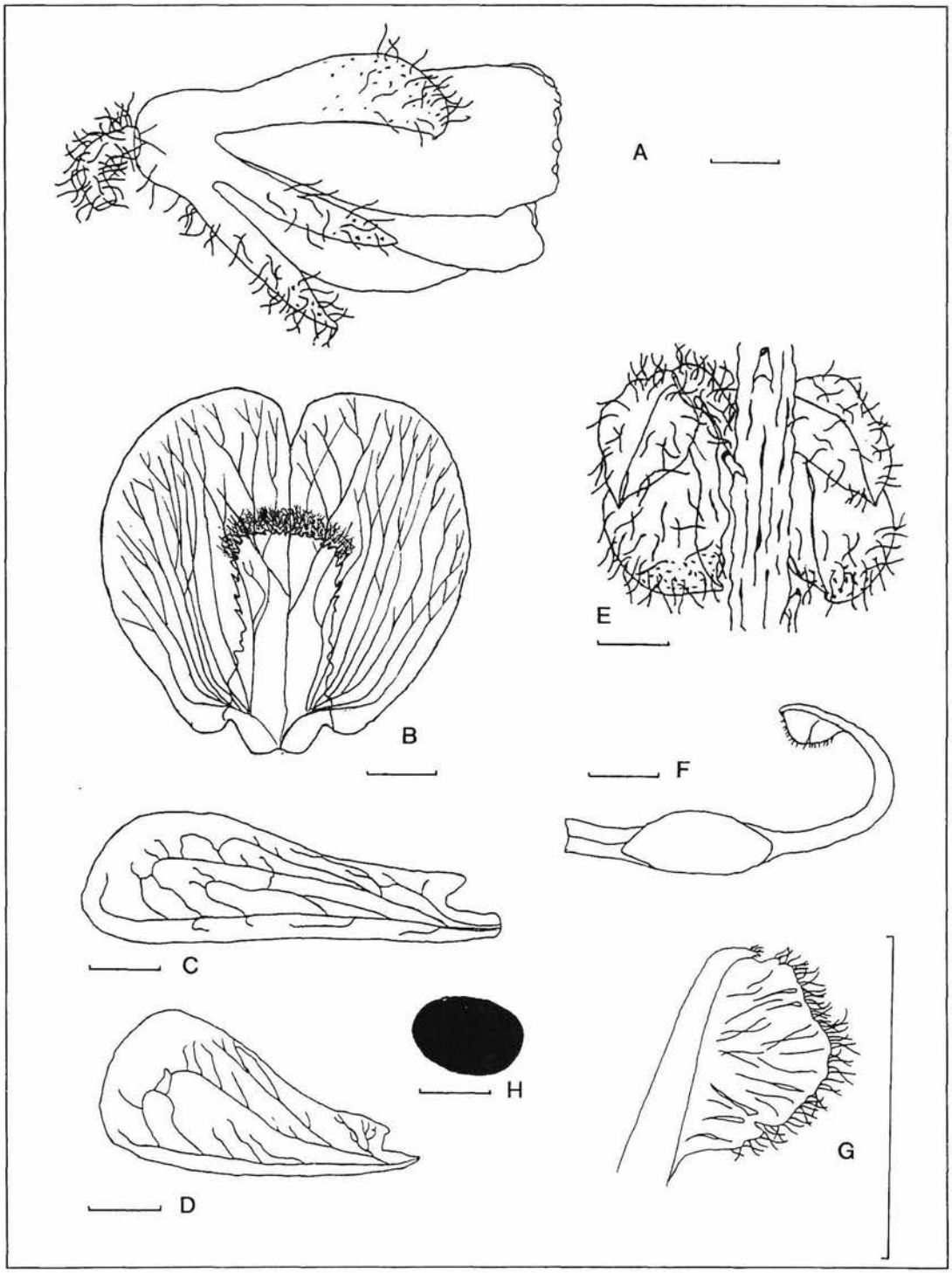

Figure 1. *Sphaerolobium pubescens*. A – single flower showing spreading hairs on the calyx and pedicel; B – standard petal; C – wing petal; D – keel petal; E – two buds illustrating the spreading hairs on the bracteoles; F – gynoecium indicating the short, broad stipe and the broad, fringed stylar wing below the stigma; G – undulating stylar wing and shortly tufted stigma; H – mature seed. Scale bar = 1 mm. Drawn from *R. Butcher, J. Wege & F. Valton* RB 24.

Phenology. *S. pubescens* flowers from October through November and sets fruit from November to January.

Conservation status. Although recent collection of *S. pubescens* has expanded its known range somewhat and two populations are in national parks, a Priority Three conservation code is considered appropriate for this species pending further survey.

Etymology. The specific epithet is the Latin word *pubescens* and refers to the hairs on the calyx, bracts, bracteoles and pedicels of this species.

Affinities. *S. pubescens* is easily distinguished from all other *Sphaerolobium* species by the long, spreading hairs on its calyx, bracts, bracteoles and pedicels. Superficially, however, *S. pubescens* resembles the eastern Australian species *S. minus*, as both have small flowers in dense, basipetal, terminal racemes and both possess uniformly brown to grey calyces. *S. pubescens* can be differentiated from *S. minus* by its slightly larger, all yellow flowers (*c.* 7 mm compared with 5–6 mm long), short, thick stipe and very broad, densely fringed stylar wing. In *S. minus* the flowers have a red area around the standard eye, at the base of the wing petals and sometimes at the apex of the keel, the stipe is long and narrow (1.2–1.7 mm long, 0.2 mm wide compared with 1 mm long, 0.5 mm wide), as is the stylar wing (0.7–1.6 mm long, 0.25–0.4 mm wide compared with 0.6–0.8 mm long, 0.4–0.6 mm wide).

An as yet undescribed taxon with affinities to the *S. macranthum* Meisn. complex which has been collected from near Scott River and the Albany area as well as the Stirling Ranges superficially resembles *S. pubescens* in its inflorescence structure and calyx and corolla colour, but can be easily distinguished by the red base to the wing petals, the prominent keel and the narrower, sparsely fringed stylar wing. The recognition of this taxon awaits a more extensive study of the *S. macranthum* complex to determine its rank.

Sphaerolobium rostratum R. Butcher, *sp. nov.*

Calyx turbinatus vel campanulatus, glaber, viridus et atropunctatus. Corolla rosea et aurantiaca; carina lata, alis et vexillio multo longior, ad apicem rostrata. Ovarium lutea cum maculis virentibus ad brunneis ornatum.

Typus: 600 m west of Peaceful Bay Rd along South Coast Highway, Western Australia, 11 October 1997, *R. Butcher & J. Chappill* RB 355 (*holo*: PERTH 05053234; *iso:* CANB, MEL, NSW).

Sub-shrub to 1.5 m, width to 0.4 m, erect to sprawling; stems slender, terete. *Stipules* absent. *Leaves* opposite, sessile, linear-subulate, *c.* 1 mm long, *c.* 0.4 mm wide, acute, caducous before flowering. *Inflorescence* a loose terminal raceme, basipetal flowering, 150–350 mm long, 5–20-flowered, 2 flowers per bract. *Pedicels* 1.6–1.7 mm long. *Bracts* caducous. *Bracteoles* ovate, *c.* 3 mm long, *c.* 1.5 mm wide, caducous. *Calyx* dark green and darkly punctate, turbinate to campanulate, 4–6 mm long, glabrous, the tube equal to or slightly longer than the upper lip; upper lip fused along *c.* 80% of its length, 2–4 mm long, rounded to truncate; lower lobes lanceolate, 2–3 mm long. *Corolla* pink and cream; standard pink, broadly cordate to orbicular, 5–9 mm long, 6–8 mm wide, including a narrow claw of 2.5–3 mm length, this with prominent callosities at apex and inrolled margins, the blade emarginate, auriculate, with a yellow, semicircular standard eye bordered with red; wings dark pink, oblong, 8–9.5 mm long, 2–4 mm wide, including a narrow claw of 2.5–3 mm length, adaxial spur sharply angled, the apex of the blade obtuse to truncate; keel cream, infused with pale pink, longer than

Figure 2. Distribution in the south-west of Western Australia. A – *Sphaerolobium pubescens*. B – *Sphaerolobium rostratum*.

the wings and standard, 9–11 mm long, 4–5 mm wide, including a narrow claw of 2–3 mm length, pouched diagonally from spur towards centre, the apex obtuse with distinct acuminate to rostrate apex (*c.* 1 mm long), the adaxial edge straight, oblique, adaxial spur triangular, abaxial edge strongly arcuate. *Stamens* with filaments *c.* 7.5 mm long; anthers narrowly ovate, versatile, dorsifixed, 0.6–0.7 mm long. *Gynoecium* 13–16 mm long including the stipe (3–3.5 mm long, 0.4–0.5 mm wide) and the style (6–7.5 mm long); ovary glabrous, egg-yolk yellow with distinctive green-brown patches from base; style curving adaxially, twisted just below apex, with a flat, narrow (1.5–2 mm long, 0.25–0.5 mm wide), fringed subapical wing; stigma tufted. *Pod* light brown with black patches from base, orbicular, compressed adaxially, *c.* 4 mm long, *c.* 3.5–4 mm wide, obliquely angled towards style. *Seed* cream and darkly punctate at first, brown with merging black spots at maturity, obovate, *c.* 1.7 mm long, *c.* 2.1 mm wide, arillate, testa smooth; aril *c.* 0.2 mm long. (Figure 3A–H)

Other specimens examined. WESTERN AUSTRALIA: Walpole–Nornalup National Park, KA 100054, PT.306, 6 Sep. 1988, *A.R. Annels* 338 (PERTH); Plot 5086, Nornalup Rd, 24.5 km SSW of Rocky Gully, 28 Sep. 1993, *A.R. Annels* ARA 3943 (PERTH; MJP); 1.7 km E of Bow Bridge on South Coast Hwy, 19 Nov. 1996, *R. Butcher, J. Wege & F. Valton* RB 31 (UWA); Denmark shire, S boundary of proposed National Park, Nutcracker Rd, 0.5 km W from Denmark–Mount Barker road, 3 Oct. 1991, *B.G. Hammersley* 538 (PERTH); Walpole–Nornalup National Park, Isle Rd, *c.* 0.6 km S of South West Hwy, 15 Oct. 1991, *J.R. Wheeler* 2744 (PERTH); Walpole–Nornalup National Park, Isle Rd, *c.* 0.5 km S of South West Hwy, 1 Dec. 1992, *J.R. Wheeler & S.J. Patrick* 3631 (PERTH); 7 km W of Walpole, 2 Apr. 1967, *P.G. Wilson* 6327a (PERTH); Coalmine Beach, S of Walpole, 28 Oct. 1994, *A. Worz* 04.10.28.13 (PERTH).

Distribution. S. rostratum has been mostly collected from Walpole–Nornalup National Park and its surrounds but two outlying collections have been made from near Mt Lindesay to the north-east and northward towards Lake Surprise on Nornalup Rd. (Figure 2B)

Habitat. S. rostratum is commonly found growing in sandy soil and clayey sand in seasonally wet swamps and *Agonis parviceps/Bossiaea* shrubland fringing creeks or other moist areas. Associated vegetation in these habitats includes *Homalospermum firmum, Xanthosia rotundifolia, Kunzea ericifolia* and *Anarthria scabra* as well as *Anigozanthus flavidus* and *Pteridium esculentum* in disturbed sites. The *Annels* 3943 collection, made from the valley floor, differs in its associated vegetation and includes *Persoonia microcarpa, Banksia quercifolia, Cosmelia rubra, Callistemon glauca, Sphenotoma gracile* and *Cephalotus follicularis*, suggesting a different habitat and therefore the possibility of more dispersed collections being made for the species.

Phenology. S. rostratum flowers between September and December and fruits from October to January.

Conservation status. S. rostratum appears restricted to the Warren Botanical District with only two populations located outside the Walpole–Nornalup National Park. A Priority Three conservation code is therefore recommended.

Etymology. The specific epithet is derived from the Latin word *rostratus* meaning "beaked" and refers to the distinctive apex of the keel petals.

Affinities. S. rostratum is superficially similar to *S. grandiflorum* Benth. as both possess large (7–11 mm long) flowers and calyces that are dark green and darkly punctate with the tube approximately equal in length to the upper lobes. *S. grandiflorum* can be differentiated from *S. rostratum*, however, by a distinct black line along the margins of its calyx lobes as well as its

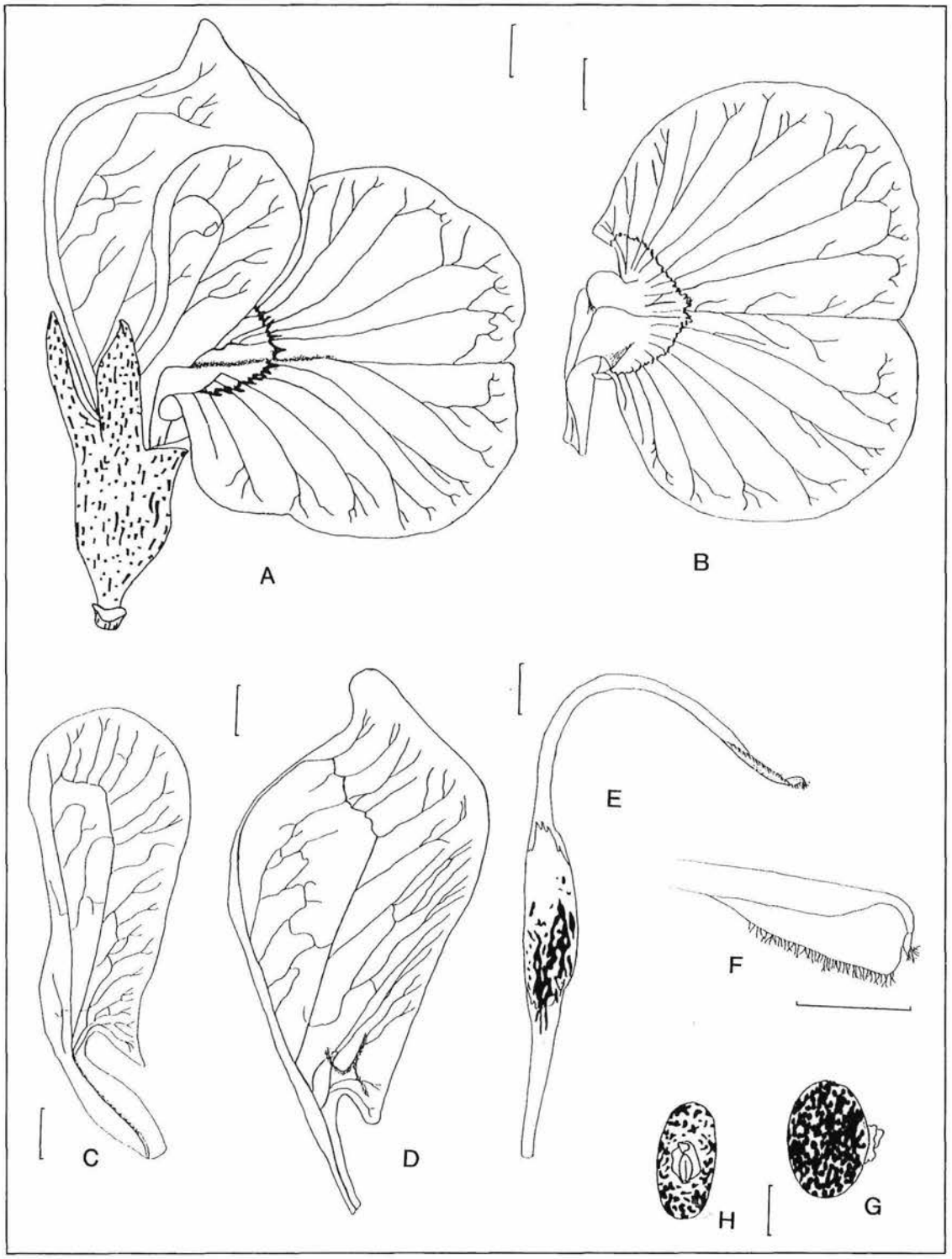

Figure 3. *Sphaerolobium rostratum*. A – single flower illustrating the length of the keel relative to the other petals and the darkly punctate calyx; B – standard petal showing the semicircular eye and the large callosities on the claw; C – wing petal; D – keel petal with rostrate apex; E – gynoecium indicating the long, narrow stipe, the ovary with dark patches from its base and the narrow, twisted stylar wing; F – flat stylar wing with tufted stigma; G – mature seed with cream aril; H – top surface of seed showing aril surrounding hilar fissure. Scale bar = 1 mm. Drawn from *R. Butcher & J. Chappill* RB 355.

geniculate keel petal with an obtuse apex which is shorter than the standard (7.5–8.5 mm long compared with 9–11 mm long). Additionally, *S. grandiflorum* has a dark green-brown to black ovary and a sharply curved style which twists 360° near the broad, densely fringed stylar wing as pods develop. The green and darkly punctate calyx and prominent keel apex of *S. rostratum* draws comparison with *S. medium* R. Br. but this latter taxon can be easily differentiated by its shorter, somewhat sprawling habit (0.4–0.8 m tall, 0.3–0.6 m wide compared with 0.8–1.5 m tall, *c.* 0.4 m wide), smaller (6–8 mm long compared with 9–11 mm long) yellow to pink flowers, more dense inflorescences (20–60 compared with 5–20 flowers) and the calyx tube shorter than the lobes. Additionally, *S. medium* has a more or less oblong keel with an acuminate apex, whilst that of *S. rostratum* is broadly curved, rostrate and considerably longer in relation to the other petals. *S. medium* can also be differentiated by its uniformly pale yellowish green ovary and straight, naked style.

Acknowledgements

I wish to thank my Honours supervisor Dr Jenny Chappill at the University of Western Australia for her invaluable comments on previous drafts, Dr Michael Crisp from the Australian National University for the loan of type photographs, and the staff and volunteers at the Western Australian Herbarium for their help in this study. I would also like to thank Mr Paul Wilson for his considerable help with the Latin component and Judy Wheeler for having a keen eye. My thanks also to the referee Dr Jim Grimes, and Dr Barbara Rye for their comments on this manuscript.

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Brachyloma nguba (Epacridaceae), a new species from the south-west of Western Australia

R.J. Cranfield

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Cranfield, R.J. *Brachyloma nguba* (Epacridaceae), a new species from the south-west of Western Australia. *Nuytsia* 12 (2): 179–183(1998). A new species endemic to the South West Botanical Province of Western Australia, *Brachyloma nguba* Cranfield, is described, illustrated and mapped. A key to the Western Australian species of *Brachyloma* (Epacridaceae) is provided.

Introduction

A specimen of *Brachyloma* (Epacridaceae) collected by the author in March 1997 east of Hyden was found to be different from the two known Western Australian species, *Brachyloma preissii* Sond. and *B. concolor* F. Muell. ex Benth. Detailed examination showed the material to be a new species. A subsequent search of herbarium records (PERTH) provided evidence that this sample was a third collection of this species from the same area.

Methods

All the material examined in this study is held at PERTH. Two or three flowers were measured from each of the three collections of the new species and the same number of flowers from selected sheets representing the other two Western Australian species. Measurements of leaves were made to encompass a range of sizes but exclude the extremes resulting from age and growth variations.

Taxonomy

Diagnostic characters for Western Australian species of *Brachyloma* are given in Table 1. The shorter pedicels, calyx lobes and style and the truncate hypogynous disc separate the new species from the other two species, *Brachyloma concolor* and *Brachyloma preissii*.

It also appears from the table that *B. nguba* is distinguished by its smaller leaves and revolute leaf margins, but the table excludes a few atypically small-leaved specimens of uncertain taxonomic status

that would partially bridge this apparent gap between the new and old species. Both *Brachyloma preissii* and *Brachyloma concolor* appear to contain several entities that require further investigation but are currently known from very little material. These include a small-leaved variant Sonder (1845) described as *Brachyloma preissii* var. *brevifolium* Sond. More collections are needed to further elucidate the taxonomy of this complex species group.

Table 1. Characters distinguishing Western Australian species of *Brachyloma*.

Character	*B. nguba*	*B. preissi*	*B. concolor*
leaf			
length (mm)	2.0–3.0	8.0–17.0	5.0–13.0
width (mm)	0.9–1.0	3.0–4.0	2.5–4.0
petiole length (mm)	0.4–0.6	1.0–1.6	0.5–1.0
section	revolute	flat-convex	flat-concave
apex	acute-apiculate	acute-apiculate	apiculate
flower			
pedicel length (mm)	0.2–0.3	1.5–2.0	1.0–1.5
sepal length (mm)	0.5–1.0	1.0–3.5	1.0–1.5
style length (mm)	0.2–0.25	1.5–2.0	1.0–1.5
hypogynous disc	truncate	shallowly 5-lobed	prominently 5-lobed
ovary locules	3, 4	4, 5	5

Key to Western Australian species of *Brachyloma*

1. Leaves concave, concolorous. Style 1.5–2.0 mm long. Disc prominently 5-lobed ..... **B. concolor**
1. Leaves flat to revolute, discolorous. Style 0.2–1.5 mm long. Disc shallowly 5-lobed to truncate
   2. Leaves usually 8–17 x 3–4 mm. Style 1–1.5 mm long. Disc shallowly 5-lobed ..... **B. preissii**
   2. Leaves usually 2–3 x *c.* 0.9 mm. Style 0.2–0.25 mm long. Disc truncate ..... **B. nguba**

Brachyloma nguba Cranfield, *sp. nov.*

Brachylomi preissii similis sed foliis minoribus ad margines recurvis, stylo c. 0.25 mm (v. 1–1.5 mm) brevivore differt.

Typus: 50 km east-north-east of Hyden (32° 24' 45", 119° 23' 29"), Western Australia, 7 April 1997, *R.J. Cranfield* 11181 (*holo:* PERTH 04671724; *iso:* CANB).

Shrub to 40 cm high. *Branchlets* hispid. *Leaves* alternate, terminally clustered on short branchlets, erect; petiole 0.4–0.6 x 0.1–0.2 mm, hispid; lamina narrowly elliptic, 2.0–3.0 x 0.9–1.0 mm, sparsely scabrid adaxially, hispid abaxially, with numerous prominent veins; margins recurved; apex acute with a short mucro. *Inflorescence* of solitary axillary flowers in terminal leaf clusters. *Pedicels* 0.2–0.3 mm long; bracteoles 3, sessile, imbricate, 0.5–1 mm long, margin fringed, apex acute; bracts

2, 1.5–2 mm long, margin ciliate, apex obtuse. *Sepals* 5, imbricate, ovate, 0.5–1 x 0.5–1.0 mm, green; margin fringed; apex obtuse. *Corolla* red; tube urceolate, 3–4.5 x 1.5–2 mm, throat constricted below lobes; internal reflexed scales 0.25 x 0.4 mm, with long hairs on apex; lobes 5, spreading, broadly triangular, 1.5–2 x *c.* 1.5 mm, acute and apex reflexed. *Stamens* 5; anther linear, 1–1.25 x *c.* 0.25 mm, longitudinally dehiscent. *Hypogynous disc* truncate, *c.* 0.25 mm wide. *Ovary* ovoid, glabrous, *c.* 1.1 x 0.9–1.0 mm, 3- or 4-locular; ovules 1 per loculus, white, *c.* 0.45 x 0.15 mm, ellipsoid; style 0.20–0.25 mm long. *Fruit* not seen. (Figure 1)

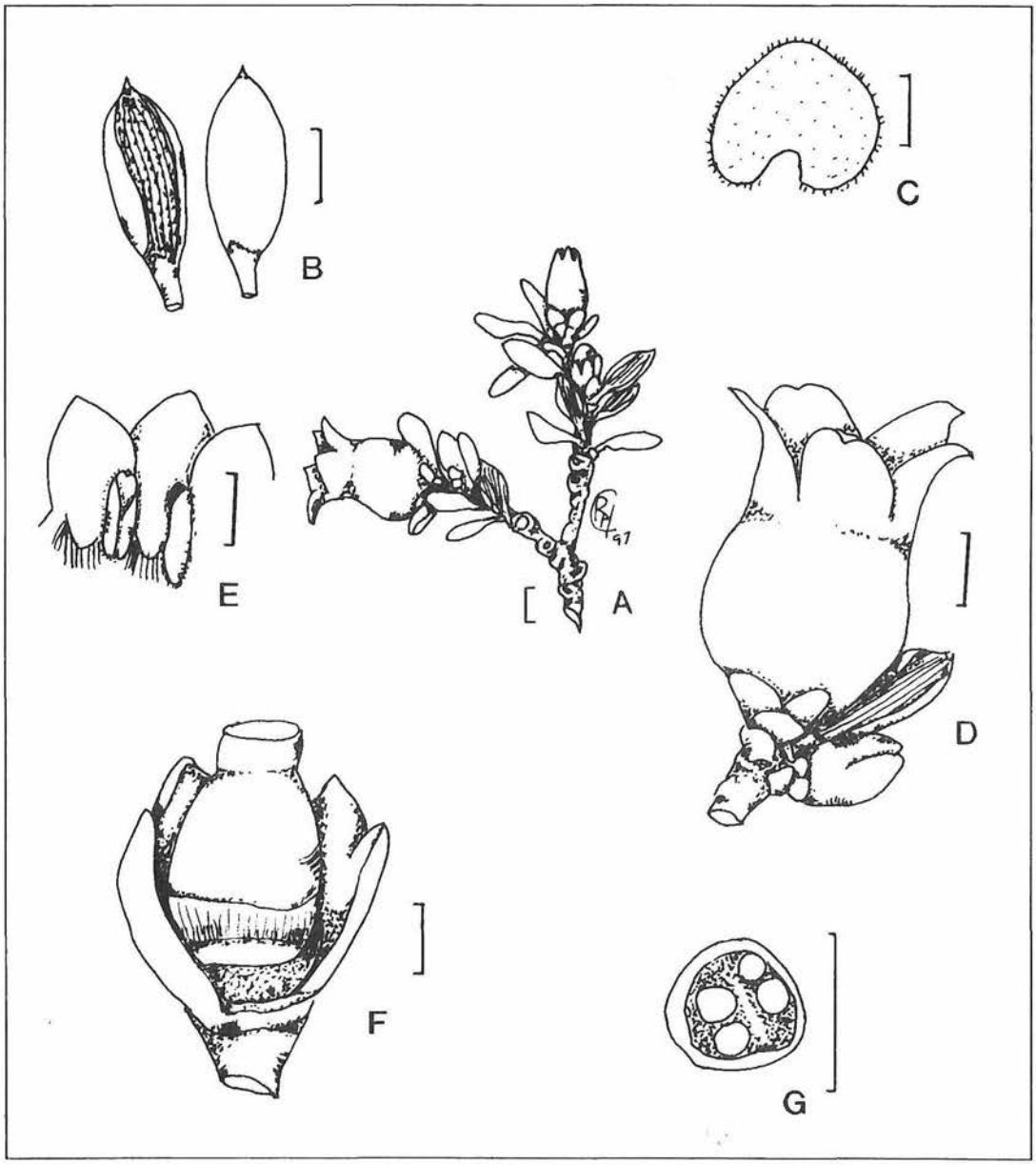

Figure 1. *Brachyloma nguba*. A – branchlet, B – leaf, C – bract, D – flower, E – anthers and lobes, F – ovary and style, G – cross-section of ovary. Scale bars = 1 mm. Drawn from the holotype.

Other specimens examined. WESTERN AUSTRALIA: 39 km E of Pingaring, May 1969, *A.S. George* 9339 (PERTH); 64 km E of Hyden, June 1966, *Smith & Kessell* 11 (PERTH).

Distribution. Endemic to the Roe Botanical District in the South West Botanical Province of Western Australia. This species is known from three collections, two from the type area and the remaining one from Pingaring, all locations being within the eastern wheatbelt. (Figure 2)

Habitat. Open mallee woodland–mallee scrub over white to brown sandy clay.

Flowering time. April to May.

Conservation status. CALM Conservation Code for Western Australian Flora: Priority One. This species is known from three collections, two from the type area and the third from Pingaring.

Etymology. The specific epithet is from the Nyoongar aboriginal word *nguba* for blood, referring to the small bright red flowers (Bindon & Chadwick 1992).

Notes. Brachyloma nguba is related to *Brachyloma preissii*, differing in having many leaf and floral characters greatly reduced in size, particularly style length, and in its truncate disc.

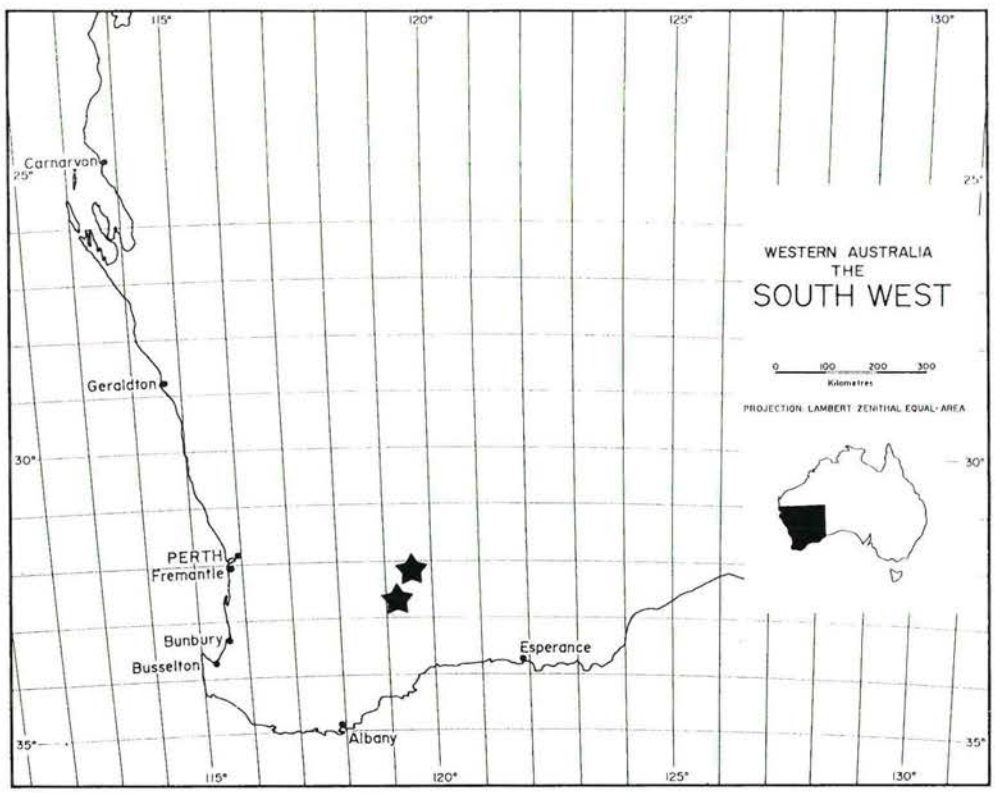

Figure 2. Distribution of *Brachyloma nguba.*

Acknowledgements

The Latin description was kindly prepared by Mr Paul G. Wilson along with other taxonomic advice. I also wish to thank Barbara Rye and John Hunter for their comments.

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Xanthosia eichleri, a new species of Apiaceae from Western Australia

J.M. Hart and M.J. Henwood

John Ray Herbarium, School of Biological Sciences, Macleay Building A12,
The University of Sydney, New South Wales 2006, Australia

Abstract

J.M. Hart and M.J. Henwood. *Xanthosia eichleri*, a new species of Apiaceae from Western Australia. Nuytsia 12 (2): 185–189 (1998). A new species in the Apiaceae, occurring in south west Western Australia, is described as *Xanthosia eichleri* J.M. Hart & M.J. Henwood. A key is provided to *Xanthosia eichleri* and its allies.

Introduction

As a result of a revision of *Xanthosia* and allied genera in the Apiaceae, a previously undescribed species from south west Western Australia is named *Xanthosia eichleri*. This species was first collected by S.W. Jackson at 'Bow River' in 1912. The specimen was deposited in the National Herbarium of NSW where it was placed within *Xanthosia tridentata*, a morphologically similar species from eastern Australia. No further collections of the species were made until 1982 when it was found beside the South Coast Highway between Denmark and Walpole; all subsequent collections have been made since 1990.

Xanthosia eichleri is a member of a morphologically distinctive group comprising five of the twenty species in the genus. The group, here referred to as the *X. tridentata* group, is characterized by fruits which are glabrous, smooth to very minutely papillate and are surmounted by slightly raised, glabrous nectaries. The taxonomic status of this group is currently under investigation. All other species in the genus have more prominent, hirsute to villous nectaries, fruits which are hirsute at least on the summit and are never minutely papillate.

Key to the *Xanthosia tridentata* group

1 Sepals peltate; eastern Australia ..... **Xanthosia tridentata**
1: Sepals not peltate; Western Australia 2
2 Leaves simple 3
2: Leaves ternately compound 4
3 Umbels simple; petals shorter than the sepals; leaves cuneate, margins often tridentate ..... **Xanthosia eichleri**
3: Umbels usually compound; petals equal to the sepals; leaves linear, margins usually entire ..... **Xanthosia ciliata**

4 Subshrub to 0.2 m high; umbels simple; peduncles reflexed; stamens about the same length as perianth; flowers green ..... **Xanthosia fruticulosa**

4: Shrub to 1.0 m high; umbels compound; peduncles erect; stamens longer than the perianth; flowers cream ..... **Xanthosia bungei**

Xanthosia eichleri J.M. Hart & M.J. Henwood, *sp. nov.*

Xanthosia sp. Warren (*A.R. Annels* 1265)

Xanthosiae tridentatae affinis sed folia integra ad tridentata; umbellae simplices cum 2–6 floribus; sepala non peltata, longiora petala; fructus 5–7 nervatus.

Typus: Gladstone Falls, Deep River, Warren District, Western Australia, 31 October 1990, *A.R. Annels* 1265 (*holo:* PERTH 3129217; *iso:* MJP 4553).

Erect, procumbent or decumbent perennial *subshrub* to 0.25 m high, sparsely hirsute, the stem becoming flaky when aged. *Leaves* simple, cauline, petiolate; petiole sheathing, *c.* 0.8 mm long, ciliate; lamina cuneate, 5–12 mm long, 1–4 mm wide, tridentate or less often entire. *Involucral bracts* 4 or 5, obovate or lanceolate, foliaceous, green, shorter than flowers, 2.1–2.6 mm long, 0.9–1.1 mm wide, apex acute. *Inflorescence* of simple umbels; umbels 2–6-flowered, leaf-opposed, often borne in pairs, pedunculate; peduncles 1.0–3.6 mm long. *Flowers* pedicellate, mostly bisexual, rarely male. *Sepals* 5, lanceolate, 1–1.6 mm long, *c.* 0.5 mm wide, green, glabrous. *Petals* 5, shorter than sepals, spathulate, the base clawed, 0.7–0.8 mm long, *c.* 0.4 mm wide, white or cream, the midrib adaxially keeled and forming a bridge with the inflexed appendix. *Stamens* 5, approximately equal to the perianth; filaments *c.* 0.5 mm long; anthers dorsally attached, *c.* 0.2 mm long. *Nectaries* 2, slightly raised, *c.* 0.3 mm high, free from the styles, glabrous. *Styles* 2, upright at male anthesis, spreading at female anthesis, up to 0.5 mm long. *Ovary* bicarpellate, laterally flattened, glabrous. *Male flowers* differ from the bisexual flowers in having an undeveloped inconspicuous ovary, with the styles barely protruding above the nectaries. *Fruit* brown, ovoid, 1.7–1.9 mm long, 1.3–2 mm wide, *c.* 0.4 mm deep. *Mericarps* glabrous, minutely papillate, ovate or elliptic in transverse section, 5–7 ribbed, the ribs keeled. (Figure 1)

Selected specimens (16 examined). WESTERN AUSTRALIA: Watershed Rd 1.8 km N of Basin Rd, 20 km NW of Denmark, 34°45'21"S, 117°08'10"E, 19 Nov. 1991, *A.R. Annels* 1977 (PERTH); Corner of Break & Nornalup roads, 34°49'18"S, 116°57'52"E, 28 Nov. 1994, *A.R. Annels* 5043 (MJP); Private property 2 km SSW of Mt Lindesay, 34°51'30"S, 117°18'00"E, 28 Oct. 1992, *B.G. Hammersley* 771 (PERTH); Denmark Shire–Centre Break road 5.5 km E from Denmark–Mount Barker road, 34°49'55"S, 117°27'50"E, 1 Oct. 1994, *B.G. Hammersley* 1180 (PERTH); Break Rd, 1 km W of Kent River crossing, 34°50'10"S, 117°03'00"E, 22 Oct. 1994, *B.G. Hammersley* 1234 (PERTH); Gladstone Falls, Deep River, 34°52'50"S, 116°35'11"E, 2 Feb. 1997, *J.M. Hart* 403 (CANB, PERTH, SYD); Gladstone Falls, Deep River, 7 Nov. 1995, *J.M. Hart* 95106 (CANB, MEL, NSW, PERTH, SYD); 2.6 km N of Mitchell River on Denmark–Mt Barker road, 9 Nov. 1995, *J.M. Hart* 95117 (PERTH, SYD); Shannon Rock, 1.2 km by road NW of Shannon River, South Western Highway, Shannon National Park, 8 Dec. 1997, *M.J. Henwood* 498 (SYD); Bow River, Nov. 1912, *S.W. Jackson* (NSW); Between Denmark and Walpole near takeoff to Parry Beach along South Coast Highway, 35°01'S, 117°09'E, 9 Dec. 1982, *K.H. Rechinger* 60181 (PERTH).

Distribution. Western Australia: Menzies and Warren Districts: from Shannon National Park east to Sheepwash Creek National Park and south to the coast. (Figure 2)

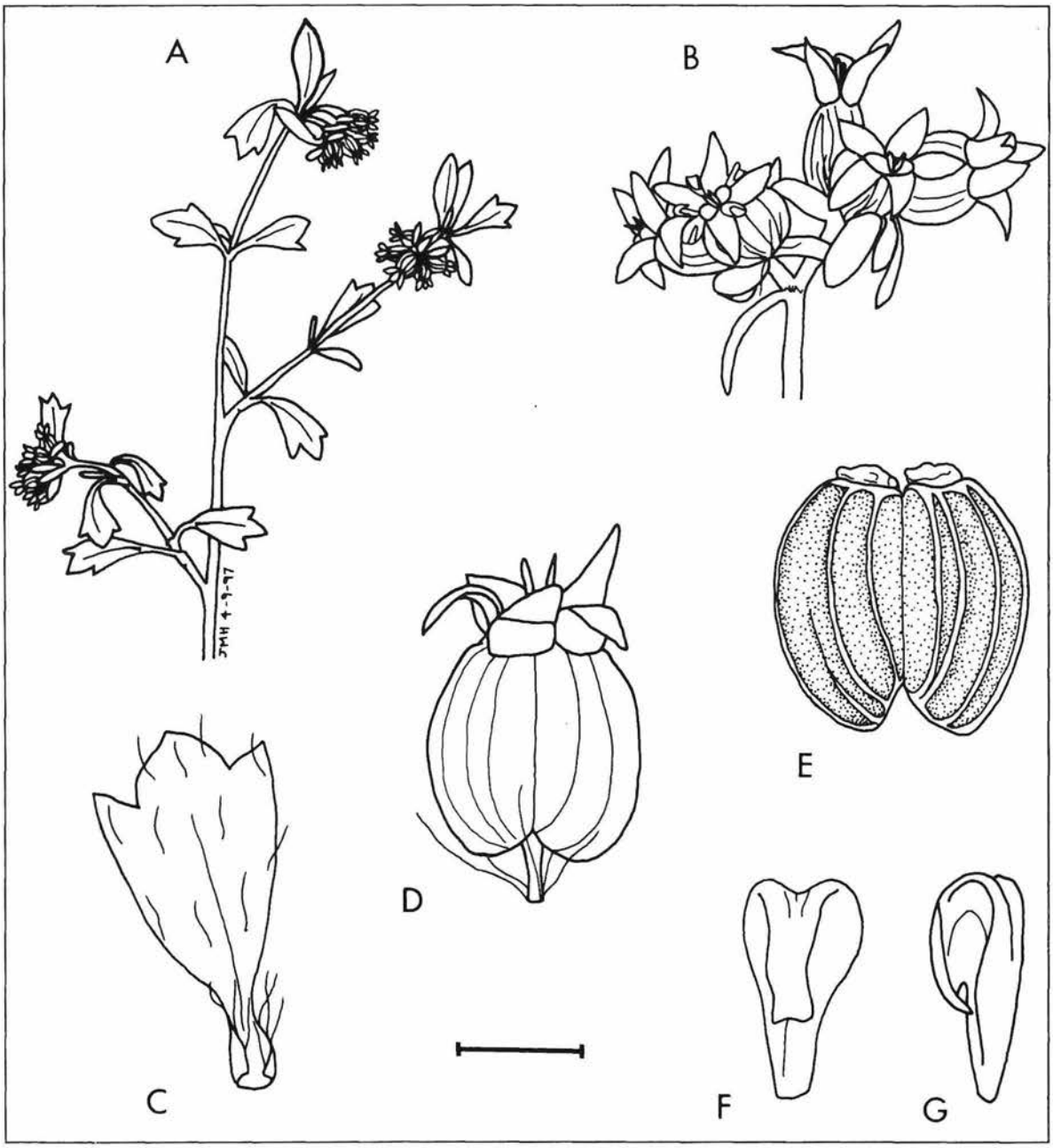

Figure 1. *Xanthosia eichleri*. A – branchlet (scale 10 mm); B – a pair of umbels (scale 2.5 mm); C – leaf with sheathing petiole (scale 3 mm); D – flower, female phase (scale 1 mm); E – fruit, styles shed (scale 1 mm); F, G petals; F – adaxial view showing inflexion, G – side view (scale 0.4 mm). Drawn from *J.M. Hart* 95106 (A–D, F, G) and *J.M. Hart* 403 (E).

Habitat. Sand, sandy loam or granite outcrops mainly in Jarrah-Marri woodland. Most collections are from roadsides.

Phenology. Flowering: October to November. Fruiting: December to February.

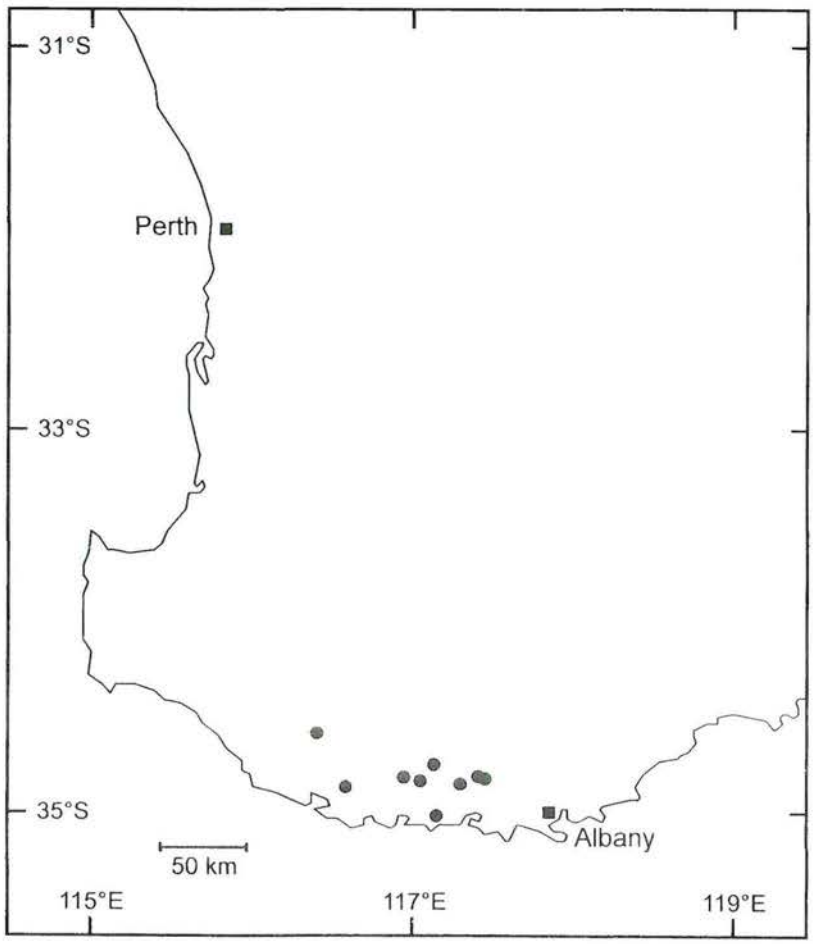

Figure 2. Known distribution of *Xanthosia eichleri* in south west Western Australia.

Conservation status. 2RC– (Briggs & Leigh 1995). Known geographical range restricted to less than 100 km. Three collections have been made within national parks and most collections are from roadsides. The size of the populations within national parks is unknown. The species has no identified threats and is perhaps more common within its range than the current number of collections would suggest. CALM Conservation Codes for Western Australian Flora: Priority Three.

Etymology. The specific epithet honours the late Dr Hansjöerg Eichler (1916–1992) in recognition of his contribution to the taxonomy of *Xanthosia* and the Australian Apiaceae.

Affinities. *Xanthosia eichleri* is distinguished from *Xanthosia tridentata* by the former's smaller leaves (which are not always tridentate), simple umbels, fruits with fewer ribs and non-peltate sepals. *Xanthosia eichleri* is also similar to *Xanthosia fruticulosa* but differs from it in having simple rather than compound leaves. Fruits of *X. fruticulosa* are smooth with flat ribs, whereas those of *X. eichleri* are minutely papillate with keeled ribs. *Xanthosia ciliata* may be distinguished from *X. eichleri* by its linear leaves, which are very rarely notched. *Xanthosia ciliata* normally has compound umbels, but tightly contracted, simple umbels may be found on individuals with small, entire, linear leaves from the Stirling Range.

Notes. The simple umbels of this species may be misinterpreted as compound umbels, which are more typical of the genus. The umbels of *X. eichleri* are commonly in pairs subtended by a single stem-clasping bract (whereas the number of bracts is equal to the number of rays in all compound umbels in *Xanthosia*) and the involucral bracts surround the flowers in the same manner as in the simple umbels of *X. fruticulosa*.

Xanthosia tridentata is restricted to New South Wales, Victoria and Tasmania and does not occur in Western Australia as stated in the "Flora of New South Wales" (Brooks & Powell 1992).

Acknowledgements

We thank the directors of NSW, MJP and PERTH for access to specimens. We are grateful to Greg Keighery for comments on an earlier draft of the manuscript.

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Notes on the genus *Lepidium* (Brassicaceae) in Western Australia, including recognition of a new species, *L. amelum*

B.J. Lepschi

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

B.J. Lepschi. Notes on the genus *Lepidium* (Brassicaceae) in Western Australia, including recognition of a new species, *L. amelum*. *Nuytsia* 12 (2): 191–195 (1998). *Lepidium amelum* Lepschi, a rare taxon from the Pilbara region of Western Australia is described, illustrated and its distribution mapped. Descriptions and illustrations of the previously unknown fruit and seed of the rare species *L. catapycnon* Hewson and *L. xylodes* Hewson are also presented.

Introduction

Lepidium L. (Brassicaceae) is a widespread genus of some 150 species, represented in Australia by 34 indigenous and eight introduced species (Hewson 1982a, b). Thirty species have been recorded from Western Australia, three of these introduced, with 12 of the indigenous taxa regarded as rare or threatened (Anon. 1996). This paper presents a description of a rare, new *Lepidium* from the eastern Pilbara region, as well as information on the fruits and seeds of two other rare species in the genus.

Materials and methods

This study is based on examination of herbarium collections from AD, BRI, DNA and PERTH. "Karratha", cited in the *exsiccatae* list for *L. amelum* and *L. catapycnon*, refers to the Department of Conservation and Land Management's regional herbarium situated at Karratha, Western Australia. All measurements were made from herbarium material (reconstituted where necessary). See the end of this issue for definitions of conservation codes used in this paper.

New species description

Lepidium amelum Lepschi, *sp. nov.*

A sp. *L. pedicellosae* F. Muell. foliorum basi sessili, auriculata differt.

Typus: 300 m north-west of Bells Pit, Woodie Woodie [mine], Oakover River Catchment, north-east Pilbara, Western Australia, early August 1996, *A.S. Weston* 96.8.1 (*holo:* PERTH 04656148; *iso:* CANB, K, MEL, US)

Erect *shrub* 0.3–1 m, all parts glabrous, leaves and stems glaucous. *Leaves* alternate, sessile, broadly elliptic to subcircular, 7.8–41 mm long, 8–36 mm wide; base auriculate; apex apiculate; margin entire. *Inflorescence* an elongate raceme, inserted terminally on the branches. *Sepals* 4, narrowly ovate to elliptic or oblong-elliptic, more or less concave and shallowly hooded distally, 5.26 mm long, 1.9–2.7 mm wide. *Petals* 4, proximal *c.* two-thirds pseudotubular (margins strongly to (rarely) weakly inrolled, cucullate at the base), distal *c.* one-third flat and ovate to rounded-triangular, entire petal more or less rhomboid when flattened out, 6.5–7.2 mm long, 2.7–3.5 mm wide, white. *Stamens* 6; filaments linear, 5.7–6 mm long; anthers elliptic to oblong-elliptic, 1.7–1.8 mm long. *Style* 3.2–3.9 mm long, markedly exsert in fruit, stigma small, subcapitate. *Pedicels* spreading in mature fruit; straight to slightly recurved, 6.5–7.5 mm long. *Silicula* elliptic to broadly elliptic, 7.7–8.3 mm long, 5.5–6 mm broad, winged, the wings obtuse to more or less acute, forming a notch *c.* 1/8–1/10 of the length of the silicula; gynophore hardly developed. *Seed* more or less elliptic, 3–3.5 mm long, 1.7–2.0 mm wide, red-brown, smooth, strongly mucose; cotyledons incumbent. (Figure 1A–C)

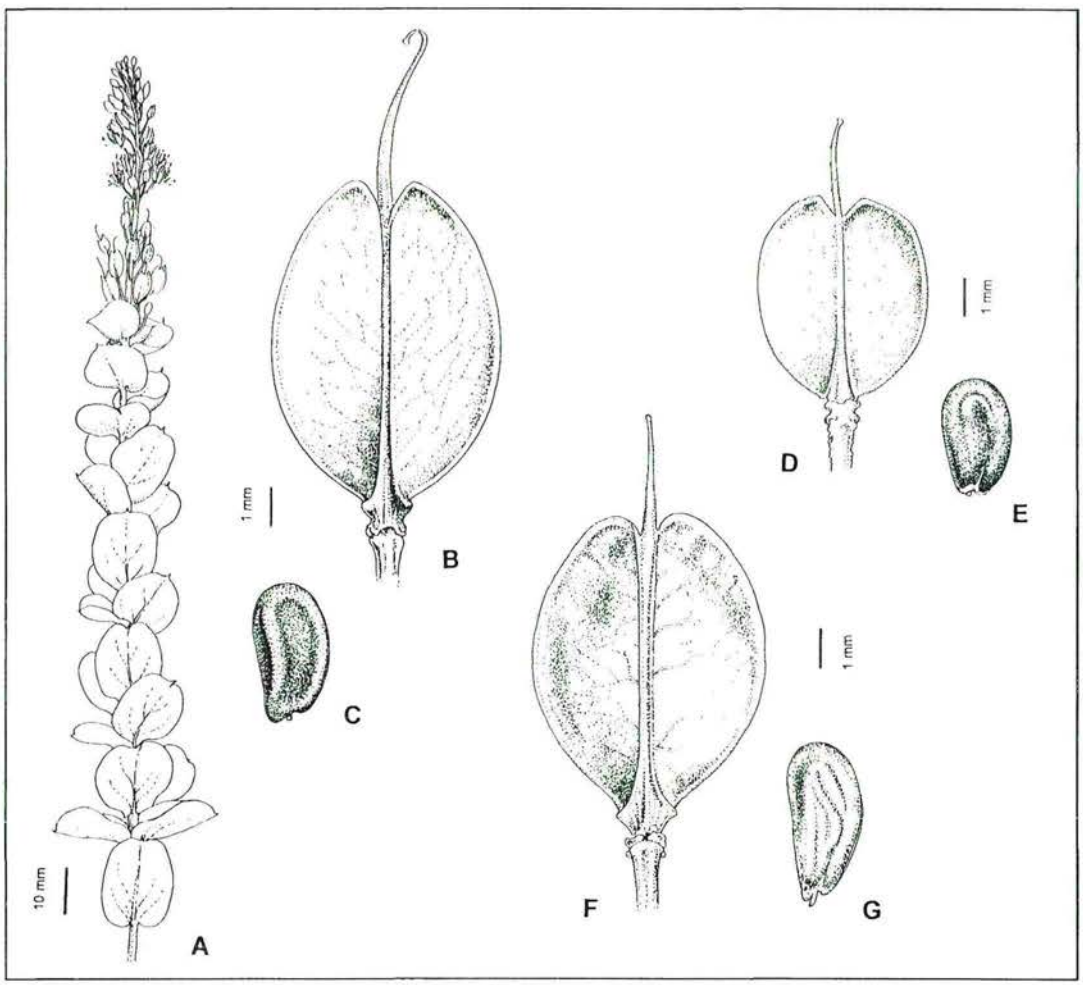

Figure 1. *Lepidium amelum.* A – branchlet; B – fruit; C – seed. *L. catapycnon.* D – fruit; E – seed. *L. xylodes* F – fruit; G – seed. Drawn from *Davis* 98 (A–C), *Start & Nicholson* 15/10/85-4 (D, E) and *Mitchell* 811 (F, G).

Specimens examined. WESTERN AUSTRALIA: [*c.* 110 km ESE of Nullagine], 20–22 June 1979, *G. Davis* 98 (PERTH); *c.* 12 km SE of Skull Springs on Wandanya Station, 1 Nov. 1996, *K.A. Leighton* PRP 1408 (CANB, NSW, PERTH); 14 km W of Tanguin Hill, *c.* 100 km SE of Shay Gap, 15 July 1984, *K.R. Newbey* 10501 (CANB, MEL, PERTH); 79.7 km from Warrawagine Homestead on a bearing of 154°, 30 June 1997, *A.L. Payne* PRP 1613 (AD, BRI, CANB, Karratha, PERTH).

Distribution. Restricted to the Oakover River Valley area, just west of Rudall River National Park in the north-eastern Pilbara region of Western Australia. (Figure 2)

Habitat. Occurs on stony, calcareous, alkaline soils formed from tertiary calcretes of the Oakover Formation (A.A. Mitchell pers. comm.). Recorded from *Triodia wiseana* C.A. Gardner hummock grassland (*Leighton* PRP 1408, *Payne* PRP 1613), low, open *Corymbia* sp. woodland (*Newbey* 10501), and with *Lepidium pholidogynum* F. Muell on the wall of a disused settlement pond on a mine site (*Weston* 96.8.1).

Phenology. Flowering and fruiting recorded June–August.

Conservation status. CALM Conservation Code for the Western Australian Flora: Priority One. Known from a small number of populations in an active mining area.

Etymology. Named from the Greek *a* – not, without, and *melos* – a limb, in reference to the sessile leaves.

Notes. Lepidium amelum is closely related to *L. pedicellosum*, with which it shares a distinctive petal morphology. It can be distinguished from this species by its sessile, amplexicaul leaf bases, and in being consistently glabrous. Leaves in *L. pedicellosum* are attenuate with a petiole up to 7 mm long,

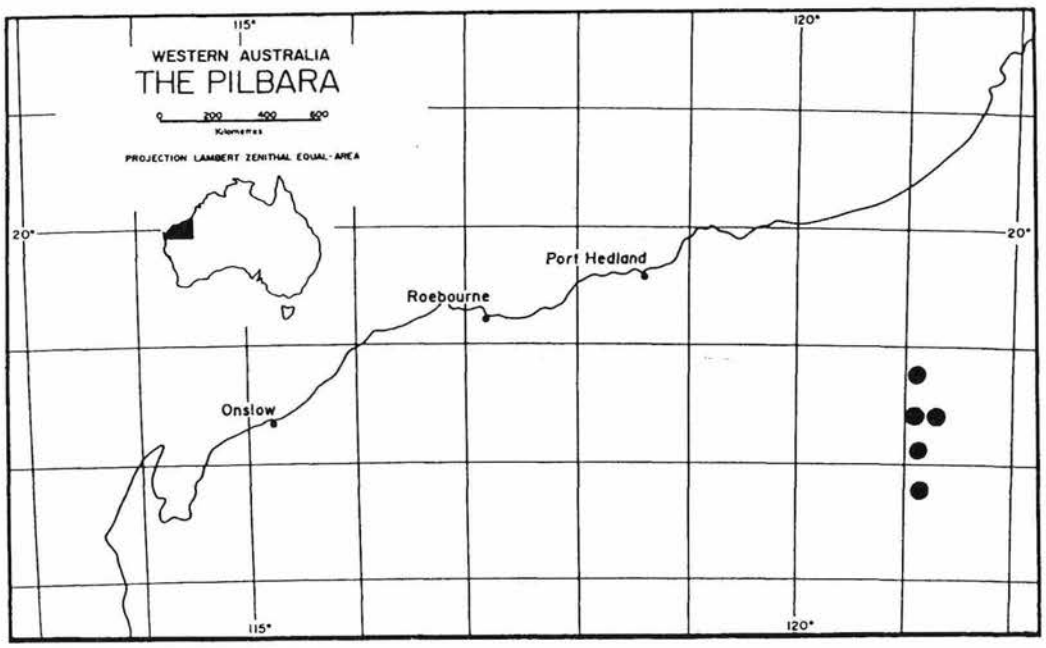

Figure 2. Distribution of *Lepidium amelum*.

and occasional plants of this species may also be hairy. *Lepidium amelum* and *L. pedicellosum* are also allied to *L. stronglophyllum* F. Muell. ex Benth., from central and eastern Australia.

While *L. amelum*, *L. pedicellosum* and *L. stronglophyllum* are similar in their overall morphology, I have elected to recognize all three as distinct species. No intergradation has been observed on herbarium material, and no intermediate plants are known in the field. All three taxa also occupy discrete geographical ranges. Treating *L. amelum* as a subspecies of *L. pedicellosum* is not realistic, as the distinctions between these taxa are of the same magnitude as the differences between *L. pedicellosum* and *L. stronglophyllum*. Reducing both *L. amelum* and *L. pedicellosum* to subspecies of *L. stronglophyllum* would also appear to serve little purpose.

Lepidium pedicellosum has been treated as conspecific with *L. stronglophyllum* by some authors in the past (e.g. Mueller 1883). However, as demonstrated by Carolin & Hewson (1981) and Hewson (1982a, b), the two species can readily be separated by petal morphology and width. Petals in *L. pedicellosum* are identical in morphology to those of *L. amelum* (see description above), and are 2.5–3.6 mm wide, while *L. stronglophyllum* has more or less flat (i.e. not pseudotubular) petals (see Carolin & Hewson 1981, Hewson 1982a, b) which are 1.2–1.7 mm wide. Note that measurements presented here are taken from reconstituted petals flattened out to their full width, and differ slightly from those cited in earlier publications (it should also be noted that the descriptions of *L. pedicellosum* presented by Carolin & Hewson (1981) and Hewson (1982a, b) do not encompass any elements of *L. amelum*). As well as differences in petal characters, *L. pedicellosum* is sometimes hairy, whereas *L. stronglophyllum* (and *L. amelum*) are always glabrous.

Lepidium amelum has been referred to as *Lepidium* sp. Tanguin Hill (*K.R. Newbey* 10501) at PERTH and by Anon. (1996).

Fruit and seed descriptions

Lepidium catapycnon and *L. xylodes* are two rare, poorly known taxa from the Eremaean Botanical Province (*cf.* Beard 1980) of Western Australia. Fruit and seed of both taxa were unknown at the time of Hewson's (1982a, b) treatments of the genus, but mature fruiting material of both taxa has since become available, allowing descriptions of the fruits and seeds to be made.

Lepidium catapycnon Hewson

Style 2.0–2.5 mm long, markedly exsert in fruit; stigma small, subcapitate. *Silicula* broadly elliptic to subcircular, 5.0–5.5 mm long, 4.0–4.5 mm broad, winged, sparsely papillose, especially on the wings; wings obtuse to more or less acute, forming a notch *c.* 1/8 the length of the silicula; gynophore hardly developed. *Seed* more or less elliptic 2.3–2.6 mm long, 2.0–2.5 mm broad, red-brown, smooth, strongly mucose; cotyledons incumbent. (Figure 1D, E)

Specimens examined. WESTERN AUSTRALIA: Near Wittenoom [precise locality withheld due to conservation reasons], 15 Oct. 1985, *A.N. Start & C.J. Nicholson* CJN 15/10/1985-2, *A.N. Start & C.J. Nicholson* CJN 15/10/1985-4 (both Karratha, PERTH); Near Newman [precise locality withheld due to conservation reasons], Jan. 1997, *M. Maier s.n.* (PERTH).

Conservation status. CALM Conservation Codes for the Western Australian Flora: Declared Rare.

Notes. Hewson (1982a) considered *L. catapycnon* to be related to *L. pedicellosum*, but *L. catapycnon* would appear to have greater affinity with *L. platypetalum* Hewson, which it superficially resembles. *Lepidium catapycnon* and *L. platypetalum* have distinctive, linear, more or less terete leaves, which are quite different from the broad, flat, transversely linear leaves of *L. pedicellosum*. These taxa also share pseudotubular, cucullate petals. *Lepidium catapycnon* and *L. platypetalum* may be separated by indumentum and silicula size.

Lepidium xylodes Hewson

Style 2.5–3.0 mm long, markedly exsert in fruit; stigma small, subcapitate. *Silicula* elliptic to ovate, 6.5–7.0 mm long, 4.5–5.0 mm broad, winged, sparsely papillose, especially on the wings; wings narrow, forming a very shallow notch; gynophore developed, to 0.7 mm long. *Seed* 3.3–3.7 mm long, 1.7–2.5 mm broad, red-brown, smooth, strongly mucose; cotyledons incumbent, tending to become biplicate. (Figure 1F, G)

Specimen examined. WESTERN AUSTRALIA: Yarlingulla Paddock, Belele Station, 12 Nov. 1980, *A.A. Mitchell* 811 (PERTH).

Conservation status. CALM Conservation Codes for the Western Australian Flora: Priority One.

Notes. The presence of more or less biplicate cotyledons in *L. xylodes* suggests a possible relationship with *L. genistoides* Hewson, a species of uncertain affinities, which also exhibits similar cotyledon morphology. Hewson (1982a) suggested *L. genistoides* may be misplaced in subsect. *Monoploca* (of sect. *Monoploca* (Bunge) Prantl), given the more or less biplicate cotyledons, and could perhaps be accommodated in subsect. *Diploploca* Hewson. This also applies to *L. xylodes*, but until more fruiting material becomes available, so that this feature can be examined in more detail, both taxa are best retained in subsect. *Monoploca*.

Acknowledgements

I am grateful to Ken Leighton, Andrew Mitchell, Alan Payne and Arthur Weston for their efforts in obtaining material of *L. amelum* for me, Margaret Pieroni for the illustrations and Paul Wilson for checking the Latin diagnosis. The curators of AD, BRI and DNA are thanked for allowing me to examine collections in their care.

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Three new triggerplant species in *Stylidium* subgenus *Centridium* (Stylidiaceae) from Western Australia

Allen Lowrie[1] and Kevin F. Kenneally[2]

[1]6 Glenn Place, Duncraig, Western Australia 6023
[2]Science Publications Unit, Corporate Relations Division, Department of Conservation and Land Management, Locked Bag 29, Bentley Delivery Centre, Western Australia 6983

Abstract

Lowrie, Allen and Kenneally, Kevin F. Three new triggerplant species in *Stylidium* subgenus *Centridium* (Stylidiaceae) from Western Australia. *Nuytsia* 12 (2): 197–206 (1998). Three new Western Australian species, *Stylidium aceratum, S. diceratum* and *S. weeliwolli* Lowrie & Kenneally are described and illustrated. They belong to *Stylidium* subgenus *Centridium* (Lindl.) Mildbr., bringing the total number of species known in this subgenus to ten. A key is provided for taxa.

Introduction

Three new species of triggerplant, belonging in *Stylidium* subg. *Centridium* (Lindl.) Mildbr. (Stylidiaceae) are described here. All members of this subgenus (Mildbraed 1908: 31) have a globose hypanthium, gynostemium mobility produced not by a sensitive hinged torosus but by the sensitive movement of a cunabulum from the convex set position to the concave triggered position, and a stipitate brush-like stigma. Haploid chromosome numbers of 11 and 13 have been recorded in this subgenus (Farrell & James 1979; S.H. James pers. comm.).

Ten species are now recognized in *Stylidium* subgenus *Centridium* in northern and western Australia, as follows:

1. Kimberley region of Western Australia and far north of Northern Territory. *Stylidium ceratophorum* O. Schwarz and *S. longicornu* Carlquist occur in both these regions while the new species *S. diceratum* is restricted to the Kimberley.

2. Ashburton District of the Eremean Botanical Province of Western Australia. The new species *Stylidium weeliwolli* is the first record from this region.

3. South-west of Western Australia. *Stylidium aceratum* (a new species), *S. calcaratum* R. Br., *S. ecorne* (F. Muell. ex F.H. Erickson & J.H. Willis) P.G. Farrell & S.H. James, *S. edentatum* Lowrie & Carlquist, *S. mimeticum* Lowrie & Carlquist and *S. perpusillum* Hook. f.

Taxonomy

Key to the species of *Stylidium* subgenus *Centridium*

1: Appendage(s) present on gynostemium 2
1 Appendage(s) absent on gynostemium 6
2: Gynostemium with 2 appendages; corolla predominately orange on adaxial surface ..... **S. diceratum**
2 Gynostemium with 1 appendage; corolla white or pink on adaxial surface 3
3: Gynostemium bearing a recurved horn-shaped appendage on the bend 4
3 Gynostemium appendage not horn-shaped 5
4: Throat appendages 2; labellum elliptic, apex not emarginate, irregularly serrate ..... **S. calcaratum**
4 Throat appendages 4; labellum lageniform, apex emarginate, not serrate ..... **S. weeliwolli**
5: Gynostemium appendage reniform, recurved from the bend; nectary spur prominent, cradled by the horizontal posterior sepal ..... **S. mimeticum**
5 Gynostemium appendage square, recurved from the bend, apex irregularly serrate; nectary spur absent or very poorly developed and hidden behind the always vertical posterior sepal ..... **S. ecorne**
6: Corolla orange; posterior corolla lobes each deeply divided into 2 (so as to appear as 4 individual lobes) ..... **S. ceratophorum**
6 Corolla white to pink; posterior corolla lobes undivided 7
7: Plants mostly 1.5–2.5 cm high; nectary spur absent ..... **S. perpusillum**
7 Plants mostly 4.5–25 cm high; nectary spur present 8
8: Posterior corolla lobes cuneate, the apex obtuse and unlobed, with a distinctive blunt lateral tooth at the base ..... **S. edentatum**
8 Posterior corolla lobes either cuneate with a tridentate apex or obovate with a crenate apex, lacking basal tooth 9
9: Plants mostly 5–9 cm tall; posterior corolla lobes cuneate, apex tridentate; nectary spur shorter than the posterior sepal ..... **S. aceratum**
9 Plants mostly 10–25 cm tall; posterior corolla lobes obovate, apex crenate; nectary spur longer than the posterior sepal ..... **S. longicornu**

Stylidium aceratum Lowrie & Kenneally, *sp. nov.*

Stylidio calcarato R. Br. affinis sed cornu appendicis e flexo gynostemii absenti.

Typus: Great Northern Highway, north of Bullsbrook [precise locality withheld], Western Australia, 9 November 1991, *A. Lowrie* 496 (*holo:* PERTH 04980336; *iso:* MEL).

A fibrous-rooted annual *herb* 5–9 cm high (including inflorescence); stem translucent white, 2.5–4 mm long, 0.8–1 mm diam.; basal rosette of leaves flat, 5–12 mm diam. *Leaves* spathulate, 3–6 mm long, 0.7–1.5 mm wide near apex, 0.3–0.6 mm wide at the base, flat in section, glabrous. *Inflorescence* usually a simple dichasium but also the beginnings of a compound dichasium in older plants, 5–9 cm long (including peduncle), glandular. *Bracts* and *bracteoles* lanceolate, 1.5–2 mm long,

0.5–0.6 mm wide, sparsely glandular. *Pedicels* 10–24 mm long, glandular. *Hypanthium* globose, 1.6–2 mm diam. at anthesis, glandular. *Sepals* 5, all free to the base, lanceolate, glandular; anterior pair horizontal and splayed outwards under the anterior corolla lobes, 1.6–2.5 mm long; middle pair erect, 1.5–1.9 mm long; posterior sepal horizontal, 1.3–1.5 mm long. *Corolla* dark pink with a white base on adaxial surface, pale pink on abaxial surface, glabrous, lobes vertically paired; anterior lobes geniculate, 6–7 mm long, 1.4–1.8 mm wide, apex ± tricrenate; posterior lobes cuneate, 5.5–7 mm long, 1.7–2 mm wide, apex tridentate. *Nectary spur c.* 0.8 mm long, cradled by the posterior sepal. *Throat* white, bearing 2 smooth mounds, each positioned at the sinus of the anterior and posterior corolla lobes, with deeply and irregularly laciniate margins between the mounds, and 2 conical appendages *c.* 0.5 mm long at the base of the posterior corolla lobes. *Labellum* positioned below the the sinus of the anterior corolla lobes, purple with a white base, concave, elliptic, *c.* 2 mm long, *c.* 1.8 mm wide; apex cuspidate, *c.* 0.5 mm long, with shorter serrate segments either side, sparsely glandular. *Gynostemium c.* 3 mm long, the erect non-sensitive basal column *c.* 1.5 mm long, the sensitive cunabulum *c.* 1.5 mm long, appendage(s) absent from the bend of the gynostemium; anthers yellow, pollen yellow; stigma stipitate between the anthers, *c.* 2 mm long, apex brush-like. *Capsule* globose, 2.5–2.7 mm diam. *Seeds* rusty brown, ± ellipsoid, 0.2–0.25 mm long, 0.1–0.15 diam., rugose. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: Type location [precise locality withheld], 3 Nov. 1993, *K.F. Kenneally* 11398 (PERTH).

Distribution. Known only from the type location.

Habitat. Grows in sandy soils on swamp heathland with *Stylidium calcaratum*, *S. mimeticum*, *S. utricularioides* Benth. and paperbarks (*Melaleuca*).

Flowering period. October–November.

Chromosome number. S.H. James (pers. comm.) has obtained a chromosome number count of n = 11 for *Stylidium aceratum*. The voucher specimen for this previously unpublished record is *A. Lowrie* 496.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. The species is known from only one locality, which is on a nature reserve. Known only from small colonies numbering 20 to 100 plants and scattered individuals over the southern portions of the nature reserve. A survey to establish the total population size over the entire nature reserve is recommended.

Etymology. The specific epithet *aceratum* is from the Greek prefix *a* – lacking and *ceras* – horn in reference to the absence of an appendage on the bend of the gynostemium.

Affinities. The nearest relative to *Stylidium aceratum* is *S. calcaratum*. Both species have geniculate anterior corolla lobes and tridentate posterior corolla lobes and a chromosome number of n = 11. *S. aceratum* differs from *S. calcaratum* (whose contrasting characters are given in parenthesis) by having 2 conical throat appendages at the base of the posterior corolla lobes (2 throat appendages reniform); nectary spur shorter than the posterior sepal (longer than the posterior sepal); appendage absent from the bend of the gynostemium (appendage present at the bend of the gynostemium); and labellum apex cuspidate with shorter serrate segments either side (labellum apex shortly serrate throughout).

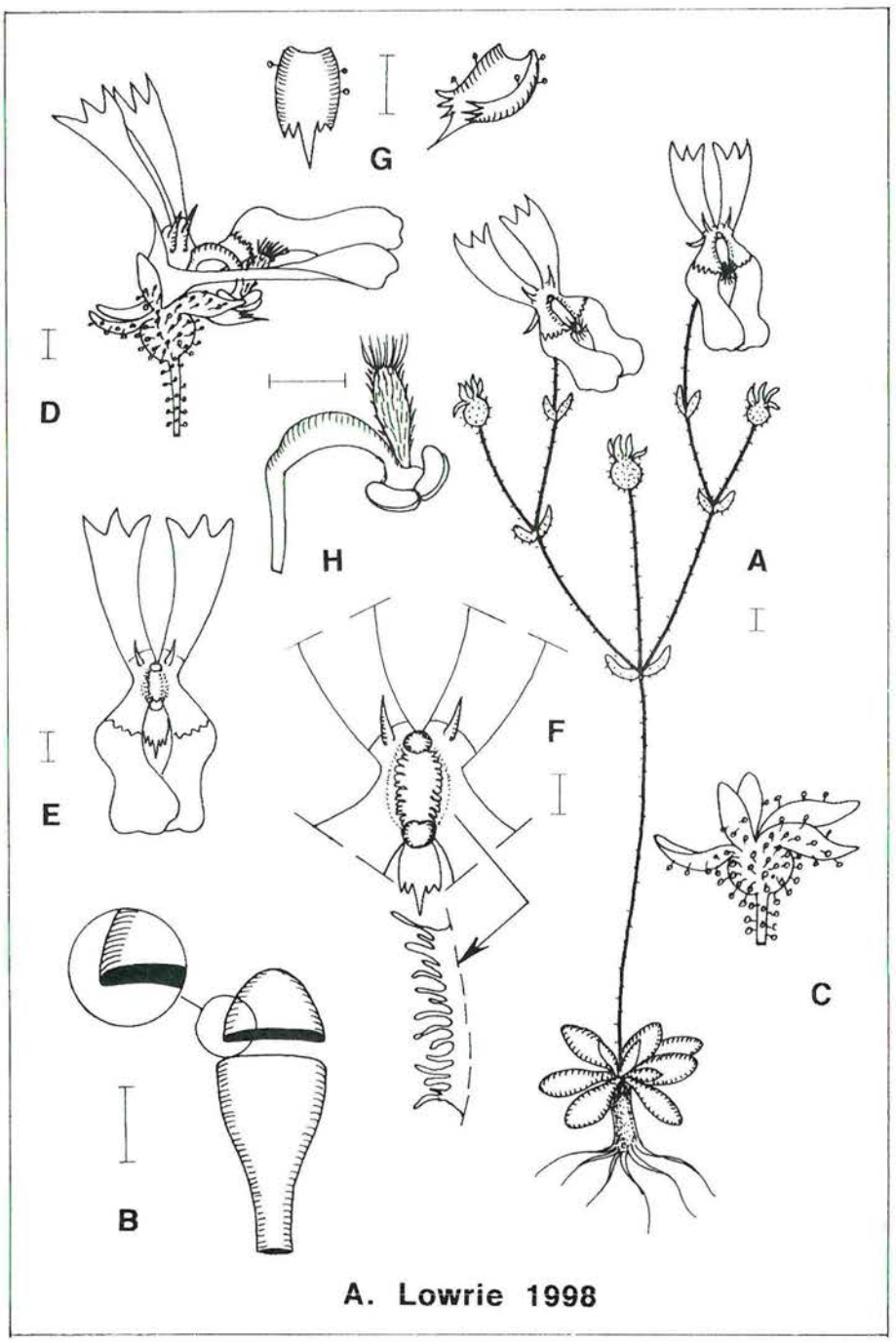

Figure 1. *Stylidium aceratum*. A – habit of flowering plant; B – leaf, enlarged section left; C – hypanthium and sepals; D – lateral view of corolla, gynostemium and hypanthium; E – corolla; F – throat appendages; G – labellum; H – lateral view of gynostemium, anthers and stipitate stigma in the set-non-triggered position. Scale bar for all = 1 mm. Drawn from *A. Lowrie* 496.

Notes. Stylidium aceratum grows near populations of *S. calcaratum* as well as *S. mimeticum* at the type location. Also populations of *S. ecorne* have been found about 1 km south of the type location. Extensive exploration in the area has found no hybrids between these taxa. The latter two species differ from *S. aceratum* in chromosome number, both having n = 13 (S.H. James pers. comm.), a factor which may contribute to their reproductive isolation.

Stylidium diceratum Lowrie & Kenneally, *sp. nov.*

Stylidio longicorno Carlquist affinis sed pagina adaxiali corollae pro parte maxima aurantiaca, appendicibus fauce 4 et cornu-appendicibus 2 supra flexum gynostemii ornata.

Typus: Along sandy creek crossing on road to Beverley Springs [precise locality withheld], Kimberley, Western Australia, 2 August 1996, *A. Lowrie* 1526 (*holo:* PERTH 04980344; *iso:* MEL).

A fibrous-rooted annual *herb* 15–35 cm high (including inflorescence); stem translucent white, 0.5–3 mm long, 0.3–0.4 mm diam.; basal rosette of leaves flat, 10–16 mm diam. *Leaves* lanceolate (longer ones) or spathulate (shorter ones), 5–8 mm long, 1–2.5 mm wide near the apex, 0.2–0.6 mm wide at the base, flat in section, glabrous. *Inflorescence* variable, 1-flowered, 3-flowered simple dichasium, 2–4-flowered raceme (juvenile specimens) or a many-flowered compound dichasium with some of the upper branches racemose (mature specimens), 6–15 cm long, glandular. *Bracts* and *bracteoles* lanceolate or elliptic, 1.5–3 mm long, 0.5–1.3 mm wide, glandular. *Pedicels* 15–65 mm long, glandular. *Hypanthium* globose, 0.9–1.4 mm diam. at anthesis, glandular. *Sepals* 5, all free to the base, lanceolate, glandular; anterior pair horizontal and splayed outwards under the anterior corolla lobes, 1.3–2.3 mm long; middle pair erect, 1.2–1.7 mm long; posterior sepal horizontal, 1.5–2 mm long. *Corolla* cream on abaxial surface with broad dark pink veins, glabrous, lobes vertically paired; anterior lobes yellowish orange with dark orange veins on adaxial surface, with 2 short and 2 long yellow radial stripes from the throat as well as a band of yellow around the glandular inside margins of the lobes, cuneate-falcate, 3.5–4.5 mm long, 2–3 mm wide, apex emarginate; posterior lobes blushed salmon pink over yellowish orange on adaxial surface and bearing reddish marks at the base with outward radiating lines, obovate, 2.5–4.5 mm long, 1.7–2.3 mm wide, apex irregularly crenate. *Nectary spur* cream, 4.5–6.5 mm long, cradled by posterior sepal. *Throat* yellow, bearing 4 (2 pairs) of appendages at base of posterior corolla lobes; appendages narrowly ovate, acute, the upper pair *c.* 1.3 mm long, the others *c.* 0.8 mm long. *Labellum* positioned below the the sinus of the anterior corolla lobes, green, concave, obovate, *c.* 1.5 mm long, *c.* 1 mm wide, apex irregularly serrate, glabrous. *Gynostemium c.* 2.2 mm long, the erect non-sensitive basal column *c.* 0.8 mm long, the sensitive cunabulum *c.* 1.3 mm long, with 2 lateral incurved horn-like appendages on the bend of the gynostemium; stigma stipitate between the anthers, *c.* 1 mm long, apex brush-like. *Capsule* globose, 2.5–3 mm diam. *Seeds* rusty brown, ± compressed-ovoid, 0.2–0.3 mm long, 0.1–0.15 diam., longitudinally finely ribbed. (Figure 2)

Other specimen examined. WESTERN AUSTRALIA: Type location [precise locality withheld], Aug. 1993, *M.D. Barrett* 235 (PERTH).

Distribution. Known only from the type location.

Habitat. Grows in sandy soils on the margins of creek with *Stylidium ceratophorum*, *S. rubriscapum* W.V. Fitzg., *Drosera caduca*, *D. paradoxa*, *Byblis liniflora* and *Grevillea pteridifolia*.

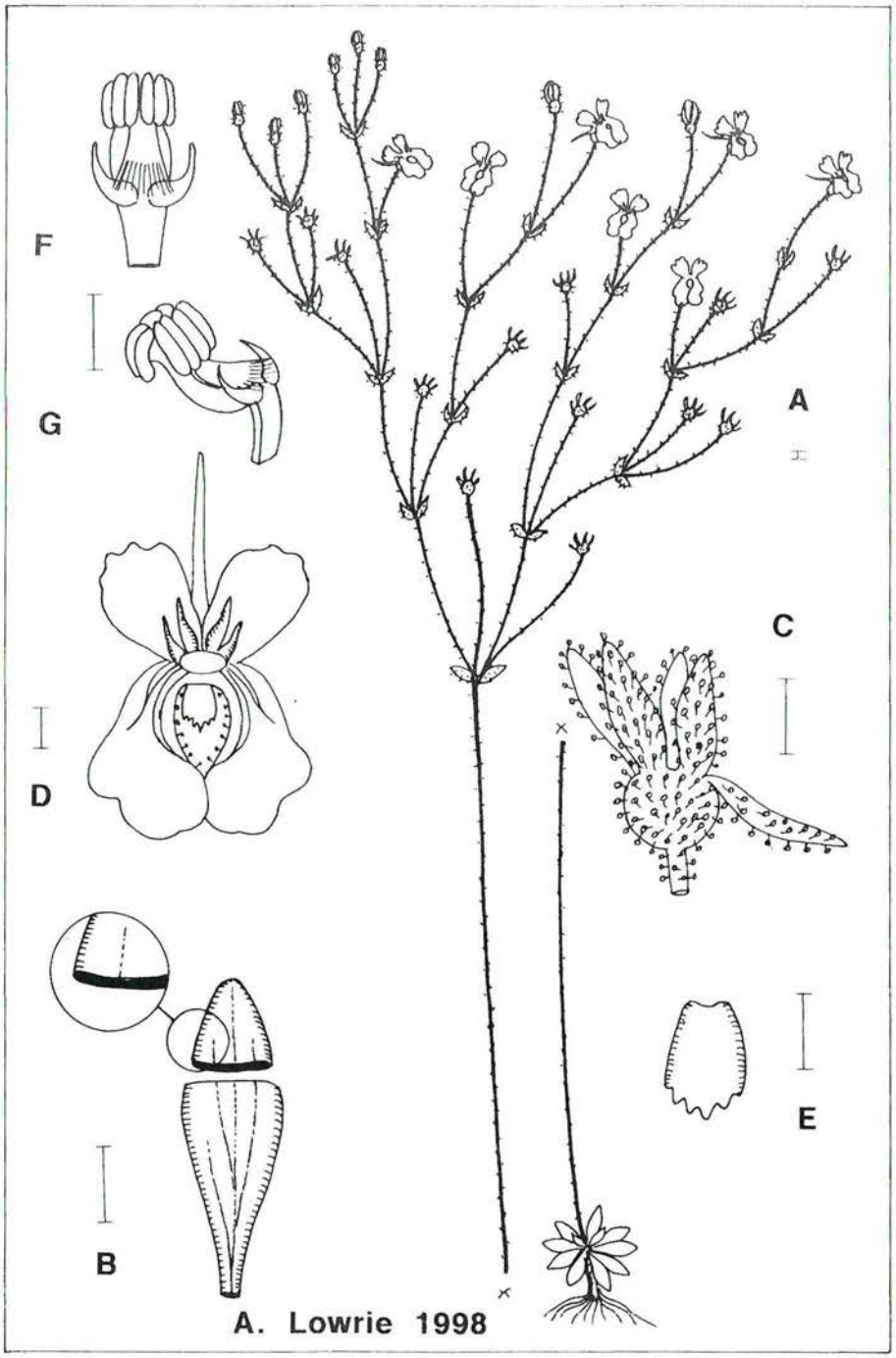

Figure 2. *Stylidium diceratum*. A – habit of flowering plant; B – leaf, enlarged section left; C – hypanthium and sepals; D – corolla; E – labellum; F – front view of gynostemium, anthers and stipitate stigma in the triggered position; G – lateral view of gynostemium, anthers and stipitate stigma in the triggered position. Scale bar for all = 1 mm. Drawn from *M.D. Barrett* 235 & *A. Lowrie* 1526.

Flowering period. June–August.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. *Stylidium diceratum* is only known from the type locality but as the region is poorly botanically explored, it is possible that it exists over a much larger area.

Etymology. The specific epithet *diceratum* from the Greek prefix *di*– two and *ceras*– horn in reference to the two appendages on the bend of the gynostemium.

Affinities. The nearest relative to *Stylidium diceratum* is *S. longicornu*. *S. diceratum* is easily distinguished from *S. longicornu* by its orange corolla, 2 horn-like appendages on the bend of the gynostemium and nectary spur *c.* 3 times longer than the posterior sepal.

Stylidium diceratum may be confused with *S. ceratophorum* because both species have an orange corolla, and they coexist at the *S. diceratum* type location. *S. ceratophorum* is distinguished from *S. diceratum* by having a corolla twice as large, with the posterior lobes each deeply divided to appear as 4 individual lobes and the anterior lobes ovate-falcate. It also differs in corolla orientation so that the gynostemium operates from above rather than from below.

Stylidium weeliwolli Lowrie & Kenneally, *sp. nov.*

Stylidio calcarato R. Br. affinis sed corolla appendicibus fauce 4 et lobis anterioribus valde cruciformibus ornata differt.

Typus: Weeli Wolli Creek, *c.* 90 km north-west of Newman, Western Australia, 22° 54' S, 119° 13' E, 28 August 1991, *D.E. Murfet* 1097 (*holo:* PERTH 04980328; *iso:* MEL).

A fibrous-rooted annual *herb* 10–25 cm high (including inflorescence); stem white, 1–4 mm long, 0.5–0.7 mm diam.; basal rosette of leaves flat, 10–50 (mostly 17–25) mm diam. *Leaves* spathulate or lanceolate, 6.5–27 (mostly 11–13) mm long, 3–4.5 (mostly 3–3.5) mm wide near apex, 0.3–1 (mostly 0.7–0.8) mm wide at the base, flat in section, glabrous, apex obtuse or acute. *Inflorescence* an open much branched compound dichasium, 10–25 cm long (including peduncle), glandular. *Bracts* and *bracteoles* obovate-elliptic, 2.2–4.5 mm long, 1.4–2.2 mm wide, apex acute, sparsely glandular. *Pedicels* 10–20 mm long, glandular. *Hypanthium* globose, 1.2–1.7 mm diam. at anthesis, glandular. *Sepals* 5, all free to the base, lanceolate, glandular; anterior pair horizontal and splayed outwards under the anterior corolla lobes, 2–2.5 mm long; middle pair erect, 2–2.5 mm long; posterior sepal horizontal, 1.8–2.5 mm long. *Corolla* dark pink on adaxial surface with reddish marks at the base, glabrous, lobes vertically paired; anterior lobes geniculate, always distinctly cruciform, 7.5–8.5 mm long, 1.8–2 mm wide, apex emarginate; posterior lobes cuneate, 5.5–6 mm long, 3–3.5 mm wide, apex ± tricrenate. *Nectary spur* 2–2.5 mm long, cradled by posterior sepal. *Throat* bearing 4 rod-shaped appendages, 2 at the base of anterior corolla lobes and 2 at the base of posterior corolla lobes; anterior appendages fused along their length, *c.* 1.5 mm long; posterior appendages free to base, *c.* 1.7 mm long. *Labellum* positioned below the sinus of the anterior corolla lobes, concave, lageniform, *c.* 1.7 mm long, *c.* 0.8 mm wide, apex emarginate, glabrous. *Gynostemium c.* 3.2 mm long, the erect non-sensitive basal column *c.* 1.5 mm long, the sensitive cunabulum *c.* 1.7 mm long, with a horn-like appendage *c.* 0.2 mm long on the bend of the gynostemium; anthers dark yellow; stigma stipitate between the anthers, *c.* 1.5 mm long, apex brush-like. *Capsule* globose, 2–3 mm diam. *Seeds* dark brown, ± ellipsoid, 0.25–0.3 mm long, 0.15–0.2 diam., rugose. (Figure 3)

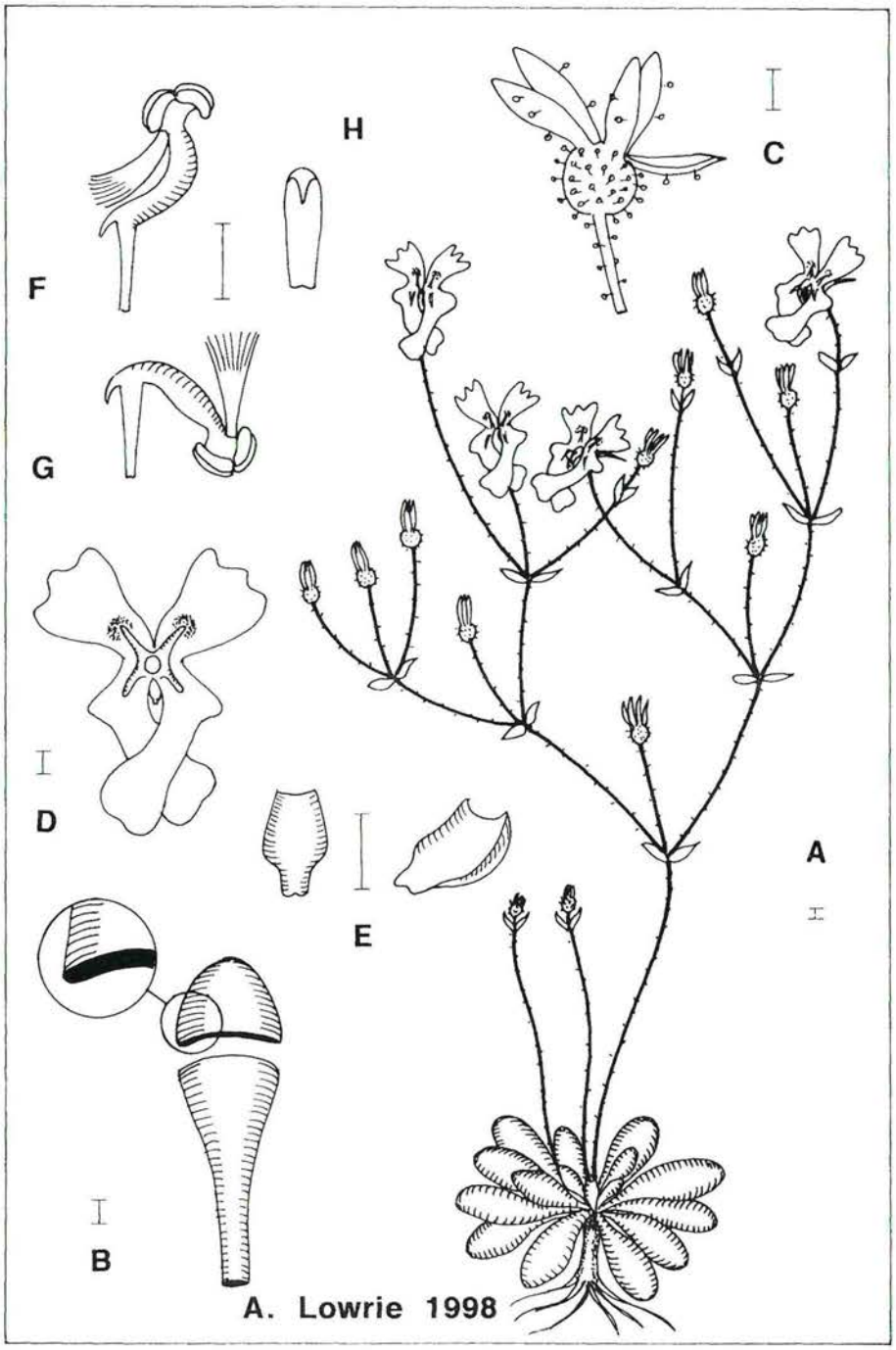

Figure 3. *Stylidium weeliwolli*. A – habit of flowering plant; B – leaf, enlarged section left; C – hypanthium and sepals; D – corolla; E – labellum; F – lateral view of gynostemium, anthers and stipitate stigma in the triggered position; G – lateral view of gynostemium, anthers and stipitate stigma in the set-non-triggered position; H – front view of horn-like appendage on the bend of the gynostemium. Scale bar for all = 1 mm. Drawn from *D.E. Murfet* 1097.

Other specimens examined. WESTERN AUSTRALIA: Base of Mt Augustus, Aug. 1997, *K. Coate s.n.* (PERTH); Weeli Wolli Springs, 22° 45' S, 119° 15' E, 22 Mar. 1994, *E. Holland* 4200 & *N. Casson* (PERTH); Weeli Wolli Creek, near springs, 8 Sep. 1992, *M.E. Trudgen* 11489 (PERTH); Barlee Range Nature Reserve, 15.2 km WSW of Jarrabuduundy Bore, 18.3 km N of Mt Palgrave, 18.9 km SW of Wongajerra Well, 23° 12' 35" S, 115° 59' 24" E, 6 July 1995, *S. van Leeuwen* 1864 (KARRATHA, PERTH); Barlee Range Nature Reserve, 16 km WSW of Jarrabuduundy Bore, 17.2 km N of Mt Palgrave, 20.2 km SW of Wongajerra Well, 23° 13' 08" S, 115° 58' 44" E, 6 July 1995, *S. van Leeuwen* 1873 (KARRATHA, PERTH).

Distribution. Known from the type location *c.* 90 km north-west of Newman, *c.* 350 km west of the type locality in the Barlee Ranges and *c.* 270 km south-west of the type locality at Mt Augustus.

Habitat. Grows in gritty sandy soil along the edge of watercourse (*D.E. Murfet* 1097); in wet root mass of *Melaleuca leucadendra* at edge of permanent pool and in similar but drier ground in sandy clay amongst root fibres with *Eleocharis geniculata, Lobelia* sp., *Fimbristylis* sp. and *Stemodia grossa* (*M.E. Trudgen* 11489); alongside pool at base of gorge, in gritty brown clay loam with lots of silt and organic material (*S. van Leeuwin* 1864); in damp red brown soil, gritty silty soil, low in landscape, herbfield around edge of pool (*S. van Leeuwin* 1873); and with *Drosera indica*, Edney's Walk, Mt Augustus (photos seen by authors, vouchers not collected, pers. comm. J. Thompson 1998).

Flowering period. August–September.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. *Stylidium weeliwolli* is locally abundant at its known locations and currently not under threat.

Etymology. The specific epithet, *weeliwolli* is from the Australian Aboriginal words meaning "we are water running" or simply "running water". The type location along Weeli Wolli Creek falls within the region used by the linguistic group known as the Nyiyaparli (sometimes incorrectly spelt Niapaili). This nomenclatural information was provided by Gordon Uline, a senior law person in this language group and communicated to us by Dr Stephen van Leeuwin, CALM, Karratha.

Affinities. The nearest relative to *Stylidium weeliwolli* is the south-western species *S. calcaratum*. *S. weeliwolli* differs from *S. calcaratum* (whose contrasting characters are given in parentheses) by having 4 rod-shaped throat appendages, 2 fused along their length and 2 subulate and free to base (throat appendages 2, reniform); anterior corolla lobes distinctly cruciform (anterior corolla lobes meeting at apex but only slightly crossed over each other); posterior corolla lobes apex ± tricrenate (apex tridentate); and labellum lageniform, apex emarginate (labellum elliptic, apex irregularly serrate).

Notes. Stylidium weeliwolli has been recorded as a perennial plant (*M.E. Trudgen* 11489), but this is doubtful as all other taxa in *Stylidiaceae* subg. *Centridium* are annuals.

Acknowledgements

We would like to thank Denzel Murfet and Malcolm Trudgen for their collections and their personal communications regarding field observations of *Stylidium weeliwolli;* Dr Stephen van Leeuwin for his collections, personal communications and information gathered for the meaning of Weeli Wolli;

Gordon Uline for providing the interpretation of the place name Weeli Wolli; John Thompson for his photographs and data on *S. weeliwolli* at Mt Augustus; Gordon Graham for his companionship on expeditions to the Kimberley; Matthew and Russell Barrett for their collection and field observations of *S. diceratum*; the leaders and members of the 1996 *Landscope* Expedition to the Kimberley; Dr Sid James for the chromosome counts; Paul Wilson for his assistance with the Latin diagnoses; Dr Barbara Rye for her comments, and the staff of the Western Australian Herbarium.

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A taxonomic revision of *Dicrastylis* sect. *Dicrastylis* (Lamiaceae subfamily Chloanthoideae)

B.L. Rye and M.E. Trudgen

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Rye, B.L. & M.E. Trudgen. A taxonomic revision of *Dicrastylis* sect. *Dicrastylis* (Lamiaceae subfamily Chloanthoideae). *Nuytsia* 12(2): 207–228(1998). The south-western Australian plant group *Dicrastylis* Drumm. ex Harv. sect. *Dicrastylis* (Lamiaceae subfamily Chloanthoideae) is revised. A key and distribution maps are given for the 11 taxa currently recognized in the section, of which nine have been formally named as species and two are known only by phrase names. *Dicrastylis morrisonii* Munir is reduced to a synonym of *D. incana* Munir. Two new species, *Dicrastylis maritima* Rye & Trudgen and *D. soliparma* Rye & Trudgen, are described and illustrated. *Dicrastylis maritima* is noteworthy in growing on the strand and coastal dunes. About half of the taxa appear to be rare and have been included on the Western Australian Priority Flora List.

Introduction

This paper presents a taxonomic revision of *Dicrastylis* sect. *Dicrastylis*. *Dicrastylis* is treated here as belonging to Lamiaceae subfamily Chloanthoideae rather than to family Chloanthaceae as in a previous paper (Rye 1996). Recent studies of anatomical and morphological characters (Cantino *et al.* 1992) and DNA studies (Olmstead *et al.* in press) have indicated that the Chloanthaceae should not be treated as a separate family but combined with the Prostanthereae to form a subfamily of the Lamiaceae.

Dicrastylis sect. *Dicrastylis* is endemic to the south-west of Western Australia. Prior to 1978 only two species belonging to this section had been described. Five additional species were described by Munir (1978, 1991), who also defined the boundaries of the section. Two further members of sect. *Dicrastylis* were recognized during a flora survey of the Shark Bay area (Trudgen & Keighery 1995) and were given the phrase names *Dicrastylis* sp. Shark Bay (*J.J. Alford* 1318) and *Dicrastylis* sp. Peron Peninsula (*M.E. Trudgen* 7373). The former species is especially interesting as it is adapted to a harsh maritime environment, growing on the strand and foredunes, a significant extension of the habitat range for the genus.

Recently two more taxa that appear to be new species have been distinguished among the *Dicrastylis* herbarium specimens at PERTH. These have been allocated phrase names and placed on the Western Australian Priority Flora List. *Dicrastylis* sp. Cue (*A.A. Mitchell* 764) is known only from immature material and *Dicrastylis* sp. Denham (*M. Lewis* 42/92) from a single specimen. More collections are needed urgently to determine the taxonomic and conservation status of these poorly known taxa, as they may be endangered.

Methods

Except where otherwise indicated, all specimens cited are housed at PERTH, although duplicates may exist in other herbaria. All measurements were taken from dry pressed material. Leaf measurements were obtained from the larger leaves on each specimen. Flower length was taken only from well pressed flowers and did not include the stamens and style. Measurements of the corolla lobes for each species were taken from 5-merous flowers. Anthers were measured at the onset of dehiscence.

Indumentum length was taken as the distance the hairs protrude vertically above the surface to which they are attached. The width of dendritic hairs can be considerably greater than their length especially if they have only a very short stalk and a much larger branched portion that is horizontal.

Distribution maps were plotted such that each symbol indicates the recorded occurrence of a taxon in a 0.25 degree latitude by 0.25 degree longitude area. The conservation codes given in this paper are those used by the Western Australian Department of Conservation and Land Management. An explanation of these codes is given at the end of this *Nuytsia* issue.

Taxonomy

Dicrastylis Drumm. ex Harv. sect. **Dicrastylis**

Type: Dicrastylis fulva Drumm. ex Harv.

Pityrodia sect. *Xenotheca* F. Muell. (Mueller 1859: 236). *Type: Dicrastylis myriantha* F. Muell. [= *Dicrastylis fulva* Drumm. ex Harv.].

Shrubs with a dense indumentum of branched (usually dendritic) hairs on the stems, on the lower surface of leaves and bracts and on the inflorescences. *Leaves* opposite and decussate or rarely in whorls of three; petiole short or absent. *Cymes* arranged in fairly lax corymbose panicles, usually obvious but sometimes hidden by the indumentum and appearing to be condensed into heads, with decussate branches each subtended by a leaf or bract, the uppermost bracts sessile, the basal peduncle usually much shorter than the main lateral branches of the panicle; upper bracts glabrous to sparsely hairy inside or hairy only near apex. *Flowers* 4–6-merous. *Pedicels* with a dense white indumentum of dendritic hairs. *Calyx* densely dendritic-hairy outside, glabrous inside or rarely with a few hairs towards apex; lobes slightly shorter than to much longer than tube. *Corolla* white, the indumentum also white, usually unequally 5-lobed, the abaxial lobe largest and the two adaxial lobes shortest, with long simple hairs inside concentrated at throat but glabrous or largely glabrous elsewhere, with usually appressed dendritic hairs and scattered sessile glands on outside of lobes and extending at least a short distance

below the base of each lobe but glabrous at base of tube; lobes about as long as or longer than tube, entire (not crenate). *Stamens* exserted but often exceeded in length by the largest corolla lobe, glabrous or with a few simple hairs on the base of the filament; filament inserted shortly below summit of floral tube, white; anther with sessile glands on the abaxial surface near the junction of the two cells. *Style* exserted, deeply 2-branched, with large white dendritic hairs densely arranged on the basal part and often extending onto the style branches (but usually with only a few scattered hairs towards the base of each branch). *Fruit* globular to broadly obovoid, usually with scattered sessile glands at least on summit, largely covered by a dense white indumentum; gynophore short, glabrous, often multi-ribbed.

Distribution and habitat. The section consists of at least 9 species, occurring in sandy habitats in the south-west of Western Australia. It is absent from the extreme south-west but widespread in the remainder of the South West Botanical Province, with a concentration of species in the northern part of the province and the adjacent part of the Eremean Botanical Province, and with one of the southern species extending into the South-western Interzone. These botanical regions are defined in Beard (1980). The distributions of all members of section *Dicrastylis* are shown in Figures 1 and 2.

Phenology. There are no significant differences in flowering times between members of section *Dicrastylis*, with all species flowering predominantly in the last three months of the year. As in many other plant groups in south-western Australia, those species with the more northern distributions tend to commence and complete flowering earlier than those with more southern distributions. Fruiting quickly follows flowering but seed set is poor. Although each ovary contains 4 ovules, most fruits contain only aborted seeds or undeveloped ovules. A few of the fruits examined had a single mature seed but none had more than one mature seed.

Notes. The main morphological characters distinguishing sect. *Dicrastylis* from other sections of the genus are the relatively lax corymbose panicles and the long corolla lobes in relation to the length of the corolla tube. These features are well illustrated in Figures 6–13 of Munir's (1978) revision, with the contrasting features of the other sections illustrated in Figures 1–5 & 14–31. Other sections of *Dicrastylis* have cymes condensed into head-like or spike-like clusters and either have corolla lobes all distinctly shorter than the corolla tube or (in the South Australian species *D. verticillata* J.M. Black) highly zygomorphic flowers with an exceptionally large abaxial corolla lobe. In sect. *Dicrastylis*, the abaxial corolla lobe varies from being distinctly larger than the other lobes to almost the same size, this feature tending to vary more within species than between species.

Indumentum characters, particularly the type and size of the hairs on various parts of the plant, are very important in distinguishing the species. Five distinct types of branched hairs are recognized here, as illustrated in Figure 3. Two of these (A, C) are clearly dendritic and two (D, E) are modified from the dendritic form to appear more scale-like. The last type of hair (B) is very distinctive, having a single sub-basal whorl of branches, and is possibly a modified stellate hair with a long central ray. All of these branched hairs have a patent stalk, but some of the more scale-like hairs have a very reduced stalk and the branched upper portion appressed to the stem. For simplicity, dendritic hairs that have the upper part borne perpendicular to the stem are referred to here as 'patent', those with the upper part horizontal but borne on a definite short stalk as 'peltate-dendritic' and those largely horizontal with an extremely short stalk as 'subsessile scale-like'.

Other important characters for distinguishing the taxa are leaf shape and size, flower length and anther length.

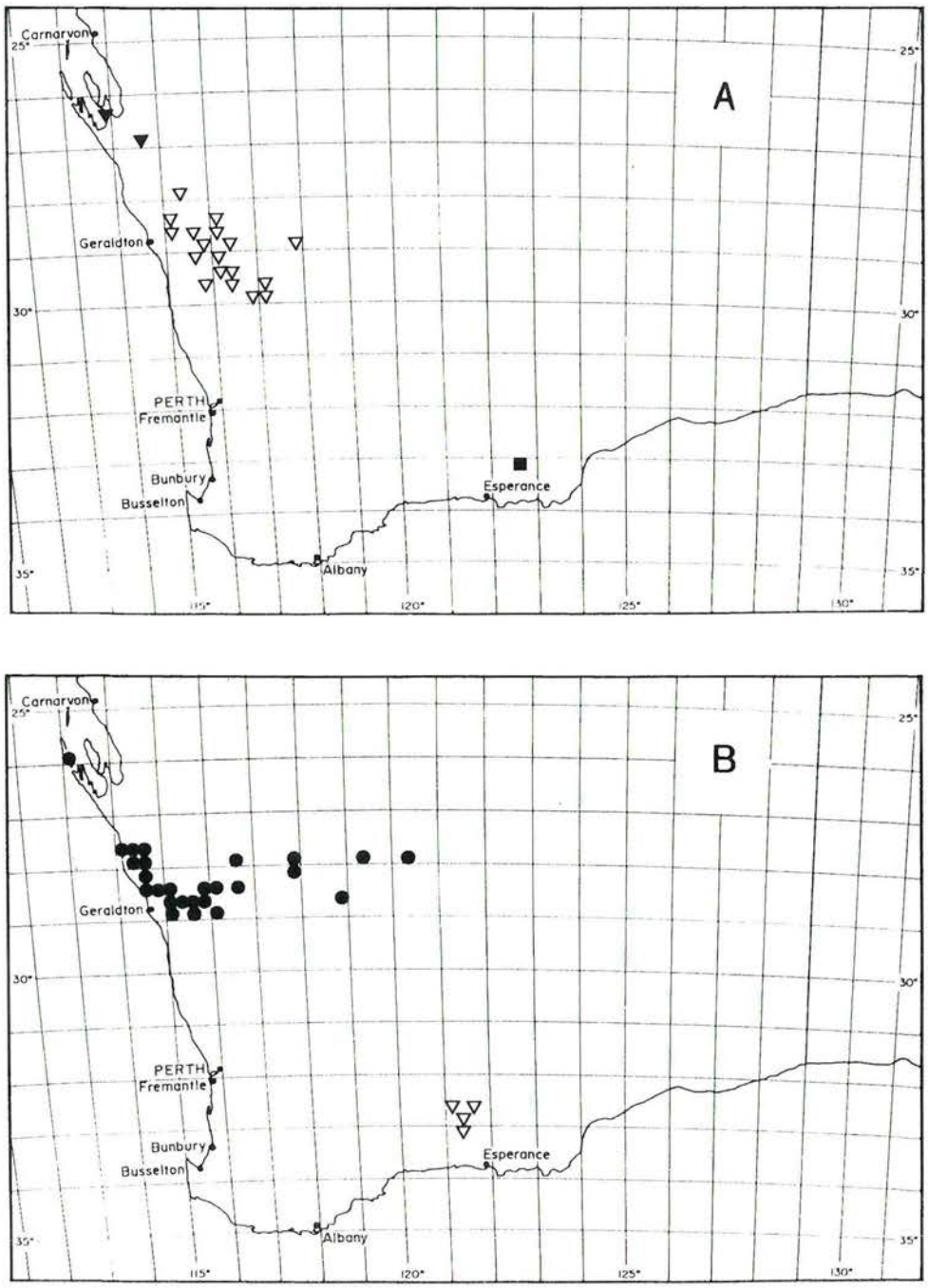

Figure 1. Geographical distributions A – *Dicrastylis archeri* ■, northern variant of *D. soliparma* ▼ and typical variant of *D. soliparma* ▽; B – *D. fulva* ● and *D. obovata* ▽.

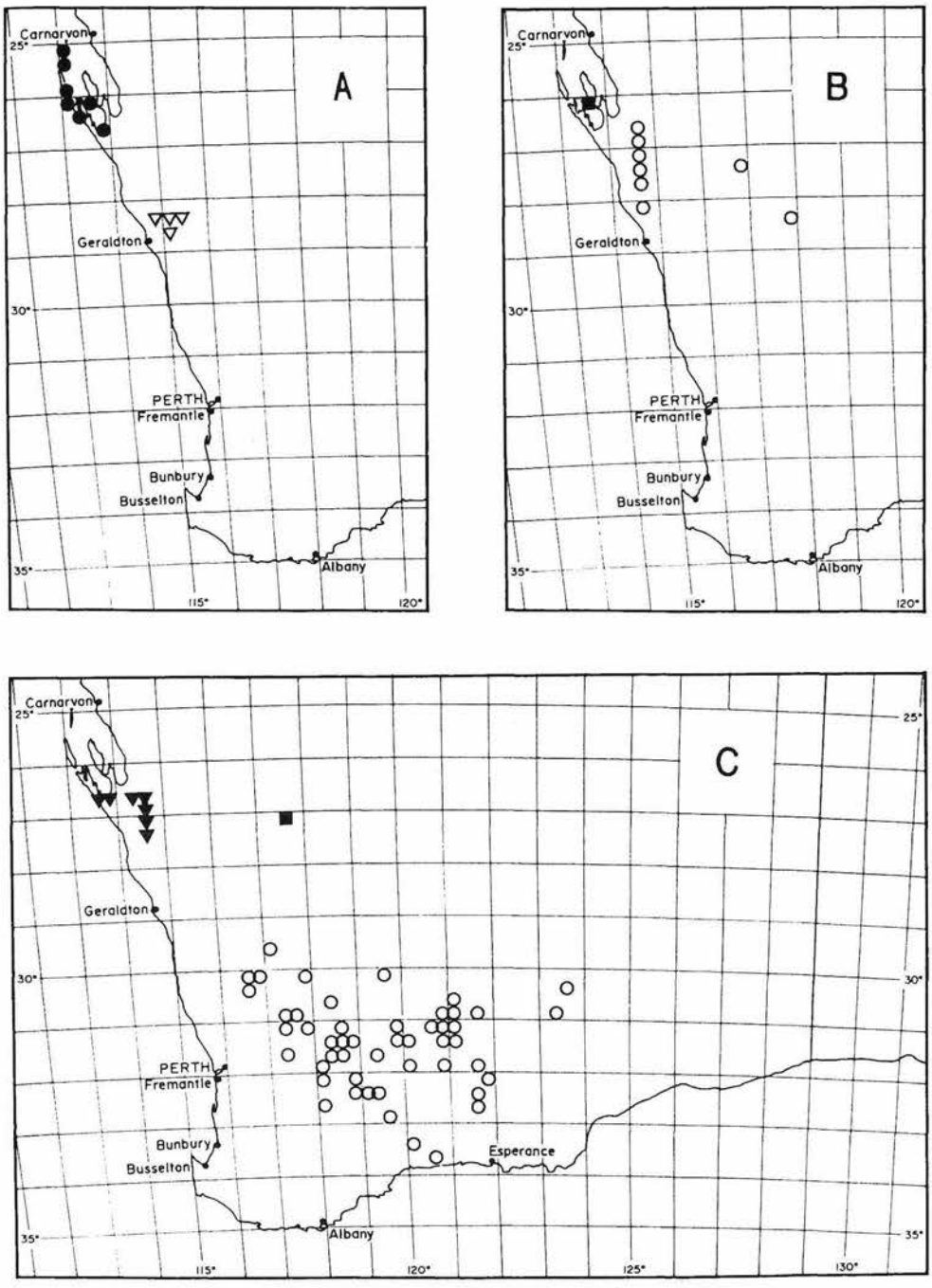

Figure 2. Geographical distributions. A – *Dicrastylis incana* ▽ and *D. maritima* ● ; B – *D. linearifolia* ○ and *D.* sp. Denham ■ ; C – *D. micrantha* ▼, *D. parvifolia* ○ and *D.* sp. Cue ■.

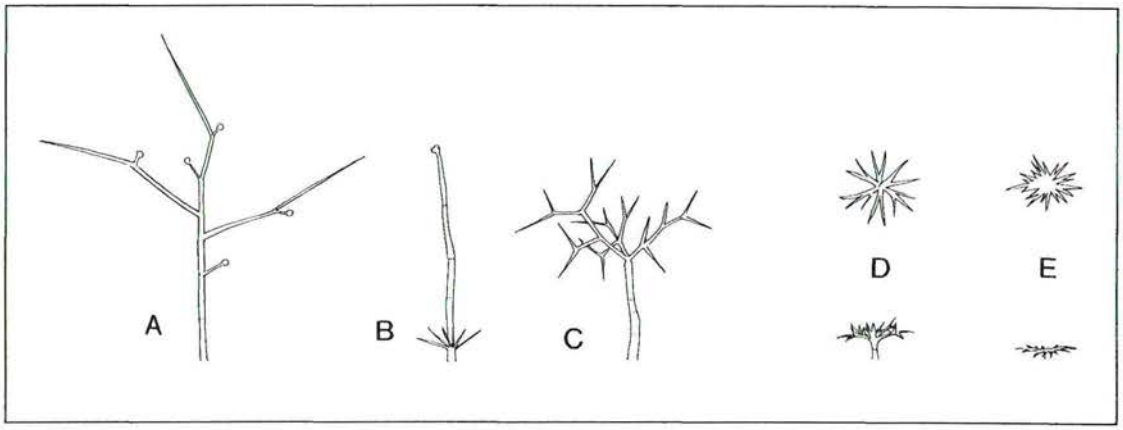

Figure 3. Stem hair types. A–C. Patent branched hairs, from side view. A – glandular dendritic hair of *Dicrastylis incana*; B – glandular hair of *D. micrantha* with sub-basal whorl of non-glandular branches; C – non-glandular dendritic hair of *D. fulva*. D,E. Non-glandular modified dendritic hairs with the branched portion horizontal, from top and side view. D – peltate-dendritic hair of *D. soliparma*; E – subsessile scale-like hair of *D. obovata*. Drawn from *C.I. Stacey* 564 (A), *E.M. Bennett* 1477 (B), *M.E. Phillips* 27723 (C), *C.A. Gardner* Nov. 1933 (D) and *G.F. Craig* 2910 (E).

Key to species

1. Pedicel and calyx with an appressed indumentum of subsessile scale-like hairs (Figure 3E) less than 0.2 mm long
   2. Leaves obovate or broadly obovate, 6–16 x 3–10 mm; upper surface fairly uniformly hairy. Anthers 0.4–0.5 mm long. Occurs east of Hyden. (Frank Hann National Park area.) ..... **D. obovata**
   2. Leaves almost linear to narrowly obovate, 13–45 x 1–6 mm; upper surface glabrous throughout or with the bullae becoming glabrous. Anthers usually 0.6–0.7 mm long. Occurs either north of Geraldton or east of Esperance
      3. Upper leaf surface shallowly bullate, hairy between the bullae. Stamens usually 5; filament 2.5–3.7 mm long. (Meadow Station to Binnu to Mount Magnet) ..... **D. linearifolia**
      3. Upper leaf surface prominently reticulate-patterned, glabrous. Stamens usually 4; filament *c.* 1.5 mm long. (Mt Heywood area) ..... **D. archeri**
1. Pedicel with patent dendritic hairs 0.2–3.5 mm long; calyx with either patent dendritic (Figure 3C) or peltate-dendritic (Figure 3D) hairs 0.2–3 mm long
   4. Stem indumentum including glandular hairs (the glands sometimes lost with age); largest hairs up to 3.5 mm long, if less than 2 mm long then with a sub-basal whorl of simple branches. Leaves sessile
      5. Largest hairs 2–3.5 mm long, dendritic, with several of the branches terminated by a gland (Figure 3A). Calyx lobes 1.2–2.3 mm long, with hairs 0.8–3 mm long. (Chapman River to Greenough River) ..... **D. incana**
      5. Largest hairs 0.5–1.3 mm long, with a sub-basal whorl of simple non-glandular branches and with a single terminal gland (Figure 3B). Calyx lobes 1–1.5 mm long, with hairs 0.2–0.35 mm long. (Useless Loop to Kalbarri National Park) ..... **D. micrantha**
   4. Stem indumentum of non-glandular hairs; largest hairs up to 1.5 mm long, dendritic. Leaves usually subsessile or shortly petiolate

6. Calyx with hairs 0.2–0.4 mm long
   7. Corolla lobes with a dense indumentum reaching the margin. Anthers 0.4–0.6 mm long, pale yellowish to medium brown. Occurs on the coast on strand, dunes and limestone. (Dorre Island to Salutation Island) ..... **D. maritima**
   7. Corolla lobes with a distinct glabrous border. Anthers 0.25–0.35 mm long, purple to black. Occurs either well inland or in hummock grassland close to, but not on, the coast
      8. Leaves 5–20 x 1–3.5(5) mm. Panicles 15–75 mm across. (Wubin area to Oldfield River to Queen Victoria Springs) ..... **D. parvifolia**
      8. Leaves (as far as known) 20–30 x 8–10 mm. Panicles *c.* 130 mm across. (Peron Peninsula) ..... **D.** sp. Denham
6. Calyx with hairs 0.5–1.5 mm long
   9. Leaves mostly narrowly ovate, the larger ones 35–40 mm long; undersurface prominently reticulate, with minute hairs not covering the large lacunae. Flowers *c.* 3 mm long. (Cue area) ..... **D.** sp. Cue
   9. Leaves varying from narrowly to broadly ovate or obovate, the larger ones 10–33(37) mm long, if more than 33 mm long then narrowly obovate; undersurface with small lacunae and/or with large hairs obscuring lacunae. Flowers 4-6 mm long
      10. Stem indumentum (not including inflorescence branches) of patent dendritic hairs 0.4–1.4 mm long (Figure 3C). Leaves mostly narrowly to broadly ovate, 5–14 mm wide. (Mainly Kalbarri to Agnew) ..... **D. fulva**
      10. Stem indumentum (not including inflorescence branches) of peltate-dendritic hairs up to 0.3 mm long (Figure 3D). Leaves mostly narrowly obovate or obovate, 3–9 mm wide. (Peron Peninsula to Jibberding Station) ..... **D. soliparma**

Dicrastylis archeri Munir (Munir 1991: 86–89). *Type:* North of Mt Heywood [precise locality withheld], Western Australia, 1 December 1990, *W.R. Archer* 112907 (*holo:* AD *n.v.*, illustration seen; *iso:* PERTH 02504847).

Illustration. The holotype is illustrated in Munir (1991: Figure 1).

Shrubs 0.4–1 m high, with a dense appressed indumentum on the young stems and inflorescences; indumentum of subsessile scale-like hairs. *Young stems* pale to medium grey at first, becoming dark grey, with white and ferruginous hairs up to 0.1 mm long. *Leaves* opposite, antrorse, subsessile or shortly petiolate. *Petioles* up to 1.5 mm long. *Leaf blades* narrowly or very narrowly obovate, 13–26 x 1.3–3.3 mm, acute or sometimes obtuse, with prominently recurved margins; lower surface pale green to whitish, closely covered by a dense short white indumentum; upper surface glabrous, medium green, prominently reticulate-patterned. *Panicles* 15–40 x 20–50 mm, many-flowered, with a dense appressed indumentum of rather scale-like white hairs on the axes, bracts, pedicels and calyx, often also with ferruginous hairs; basal peduncle up to 10 mm long. *Bracts* subtending upper branches usually narrowly oblong-elliptic, the larger ones 2–3 mm long. *Pedicels* up to 4 mm long; indumentum *c.* 0.1 mm long. *Flowers* 4- or 5-merous or heteromerous (with 5 calyx lobes, 4 or 5 corolla lobes and 4 stamens), *c.* 3 mm long. *Calyx* with hairs *c.* 0.1 mm long; tube *c.* 0.5 mm long; lobes ovate or narrowly

ovate, *c.* 1.4 mm long, usually narrowly obtuse. *Corolla*: tube *c.* 1.4 mm long, the outside sparsely dendritic-hairy above the middle, with the indumentum becoming denser towards summit; lobes ovate or broadly ovate, the largest lobe *c.* 2 mm long and the others slightly shorter, obtuse, with a distinct glabrous border around the margin outside. *Stamens*: filament *c.* 1.5 mm long; anther *c.* 0.6 mm long, pale-coloured. *Style* with peltate-dendritic hairs *c.* 0.3 mm long; entire portion *c.* 1.4 mm long; branches commonly 2–2.5 mm long. *Fruit c.* 1.6 x 1.4 mm but not seen at maturity, fairly uniformly hairy. *Seed* not seen.

Other specimen examined. WESTERN AUSTRALIA: NW of Mt Ney Rd [precise locality withheld], 21 May 1993, *G.F. Craig & B. Haberley* 2776.

Distribution. Occurs in the south-east of the South West Botanical Province, known from a small area near Mt Heywood (east of Grass Patch).

Habitat. Recorded in white sand in open mallee woodland.

Phenology. Flowers and fruits: November to December.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority One. This species is known only from two collections, probably both made from the same population.

Notes. The extent of morphological variation in this species is scarcely known, as only one of the two available specimens is in flower and there are no mature fruits. The single flowering specimen has more 4-merous flowers than 5-merous ones, and also many heteromerous flowers with 5 calyx lobes and 4 stamens. In all other members of sect. *Dicrastylis*, most of the flowers are 5-merous.

Dicrastylis fulva J.R. Drumm. ex Harv. (Harvey 1855: 56). *Type:* Northern districts, [Western Australia], *J. Drummond* coll. 6, *s.n.* (*lecto:* TCD, *fide* Munir (1978: 479); *isolecto:* MEL 40849, 40851, 40854, 40856, 40857, 41230).

Pityrodia myriantha F. Muell. (Mueller: 1859: 236, 244). *Type:* Murchison River, [Western Australia,] *A. Oldfield* (*holo:* MEL 40855).

Illustration. Munir (1978: Figure 11).

Shrubs 0.3–1.2(1.6) m high, with a dense indumentum on the young stems, leaves and inflorescences, the young shoots pale to medium ferruginous. *Young stems* pale to dark ferruginous, with patent dendritic hairs, the larger ones 0.4–1.5 mm long. *Leaves* opposite or very rarely in whorls of three, widely spreading, often somewhat retrorse, subsessile or shortly petiolate, densely hairy at first. *Petioles* up to 1.5 mm long. *Leaf blades* usually ovate to elliptic or broadly so, sometimes narrowly ovate or narrowly obovate to obovate but the uppermost leaves subtending the main branches of the panicle always more or less ovate, (12)14–33 x (5)6–14 mm, narrowly to broadly obtuse, with recurved margins, medium grey-green or somewhat ferruginous at first, becoming dark green on both surfaces or somewhat paler on lower surface; lower surface becoming sparsely hairy with age and the sessile glands within the pits then becoming visible; upper surface moderately deeply to deeply bullate, with hairs 0.3–1.2 mm long. *Panicles* (15)30–160 x (25)70–190 mm, with pink or ferruginous hairs as well as white hairs on the axes, bracts and calyx lobes; basal peduncle up to 60 mm long. *Bracts* subtending upper branches ovate, the larger ones 4–7.5 mm long. *Pedicels* up to 6.5 mm long; indumentum

0.4–1.1 mm long. *Flowers* mostly 5-merous, with occasional 6-merous flowers sometimes present, 5–6 mm long. *Calyx* with white and coloured (pink or ferruginous) hairs 0.7–1.5 mm long; tube 0.4–1 mm long; lobes ovate or narrowly ovate, 0.8–1.5 mm long, usually narrowly obtuse or acute. *Corolla*: tube 1.3–2.0 mm long, the outside glabrous or subglabrous on the ribs but hairy at base of each corolla lobe, the hairs usually becoming denser towards summit; lobes obovate-oblong or broadly so, the largest lobe 1.5–4.3 mm long and the others 1.3–3.5 mm long, broadly obtuse, with a distinct glabrous border around the margin outside. *Stamens*: filament 1.6–3.5 mm long; anther 0.4–0.6 mm long, dark purplish black. *Style* with patent dendritic hairs 0.4–0.9 mm long; entire portion 1.0–2.1 mm long; branches 1.5–2.5 mm long. *Fruit* possibly not fully mature, the largest seen *c.* 1.8 x 1.3 mm, with the largest hairs towards the summit. *Seed* not seen. (Figures 3C, 4A–C)

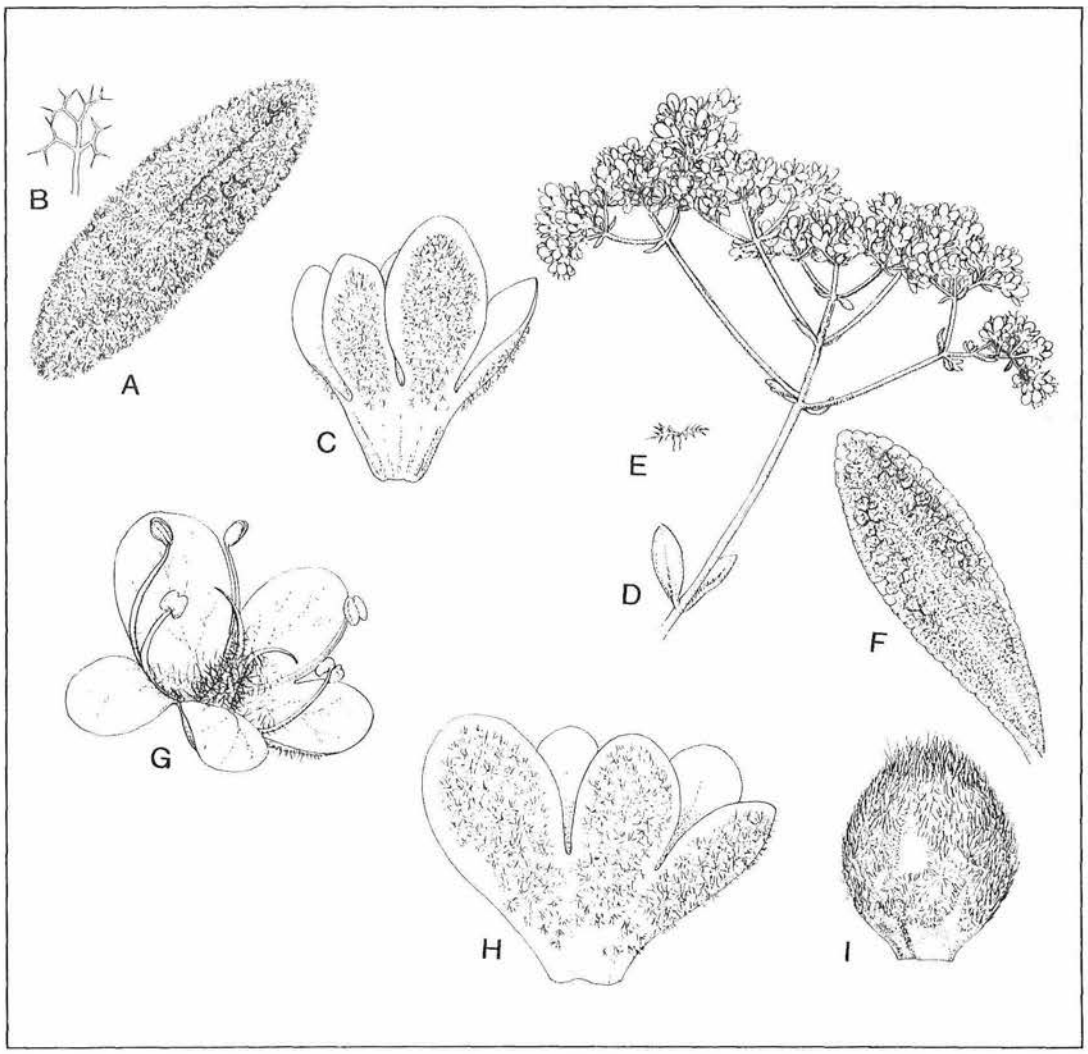

Figure 4. A–C. *Dicrastylis fulva*. A – leaf (x2); B – leaf hair (x20); C – corolla (x8). D–I. *Dicrastylis soliparma*. D – flowering branch (x1); E – stem hair (x30); F – leaf (x2); G – flower (x8); H – corolla (x8); I – fruit (x12). Drawn from *G.E. Brockway* Oct. 1947 (A–C). *R.J. Cranfield & P. Spencer* 8378 (D,E,G,H) and *F. Lullfitz* 3165 (F,I).

Selected specimens examined. WESTERN AUSTRALIA: Near Youanmi, Oct. 1931, *G.E. Brockway* 33; 28 miles [45 km] N of Ajana, Oct. 1947, *G.E. Brockway*; 10 miles [16 km] along Mullewa–Morawa road, 6 Oct. 1984, *A.C. Burns* 3; Mount Magnet, 2 Oct. 1959, *W.H. Butler*; 158.3 km WSW of Yalgoo towards Mullewa, 31 Aug. 1976, *R. Coveny* 7941 *& B.R. Maslin*; Northampton, Nov. 1901, *Diels & Pritzel*; 21.6 km N of Northampton Post Office on North West Coastal Highway, 2 Oct. 1988, *J.M. Fox* 88/107; E of Casuarinas Rd, E of Geraldton, 24 Oct. 1992, *E.A. Griffin* 7528; Dirk Hartog Island, *Martin* 32 (MEL); State Farm, Chapman River, 1 Nov. 1903, *A. Morrison*; East Yuna Reserve, Oct. 1976, *B.G. Muir* 344; 58 km W of Yalgoo, 8 Oct. 1989, *B. Nordenstam & A. Anderberg* 438; 4 miles [6 km] inland from Kalbarri, 18 Sep. 1968, *M.E. Phillips*; *c.* 8 km W of Mullewa, 5 Oct. 1969, *D.J.E. Whibley* 3126.

Distribution. Extends from Eurardy Station and Kalbarri National Park in the north of the South West Botanical Province east to near Agnew in the Eremean Botanical Province. A very isolated record 200 km further north from Dirk Hartog Island (*Martin* 32, MEL) may be inaccurate in its locality as no collections have been made since of the species from this island. The Dirk Hartog Island specimen has no date but must have been collected by 1883 because it was cited in Mueller (1883).

Habitat. Occurs in a variety of sandy soils, probably mainly on plains, in vegetation dominated by varied shrub and tree species.

Phenology. Flowers mainly August to December, also recorded July. Fruits recorded October to December, but only one specimen (*G.E. Brockway* 33) appears to have mature fruits.

Conservation status. Dicrastylis fulva is a fairly common species, with a range of over 600 km, and is not considered to be at risk.

Notes. A single specimen of *D. fulva* (*A.C. Burns* 3) is atypical in having leaves in whorls of three, all other specimens having opposite leaves. Occasional floral abnormalities are found in a few specimens. For example, one specimen (*R. Coveny* 7941 *& B.R. Maslin*) has a few flowers that have eight calyx lobes and three style branches.

In *Dicrastylis fulva* most of the leaves are elliptic to broadly ovate rather than narrowly obovate or obovate as in its closest relative *D. soliparma*.

Dicrastylis incana Munir (Munir 1978: 484–486). *Type:* 35 miles [56 km] from Geraldton towards Mullewa, Western Australia, 30 September 1962, *M.E. Phillips* (*holo:* CBG 020641 *n.v.*, photograph PERTH 03200973).

Dicrastylis morrisonii Munir (Munir 1978: 485–489). *Type:* State Farm, upper Chapman River, north-east of Geraldton, Western Australia, 5 November 1903, *A. Morrison* (*holo:* PERTH 01173626).

Illustrations. The holotype of *D. incana* is illustrated in Figure 12 and the holotype of its synonym *D. morrisonii* in Figure 13 of Munir (1978).

Shrubs 0.3–1.5 m high, with a dense indumentum on the young stems, leaves and inflorescences, the young shoots usually pale grey-green; indumentum of long patent dendritic hairs with multiple glands each terminating a short branch. *Young stems* pale greyish or rarely pale brown or ferruginous, the larger hairs 2–3.5 mm long. *Leaves* opposite, usually antrorse, sometimes widely spreading, sessile,

narrowly ovate-triangular to narrowly ovate, 11–25 x 2.5–7.5 mm, narrowly to broadly obtuse, with prominently recurved margins, densely hairy at first, medium grey-green or somewhat ferruginous at first; lower surface sometimes scarcely visible between the recurved margins, pale grey-green, with a dense indumentum of long white hairs; upper surface deeply or very deeply bullate, dark green, with white hairs mainly between the bullae, the larger hairs 1.5–3 mm long at first but generally becoming broken off towards the base in older leaves. *Panicles* 30–80 x 45–140 mm, many-flowered, with white and sometimes also ferruginous hairs on the axes, bracts and calyx lobes; basal peduncle up to 15 mm long. *Bracts* subtending upper branches narrowly or very narrowly ovate to linear, the larger ones 4–10 mm long. *Pedicels* up to 5(10) mm long; indumentum 0.8–2.3(3.5) mm long. *Flowers* mostly 5-merous with occasional 6-merous flowers sometimes present, possibly also occasionally some 4-merous flowers, 3–5 mm long. *Calyx* with white or rarely pale ferruginous hairs 0.8–2(3) mm long; tube 0.3–0.4 mm long; lobes narrowly triangular to narrowly ovate, 1.2–2.3 mm long, usually narrowly obtuse or acute. *Corolla*: tube 1.6–2.2 mm long, glabrous or sparsely hairy on the ribs outside; lobes obovate-oblong to ovate or broadly so, the largest lobe 2.2–3.6 mm long and the others 1.3–2.8 mm long, broadly obtuse, with a distinct glabrous margin outside. *Stamens*: filament 0.8–2 mm long; anther 0.4–0.5 mm long, dark purplish. *Style* with patent dendritic hairs 0.4–0.5 mm long; entire portion 0.7–2.0 mm long; branches 1.2–2.3 mm long. *Fruit c.* 1.6 x 1.5 mm, with the largest hairs on the summit. *Seed* not seen. (Figure 3A)

Other specimens examined. WESTERN AUSTRALIA: East Yuna Reserve, Oct. 1976, *B.G. Muir* 331; 12 km E of Greenough River crossing on Geraldton–Mullewa road, 5 Oct. 1994, *S. Patrick* 2034; 14.8 km N along Valentine Rd from Geraldton–Mount Magnet road W of Eradu, 1 Nov. 1994, *S. Patrick* 2143; 0.5 mile [0.8 km] E of Greenough River at Eradu, 31 Oct. 1963, *R.D. Royce* 8020; 11 km SE of Yuna, 29 Sep. 1976, *C.I. Stacey* 564; Eradu, Nov. 1934, *H. Steedman*; *c.* 36 km E of Yuna, 8 Nov. 1990, *N. & J. Tunbridge* 4.

Distribution. Occurs in the northern part of the South West Botanical Province, extending from the upper Chapman River south to Eradu and east to north of Pooten Crossing (Greenough River).

Habitat. Occurs in sandy soils, often in low or very open woodlands, dominated by a variety of sandplain species in genera such as *Actinostrobus* and *Grevillea.*

Phenology. Flowers: September to November. Fruits recorded in November.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Previously listed twice on the Priority Flora List, first as *D. incana* with Priority One and the second time as a presumed extinct species *D. morrisonii.* Now known from more localities including a flora reserve and consequently given a reduced priority level.

Notes. This species is the only member of sect. *Dicrastylis* to have glandular dendritic hairs of the type illustrated in Figure 3A. These hairs have a number of short branches each terminated by a gland.

The name *Dicrastylis morrisonii* was published at the same time as *D. incana*, with both taxa described from single collections, the former taxon representing an extreme of the variation found within this species. Seven additional collections are cited above, all closer to the latter type but including some intermediate states in the characters originally used to distinguish the two taxa. The type of *D. morrisonii* appears to be a particularly lush specimen, possibly collected close to the banks of the Chapman River. *D. morrisonii* is here reduced to a synonym of the more commonly used name *D. incana.*

Although most specimens have the greyish appearance implied by the epithet *incana* owing to their long white or off-white indumentum, one collection (*C.I. Stacey* 564) has pale ferruginous hairs. All specimens at PERTH have 5-merous flowers and several (e.g. *B.G. Muir* 331) have occasional 6-merous flowers. The type specimen of *D. incana* was reported to have occasional 4-merous flowers (Munir 1978: 485).

Dicrastylis linearifolia Munir (Munir 1978: 468–470). *Type:* 473 mile post on North West Coastal Highway [262 km north of Geraldton, south of Billabong Roadhouse], Western Australia, 12 December 1971, *A.M. Ashby* 4496 (*holo:* AD *n.v.*, illustration seen; *iso:* PERTH 01082167).

Illustration. The holotype of *D. linearifolia* is illustrated in Munir (1978: Figure 7).

Shrubs 1.5–3 m high, with a dense appressed indumentum on the young stems and inflorescences; indumentum of subsessile scale-like hairs, the young shoots pale grey-green or pale ferruginous-green. *Young stems* bright orange or dark orange-brown, with mainly ferruginous hairs up to 0.2 mm long. *Leaves* opposite, antrorse or sometimes fairly widely spreading, shortly petiolate. *Petioles* 1–4.5 mm long. *Leaf blades* almost linear to narrowly obovate, 16–45 x 3–6 mm, acute or obtuse, with recurved margins; lower surface pale grey-green, densely covered by an appressed white indumentum, with scattered sessile glands sometimes visible; upper surface medium to dark green, shallowly bullate on upper surface and becoming glabrous on the bullae but retaining very short white hairs between the bullae. *Panicles* usually many-flowered and 20–45 x 30–55 mm, rarely reduced to a few flowers and only *c.* 10 mm long, with ferruginous hairs as well as white hairs on the axes, bracts and calyx lobes; basal peduncle up to 13 mm long. *Bracts* subtending upper branches usually narrowly ovate to ovate, the larger ones 1–2 mm long. *Pedicels* up to 3.5 mm long; indumentum *c.* 0.05 mm long. *Flowers* mostly 5-merous with occasional 4-merous flowers sometimes present, 4.5–6.5 mm long. *Calyx* with an indumentum *c.* 0.05 mm long; tube 0.5–1.3 mm long; lobes narrowly triangular to ovate, 0.9–1.6 mm long, usually acute. *Corolla:* tube 1.7–2.3 mm long, the outside sparsely hairy for a short distance below the middle and fairly densely hairy above the middle; lobes usually obovate or broadly obovate, the largest lobe 2.8–4 mm long and the others 2.2–3.3 mm long, broadly obtuse, with a distinct glabrous margin outside. *Stamens*: filament 2.5–3.7 mm long; anther 0.6–0.7 mm long, pale-coloured or red-brown. *Style* with patent dendritic hairs *c.* 0.3 mm long; entire portion 1.5–3 mm long; branches 1.5–2.5 mm long. *Fruit* 1.8–2.4 x 1.6–1.8 mm, fairly uniformly hairy. *Seed* not seen.

Other specimens examined. WESTERN AUSTRALIA: Iona Station, near Mount Magnet, 25 Sep. 1973, *J.S. Beard* 6666; Meadow turnoff, Carnarvon road, 17 Nov. 1968, *H. Demarz* 707; 0.5 mile N of 419 mile peg on North West Coastal Highway [173 km N of Geraldton], 7 Dec. 1972, *H. Demarz* 4177; 439 mile peg on Carnarvon road [204 km N of Geraldton], 10 Dec. 1974, *H. Demarz* 5531; 413 mile peg, Great Northern Highway [163 km N of Geraldton], 21 Jan. 1976, *H. Demarz* 5991; 438 mile peg on North West Coastal Highway [203 km N of Geraldton], *C.A. Gardner* 2185; Cistern 1, 40 km N of Murchison River, 20 Dec. 1962, *C.A. Gardner* 14274; 0.75 mile N of 415 mile peg on Carnarvon road [167 km N of Geraldton], 14 Dec. 1964, *F.W. Humphreys* 6333; Binnu, 18 Dec. 1962, *F. Lullfitz* 1954; 438 mile peg [203 km N of Geraldton], *F. Lullfitz* 2185; 435 mile peg on North West Coastal Highway [198 km N of Geraldton], 7 Dec. 1965, *F. Lullfitz* 4553; 436 mile peg on North West Coastal Highway [200 km N of Geraldton], 11 Dec. 1966, *F. Lullfitz* 5956; Botra paddock, Meka Station, 10 Dec. 1980, *A.A. Mitchell* 842.

Distribution. Occurs in the northern part of the South West Botanical Province from Meadow Station south to Binnu. Also known from Meka and Iona Stations (both near Mount Magnet) in the Eremean Botanical Province.

Habitat. Recorded in red sandy soils. Of the two inland records, one is given as a sand ridge and the other as "bowgada [*Acacia*] sand plain". The western collections give no information on associated vegetation or landforms except for one mention of sandheath.

Phenology. Flowers recorded in November to December. Fruits recorded December to January.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. This species is now known from about ten localities over a range of almost 400 km, but none from conservation reserves.

Notes. This species has the shortest indumentum and the most obviously petiolate leaves known for section *Dicrastylis*. Although the panicles are occasionally reduced to a few flowers, some many-flowered panicles are present on all specimens. Most specimens appear to have uniformly 5-merous flowers but some of the flowers are 4-merous on *F. Lullfitz* 1954.

Dicrastylis maritima Rye & Trudgen, *sp. nov.*

Dicrastyli soliparmae affinis sed floribus parvioribus et indumento calycis breviore.

Typus: Peron Peninsula, Western Australia, 4 November 1989, *M.E. Trudgen* 7375 (*holo:* PERTH 01224751; *iso:* CANB, K, MEL).

Shrubs 0.1–0.5 m high, erect or decumbent, often spreading, with a silvery appearance resulting from a dense white indumentum of patent dendritic hairs on the stems and leaves. *Stems* with hairs commonly 0.2–0.4 mm long on young stems, up to 0.8 mm long on older stems. *Leaves* opposite, widely spreading and often somewhat retrorse, subsessile or shortly petiolate. *Petioles* up to 1.3 mm long. *Leaf blades* narrowly ovate or narrowly oblong to elliptic, 7–24 x 3–9 mm, obtuse or acute, with recurved margins, pale green or grey-green, the indumentum in young leaves commonly 0.1–0.2 mm long over most of blade but often 0.3–0.5 mm long along the midvein, in old leaves becoming sparse and up to 1 mm or more long; lower surface with a dense indumentum and scattered sessile glands; upper surface very shallowly bullate. *Panicles* 10–45 x 15–85 mm, many-flowered, with ferruginous hairs as well as white hairs on the axes, bracts and calyx lobes; basal peduncle up to 32 mm long. *Bracts* subtending upper branches ovate, the larger ones 2–2.5 mm long. *Pedicels* up to 2.5 mm long; indumentum 0.2–0.3 mm long. *Flowers* 4–6-merous but mostly 5-merous, 3–4 mm long. *Calyx* with white and ferruginous hairs 0.2–0.3 mm long; tube 1.0–1.4 mm long; lobes ovate or broadly ovate, 1.0–1.4 mm long, narrowly obtuse or acute. *Corolla*: tube 1.4–1.8 mm long, the outside hairy above the middle, the indumentum becoming denser towards summit; lobes ovate or broadly ovate, the largest lobe 1.6–2.4 mm long and the others 1.3–2.0 mm long, broadly obtuse, with a very dense indumentum throughout the outer surface. *Stamens*: filament 1.8–3 mm long; anther 0.5–0.6 mm long, pale yellowish to medium brown. *Style* with patent dendritic hairs 0.4–0.6 mm long; entire portion 1.0–1.8 mm long; branches 1.5–2 mm long. *Fruit* 2.0–2.5 x 1.9–2.2 mm, fairly uniformly hairy or with some longer hairs on summit. *Seed c.* 1.5 x 0.9 mm, soft, white, with an inconspicuous extremely fine reticulate pattern on the surface. (Figures 3D, 5)

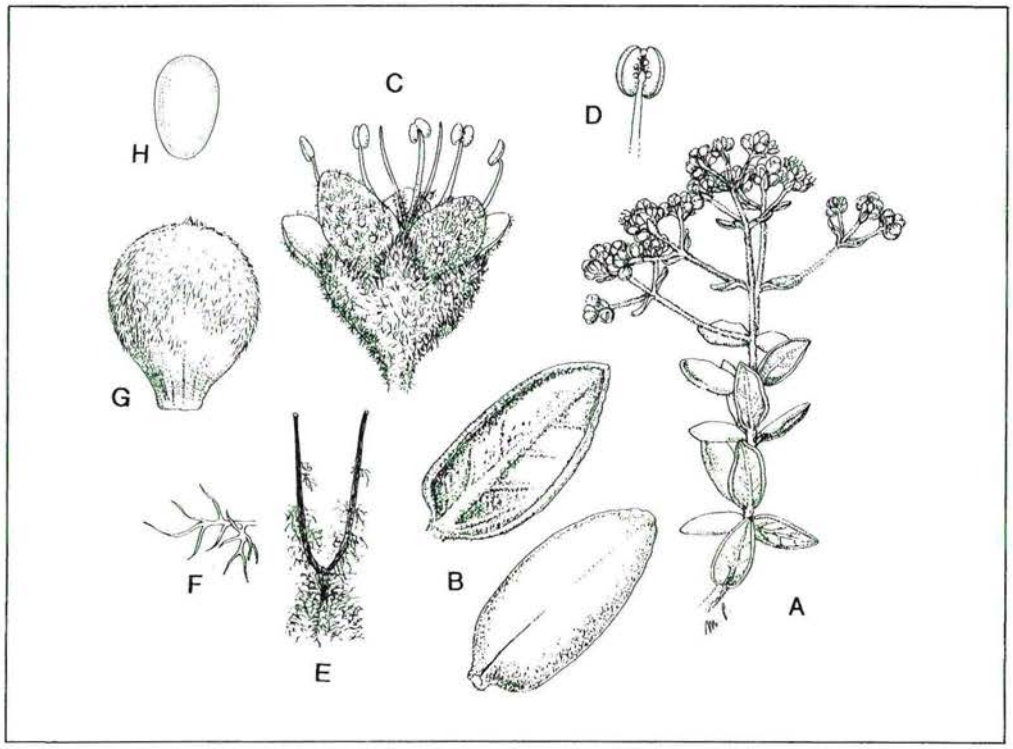

Figure 5. *Dicrastylis maritima*. A – flowering stem (x1), B – lower and upper surfaces of leaf (x3), C – flower (x7), D – stamen (x13), E - style (x10), F – dendritic hair from a style branch (x60), G – fruit (x10), H – seed (x8.5). Drawn from *M.E. Trudgen* 7375 (A–C), *H. Demarz* 5508 (C–F) and *P.G. Wilson* 8238 (G,H).

Other specimens examined. WESTERN AUSTRALIA (all PERTH): Salutation Island, Freycinet Estuary, 12 Sep. 1989, *J.J. Alford*; Salutation Island, Freycinet Estuary, 14 Sep. 1989, *J.J. Alford* 1318; 2 km N of Eagle Bluff, Peron Station, 11 Nov. 1982, *R.J. Cranfield* 2560; Eagle Bluff, 6 Dec. 1974, *H. Demarz* 5508; Behind White Beach, Dorre Island, 11 Nov. 1973, *T. Evans*; By Homestead, Dirk Hartog Island, 7 Sep. 1972, *A.S. George* 11617; Dorre Island, 16 Dec. 1973, *K.F. Kenneally* 12; Sandy Point, Dirk Hartog Island, 6 Sep. 1967, *M.H. Manning*; Near southern part of Useless Inlet, 29 Sep. 1989, *M.E. Trudgen* 7374; South Transect, Dorre Island, 16 Aug. 1977, *A.S. Weston* 10527; S of South Transect, Dorre Island, 18 Aug. 1977, *A.S. Weston* 10545; N of Goulet Bluff, Peron Peninsula, 22 Mar. 1969, *P.G. Wilson* 8238.

Distribution. Restricted to the Shark Bay region, extending from Dorre Island south to Useless Loop in the Eremean Botanical Province and also recorded from Salutation Island in the far north of the South West Botanical Province.

Habitat. Occurs on off-shore islands and along the coast on the mainland, growing in deep sand on the upper strand and coastal dunes, also in sand over limestone on coastal cliffs. Recorded in low coastal shrublands and *Spinifex* hummock grasslands. Sometimes *Dicrastylis maritima* is the dominant shrub species. Like many other coastal plants, the species sometimes has long, more or less horizontal main stems buried in the shifting sands.

Phenology. Flowers recorded August to December. Fruits recorded December to March.

Conservation status. Although of fairly restricted distribution and habitat, this species is not considered to be at risk at present. Known from at least ten locations including three nature reserves or national parks.

Etymology. From the Latin *maritimus* – by the sea, referring to the coastal distribution of the species.

Notes. The phrase name *Dicrastylis* sp. Shark Bay (*J.J. Alford* 1318) has been applied to this species at PERTH. *Dicrastylis maritima* can be distinguished from the other members of sect. *Dicrastylis* by the more extensive indumentum on the outside of its corolla lobes, which reaches and protrudes slightly beyond the margin, the other species having a distinct glabrous border to the corolla lobes. It shows greatest similarity to *D. soliparma*, differing vegetatively in its usually shorter and broader leaves, which are more often patent to retrorse than in the other species, and its more erect branches on the stem hairs. It also differs from *D. soliparma* in its usually smaller panicles, smaller flowers, shorter calyx indumentum and paler anthers.

Dicrastylis maritima is the only member of its genus recorded from coastal dunes, and certainly the only one known from the strand. It occurs north or north-west of the known ranges of other members of sect. *Dicrastylis*, overlapping slightly with *D. micrantha* and possibly also overlapping with *D. fulva*. One odd specimen collected from Peron Peninsula appears to be intermediate in morphology between *D. maritima* and *D. micrantha*. This might possibly be a hybrid or a new variant of one of the two species but is currently treated as a distinct species under the phrase name *Dicrastylis* sp. Denham (*M. Lewis* 42/92).

Two vegetative specimens (*M.H. Manning* 6/9/1967 and *A.S. Weston* 10545) of *D. maritima* differ from the flowering and fruiting specimens in having larger mature leaves with a longer sparser indumentum. Occasional 6-merous flowers or heteromerous flowers (e.g. with six calyx lobes but only five corolla lobes) have been observed on a number of specimens and occasional 4-merous flowers observed on other specimens such as the type. The description given above for the fruit and seed is based on a few fruits from *P.G. Wilson* 8238 and *H. Demarz* 5508, the only known fruiting specimens.

Dicrastylis micrantha Munir (Munir 1978: 475–478). *Type:* About 175 km north of Geraldton, Western Australia, 2 October 1966, *E.A. Shaw* 610 (*holo:* AD *n.v.*, illustrations seen).

Illustrations. The holotype of *D. micrantha* is illustrated in Munir (1978: Figures 9,10).

Shrubs 0.4–1 m high, with a dense indumentum on the young stems, leaves and inflorescences, the young shoots pale grey-green or pale ferruginous, the vegetative indumentum of minute and much larger patent branched hairs; large hairs with a sub-basal whorl of non-glandular branches and a thick main axis terminated by a gland. *Young stems* dark red-brown to pale ferruginous, the glandular hairs 0.5–1.3 mm long. *Leaves* opposite, usually antrorse, sometimes widely spreading, sessile, usually narrowly obovate, sometimes narrowly oblong-elliptic or narrowly ovate, 17–38 x 3–9.5 mm, acute to broadly obtuse, with recurved margins; lower surface usually somewhat paler than upper surface, the indumentum mainly of short star-like hairs but also some long glandular hairs especially on the midvein, with sessile glands visible within the pits; upper surface moderately deeply to deeply bullate, medium to dark green, with a mixture of short star-like and long glandular hairs, the glandular hairs up to 1 mm long. *Panicles* (25)40–160 x (30)60–200 mm, many-flowered, with deep pink or ferruginous hairs as well as white hairs on the axes, bracts and calyx lobes; basal peduncle up to 50 mm long. *Bracts* subtending upper branches narrowly ovate to narrowly obovate, the larger ones

2.5–4 mm long. *Pedicels* up to 3 mm long; indumentum 0.2–0.4 mm long. *Flowers* 4–6-merous but mostly 5-merous, 2–3 mm long. *Calyx* with hairs 0.2–0.35 mm long; tube 0.3–0.5 mm long; lobes ovate or narrowly ovate to narrowly oblong, 1–1.5 mm long, usually narrowly obtuse or acute. *Corolla*: tube 1.2–1.7 mm long, the outside hairy near base of each corolla lobe and glabrous or subglabrous on the ribs; lobes obovate to broadly ovate, the largest lobe 1.4–2 mm long and the others 0.9–1.6 mm long, broadly obtuse, with a distinct glabrous margin outside. *Stamens*: filament 1.4–2.5 mm long; anther 0.3–0.4 mm long, dark purple to black. *Style* with patent dendritic hairs 0.3–0.4 mm long; entire portion 0.6–1.3 mm long; branches 0.5–1.5 mm long. *Fruit c.* 1.3 x 0.7 mm but possibly not fully mature, with the largest hairs on the summit. *Seed* not seen. (Figure 3B)

Other specimens examined. WESTERN AUSTRALIA: Carnarvon–Geraldton road nearer Geraldton, Sep. 1968, *K. Baird*; Between Hamelin and Tamala, 10 Oct. 1973, *J.S. Beard* 6796; 436 miles along North West Coastal Highway [200 km N of Geraldton], 2 Oct. 1966, *E.M. Bennett* 1477; Tamala Station, 12 Oct. 1973, *J.S. Beard* 6816; Useless Loop–Tamala road, 27 Oct. 1974, *J.R. Cannon* 331; 0.5 mile N of 441 mile peg on Carnarvon road [209 km N of Geraldton], 17 Nov. 1968, *H. Demarz* 711; 23 km N of Nerren Nerren, 3 Oct. 1985, *H. Demarz* 10802; Murchison area, 11 Dec. 1985, *H. Demarz* 11187; 16 miles [26 km] S of Wannoo Roadhouse, North West Coastal Highway, 9 Sep. 1970, *A.S. George* 10368; Carnarvon District, Oct. 1966, *J.N. Hutchinson*; 410 mile peg on North West Coastal Highway [158 km N of Geraldton], 20 Dec. 1962, *F. Lullfitz* 1962; 426 mile peg on North West Coastal Highway [184 km N of Geraldton], 20 Oct. 1965, *F. Lullfitz* 4294; *c.* 14.5 miles [23 km] S of Wannoo, 17 Sep. 1968, *M.E. Phillips*.

Distribution. Extends from Useless Loop in the Eremean Botanical Province south-east to between Nerren Nerren Station and Kalbarri National Park in the north of the South West Botanical Province, a range of *c.* 170 km.

Habitat. Recorded from red sand or sandplain, one record from "intermediate sandplain (*Acacia-Hakea-Melaleuca*)".

Phenology. Flowers: September to December. Fruits recorded in December.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Known from a fairly restricted distribution (150 km) and not known from any conservation reserves.

Notes. This species can be readily identified by the very distinctive indumentum on its stems. The larger hairs are comprised of a thick patent axis of *c.* 5 elongate cells and a whorl of short spreading non-glandular branches located at the junction of the two basal cells, the axis terminated by a gland (Figure 3B). All other species in sect. *Dicrastylis* have the hairs branched towards the summit or for most of their length, not just near the base and not forming a simple whorl.

The largest leaves of the PERTH specimens are all in the range 3–9.5 mm wide, but according to the original description the leaves are occasionally as large as 10–15 mm wide. Although the flowers are small, they are arranged in a very large inflorescence with long branches. Flowers are mostly 5-merous, with occasional 4-merous flowers observed on a number of specimens, while 6-merous flowers were observed only on *J.S. Beard* 6816.

Two specimens collected from areas that are far outside the known range of this species were previously included under it but are excluded here. These have now been redetermined as *D. parvifolia* and are discussed under that species.

Dicrastylis obovata Munir (Munir 1978: 465–468). *Type:* Frank Hann National Park, west of 90 Mile Tank, Western Australia, 10 December 1971, *R.D. Royce* 10231 (*holo:* PERTH 01603574).

Illustration. The holotype of *D. obovata* is illustrated in Munir (1978: Figure 6).

Shrubs 0.4–1.7 m high, with a dense appressed indumentum on the young stems and inflorescences, the young shoots pale grey-green; indumentum of subsessile scale-like hairs. *Young stems* yellowish to orange-brown at first, becoming dark ferruginous with age, with white and ferruginous hairs up to 0.2 mm long. *Leaves* opposite or rarely in whorls of three, antrorse, subsessile or shortly petiolate. *Petioles* up to 1.3 mm long. *Leaf blades* obovate or broadly obovate, 6–16 x 3–10 mm, broadly obtuse, with recurved margins, usually moderately densely hairy at first, with scattered sessile glands often visible; lower surface usually appearing slightly paler then upper surface and more distinctly reticulate-patterned, the pits densely white-hairy, the ridges tending to become glabrous and medium green; upper surface very shallowly bullate to rugose, medium green, with hairs *c.* 0.1 mm long. *Panicles* 15–50 x 15–65 mm, many-flowered, with ferruginous hairs as well as white hairs on the axes and bracts; basal peduncle up to 4 mm long. *Bracts* subtending upper branches usually narrowly ovate, the larger ones commonly 2–4 mm long. *Pedicels* up to 4 mm long; indumentum *c.* 0.1 mm long. *Flowers* mostly 5-merous, with occasional 4-merous flowers sometimes present, 4–6 mm long. *Calyx* often with deep pink and/or ferruginous hairs as well as white hairs *c.* 0.1 mm long; tube *c.* 0.5 mm long; lobes ovate or narrowly ovate, commonly 1.5–2 mm long, usually narrowly obtuse, with a distinct glabrous margin outside. *Corolla*: tube commonly 1.7–2.5 mm long, largely glabrous outside but hairy below each corolla lobe; lobes broadly or very broadly ovate, the largest lobe 2.4–3 mm long and the others 1.3–2 mm long, broadly obtuse. *Stamens*: filament 2–2.5 mm long; anther 0.4–0.5 mm long, pale-coloured. *Style* with peltate-dendritic hairs 0.2–0.3 mm long; entire portion 1.5–2.3 mm long; branches 1.5–2.5 mm long. *Fruit c.* 1.5 x 1.4 mm but not seen at maturity, fairly uniformly hairy. *Seed* not seen. (Figure 3F)

Other specimens examined. WESTERN AUSTRALIA: 36.9 km E of Vermin Proof Fence along Lake King–Norseman road, Frank Hann National Park, 19 Sep. 1993, *G.F. Craig* 2910; Lake King–Norseman road, 30 Oct. 1988, *E.J. Croxford* 6244; 25 miles [40 km] W of 90 Mile Tank, 17 Oct. 1974, *H. Demarz* 5366; Between Forrestania and Lake King, 25 Nov. 1964, *C.A. Gardner*; 46.2 miles [74 km] E of Lake King crossroads, 14 Nov. 1965, *F.W. Humphreys*; 46.3 miles [75 km] E of Lake King crossroads, 14 Nov. 1965, *F.W. Humphreys*; 45 km SW of 90 Mile Tank, Frank Hann National Park, 13 Nov. 1979, *K.R. Newbey* 6505; 28 miles [45 km] W of 90 Mile Tank, 17 Oct. 1974, *E. Wittwer* 1446; 23 miles [37 km] E of vermin fence, Lake King to Daniel, 28 Nov. 1974, *E. Wittwer* 1487.

Distribution. Recorded from west of Lake Hope and from Frank Hann National Park in the South West Botanical Province.

Habitat. Recorded mainly growing in yellow sand on ridges or low dunes, with *Grevillea excelsior* or other shrub or mallee species.

Phenology. Flowers: October to November. Fruits: November to December, judging from the only fruiting specimen (*E. Wittwer* 1487), which bore immature fruits in late November.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Although the species occurs in a large national park, it is known from only a few localities in a small area and a recent survey of this area (Diana Papenfus pers. comm.) has failed to relocate the species.

Notes. Readily distinguished from other members of section *Dicrastylis* by its rather short and broad obovate leaves.

Dicrastylis parvifolia F. Muell. (Mueller 1861: 160). *Type:* East River, near Stokes Inlet, [Western Australia], *G. Maxwell* (*lecto:* MEL 40917, *fide* Munir (1978: 470); *isolecto:* MEL *n.v.*).

Dicrastylis? rosmarinifolia Turcz. (Turczaninow 1863: 226). *Type:* [Western Australia], *J. Drummond* coll. 4, 236 (*holo:* KW *n.v.*, photograph PERTH; *iso:* PERTH 01603582).

Illustration. (Munir 1978: Figure 8).

Shrubs 0.15–0.6 m high with a dense semi-appressed indumentum of peltate-dendritic hairs on the young stems and inflorescences, the young shoots pale grey-green to almost white. *Stems* pale grey-brown to ferruginous or white at first, with white or ferruginous hairs, the larger ones 0.1–0.2 mm long. *Leaves* opposite, antrorse or sometimes widely spreading, usually subsessile. *Petioles* up to 0.7 mm long. *Leaf blades* usually almost linear or narrowly ovate to narrowly obovate, rarely ovate to obovate, 5–20 x 1–3.5(5) mm, narrowly to broadly obtuse, with recurved margins, usually concolorous; lower surface with a dense white indumentum and scattered sessile glands; upper surface shallowly bullate, with hairs up to 0.2 mm long. *Panicles* 12–115 x 15–65 mm, many-flowered, with ferruginous hairs as well as white hairs on the axes and sometimes on the bracts and apex of each calyx lobe; basal peduncle up to 30 mm long. *Bracts* subtending upper branches ovate or narrowly ovate, the larger ones 1.7–2.5 mm long. *Pedicels* up to 1 mm long; indumentum 0.3–0.6 mm long. *Flowers* 4–6-merous but mostly 5-merous, 2–3 mm long. *Calyx* with hairs 0.2–0.4 mm long; tube 0.4–0.6 mm long; lobes ovate or narrowly ovate, 0.5–1.0 mm long, usually obtuse. *Corolla*: tube 0.9–1.5 mm long, glabrous or subglabrous on the ribs outside, often only sparsely hairy near base of each corolla lobe; lobes obovate-oblong or broadly so, the largest lobe 1.5–2.3 mm long and the others 0.8–1.7 mm long, broadly obtuse, with a distinct glabrous margin outside. *Stamens*: filament 2.1–2.7 mm long; anther 0.25–0.3 mm long, pale to medium brown. *Style* with patent dendritic hairs 0.3–0.5 mm long; entire portion 0.4–1.3 mm long; branches 2.0–3.3 mm long. *Fruit* 0.6–1.3 x 0.6–0.7 mm, fairly uniformly hairy. *Seed* not seen.

Selected specimens examined. WESTERN AUSTRALIA: Burra Rock Nature Reserve, 60 km SE of Coolgardie, 14 Nov. 1988, *A. Chapman* 28; 16 km ESE of Biljahnie Rock on vermin fence, 3 Dec. 1997, *R.J. Cranfield* 11747; 3 km N of Lake Kurrenkutten, 22 Nov. 1995, *R. Davis* 363; 32.5 km N of Hyden, 22 Nov. 1985, *D.B. Foreman* 1165; Water Reserve 1, Kulin, 15 Dec. 1994, *S. Murray* 158; Stennet Rock, *c.* 50 km SSW of Norseman, 27 Sep. 1980, *K.R. Newbey* 7674; N of Gabbin, 27 Oct. 1963, *S.B. Rosier* 385; Goddard Creek, N of Zanthus, 27 Jan. 1956, *R.D. Royce* 5344; 58 km N of Salmon Gums, 9 Nov. 1982, *A. Strid* 21299.

Distribution. Occurs in the South West Botanical Province and South-western Interzone, extending from Whitewells Station (north-east of Wubin) and Wubin, south-east to Oldfield River and east to Queen Victoria Springs.

Habitat. Occurs in sandy soils, commonly on sandplains, dominated by a wide variety of shrub and tree species.

Phenology. Flowers: mainly late October to January. Fruits recorded December to January.

Conservation status. The most common and widely distributed member of sect. *Dicrastylis*.

Notes. This widespread species is extremely variable. A specimen from north of Zanthus (*R.D. Royce* 5344), which was included by Munir (1978) in *D. micrantha*, is actually a particularly large-leaved variant of *D. parvifolia* with lush growth, presumably due to its growing near a watercourse in very favourable conditions. A second specimen (*S.B. Rosier* 385) previously included in *D. micrantha* is quite typical of *D. parvifolia*.

Dicrastylis parvifolia can produce an interrupted series of erect stems along a horizontal underground stem as in *A.S. George* 5956, although the single-stemmed shrub habit is far more common.

Most specimens of *D. parvifolia* can be readily distinguished from other members of section *Dicrastylis* by their very small narrow leaves. The species generally has more deeply divided styles than other species, the entire portion only 0.4–1.2 mm long and the two branches up to seven times longer. Where the style is not more deeply branched than in other species, it differs instead in having the dendritic hairs restricted to the base of the entire portion rather than extending up to the branches of the style.

Dicrastylis soliparma Rye & Trudgen, *sp. nov.*

Dicrastylis fulva f. *angustifolia* Munir (Munir 1978: 484). *Type:* 300 mile peg on Mullewa–Morawa road, Western Australia, 22 September 1968, *A.C. Burns* 74 (*holo:* PERTH 01603108).

Dicrastyli fulvae arcte affine sed pilis supra caulem brevioribus et magis lepidoideis, foliis praecipue anguste obovatis vel obovatis differt.

Typus: Canna Siding, Western Australia, November 1933, *C.A. Gardner s.n.* (*holo:* PERTH 03666697; *iso:* CANB, K).

Shrubs 0.3–1(1.5) m high, with a dense white and/or ferruginous indumentum on the young stems, leaves and inflorescences, the young shoots white to pale green or pale ferruginous. *Young stems* pale to dark ferruginous, with peltate-dendritic to subsessile hairs, the larger hairs 0.05–0.2(0.3) mm long, often with somewhat longer hairs occurring on the inflorescence axes. *Leaves* opposite, usually antrorse to patent, rarely retrorse, subsessile or shortly petiolate, densely covered at first by an indumentum of somewhat scale-like hairs. *Petioles* up to 1 mm long. *Leaf blades* mostly narrowly obovate to obovate, 10–27(39) x 3–9 mm, narrowly to broadly obtuse, with recurved margins; lower surface usually distinctly paler than upper surface at maturity, becoming sparsely hairy with age and the sessile glands within the pits becoming visible; upper surface usually pale to medium green at first and becoming dark green, shallowly to moderately deeply bullate, with hairs *c.* 0.1 mm long. *Panicles* 20–65 x (25)35–110(145) mm, with ferruginous hairs as well as white hairs on the axes and bracts; basal peduncle up to 60 mm long. *Bracts* subtending upper branches ovate or narrowly ovate, the larger ones 2.5–5 mm long. *Pedicels* up to 4 mm long; indumentum 0.3–0.8 mm long. *Flowers* mostly 5-merous with occasional 6-merous flowers sometimes present, 4–6 mm long. *Calyx* with hairs 0.5–1.3 mm long, either with all the hairs white or with ferruginous or pink hairs in distal half; tube 0.5–1 mm long; lobes ovate or narrowly ovate, 0.9–1.4(2.3) mm long, usually narrowly obtuse. *Corolla*: tube 1.3–2.2 mm long, the outside uniformly dendritic-hairy above the middle or hairy between the ribs, with hairs sometimes becoming denser towards summit; lobes obovate-oblong or broadly so, the largest lobe 2.2–3.4 mm long and the others 1.1–2.0 mm long, broadly obtuse, with a distinct glabrous border around the margin outside. *Stamens*: filament 1.3–3 mm long; anther 0.4–0.5 mm long, dark purplish black. *Style* with patent dendritic hairs 0.4–1.1 mm long; entire portion 0.8–2.3 mm long; branches

1.3–3 mm long. *Fruit* 1.5–2.2 x 1.4–1.8 mm, with the longest hairs towards summit. *Seed c.* 1.3 x 0.65 mm, soft, pale yellow-brown or whitish, with an inconspicuous fine reticulate pattern on the surface. (Figures 3E, 4D–I)

Selected specimens examined (typical variant). WESTERN AUSTRALIA: Wilroy, 4 Dec. 1962, *J. Beard & F. Lullfitz*; SE of Coolcalalaya Station, 13 Oct. 1988, *A.H. Burbidge* 4433; 2 miles [3 km] N of Perenjori, 8 Dec. 1955, *N.T. Burbidge* 4695; 22.5 km NE of Yandanooka, 24 Oct. 1994, *A. Carr* 311; 25.8 km N of Perenjori on Morawa road, Oct. 1982, *J. Coleby-Williams* 248; 19 km SSW of Mt Gibson, 21 Nov. 1992, *R.J. Cranfield* 8510; Latham, 1945, *C.A. Gardner*; 6 miles [10 km] W of Pindar, 10 Oct. 1945, *C.A. Gardner* 7780; Along the road between Wubin and Paynes Find, 30 Nov. 1994, *E.D. Kabay* 1189; N of East Yuna Reserve on Wandin Rd, 7.6 km E of the junction with Bindoo Rd, 1 Nov. 1994, *S. Patrick* 2149; 10 miles [16 km] S of Tardun, 1 Oct. 1962, *M.E. Phillips* 1698; 51.5 km W of Yalgoo, 14 Oct. 1983, *C.I. Stacey* 742.

Specimens examined (northern variant). WESTERN AUSTRALIA: 13 km S of Wannoo, 24 Nov. 1996, *T.F. Houston* 900-5; Peron Peninsula, 20 Nov. 1989, *M.E. Trudgen* 7373.

Distribution. Occurs mainly in the north of the South West Botanical Province, extending from Peron Peninsula south-east to near Jibberding Station (north-east of Wubin), with one record from the Eremean Botanical Province near Wydgee (north of Paynes Find). The typical variant extends from west of Lake Nerramyne south-east to Jibberding and Wydgee. An atypical northern variant has been recorded from Peron Peninsula and near Wannoo, the disjunction between these specimens and the remainder of the known range of the species being about 115 km.

Habitat. Occurs in a variety of sandy soils, often on sandplains.

Phenology. Flowers October to December. Fruits November to January.

Conservation status. The typical variant is known from numerous populations and is not considered to be at risk. However, the northern variant is known from only two collections and needs further study to determine its taxonomic status and conservation status.

Etymology. From the Latin *sol* – sun and *parma* – small shield, referring to the parasol-like nature of the hairs, with the much-branched summit forming a covering perpendicular to the stalk.

Notes. The phrase name *Dicrastylis* sp. Peron Peninsula (*M.E. Trudgen* 7373) has been used at PERTH for the poorly known northern variant of this species. This differs from the typical variant in its more silvery appearance and usually shorter calyx indumentum. It does not appear to be sufficiently distinct to treat as a separate species but may warrant recognition at the subspecific level and may need to be added to the Priority Flora List. One of the northernmost collections (*S. Patrick* 2149) of the typical variant has rather silvery leaves and shows the closest approach to the northern variant.

The typical variant of *Dicrastylis soliparma* was included within *Dicrastylis fulva* by Munir (1979). The latter species can be distinguished by its longer indumentum on the stems, with patent dendritic hairs rather than peltate-dendritic ones, and by its mostly elliptic to broadly ovate leaf blades. *D. fulva* also tends to have more ferruginous young leaves, longer bracts that are subsessile rather than sessile, more commonly reddish-haired flower buds, and a longer corolla that is usually less hairy on the outside of the tube, but the two species show some overlap in all of these characters.

Included within the typical variant of *Dicrastylis soliparma* are a few specimens with relatively long narrow leaves and a more distinctly crenate margin than usual that have been called *Dicrastylis fulva* f. *angustifolia*. These specimens intergrade fully with other specimens, some of which have long narrow leaves with the margin not very distinctly crenate and some of which have shorter broader leaves with a distinctly crenate margin. Consequently the form is not recognized here.

Probable new taxa

The specimens discussed below cannot be placed in the taxa described above and appear to represent new species, but could be abnormal specimens or hybrids. There is also a possible new infraspecific taxon noted under *D. soliparma* (see above).

Dicrastylis sp. Cue (*A.A. Mitchell* 764). This taxon is known from two immature specimens, both collected in the Cue area by A.A. Mitchell and possibly both from the same granite outcrop on Coodardy Station (Andrew Mitchell pers. comm.). *Dicrastylis* sp. Cue is a large shrub 1–3 m high and has very large leaves, perhaps in response to its preference for the runoff zone of granite outcrops. Its indumentum and other characters seem to place it closest to *D. fulva* and *D. soliparma*, but it tends to be more glandular, having numerous sessile glands on the undersurface of the leaves. The two specimens of *Dicrastylis* sp. Cue are in bud in September and mid October respectively, but the one collected in October has a few flowers just opened, which appear to be smaller than the flowers of *D. fulva* and *D. soliparma*. CALM Conservation Codes for Western Australian Flora: Priority One.

Dicrastylis sp. Denham (*M. Lewis* 42/92). The only known collection of this taxon was made on 26 September 1992 from south of Denham on the Peron Peninsula, in grey sand with hummock grassland. *Dicrastylis* sp. Denham is similar to *D. micrantha* in its habit, inflorescence form and floral characters, such as its black anthers *c.* 0.3 mm long, but is more like *D. maritima* in its indumentum on the vegetative parts and in its shortly petiolate leaves. More material is needed to determine its taxonomic status. CALM Conservation Codes for Western Australian Flora: Priority One.

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Anthotium odontophyllum (Goodeniaceae), a new species from Western Australia

L.W. Sage

C/- Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Sage, L.W. *Anthotium odontophyllum* (Goodeniaceae), a new species from Western Australia. *Nuytsia* 12 (2): 229–231 (1998). *Anthotium odontophyllum* Sage is described. It is endemic to the Western Australian wheatbelt, specifically the Dale and Avon Districts of the South West Botanic Province. Amendments to the key to *Anthotium* in the "Flora of Australia" are provided.

Introduction

In the course of examining collections at the Western Australian Herbarium, material belonging to an undescribed species of *Anthotium* R. Br. (Goodeniaceae) was recognized amongst material placed in *A. humile* R. Br. Morrison (1992) included this taxon within his concept of *A. humile*, but detailed examination showed it to be a distinct species. The new species is related to *Anthotium humile* and *A. rubriflorum* F. Muell. ex Benth.

Taxonomy

Anthotium odontophyllum Sage, *sp. nov.*

A *Anthotio humili* indusio et petalis inferioribus pilis glandularibus ornatis, a *A. rubrifloro* petalis cremeis et pedunculis brevioribus recedit.

Typus: Junction of Dumberning Rd and Forestry West Rd, Highbury State Forest (33°04' S, 117°06' E), Western Australia, 6 December 1996, *G.S. Durell* 132 (*holo:* PERTH 04552679; *iso:* CANB, K, NSW).

Tufted clonal herb, with *c.* 4 separate tufts connected underground to a central rootstock, to 8 cm high and 7 cm wide. *Leaves* all basal, flat, spathulate, 12–58 mm long, 2–6 mm wide, margins usually denticulate; apex acute. *Flowering stalks* ribbed, typically curved, 0.9–3 cm long, usually just shorter

than the leaves; head compact, each of up to 9 crowded cymes; bracts linear, terete, though mostly flattened near the base, 5.5–14 mm long, 0.8–1.5 mm wide, apex obtuse to acute; bracteoles linear to triangular, 3.4–5.8 mm long, *c.*1 mm wide, apex acute to acuminate. *Calyx lobes* 3–4 mm long, 0.6–1.1 mm wide, apex acute to acuminate. *Corolla* cream, auricles sometimes purplish red; tube *c.* 1 mm long, inferior petals fused for a further 0.4–0.6 mm; inferior lobes 2.7–3.5 mm long, 1.2–1.5 mm wide, with glandular hairs on the inner anterior margins, auricle 1.2–1.8 mm long, 1–1.5 mm wide; superior lobes 2.5–4.8 mm long, 0.7–1.2 mm wide, wings 1.6–3.2 mm long, 0.4–0.5 mm wide. *Staminal filaments* 0.7–1.7 mm long; anthers 0.9–1.2 mm long. *Ovary* 2.2–3.5 mm long, ribbed, with 6–8 pairs of ovules per locule. *Style* bent or curved, 2.9–3.5 mm long; indusium with simple glandular hairs near the base. *Fruit* not seen.

Other specimens examined. WESTERN AUSTRALIA: Highbury State Forest, 6 Dec. 1996, *G.S. Durell* 133 (PERTH); Mokine road, S of Narrogin, 6 Dec. 1996, *G.S. Durell* 134 (PERTH); Foxes Lair, Narrogin, 6 Dec. 1996, *G.S. Durell* 135 (PERTH); Tutanning Reserve, 14 Dec. 1970, *A.S. George* 10517 (PERTH); S of Dumberning Siding, Narrogin to Arthur River, 26 Nov. 1984, *G.J. Keighery* 7861 (PERTH); Dryandra State Forest, 26 Nov. 1987, *D.M. Rose* 546 (PERTH); Dryandra State Forest, 30 Nov. 1987, *D.M. Rose* 556 (PERTH); Highbury Block, 22 Nov. 1995, *L.J. Silvester* 5 (PERTH);

Distribution. Occurs from Highbury in the Narrogin region, northwards to Dryandra National Park and Tutanning reserve in the western wheatbelt of Western Australia. This area is included in the Dale and Avon Botanical Districts in the South West Botanical Province of Western Australia.

Habitat. Occurs mostly in open *Eucalyptus wandoo* Blakely woodland over low heath, in mostly sandy clay soil.

Conservation status. Common within its distribution, with at least three populations located within nature reserves.

Etymology. The specific epithet, *odontophyllum* is from the Latin *odonto* – toothed, and *phyllum* – leaf, in reference to the minutely toothed leaf margins of the species.

Affinities. Anthotium odontophyllum is allied to *A. humile* and *A. rubriflorum*. *Anthotium humile* typically has entire linear-terete leaves to 1mm wide (rarely to 2.5 mm when not inrolled), flowering stalks that are typically straight and inferior petals fused for 1.3–2.5 mm from the corolla tube. *A. odontophyllum* has denticulate spathulate leaves to 6 mm wide, typically curved flowering stalks and inferior petals fused for 0.4–0.6 mm from the corolla tube. *A. odontophyllum* can be readily distinguished from *A. rubriflorum* by its cream petals, much shorter flowering stalks and smaller ovary length. Morrison (1992) included *A. odontophyllum* in his description of *A. humile*; this would seem to have been due to a lack of adequate specimens at the time. Morrison's description of *A. humile* does not include the presence of glandular hairs near the base of the indusium and inner anterior margins of the inferior lobes which are clearly present on all the PERTH specimens.

Key to the species

The *Anthotium* key in the "Flora of Australia" (Morrison 1992) should be altered to read as follows.

1 Leaves lanceolate or spathulate, 2–6 mm wide, flat, sometimes serrulate or denticulate

2 Petals usually bright scarlet; flowering stalks 9–16 cm long, usually twice as long as the leaves; ovary 4–5 mm long ..... **A. rubriflorum**

2: Petals cream or off white, auricles sometimes purplish red; flowering stalks 0.9–3 cm long, usually just shorter than the leaves; ovary 2.2–3.5 mm long ..... **A. odontophyllm**

1: Leaves linear to terete, 0.5–1 mm wide (rarely 2.5 mm wide when not inrolled)

3 Flowering stems 2–7 cm long; corolla usually creamy white ..... **A. humile**

3: Flowering stems 12–40 cm long; corolla pale blue or mauve ..... **A. junciforme**

Acknowledgements

The author is grateful to Greg Durell for his collection of plant material, to Paul G. Wilson for the Latin diagnosis, Carol Wilkins for suggesting the specific epithet and Brendan Lepschi for his thoughts on the manuscript.

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New subspecies of *Goodenia drummondii* and *G. laevis* (Goodeniaceae) from the south-west of Western Australia

L.W. Sage

C/- Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

Abstract

Sage, L.W. New subspecies of *Goodenia drummondii* and *G. laevis* (Goodeniaceae) from the south-west of Western Australia. *Nuytsia* 12(2): 233–238 (1998). *Goodenia drummondii* subsp. *megaphylla* Sage and *G. laevis* subsp. *humifusa* Sage are described and mapped. In both cases the new subspecies is geographically distinct from the typical subspecies. *G. drummondii* subsp. *megaphylla* grows taller than the typical subspecies, has leaves that are longer, longer corolla lobes and longer flowering spikes. *G. laevis* subsp. *humifusa* differs from the typical subspecies in its prostrate rather than erect habit and in its broader leaves that are sometimes lobed.

Introduction

Carolin's (1992: 171) treatment of *Goodenia helmsii* (E. Pritz.) Carolin (Goodeniaceae) in the "Flora of Australia" mentions a collection (*A.S. George* 464) that "has leaves 6 cm long...in many ways approaching *G. drummondii*". The author was able to rediscover this population with the help of eminent botanist Alex George, whose collection was made in 1960, and to locate several additional specimens and new populations of the same taxon. From studying this material, the author determined that recognition of a new subspecies of *G. drummondii* was required.

Goodenia laevis Benth. is described in the "Flora of Australia" as being "procumbent or ascending" (Bentham 1868: 61). Charles Gardner noted on his collection of *G. laevis* from Lake King, (C.A. Gardner *s.n.*, Nov. 1931) that it appeared to match the type collection "but some stems are erect: all leaves are smaller than mine". Examination of *G. laevis* material at PERTH by the author revealed that there are two distinct variants of the species. The variants are geographically and morphologically distinct and therefore the author has decided that a new subspecies of *G. laevis* also requires recognition.

Taxonomy

Key to the subspecies of *Goodenia drummondii*

Longest leaves to 7.8 cm long, 0.3–2.2 mm wide, entire; corolla 6–8.3 mm long, lobes 3.2–4.3 mm long; flowering spike to 44 cm long (Armadale to Northam area) ..... subsp. **megaphylla**

Longest leaves to 4 cm long, 1.0–4.0 mm wide, dentate; corolla *c.* 6 mm long, lobes *c.* 2.5 mm long; flowering spike to 20 cm long (Kalbarri National Park to Latham) ..... subsp. **drummondii**

Goodenia drummondii Carolin subsp. **megaphylla** Sage, *subsp. nov.*

Differt a *Goodenia drummondii* subsp. *drummondii* foliis et floribus grandioribus, lobis florum grandioribus, et statura majore.

Typus: Darling Range, east of Armadale [precise locality withheld for conservation purposes], Western Australia, *L.W. Sage* 951, 27 November 1996 (*holo:* PERTH 04782763; *iso:* AD, CANB, K, MEL, NY, PERTH (6 sheets)).

Erect shrub to 1.2 m tall, glabrous except for a few hairs in the leaf axils. *Leaves* cauline, fasciculate, linear, entire, flat, thick; main stem leaves 1.2–7.8 cm long, 0.3–2.2 mm wide. *Inflorescence* a spike to 44 cm; bracts linear to triangular, 1.7–2.5 mm long, not exceeding the sepals, acute; bracteoles similar, 1.2–1.6 mm long. *Sepals* narrowly ovate, 1–1.7 mm long, acute. *Corolla* white with purplish spots in the throat, 6–8.3 mm long; lobes equal, 3.2–4.3 mm long, wings 0.3–0.6 mm wide. *Staminal filaments c.* 2.5 mm long; anthers 1–1.5 mm long.

Other specimens examined [precise localities withheld]. WESTERN AUSTRALIA: Off Brookton Highway, 19 Nov. 1981, *R.J. Cranfield* 1978 (PERTH); Type locality, 1 Jan. 1960, *A.S. George* 464 (PERTH); SW of Northam, 12 Nov. 1985, *G.J. Keighery & J.J. Alford* 478 (PERTH); SW of York, 14 Nov. 1996, *L.W. Sage* 945 (PERTH); Karragullen, 27 Nov. 1996, *L.W. Sage* 953 (PERTH); Karragullen, 27 Nov. 1996, *L.W. Sage* 954 (PERTH); Boyagin, 30 Dec. 1981, *K.J. Wallace* 922 (PERTH).

Distribution. Extends from east of Armadale in the Darling Range to Boyagin and north to south-west of Northam. This area is part of the Northern Forest Region and is included in Darling Botanical District of the South West Botanical Province of Western Australia. (Figure 1)

Habitat. *G. drummondii* subsp. *megaphylla* is mostly associated with granite outcropping in the northern Jarrah forest, but occurs in Wandoo woodland over laterite at the most northern population south-west of Northam.

Flowering period. November to late December or early January.

Conservation status. Priority Three should be considered for this subspecies as there are only six known populations. Of these populations, one is under immediate threat as it occurs on a roadside and in private property, one is in a nature reserve and the rest in State forest.

Etymology. The specific epithet - *megaphylla*, alludes to the relatively large maximum leaf length of the subspecies.

Affinities. Goodenia drummondii subsp. *megaphylla* can be distinguished from subsp. *drummondii* by its entire rather than dentate leaves, longer maximum leaf length, larger corolla with longer lobes, and larger flowering spike. It also tends to be a larger plant than subsp. *drummondii*. Subsp. *drummondii* occurs further north, extending from Kalbarri National Park to south-east of Latham.

Discussion. Goodenia drummondii is closely related to *G. helmsii*, differing in having longer leaves, corolla and flowering spike, and no copious axillary wool. The two species appear to intergrade to some degree, though evidence for this is restricted to only four sheets at the Western Australian Herbarium (PERTH). *G. helmsii* is distributed further inland in the south-west than *G. drummondii,* mostly in the wheatbelt, while the intergradation of the two species seems to be centred at Wongan Hills.

There are also collections of typical *G. helmsii* which have leaves longer than the 5 mm maximum length described in the "Flora of Australia" (Carolin 1992) and hence would fail to key out correctly there. This problem could be readily overcome by modifying couplet 7 of the key on page 152 as follows:

7 Leaves 10–78 mm long, with little axillary wool; corolla 5.5–8.3 mm long ..... **G. drummondii**

7: Leaves 2–5.5 mm long, with copious axillary wool; corolla 4–5.5 mm long ..... **G. helmsii**

Goodenia laevis Benth., Fl. Austral. 4: 61 (1868). *Type:* Phillips Range, Western Australia, *G. Maxwell* (*lecto*, here selected: K (right hand upper portion), photo PERTH).

Typification. The K sheet on which the Maxwell type is mounted has a mixed collection consisting of two separate pieces, the upper piece being the narrow-leaved variant and the lower piece being the broad-leaved variant of *G. laevis*. Bentham (1868: 61) in "Flora Australiensis" apparently included both variants in his description of *G. laevis*, the lower piece used for the 'lower leaves' and the upper piece for the 'upper leaves' of his sentence "Lower leaves oblong-cuneate, obtuse, with 2 or 3 coarse teeth or lobes, narrowed into a short petiole, 1 to 1 1/2 in. long, upper ones narrow-linear, entire all rather thick and smooth". The upper right hand piece with the narrow leaves is here is selected as the lectotype of *G. laevis* because it is a larger specimen.

Notes. The description of *G. laevis* given in Carolin (1992) apparently applies only to the new subspecies as no specimens of the typical subspecies appear to have been mapped and certainly none has been cited.

Key to the subspecies of *Goodenia laevis*

Prostrate habit; leaves narrowly to widely spathulate, the larger ones 23–43 mm long and 5–13 mm wide, sometimes with two lobes near the apex (Ravensthorpe to Dumbleyung region) ..... subsp. **humifusa**

Erect habit; leaves linear to rarely narrowly spathulate, the larger ones 15–25 mm long and 1–3 mm wide, entire (inland Esperance region) ..... subsp. **laevis**

Goodenia laevis Benth. subsp. **humifusa** Sage, *subsp. nov.*

Habitus prostratus. Folia late spathulata vel anguste spathulata, ad 7 cm longa, 13 mm lata, interdum versus apicem lobis 2 ornatis.

Typus: 0.5 km north of Hatters Hill, *c.* 41 km north-east of Lake King, 32° 49' 01"S, 119° 59' 00" E, Western Australia, 13 November 1979, *K.R. Newbey* 6549 (*holo:* PERTH 02607735, *iso:* CANB).

A prostrate, woody *subshrub*, glabrous; stems to *c.* 50 cm long. *Leaves* narrowly to widely spathulate, 23–43 mm long, 5–13 mm wide, entire or with two lobes near the apex, apex acute to rounded.

Other specimens examined. Near Jerdacuttup River, 11 miles [18 km] E of Ravensthorpe, 33° 26' 12" S, 120° 01' 53" E, 27 Oct. 1963, *T.E.H. Aplin* 2688 (PERTH, CANB); 14 km E of Ravensthorpe, 33° 36'S, 120° 10' S, 10 Jan. 1979, *B. Barnsley et al.* BB 467 (PERTH); Tarin Rock, 33° 07' E, 118° 14' S, 29 Oct. 1962, *J.S. Beard* 2154 (PERTH); 10 miles [16 km] E of Ravensthorpe, 33° 34' 47" S, 120° 12' 39" E, 2 Sep. 1968, *E.M. Bennett* 2738 (PERTH, CANB); 20 miles [32 km] E of Dumbleyung, 33° 18' 47" S, 118° 04' 22" E, 12 Nov. 1931, *W.E. Blackall* 1343 (PERTH); Elverton [Elverdton] roadside off Ravensthorpe–Esperance road, 33° 37' 35" E, 120° 08' 24" E, 29 Oct. 1988, *E.J. Croxford* 6239 (PERTH); Lake King, 33° 05' 30" S, 119° 41' 06" E, Nov. 1931, *C.A. Gardner s.n.* (PERTH); N of Needilup, 33° 57' 11" S, 118° 46' 30" E, 29 Oct. 1965, *A.S. George* 7019 (PERTH); 2 km E of Lake King, 33° 05' S, 119° 41' E, 15 Sep. 1993, *M. Gustafsson et K. Bremer* 134 (PERTH); Diggers Rock, Forrestania, 32° 43'E, 119° 50' 53" E, 9 Dec. 1964, *F. Lullfitz* L3976 (PERTH); Bandalup Creek, E of Ravensthorpe, 33° 36' 17" S, 120° 18' 11" E, 6 Oct. 1966, *F. Lullfitz* 5488 (PERTH); 3 miles [5 km] SE of Ravensthorpe, 33° 36' 38" S, 120° 04' 43" E, 13 Dec. 1964, *K.R. Newbey* 1722 (PERTH); Frank Hann National Park, 33° 00' 18" S, 120° 05' 30" E, 10 Dec. 1971, *R.D. Royce* 10235 (PERTH, CANB); 5 km E of Ravensthorpe, 33° 34' 47" S, 120° 05' 43" E, 8 Oct. 1966, *P.G. Wilson* 5531 (PERTH 02889218, CANB).

Distribution. Found from just east of Ravensthorpe, south to Jerramungup, west to Dumbleyung and north to Digger Rocks. (Figure 1)

Habitat. This subspecies can be found in loamy clay or sand, in open mallee shrublands.

Flowering period. August to early January.

Conservation status. Goodenia laevis subsp. *humifusa* is common throughout its range.

Etymology. From the Latin *humifusa* - lying down, alluding to the prostrate habit of the subspecies.

Notes. G. laevis subsp. *humifusa* can readily be distinguished from subsp. *laevis* by its prostrate habit, widely spathulate to narrowly spathulate leaves to 13 mm wide and its more western distribution in the Ravensthorpe to Dumbleyung region of the wheatbelt of southern Western Australia.

Goodenia laevis Benth. subsp. **laevis**

Erect woody *subshrub*, glabrous; stems to 25 cm long. *Leaves* mostly linear, rarely narrowly spathulate, 15–25 mm long, 1–3 mm wide, entire, apex mostly acute, entire.

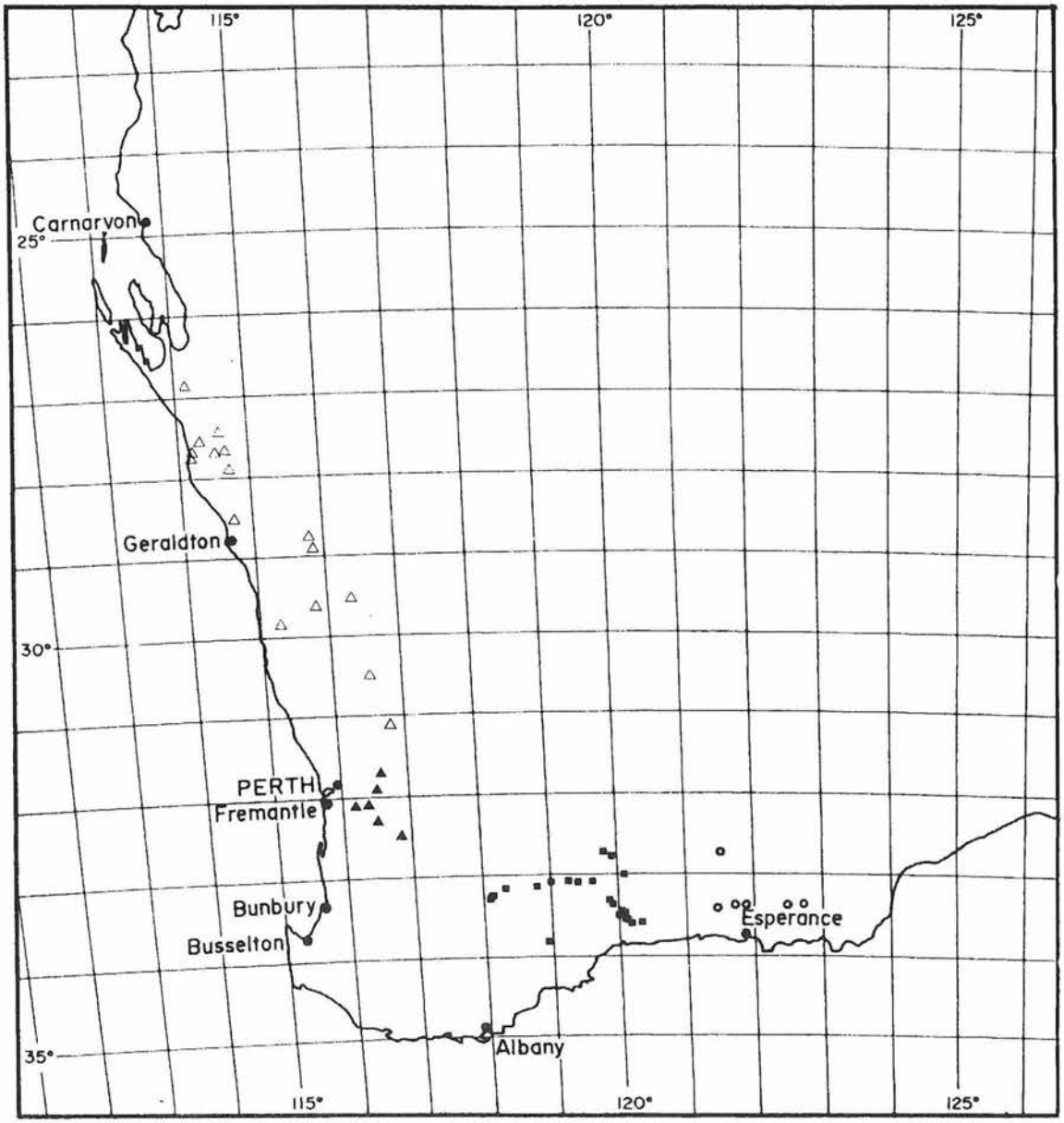

Figure 1. Distribution map of *Goodenia drummondii* subsp. *drummondii* △, *G. drummondii* subsp. *megaphylla* ▲, *G. laevis* subsp. *laevis* ○ and *G. laevis* subsp. *humifusa* ■.

Other specimens examined [precise localities withheld]. S of Mt Ney, Aug. 1983, *M.A. Burgman* 1708 (PERTH); Kumarl, Apr. 1938, *L.A. Horbury* 36 (PERTH); SE of Mt Beaumont, 10 Nov. 1980, *K.R. Newbey* 7996 (PERTH); N of Gibson, 9 Nov. 1982, *A. Strid* 21263 (PERTH); Scadden, 24 Dec. 1995, *C.D. Turley* 10/1295 (PERTH); E of Scadden, 2 Dec. 1982, *P. van der Moezel* PGV242 (PERTH).

Distribution. Occurs inland from Esperance to Scadden siding and Mt Ney. (Figure 1)

Habitat. Found in well drained sandy loam or laterite.

Flowering period. August to December, with one occurrence in April.

Conservation status. *Goodenia laevis* subsp. *laevis* is known from only six populations, two possibly in a reserve, therefore a Priority Three for poorly known taxa should be considered for this subspecies.

Acknowledgements

I am grateful to Paul G. Wilson for the Latin diagnosis and nomenclatural guidance, Carol Wilkins, Ray Cranfield, Patrick Pigott, John Timmer and Barbara Rye for for their much appreciated help.

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Bentham, G. (1868). *Goodenia*. *In*: "Flora Australiensis." Vol. 4. pp. 50–80. (L. Reeve & Co.: London.)

A taxonomic review of the genera *Eriostemon* and *Philotheca* (Rutaceae: Boronieae)

Paul G. Wilson

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Wilson, Paul G. A taxonomic review of the genera *Eriostemon* and *Philotheca* (Rutaceae: Boronieae). *Nuytsia* 12 (2): 239–265 (1998). The circumscription of the genera *Eriostemon* and *Philotheca* (Rutaceae: Boronieae) is reviewed with the majority of the species of the former genus being transferred to *Philotheca*. Five species are described as new, namely *P. acrolopha* Paul G. Wilson, *P. coateana*, *P. cuticularis*, *P. eremicola*, and *P. kalbarriensis*. Five new subspecies are described, namely *P. buxifolia* subsp. *falcata*, *P. deserti* subsp. *brevifolius*, *P. gardneri* subsp. *globosa*, *P. nodiflora* subsp. *latericola*, and *P. salsolifolia* subsp. *pedicellata*. The following three new sectional combinations are made: *Philotheca* sect. *Corynonema* (Paul G. Wilson) Paul G. Wilson, *Philotheca* sect. *Cyanochlamys* (F. Muell.) Paul G. Wilson, and *Philotheca* sect. *Erionema* (F. Muell.) Paul G. Wilson. Thirty-three new species combinations and eight new subspecies combinations are made, these having been transferred from *Eriostemon*.

Introduction

Since Bentham's (1863) treatment of the genus, *Eriostemon* (Rutaceae: Boronieae) has been distinguished from the apparently closely related genus *Philotheca* by its free rather than united stamens. Wilson (1970) retained this circumscription although he pointed out that *Philotheca* was more closely related to *Eriostemon* sect. *Nigrostipulae* than that section was to the others in *Eriostemon*.

Smith-White (1954) indicated that this broad circumscription of *Eriostemon* is incorrect and that the genus should be recognized as consisting of only the one or two species that are placed in *Eriostemon* sect. *Eriostemon*. This suggestion is here accepted.

Armstrong (1991) examined the question of generic relationships in the tribe Boronieae but he has yet to publish on this matter. Basically, his preliminary conclusion was that *Eriostemon* sect. *Eriostemon* is the sister taxon to the genus *Crowea* Sm. and that these together form the sister taxon to the remainder of the sections in *Eriostemon* and *Philotheca* (but excluding *E. deserti*).

Michael Bayly, formerly of Melbourne University, has studied the relationships within the genus *Eriostemon s.lat.* but has yet to publish on this matter. He has also a particular interest in the *Eriostemon*

myoporoides complex in sect. *Erionema* which will be the subject of a separate paper by him. For this reason *E. myoporoides* is omitted from this revision.

The New Caledonian species, *Eriostemon pallidus* Schltr., was excluded from the genus by Wilson (1970) who based his decision solely on his interpretation of the protologue provided by Schlechter. However, herbarium material has since been examined and it is clear that this species is representative of a taxon quite distinct from either *Eriostemon* or *Philotheca*. The flowers have very thick induplicate valvate petals which have only one vascular strand (imbricate with *c.* 5 strands in *Eriostemon*), while the seed lacks both a sclerotesta and a circular chalazal aperture (characters that are found in all Australian and New Zealand members of the tribe Boronieae but which have not been observed elsewhere). Hartley (1995) implied that *E. pallidus* possessed a linear embryo similar to that found in the Australian members of the Boronieae, however, he now considers (Hartley 1996, pers. comm.) that this conclusion was based on the examination of immature seeds. The examination of more mature seeds suggests that they have flattened elliptic cotyledons which are considerably wider than the hypocotyl; this implies that *E. pallidus* is part of the lineage comprising *Boronellas* Baill., *Myrtopsis* Engl., *Euodia* J.R. & G. Forst., *Brombya* F. Muell., and *Medicosma* Hook. f., which suggestion is supported by the seed morphology. The chromosome number of *E. pallidus* has been determined as n=20 (Guerra 1984) whereas for *Eriostemon s. str.* it is n=17, and for *Philotheca* in the sense here accepted it is n=14, 28 (Smith-White 1954).

The generic circumscription of *Philotheca* is still not satisfactorily resolved. I have here delineated it in a broad sense so as to include the sections formerly placed in *Eriostemon*, other than sect. *Eriostemon*, although, as is explained in the notes under *Philotheca* sect. *Philotheca*, this would appear to render *Philotheca* paraphyletic with reference to *Geleznowia* Turcz.

Morphology

In discriminating the generic and infrageneric taxa within the *Eriostemon* group attention has been given to two morphological characters that have not previously been included in its description and therefore require explanation. These are as follows.

Foliar sclereids (terminology following Rao 1991). The idioblasts present in leaves of a range of species in all members of the Boronieae were examined. In most of the taxa investigated tracheoids were present. Sclereids were confirmed in a number of species of *Boronia* whose presence has been documented by Rao & Bhattacharya (1978, 1981).

In the *Eriostemon* group tracheoids associated with vein-endings were found to be widespread. The only sclereids observed in the genus, in the broad sense, were the filiform type (Figure 1A). These were found in all species of *Philotheca* and in each of the 10 species examined of *Eriostemon* sect. *Nigrostipulae* except for *E. linearis* in which neither sclereids nor tracheoids were observed. This filiform type of sclereid was also found in *Geleznowia verrucosa* Turcz. but in none of the other taxa of the Boronieae.

Petal venation. All members of the tribe Boronieae subtribe Eriostemoninae possess only one central nerve (Figure 1C) except for the two species of *Eriostemon* sect. *Eriostemon* in which about five parallel nerves are found (Figure 1B). Petals with three to five nerves are also found in most members of *Boronia* sect. *Boronia* and in the New Caledonian genus *Boronella* but not elsewhere in the Boronieae.

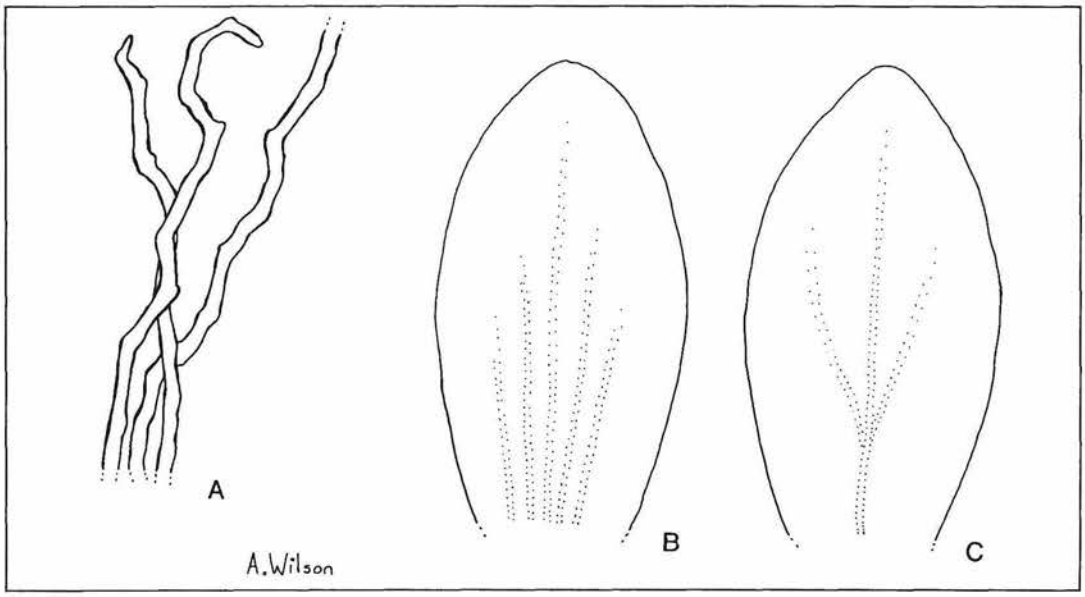

Figure 1. A – sclereids (x200) from leaf of *Philotheca deserti* subsp. *deserti*; B – petal of *Eriostemon australasius* showing venation (x4); C – petal of *Philotheca verrucosa* showing venation (x8).

Key to genera in the Eriostemon complex

1 Petals valvate, thick, covered with basally branched silky hairs; seeds with pale brown thin weak inner testa, without a circular chalazal opening; embryo with flattened elliptic cotyledons (New Caledonia; n=20) ..... **Eriostemon pallidus**

1: Petals imbricate, ± papery, glabrous or with stellate or simple hairs; seeds with black thick brittle inner testa, with a supra-basal circular chalazal opening; embryo with terete cotyledons

2 Petals multinerved, stellate-lepidote; staminal filaments with a subapical adaxial and abaxial verrucosity; anther apiculum absent or glabrous; (Eastern Australia; n=17) ..... **Eriostemon**

2: Petals 1-nerved; glabrous or with simple hairs; staminal filaments smooth; anther apiculum glabrous or pilose

3 Anther and apiculum glabrous (Southern and eastern Australia; n=14, 28) ..... **Philotheca**

3: Anther and apiculum pilose (South-west and eastern Australia; n=19) ..... **Crowea**

Eriostemon

Eriostemon Sm., *Trans. Linn. Soc.* 4: 221 (1798). *Type: Eriostemon australasius* Pers. (1805), lectotype, see Wilson (1970) and below.

Critical features. Leaves with tracheoids. *Petals* stellate-lepidote, with *c.* 5 parallel nerves. *Staminal filaments* with adaxial verrucosity near apex and an opposite abaxial hump; anther with a rounded apex or with a white non-glandular apiculum. *Seed* reniform; adaxial face concave; outer testa coriaceous, crinkled and glossy; sclerotesta smooth; hilum elliptic in centre of adaxial face; raphe in centre of

adaxial face beneath a thick crustaceous cover; chalazal opening at base of raphe and beneath crustaceous cover; placental endocarp thick, persistent. (Figures 1B, 2A–C)

Chromosome number: n=17 in *E. australasius* (Smith-White 1954).

Notes. The protologue of *Eriostemon* gave the locality of the genus as Australasia (i.e. Australia). Smith did not indicate which Australian species were to be included in the genus but did state that *Diosma uniflora* L. (a South African species) belonged here even though it differed from *Eriostemon* in having five of its stamens sterile. The first Australian species described in the genus was *E. australasius* Pers. and, judging from Smith's protologue and from his herbarium, it was on material of this species that he based the generic description.

A brief nomenclatural history of the genus is given in Wilson (1970) where *E. australasius* is stated to be the type, whereas in Farr *et al.* (1979) the type is given as '*E. lanceolatus* K.F. Gaertner (1805)'. The date cited for the latter name is incorrect, it should be 1807, and the name is simply an illegitimate *nom. nov.* for *E. australasius* Pers.

Two species are now recognized in the genus (Bayly *et al.* 1998) and these are endemic to near the east coast of Australia. The solitary species of *Eriostemon* recorded from New Caledonia (*E. pallidus* R. Schlechter, *nom. illeg.*) clearly belongs to its own monotypic genus (see above).

Eriostemon australasius Pers., Syn. Plant. 1: 465 (1805). *Type:* not seen.

Note. See Wilson (1970) for synonymy.

Eriostemon banksii A. Cunn. ex Endl. *in* Endl. *et al.*, Enum. Pl. Huegel 15 (1837). – *E. australasius* subsp. *banksii* (A. Cunn. ex Endl.) Paul G. Wilson, *Nuytsia* 1: 24 (1970). *Type:* Endeavour River, Queensland, July 1819, *A. Cunningham* (*iso:* CANB, K).

Notes. This taxon was made a subspecies of *E. australasius* by Wilson (1970) who, due to the absence of flowering material, thought that the two species differed only in leaf shape. Recent collections have shown that in flower, fruit and leaf characters they are distinct (see Bayly *et al.* 1988). In *E. banksii* the petals are white, the anthers have no white apiculum and the cocci have a distinct beak, whereas in *E. australasius* the petals are pink, the anthers have a white apiculum and the cocci are erostrate. In addition, the leaves of *E. banksii* are distinctly 5-nerved, while in *E. australasius* they are 3-nerved, even in broadly leaved variants. The areas of distribution of the two species do not overlap.

Philotheca

Philotheca Rudge, *Trans. Linn. Soc. Botany* 11: 298 (1816). *Type: P. australis* Rudge [= *P. salsolifolia* (Sm.) Druce].

Critical features. *Leaves* with filiform sclereids or non-filiform tracheoids, frequently, in sect. *Philotheca*, with a pair of small dark-coloured stipular excrescences. *Petals* glabrous or sparsely pilose, 1-nerved. *Staminal filaments* terete or linear-acuminate, smooth throughout; anther with a white apiculum. *Seed* reniform; adaxial face concave; outer testa coriaceous or membranous; sclerotesta

smooth or rugose; hilum elliptic to linear in centre of adaxial face; raphe variable; chalazal opening at base of raphe; placental endocarp thick and persistent or membranous and deciduous.

A genus of 45 species endemic to Australia. They are divided into four sections.

Philotheca Rudge Sect. 1. **Philotheca**

Philotheca Rudge sect. *Philotheca*

Eriostemon sect. *Nigrostipulae* Paul G. Wilson, *Nuytsia* 1: 25 (1970). *Type: E. difformis* A. Cunn. ex Endl. [= *P. difformis* (A. Cunn. ex Endl.) Paul G. Wilson].

Eriostemon sect. *Gymnanthos* Paul G. Wilson, *Nuytsia* 1:59 (1970). *Type: E. deserti* E. Pritz. [= *P. deserti* (E. Pritz.) Paul G. Wilson].

Critical features. Leaves with filiform sclereids (sclereids absent in *P. linearis*). *Petals* glabrous or with simple hairs, 1-nerved. *Staminal filaments* slender, flattened, smooth; anthers with a white non-glandular apiculum. *Seed* reniform; adaxial face concave; outer testa thin, smooth, glossy; sclerotesta smooth; hilum delta-shaped, in centre of adaxial face; raphe in centre of adaxial face beneath a thin crustaceous cover or this crustaceous cover absent; chalazal opening at base of raphe and beneath cover; placental endocarp thick, persistent. (Figures 1A, 2D–I)

Chromosome number. n=14 in *P. reichenbachii* and *P. salsolifolia* (Smith-White 1954), and *P. tubiflora* (Keighery 1978); n=28 in *P. brevifolia* (Smith-White 1954).

Notes. A section of 31 species in southern and eastern Australia. The genus *Philotheca* has previously been separated from *Eriostemon* sect. *Nigrostipulae* solely on the presence of united staminal filaments, however, this is a character of little moment since a gradation from free to united filaments can be found within sect. *Philotheca*.

Filiform sclereids (Figure 1A) of the type present in *Philotheca* sect. *Philotheca* (with apparently the sole exception of *P. linearis*), also occur in *Geleznowia* which genus possesses a similar seed and the same chromosome number. *Geleznowia* has, however, a retuse anther that lacks an apiculum. The morphological similarity otherwise suggests a close relationship between the two genera and therefore it is possible that the inclusion of the three non-typical sections in *Philotheca* renders the genus paraphyletic.

Philotheca acrolopha Paul G. Wilson, *sp. nov.*

Frutex densus ad 1 m altus. Ramuli ascendentes, in lineis latis puberuli inter decurentias glabras. Folia congesta; lamina anguste cuneata, 7–13 mm longa, ad apice obcordata minute glandulariter apiculata, basi attentuata in petiolo brevi, tenuiter coriacea, glabra, laevis, margo recurvo. Stipula resinosa, *c.* 0.3 mm longa. Flores terminales, solitarii; pedicellus *c.* 2.5 mm longus, glaber. Sepala orbiculares, *c.* 1.5 mm longa, coriacea. Petala anguste ovata, *c.* 5 m longa, subcoriacea, intra sparse puberula, extra marginem versus sparse puberula. Filamenta staminum anguste oblongo-attenuata, ad basim adnata et ad petalas connata, pilosa; apiculum antherorum minutum, rubellum.

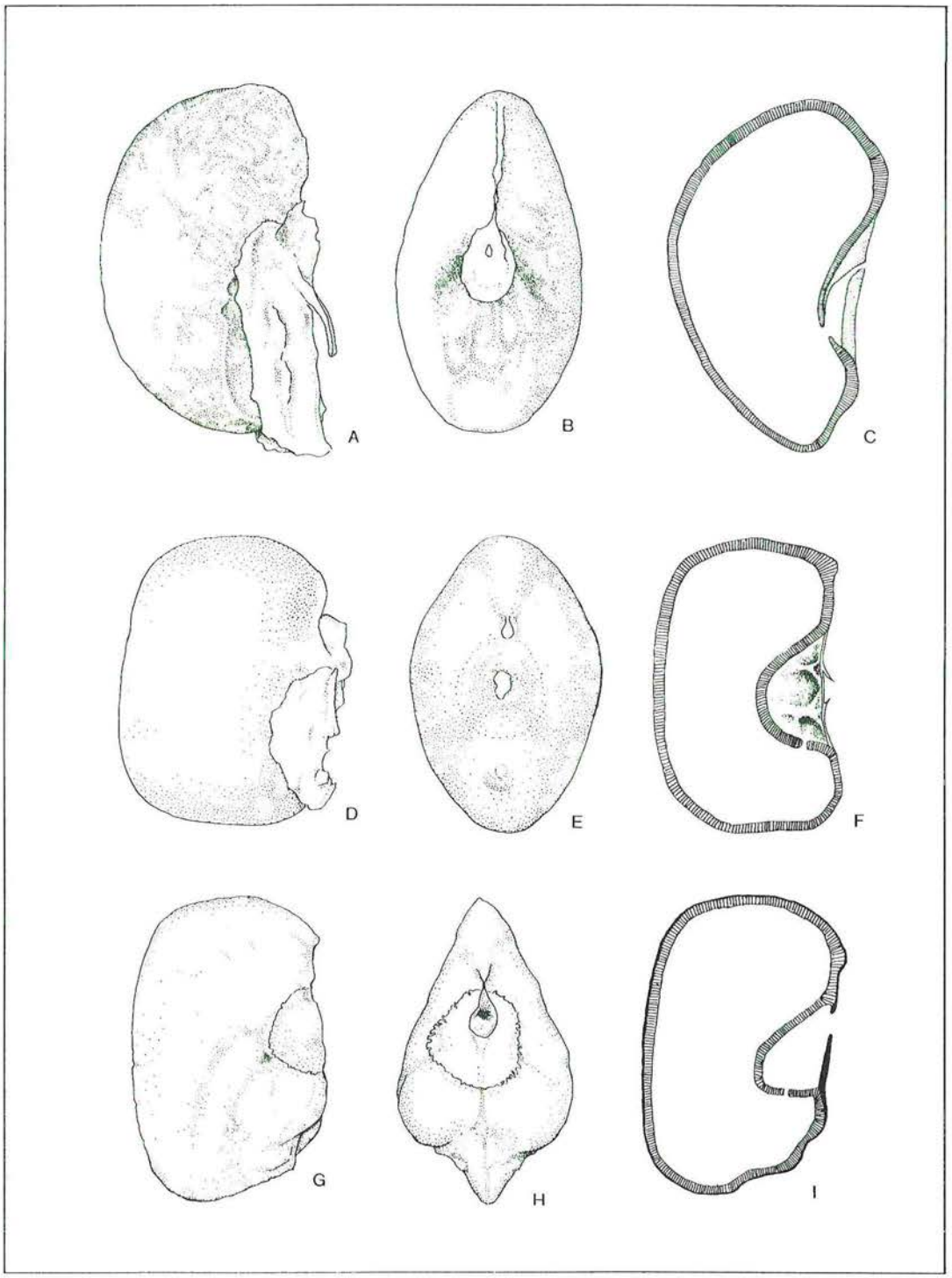

Figure 2. A–C. Seed of *Eriostemon australasius* (x10) from *C. Dunn* & *T. James* 580 (NSW). A – lateral view; B – view of adaxial surface; C – longitudinal radial section. D–F. Seed of *Philotheca deserti* subsp. *deserti* (x20) from *Paul G. Wilson* 13076 (PERTH). D – lateral view, placental endocarp present; E – view of adaxial surface, placental endocarp removed; F – longitudinal radial section. G–I. Seed of *Philotheca difformis* seed (x10) from Adelaide Botanic Garden, 1965. G – lateral view; H – view of adaxial surface; I – longitudinal radial section.

Typus: Summit of Mt Tozer, Queensland, 28 July 1986, *K. Hill* 1839, *P. Hind & D. Healey* (*holo:* BRI ex NSW).

Dense *shrub* to 1 m high. *Branchlets* ascending, reddish when young, puberulous in broad lines between glabrous leaf-decurrences. *Leaves* congested; lamina cuneate, apex obcordate and minutely glandular-apiculate, base attenuate to a short petiole, in all 7–13 mm long, 3–6 mm wide, thinly coriaceous, recurved on margin, glabrous, smooth. *Stipules* c. 0.3 mm long, resinous. *Flowers* terminal, solitary; mature bud narrowly ovoid; pedicel *c.* 2.5 mm long, glabrous, fleshy. *Sepals* orbicular, *c.* 1.5 mm long, coriaceous, glabrous. *Petals* narrowly ovate, *c.* 5 mm long, firm, subcoriaceous, sparsely puberulous within and towards margin outside, white to very pale pink; keel thickened. *Staminal filaments* narrowly oblong-attenuate, at their bases united to each other and to the petals, pilose; anthers suborbicular, *c.* 0.6 mm long with a minute reddish apiculum. *Disc* continuous with ovary. *Carpels* glabrous; style terete, pilose in lower half; stigma small, capitate. *Cocci* (immature) with a small rounded apiculum. *Seed* not seen. (Figure 3)

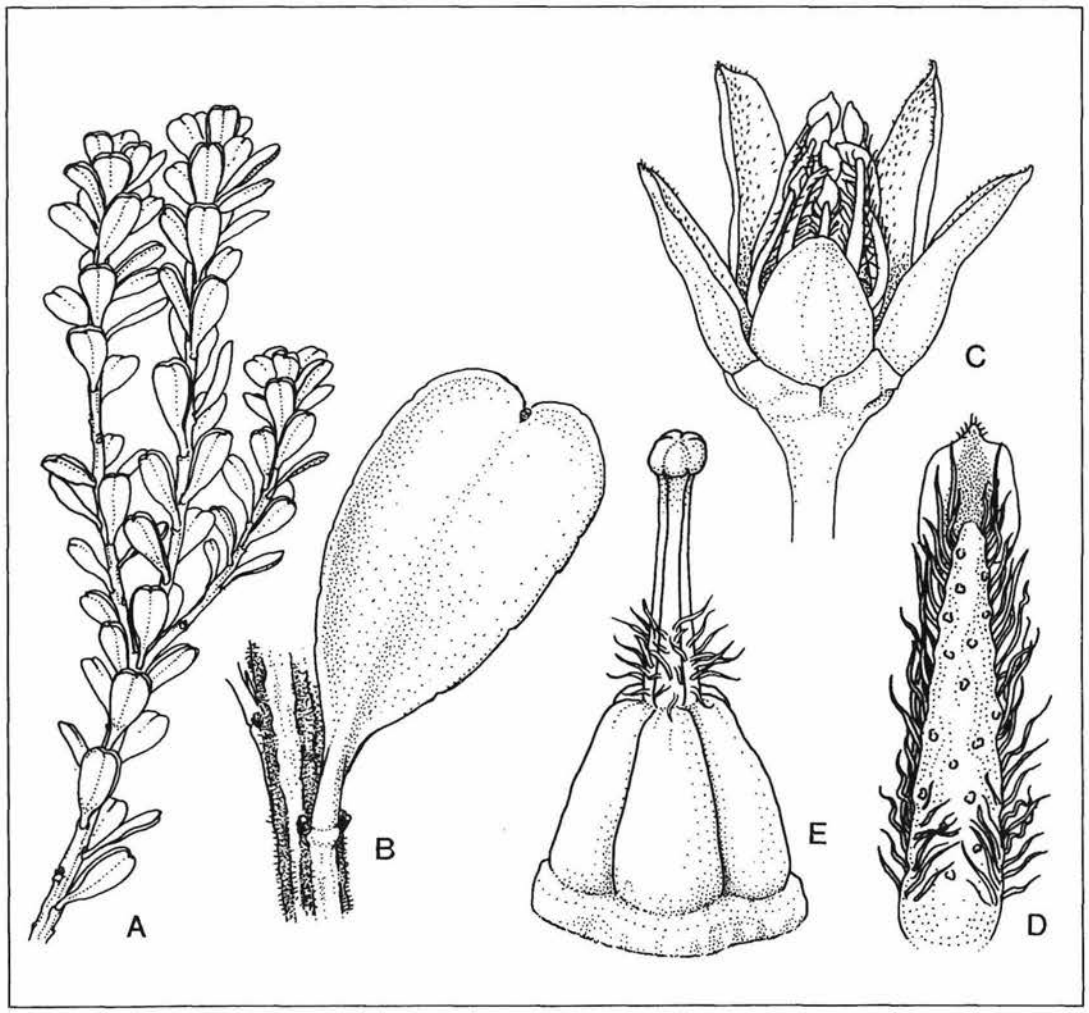

Figure 3. *Philotheca acrolopha*. A – branch (x0.8); B – leaf showing gland-like stipules (x6); C – flower (x0.7); D – petaline stamen, abaxial view (x2); E – pistil and disc (x2). From *P.I. Forster* 15433 (BRI).

Additional specimens examined. QUEENSLAND: Mt Tozer, *P. Foster* 47 (BRI); *ibid.*, *M.B. Thomas* 302 (BRI); *ibid.*, *L.J. Brass* 19483 (CANB).

Distribution. Known only from Mt Tozer, Cape York Peninsula, Queensland.

Habitat. Growing on granite near the mountain summit in heathland.

Etymology. The epithet is derived from the Greek words *acros* – summit, and *lophos* – crest, and has reference to the habitat of the plant.

Notes. This species has leaves that are different in shape from those of any other member of the genus, however, in floral morphology and in the possession of filiform sclereids it is typical of sect. *Philotheca*. It is also the most northerly representative of the genus.

Philotheca angustifolia (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon angustifolius Paul G. Wilson, *Nuytsia* 1: 31 (1970). *Type:* Near Finnis River, South Australia, 25 August 1963, *D.N. Kraehenbuehl* 906 (*holo:* AD 96415113).

a. Philotheca angustifolia (Paul G. Wilson) Paul G. Wilson subsp. **angustifolia**

b. Philotheca angustifolia subsp. **montana** (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon angustifolius subsp. *montanus* Paul G. Wilson, *Nuytsia* 1: 32 (1970). *Type:* North-west slopes of Mt Difficult, Victoria, 12 October 1962, *T.B. Muir* 2647 (*holo:* MEL 4057; *iso:* CANB).

Philotheca apiculata (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon apiculatus Paul G. Wilson, *Nuytsia* 1: 35 (1970). *Type:* Norseman, Western Australia, 17 September 1965, *J. Bale* 185 (*holo:* PERTH 01615440).

Notes. This species in its typical form occurs in southern Western Australia near Norseman where it grows on ultra basic rocks. Recently a collection was made *c.* 180 km south-east of Norseman at Mt Buraminya. This collection differs from the specimens of the Norseman area in having leaves that are prominently channelled above (not smooth) and sepals that are less than 1 mm long (not 1.5–2 mm); further study may indicate that it should be recognized as a distinct taxon.

Philotheca basistyla Mollemans, *Nuytsia* 9: 101 (1993). *Type:* south-south-east of Trayning, Western Australia, 25 August 1991, *F.H. & M.P. Mollemans* 4126 (*holo:* PERTH 01615440).

Philotheca brevifolia (Endl.) Paul G. Wilson, *comb. nov.*

Eriostemon brevifolius A. Cunn. ex Endl. *in* Endl. *et al.*, Enum. Pl. Huegel 16 (1837). *Type:* Peels Range [Cocoparra Range], New South Wales, June 1817, *A. Cunningham* 162 (*iso:* K).

E. difformis var. *teretifolius* Benth., Fl. Austral. 1: 335 (1863). *Type:* Peels Range [Cocoparra Range], New South Wales, June 1817, *A. Cunningham* 162 (*lecto:* K) *fide* Wilson, *Nuytsia* 1: 31 (1970).

Notes. The name *E. difformis* var. *teretifolius* Benth. was stated by Wilson (1970) to be based on *E. brevifolius* Endl. However, Bentham cited several collections in addition to the type of that species and therefore Wilson's statement should be taken as a lectotypification.

Philotheca ciliata Hook. *in* T.L. Mitch., J. Exped. Int. Trop. Australia 347 (1848). – *P. australis* var. *parviflora* Benth., Fl. Austral. 1: 348 (1863). *Type:* Mount Faraday, Queensland, 10 October 1846, *Stephenson & T.L. Mitchell* (*syn:* K (*Mitchell* 392,395, photo seen), MEL (*Mitchell s.n.*), TCD (*Mitchell s.n.*)).

Philotheca citrina Paul G. Wilson, *Nuytsia* 8: 247 (1992). *Type:* Curbur Station, Western Australia, 30 August 1989, *R.C. Cranfield* 7665 & *S. Patrick* (*holo:* PERTH 1461192).

Philotheca coateana Paul G. Wilson, *sp. nov.*

Frutex ad 50 cm altus. Ramuli laeves, griseo-viridi, glabri. Folia exstipulata; lamina ellipsoidea, 3–4 mm longa, giseo-virida, obtusa, glabra, supra applanata. Flores terminales, solitarii; pedicellus 1–3 mm longus, glaber. Sepala late-triangularia, *c.* 3 mm longa, glabra. Petala elliptica, 7–9 mm longa, intra sparse puberula, extra glabra, alba, costa pallido-rubra. Filamenta staminalia libra, lanato-ciliata; anthera minute albo-apiculata.

Typus: 20 km south of Bulga Downs Station boundary, Western Australia, 3 August 1993, *K.H. Coate* 292 (*holo:* PERTH 03281973).

Shrub to 50 cm high. *Branchlets* smooth, greyish green, glabrous. *Leaves* exstipulate; lamina ellipsoid, 3–4 mm long, dull greyish green, flattened above, obtuse, glandular-punctate, glabrous. *Flowers* terminal, solitary; pedicel 1–3 mm long, glabrous. *Sepals* broadly triangular, *c.* 3 mm long, smooth, glabrous. *Petals* elliptic, 7–9 mm long, sparsely puberulous within, glabrous outside, white with pink midrib. *Staminal filaments* free, linear-attenuate, woolly ciliate; anther *c.* 1.5 mm long, minutely white-apiculate. *Style* terete, glabrous. *Cocci* truncate, with a slender apiculum *c.* 1.5 mm long.

Additional specimens examined. WESTERN AUSTRALIA: Boundary of Perrinvale and Walling Rock Stations, *R.J. Cranfield* 7169 (CANB, PERTH); near Menzies, Sep. 1927, *C.A. Gardner & W.E. Blackall* (PERTH); 18 miles [29 km] W of Old Gidgee, *R.D. Royce* 10457 (PERTH).

Distribution. Found near Menzies in the Austin Botanical District of Western Australia.

Conservation status. Known from a few collections over an area of 300 km. CALM Conservation Code for Western Australian Flora: Priority Three.

Etymology. Named after the naturalist Kevin Coate who drew my attention to this species.

Note. This species is similar to *P. eremicola*, *q.v.*

Philotheca coccinea (C.A. Gardner) Paul G. Wilson, *comb. nov.*

Eriostemon coccineus C.A. Gardner, *Hooker's Icon. Pl.* 34: t. 3378 (1939). *Type:* Near Koorarawalyee, Western Australia, October 1931, *W.E. Blackall* 936 (*holo:* PERTH 01615483).

Philotheca cuticularis Paul G. Wilson, *sp. nov.*

Frutex rotundatus ad 60 cm altus. Ramuli glanduloso-verrucosi, sparse puberuli; cuticula mox secedens, tunicam formans. Folia congesta, minutissime stipulata vel exstipulata; lamina carnosa, subteretia, 1.5–2 mm longa, glanduloso verrucosa, glabra, supra applanata, apice obtusa vel rotundata. Flores terminales, solitarii; pedicellus carnosus, 0.5–1 mm longus, sparse puberulus. Sepala glabra, amplitudine admodum variabilia, triangularia *c.* 1 mm longa vel semiteretia obtusa foliacea *c.* 2 mm longa. Petala elliptica, *c.* 2.5 mm longa, alba, intra puberula, extra glabra. Stamina libra; filamenta lineari-attenuata, ciliata; anthera minute albo-apiculata.

Typus: Grey-Gowan Ranges, Queensland, 9 April 1984, *R.W. Purdie* 2075 (*holo:* CBG; *iso:* BRI *n.v.*).

Rounded *shrub* to 60 cm high. *Branchlets* glandular-verrucose, sparsely puberulous when young; cuticle soon separating as a membranous pale tunic; corky eruptions not forming. *Leaves* crowded, extremely minutely stipulate when young or exstipulate; petiole 0.3 mm long; lamina fleshy, subterete, 1.5–2 mm long, glandular-verrucose, glabrous, somewhat flattened above; apex obtuse to rounded. *Flowers* terminal, solitary. *Pedicel* fleshy, 0.5–1 mm long, very sparsely puberulous. *Sepals* glabrous, irregular in size and shape, from triangular and very fleshy with scarious margins *c.* 1 mm long, to semiterete, obtuse, foliaceous and *c.* 2 mm long. *Petals* elliptic, *c.* 2.5 mm long, white, glabrous outside, puberulous within. *Stamens* free; filaments linear-attenuate, ciliate; anthers orbicular, minutely white-apiculate. *Ovary* sparsely pilose; style short, glabrous.

Additional specimen examined. QUEENSLAND: 33 miles [53 km] E of Adavale, 16 Sep. 1967, *L. Pedley* 2502 (CBG).

Distribution. Found in the Gowan Range area of southern Queensland and possibly in north-west New South Wales (see below).

Etymology. The specific epithet is Latin for cuticular, and refers to the cuticle which soon separates as a grey membrane.

Habitat. Growing in shallow soil overlying laterite.

Notes. This species is unusual in having sepals that vary in size on the same flower, and that range in shape from triangular to semiterete and leaf-like.

A vegetative collection from Koonenberry Mountain, New South Wales, 17 August 1883, *P.H. MacGillivray* 965 (NSW 69047), appears to belong to this species.

Philotheca cymbiformis (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon cymbiformis Paul G. Wilson, *Nuytsia* 1: 205 (1971). *Type:* Fitzgerald River Reserve, Western Australia, 7 October 1970, *Paul G. Wilson* 10176 (*holo:* PERTH 01066293).

Philotheca deserti (E. Pritz.) Paul G. Wilson, *comb. nov.*

Eriostemon deserti E. Pritz. *in* Diels & E. Pritz., *Bot. Jahrb. Syst.* 35: 320, tab. 39 A–C (1904); *Phebalium deserti* (E. Pritz.) Ewart & B. Rees, *Proc. Roy. Soc. Victoria* ser. 2, 25: 111 (1912). *Type:* Ghooli, Western Australia, October 1901, *E. Pritzel* 868 (*iso:* AD 96350140, K, MEL 4674, NSW 69249).

Notes. This species was placed in its own section of *Eriostemon* by Wilson (1970) who considered that it was not closely related to any other section of either *Eriostemon* or of *Phebalium*. This uncertainty was due to the presence of a broad disc and of glabrous spreading stamens. Further study has shown that its seed is typical of that found in *Philotheca* sect. *Philotheca* and that it possesses abundant filiform foliar sclereids which are also typical of that section. The chromosome number is unknown. Two subspecies are recognized.

Leaves subulate, 2–3 cm long ..... subsp. **deserti**

Leaves fusiform to narrowly obovoid, 3–5 mm long ..... subsp. **brevifolia**

a. Philotheca deserti (E. Pritz.) Paul G. Wilson subsp. **deserti**

Eriostemon intermedius Ewart *nom. illeg.*, *Proc. Roy. Soc. Victoria* ser 2, 19: 40 (1907), *non* Hook. (1849). *Type:* Cowcowing, Western Australia, August 1904, *M. Koch* 1168 (*syn:* MEL 4541, 4543); between the sources of the Blackwood River and Lake Lefroy, Western Australia, 1893, *M. Cronin* (*syn:* MEL 4542).

b. Philotheca deserti subsp. **brevifolia** Paul G. Wilson, *subsp. nov.*

Folia breviter petiolata; lamina fusiformis vel anguste obovoidea, 3–5 mm longa, acuta vel obtusa, supra laevis et applanata, infra rotundata.

Typus: Walling Rock Station, Western Australia, 9 September 1988, *R.J. Cranfield* 7258 (*holo:* PERTH 02251191; *iso:* CANB, K, MEL).

Leaves shortly petiolate; lamina fusiform to narrowly obovoid, 3–5 mm long, smooth and somewhat flattened above, rounded below, acute to obtuse. (Figure 4)

Specimens examined. Only known from the type collection.

Distribution. Occurs in central southern Western Australia, *c.* 70 km north-west of Menzies.

Habitat. Found growing on red sandy clay.

Conservation status. Although only known from one locality on unreserved land, it does not appear to be under immediate threat. CALM Conservation Code for Western Australian Flora: Priority One.

Etymology. The varietal epithet is a Latin word meaning short-leaved.

Notes. This subspecies appears to differ from the typical only in the size and shape of the leaves. It is found about 100 km north-east of the nearest recorded population of subsp. *deserti*.

Philotheca difformis (A. Cunn. ex Endl.) Paul G. Wilson, *comb. nov.*

Eriostemon difformis A. Cunn. ex Endl. *in* Endl. *et al.*, Enum. Pl. Huegel 15 (1837). *Type:* Lachlan River, New South Wales, 24 May 1817, *A. Cunningham* 163 (*iso:* K).

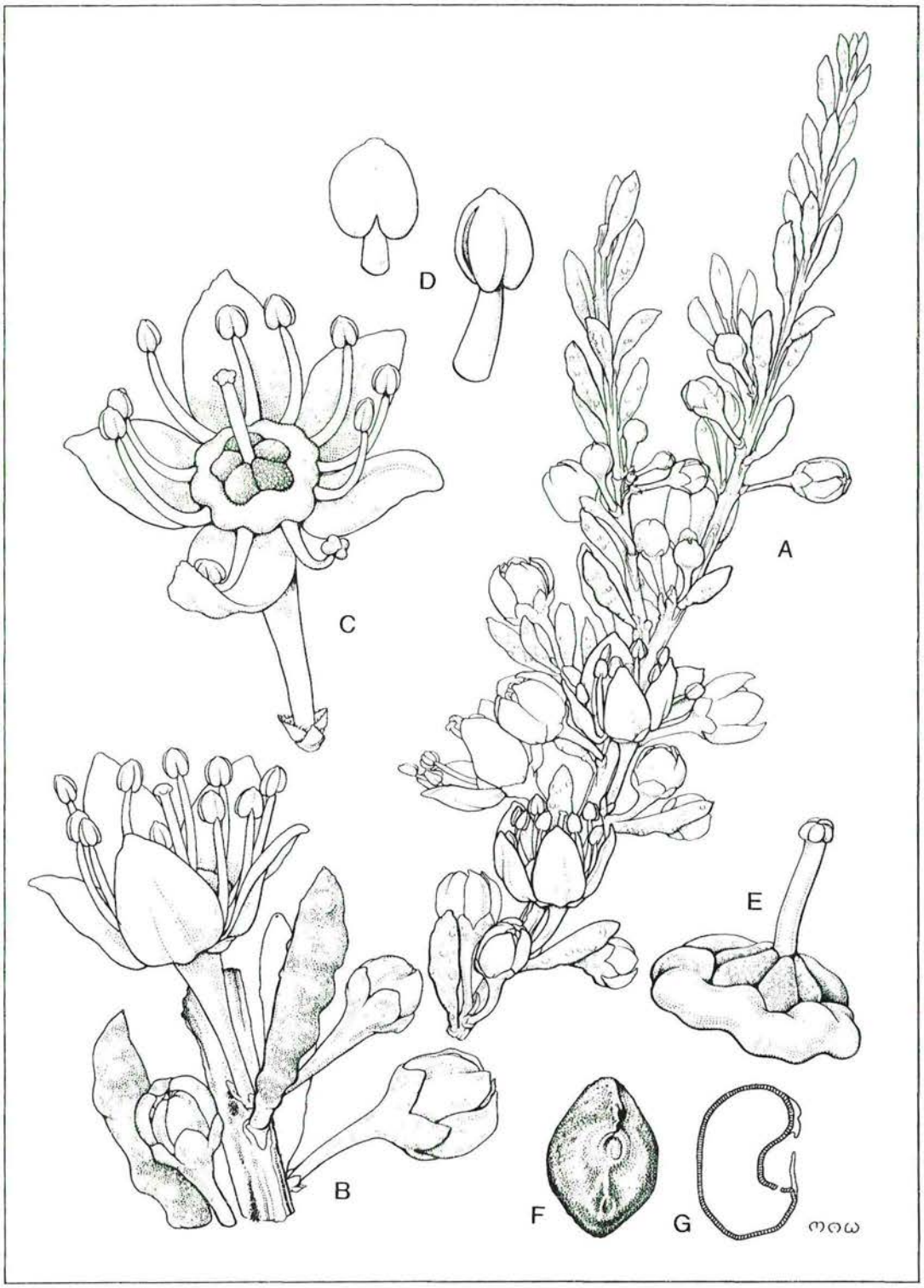

Figure 4. *Philotheca deserti* subsp. *brevifolia*. A – branch (x3); B – flowers and buds (x8); C – flower (x8); D – anthers (x20); E – pistil and disc (x10); F – seed, abaxial surface (x12); G – seed, longitudinal radial section (x12). From *R.J. Cranfield* 7258 (PERTH).

a. Philotheca difformis (Endl.) Paul G. Wilson subsp. **difformis**

E. rhombeus Lindl. *in* T. Mitch., J. Trop. Australia 293 (1848). *Type:* Mantuan Downs [= Drummond Range], Queensland, 1 September 1846, *T.L. Mitchell* 590 (*holo:* CGE; *iso:* TCD).

b. Philotheca difformis subsp. **smithiana** (Benth.) Paul G. Wilson, *comb. nov.*

Eriostemon difformis subsp. *smithianus* (Benth.) Paul G. Wilson, *Nuytsia* 1: 30 (1970). – *E. difformis* var. *smithianus* Benth., Fl. Austral. 1: 335 (1863). *Type:* Wide Bay, Queensland, *W. Hill* (*lecto:* MEL 4094) *fide* Wilson, *loc. cit.*

E. parvifolius R. Br. ex Benth., Fl. Austral. 1: 335 (1863). *Type:* Shoalwater Bay, Queensland, 26 August 1802, *R. Brown* (*holo:* K; *iso:* CANB, MEL 4018).

Philotheca eremicola Paul G. Wilson, *sp. nov.*

Ex affinitae *P. coateanae* foliis congestis, anguste fusiformis, acutis *c.* 2.5 mm longis glabris nitidis, pedicellis tenuibus *c.* 4 mm longis, sepalis ovatis vel anguste triangularibus acutis vel acuminatis glandulis bruneis ornatis differt.

Typus: 5 km south-east of Tjirrkarli Outstation (Blyth Pool), Gibson Desert, Western Australia, 19 September 1992, *D.J. Pearson* 2875 (*holo:* PERTH 03080048).

Distribution. Only known from the type locality in the Gibson Desert, Western Australia.

Habitat. Growing in *Acacia aneura* shrubland on rocky slopes of red skeletal laterite.

Conservation status. Only known from one locality on unreserved land, but does not appear to be under threat. CALM Conservation Code for Western Australian Flora: Priority One.

Etymology. The epithet is derived from the Latin words *eremus* – a desert, and *incola* – a dweller.

Notes. This species is similar to *P. coateana* from which it differs as follows: leaves congested, narrowly fusiform, acute, *c.* 2.5 mm long, glabrous, glossy; pedicels slender, *c.* 4 mm long; sepals ovate to narrowly triangular, acute to acuminate, with prominent brown glands.

Philotheca ericifolia (A. Cunn. ex Benth.) Paul G. Wilson, *comb. nov.*

Eriostemon ericifolius A. Cunn. ex Benth., Fl. Austral. 1: 335 (1863). *Type:* Liverpool Plains, New South Wales, May 1825, *A. Cunningham* 13 (*holo:* K).

Philotheca falcata (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon falcatus Paul G. Wilson, *Nuytsia* 1: 11 (1970). *Type:* Yellowdine, Western Australia, October 1931, *W.E. Blackall* 917 (*holo:* PERTH 01174053).

Philotheca gardneri (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon gardneri Paul G. Wilson, *Nuytsia* 1: 33 (1970). *Type:* Jerramungup, Western Australia, September 1939, *C.A. Gardner* 5006 (*holo:* PERTH 01615556).

a. Philotheca gardneri (Paul G. Wilson) Paul G. Wilson subsp. **gardneri**

b. Philotheca gardneri subsp. **globosa** Paul G. Wilson, *subsp. nov.*

Philothecae gardnero subsp. *gardnero* affinis, a qua imprimis differt folliis globularibus, 1.5–2 mm longis, carnosis.

Typus: 11 km west-south-west of Dog Rock, Western Australia, 21 September 1979, *J. Taylor* 723 (*holo:* CBG; *iso:* PERTH 03514536).

Rounded *shrub* to 30 cm high. *Branchlets* glabrous beneath leaves, otherwise puberulous. *Stipular excrescences* prominent, reddish brown. *Leaves* glabrous; petiole *c.* 0.5 mm long; lamina globular, 1.5–2 mm long, fleshy; apex rounded. *Flowers* terminal, solitary; pedicel *c.* 1.5 mm long, puberulous. *Sepals* ovate, *c.* 1.5 mm long, very fleshy with a narrow scarious margin, ciliate, otherwise glabrous. *Petals* ovate, *c.* 6 mm long, white, glabrous outside, puberulous within. *Stamens* free; filaments linear-attenuate, woolly-ciliate; anthers *c.* 0.8 mm long, apiculum 0.3–1.0 mm long, white. *Ovary* puberulous towards apex; style short, glabrous. *Fruit* not seen.

Specimens examined. WESTERN AUSTRALIA: 22.5 km ENE of Coujinup Hill, *M.A. Burgman* 1535 (PERTH); 40 km ENE of Muckinwobert Rock, *M.A.Burgman* 2190a (PERTH); 39 km SSW of Peak Eleanora, *M.A. Burgman* 1928a (PERTH).

Distribution. Known from a small area between Ravensthorpe and Norseman in southern Western Australia.

Habitat. Growing on sand in heathland.

Etymology. The specific epithet refers to the shape of the leaves.

Notes. This subspecies is distinctive because of the shape and size of its leaves which in the typical subspecies are narrowly clavate and 5–8 mm long.

Philotheca glabra (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon glaber Paul G. Wilson, *Nuytsia* 1: 35 (1970). *Type:* Cowcowing, Western Australia, September 1904, *M. Koch* 1020 (*holo:* NSW; *iso:* PERTH 01615564).

Philotheca kalbarriensis Paul G. Wilson, *sp. nov.*

Philothecae wonganensi affinis sed foliis fusiformis, staminum filamentis ciliatis, disco angustiore differt.

Typus: Kalbarri National Park, Western Australia, 4 August 1996, *G.J. Keighery & N. Gibson* 2034 (*holo:* PERTH 04629817).

Shrub to 1 m; branchlets ascending, reddish brown except for short green leaf decurrencies, sparsely puberulous when young otherwise glabrous. *Leaves* ascending, crowded, narrowly fusiform, *c.* 4 mm long, flattened and sulcate above, rounded below and sparsely glandular-bullate, *Flowers* axillary, solitary; pedicel 1–2 mm long. *Sepals* deltate, *c.* 0.7 mm long, fleshy, glabrous. *Petals* ovate, obtuse, *c.* 3 x 2 mm, glabrous, white. *Stamens* free; filaments linear, moderately ciliate; anthers suborbicular, *c.* 0.5 mm long with a prominent rounded white apiculum *c.* 0.2 mm long. *Disc* narrow, glabrous. *Ovary* glabrous; style terete, glabrous, *c.* 0.5 mm long; stigma capitate.

Additional specimen examined. WESTERN AUSTRALIA: 320 miles [*c.* 510 km] S of Carnarvon on Geraldton road, *I. Olsen* 575 (PERTH).

Distribution. Only known for certainty from Kalbarri National Park, *c.* 120 km north of Geraldton, Western Australia.

Habitat. Acacia acuminata scrub over mixed heath.

Etymology. The specific epithet refers to the Kalbarri National Park within whose boundaries the type, and possibly also the paratype, were collected.

Conservation status. The only locality where this is known to occur is in a national park. CALM Conservation Code for Western Australian Flora: Priority Two.

Notes. This species differs most noticeably from *P. wonganensis*, to which it is most closely allied, in leaf shape, in having ciliate staminal filaments, and in having a narrow disc.

Philotheca langei Mollemans, *Nuytsia* 9: 98 (1993). *Type:* North-west of Chiddarcooping Hill, Western Australia, 25 August 1991, *F.H. & M.P. Mollemans* 4127 (*holo:* PERTH 2005360).

Philotheca linearis (A. Cunn. ex Endl.) Paul G. Wilson, *comb. nov.*

Eriostemon linearis A. Cunn. ex Endl. *in* Endl. *et al.*, Enum. Pl. Huegel 16 (1837) *Type:* Barren ranges on the Lachlan River, New South Wales, 22 June 1817, *A. Cunningham* (?*iso:* K 'Peels Range, June 1817, *A. Cunningham* 161').

E. halmaturorum F. Muell., Linnaea 25: 376 (1853). *Type:* Elders Range, South Australia, October 1851, *F. Mueller* (*holo:* MEL 4021).

Philotheca nutans (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon nutans Paul G. Wilson, *Nuytsia* 1: 28 (1970). *Type:* Ninghan, Western Australia, 17 August 1953, *C.A. Gardner* 12030 (*holo:* PERTH 01066285).

Philotheca pachyphylla (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon pachyphyllus Paul G. Wilson, *Nuytsia* 1: 27 (1970). *Type:* 20 miles [32 km] west of Coolgardie, Western Australia, 17 September 1962, *M.E. Phillips* (*holo:* AD 964251).

Philotheca reichenbachii Sieber ex Sprengel, Syst. Veg. 4 pt 2: 253 (1827). *Philotheca reichenbachiana* Sieber ex Reichb. *nom. illeg.*, Icongr. Bot. Exot. 200 (1828) based on above. *Philotheca australis* var. *reichenbachiana* Maiden & Betche, *Proc. Linn. Soc. New South Wales* 29: 736 (1905). *Type:* "Nov. Holl.", *F.W. Sieber* 308 (*iso:* K, MEL 232756, TCD).

Philotheca longifolia Turcz., *Bull Soc. Naturalistes Moscou* 22/2: 16 (1849). *Type:* Nova Hollandia, *W. Stephenson* 147 (*holo:* KW, photo seen).

Nomenclature. Sprengel failed to cite any collections under *P. reichenbachii*, and while his description is too brief to permit precise identification, since he attributed the name to Sieber, it can be assumed that it was based on a Sieber collection from New South Wales. When H.G.L. Reichenbach redescribed and illustrated the species, and at the same time altered the spelling of the epithet to *reichenbachiana*, he cited Sieber 308 as his source. Bentham (1863) recognized this species [as *Philotheca Reichenbachiana*] and cited only 308 of the Sieber collections. I have therefore assumed this to be the type since it appears to have been the only collection of this species made by Sieber.

Notes. Although this species was recognized as distinct from *P. australis* (= *P. salsolifolia*) by Bentham (1863) his description failed to include the long hairs on the anthers which is its most distinctive feature. Possibly because of this omission Mueller (1869) and subsequent botanists have considered the two taxa to be conspecific. *Philotheca reichenbachii* is only found in the vicinity of Sydney.

Philotheca rhomboidea (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon rhomboideus Paul G. Wilson, *Nuytsia* 1: 34 (1970). *Type:* 1 km north of Lake King township, 16 September 1964, *Paul G. Wilson* 3228 (*holo:* AD; *iso:* PERTH 01616005).

Philotheca salsolifolia (Sm.) Druce, *Bot. Soc. Exch. Club Brit. Isles* 4: 639 (1917). – *Eriostemon salsolifolius* Sm. *in* Rees, Cyclo. 13: n. 3 (1809). – *Philotheca australis* Rudge *nom. illeg.*, *Trans. Linn. Soc. Botany* 11: 298 (1816). *Type:* Port Jackson, New South Wales, 1795, *J. White* (*syn:* LINN, photo seen).

Note. Two subspecies can be recognized.

a. Philotheca salsolifolia (Sm.) Druce subsp. **salsolifolia**

Philotheca gaudichaudii G. Don, Gen. Syst. 1: 792 (1831) *nomen subnudum. Type:* Port Jackson, New South Wales, *T.N. Baudin* (*iso:* K), see below.

Eriostemon gracile Graham, *Edinburgh New Philos. J.* 16: 175 (1834) *ex descr. Type:* "raised from seed imported by Mr Cunningham, at Comely Bank Nursery, Edinburgh" (*n.v.*).

Leaves well-spaced to somewhat crowded, semiterete, thick, blunt, 3–5 mm long, to slender, acute, to 12 mm long, glabrous or sparsely ciliate. *Pedicels* turbinate 1–2 mm long. *Cocci* almost erect.

Typification. A collection of *P. salsolifolia* at herb. K that was received from the Paris Herbarium in December 1880 is labelled *Philotheca Gaudichaudii* Don/Cap Baudin/Nouvelle-Hollande/Port Jackson. I consider it to be a probable isotype of the latter name.

Distribution. Occurs in near coastal New South Wales from near Taree south to near Bega, and inland near Coonabarabran and Pilliga.

Habitat. Generally growing in heathland on sandstone.

Notes. A widely distributed and variable subspecies.

b. Philotheca salsolifolia subsp. **pedicellata** Paul G. Wilson, *subsp. nov.*

Folia congesta, lineares, acuta, supra applanata, c. 10 mm longa, glabra. Pedicelli tenues, c. 8 mm longi. Cocci divergentes.

Typus: 1 mile [1.6 km] from the coast and 4.5 miles [7.2 km] south of Yamba, New South Wales, 30 June 1966, *L.P. & D.J. McGillivray* 2145 (*holo:* NSW 93929).

Leaves crowded, flattened above, linear, acute, *c.* 10 mm long, glabrous. *Pedicels* slender, *c.* 8 mm long. *Cocci* spreading.

Additional specimens examined. NEW SOUTH WALES: Angourie, 20 Sep. 1970, *M.E. Phillips* CBG 035333 (BRI); Angourie Bay, *B. Auld* 120484 (NSW).

Distribution. Known only from near Angourie on the north coast of New South Wales.

Habitat. Growing on sand in coastal or near coastal situations.

Etymology. The subspecific epithet refers to the prominent pedicels of the flowers.

Philotheca sericea (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon sericeus Paul G. Wilson, *Nuytsia* 1: 37 (1970). *Type:* 15 miles [*c.* 24 km] east of Kalli, Western Australia, 22 July 1958, *N.H. Speck* 1041 (*holo:* CANB; *iso:* PERTH 01616013).

Philotheca sporadica (M. Bayly) Paul G. Wilson, *comb. nov.*

Eriostemon sporadicus M. Bayly, *Austral. Syst. Bot.* 7: 275 (1994). *Type:* 110 km south-west of Kogan, Queensland, 13 September 1992, *M.J. Bayly, M. Duretto & N. Marsh* MJB 149 (*iso:* PERTH 04097246).

Philotheca thryptomenoides (S. Moore) Paul G. Wilson, *comb. nov.*

Eriostemon thryptomenoides S. Moore, *J. Linn. Soc. Bot.* 45: 166 (1920). *Type:* Nungarin, Western Australia, *F. Stoward* 784 (*n.v.*) *ex descr.*

Philotheca tomentella (Diels) Paul G. Wilson, *comb. nov.*

Eriostemon tomentellus Diels, *Bot. Jahrb. Syst.* 36: 320 tab. 39 G–J (1904). *Type*: South of Menzies, Western Australia, *F. Diels* 5164a (*holo:* B *n.v.* destroyed); 5 km north of Comet Vale, Western Australia, 5 July 1995, *R.J. Cranfield* 9852 (*neo:* PERTH 04366921), neotype here chosen.

E. stowardii S. Moore, *J. Linn. Soc. Bot.* 45: 166 (1920). *Type:* Trayning, Western Australia, *F. Stoward* 291 (*syn:* MEL 4547); Nungarin, Western Australia, *F. Stoward* 794 (*syn: n.v.*).

Philotheca tubiflora A.S. George, *Nuytsia* 1: 208 (1971). *Type:* Near Point Kidman, Western Australia, 29 June 1963, *A.S. George* 4506 (*holo:* PERTH 1070541).

Philotheca wonganensis (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon wonganensis Paul G. Wilson, *Nuytsia* 4: 47 (1982). *Type:* 13.5 km north-east of Wongan Hills township, Western Australia, 1 September 1980, *K.F. Kenneally* 7466 (*holo:* PERTH 01005391).

Sect. 2. **Erionema**

Philotheca sect. *Erionema* (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon sect. *Erionema* F. Muell., Pl. Victoria 1: 121 (1862). *Type: E. myoporoides* DC., *fide* Paul G. Wilson, *Nuytsia* 1: 38 (1970).

Eriostemon sect. *Osmanthos* Paul G. Wilson, *Nuytsia* 1: 51 (1970). *Type: E. brucei* F. Muell. [= *P. brucei* (F. Muell.) Paul G. Wilson].

Critical features. Leaves with tracheoids, exstipulate, glabrous or with simple or rarely stellate hairs. *Petals* glabrous or with simple hairs, 1-nerved. *Staminal filaments* narrowly oblong, abruptly narrowed in upper third, usually pilose; anther with 2 (rarely more) glands (sometimes obscure) at base of thin white apiculum. *Seed* flattened-ellipsoid, 3.5–5 mm long; aril a narrow, fleshy cord along adaxial margin; outer testa somewhat coriaceous, smooth, glossy; sclerotesta smooth; hilum a prominent linear groove; raphe basal fleshy, prominent, covered by a thin black crustaceous layer; placental endocarp membranous, deciduous. (Figure 5)

Chromosome number. n=14 in *Philotheca buxifolia, P. hispidula, P. myoporoides, P. obovalis* and *P. scabra* (Smith-White 1954).

Notes. The nine species of this section differ most noticeably from those of sect. *Philotheca* in having two (or more) imbedded glands at the base of the anther apiculum, and in having a seed which is laterally flattened with a linear hilum and coriaceous outer testa. Recent work has shown that the anthers of *P. brucei*, the type of sect. *Osmanthos*, also have a biglandular apiculum and that its seed (Figure 5D–F) is similar to that of *E. myoporoides* (Figure 5A–C).

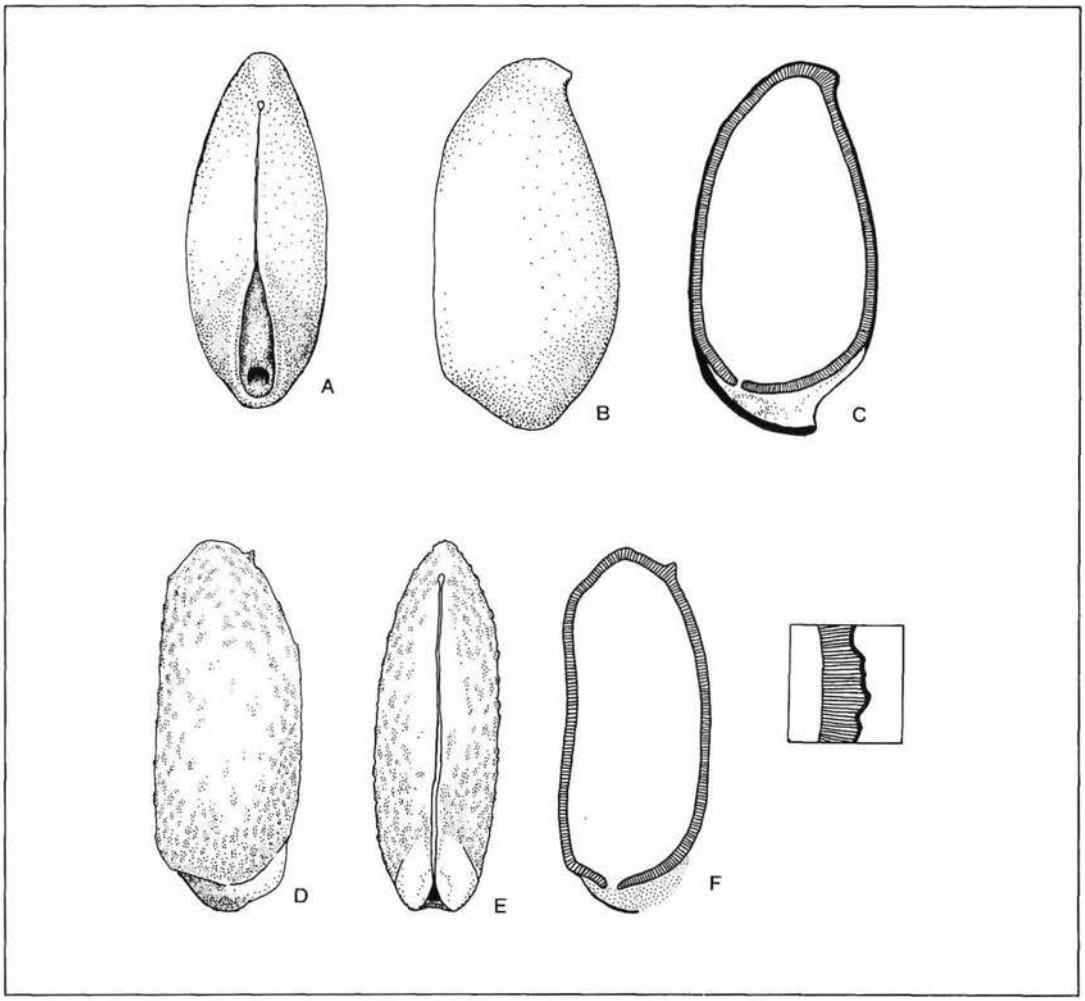

Figure 5. A–C. Seed of *Philotheca myoporoides* (x12), from *J.H. Maiden* (NSW 68749). A – view of adaxial surface; B – lateral view; C – longitudinal radial section. D–F. Seed of *Philotheca brucei* subsp. *brucei* (x10), from *R.D. Royce* 4473 (PERTH). D – lateral view; E – view of adaxial surface; F – longitudinal radial section, with magnified section through testa.

Philotheca brucei (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon brucei F. Muell., Fragm. 7: 38 (1869). *Type:* Near Lake Barlee, Western Australia, 1869, *J. Forrest* (*holo:* MEL 4533).

a. Philotheca brucei subsp. **brevifolia** (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon brucei subsp. *brevifolius* Paul G. Wilson, *Nuytsia* 1: 52 (1970). *Type:* 34 miles [*c.* 54 km] east of Mount Magnet, Western Australia, 27 August 1957, *J.W. Green* 1618 (*holo:* PERTH 01615459).

b. Philotheca brucei (F. Muell.) Paul G. Wilson subsp. **brucei**

c. Philotheca brucei subsp. **cinerea** (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon brucei subsp. *cinereus* Paul G. Wilson, *Nuytsia* 1: 53 (1970). *Type:* Ejah, between Mileura and Nookawarra Stations, Western Australia, 2 June 1961, *S.J.J. Davies* (*holo:* PERTH 01615467).

Philotheca buxifolia (Sm.) Paul G. Wilson, *comb. nov.*

Eriostemon buxifolius Sm. *in* Rees, Cycl. 13: (1809). *Type:* Port Jackson, New South Wales, *J. White* (*lecto:* LINN, Smith herb. no 755.3, left-hand specimen), see P.G. Wilson, *Nuytsia* 1: 45 (1970) and note below.

Typification. Two 'varieties' were described by Smith under *E. buxifolius* but he gave no names to these. Wilson (1970) lectotypified the species name on the variety with the leaves "broadly elliptical, heart-shaped, and embracing the stem at their base generally even and entire at their edges, though occasionally furnished, in the very same manner, with blunt glandular teeth". At the time Wilson had not seen the corresponding specimen in herb. LINN but this omission has since been rectified (see above).

a. Philotheca buxifolia (Sm.) Paul G. Wilson subsp. **buxifolia**

Eriostemon buxifolius var. *ellipticus* G. Don, Gen. Hist. 1: 792 (1831). *Type:* based on lectotype of the species.

b. Philotheca buxifolia subsp. **falcata** Paul G. Wilson, *subsp. nov.*

Philothecae buxifoliae subsp. *buxifoliae* affinis, a qua imprimis differt foliis conduplicatis, falcatis, ubi applanatis late ellipticis c. 10 mm longis 8 mm latis, acutis basi cuneatis, supra laevibus infra verrucosis in statu siccatis.

Typus: 4.5 km south-west of Jervis Bay on the Caves Beach Road, Australian Capital Territory, 12 October 1971, *R. Coveny* 3720 (*holo:* NSW 298558; *iso:* PERTH 00934615).

Similar to subsp. *buxifolia* but with leaves conduplicate falcate (or if flattened then broadly elliptic), c. 10 mm long and 8 mm wide, acute, narrowed at base, smooth above, somewhat verrucose below when dry.

Selected specimens examined. NEW SOUTH WALES: Point Perpendicular, July 1965, *W. McReadie* (NSW); Beecroft Peninsula, *A.M. Lyne* 377 (CANB, PERTH).

Distribution. Jervis Bay area of the Australian Capital Territory and New South Wales.

Habitat. Found near the coast growing in sandy soil in dry sclerophyll forest.

Etymology. The Latin epithet *falcata* means falcate and refers to the shape of the leaf when folded.

Note. This subspecies appears to grade northward into subsp. *buxifolia*.

c. Philotheca buxifolia subsp. **obovata** (G. Don) Paul G. Wilson, *comb. nov.*

Eriostemon buxifolius subsp. *obovatus* (G. Don) Paul G. Wilson, *Nuytsia* 1: 45 (1970). — *E. buxifolius* var. *obovatus* G. Don, Gen. Hist. 1: 792 (1831). *Type:* Port Jackson, New South Wales, 1795, *J. White* (*holo:* LINN Smith herb. n. 755.3, right-hand specimen).

[*Eriostemon buxifolius* var. *'a'*, Augustin P. de Candolle, Prod. 1: 720 (1824).]

Notes. No reference was given by G. Don for the use of the varietal epithet *obovatus* nor was any material cited by him. However, the reference "Smith in Rees" was given for the species, and the description of the variety is a translation of that provided by de Candolle for *Eriostemon buxifolius* var. *a.* De Candolle's description in its turn was based on the description given by Smith, *loc.cit.*, for the variety in which "the leaves are obovate, narrow at the base, bluntly crenate and glandular at the edges".

Philotheca hispidula (Spreng.) Paul G. Wilson, *comb. nov.*

Eriostemon hispidulus Sieber ex Spreng., Syst. Veg. 4/2: 164 (1827). *Type: F.W. Sieber* 305 (*iso:* K, MEL 4286 & 4534, TCD).

Philotheca obovalis (A. Cunn.) Paul G. Wilson, *comb. nov.*

Eriostemon obovalis A. Cunn. in Field, Geogr. Mem. New South Wales 331 (1825). *Type:* Blue Mountains, New South Wales, October 1822, *A. Cunningham* 45 (*holo:* K; *iso:* BRI 014176, CANB 251249, MEL 4532).

Philotheca scabra (Paxton) Paul G. Wilson, *comb. nov.*

Eriostemon scaber Paxton, *Paxton's Mag. Bot.* 11: 190 (1844). *Type:* cult. Messrs Henderson; seeds from gardens of C.A.A. von Huegel (*n.v.*).

E. scaber Gerard *nom. illeg.*, *Hortic. Univ.* ser. 2, 7: 131 (1846), later homonym. *Type:* No mention of origin (*n.v.*).

E. scaber A.DC. *nom. illeg.*, Not. Pl. Rar. 10: 8 (1848), later homonym. *Type:* "Cette espece introduite dans les jardins de Belgique, a ete presentee par M. Muzy dans une exposition de fleurs, le 22 avril 1846, a Geneve" (*n.v.*).

a. Philotheca scabra subsp. **latifolia** (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon scaber subsp. *latifolius* Paul G. Wilson, *Nuytsia* 1: 44 (1970). *Type:* Bundanoon, New South Wales, 27 September 1957, *J.C.R. Holford* 259 (*holo:* NSW 68808).

b. Philotheca scabra (Paxton) Paul G. Wilson subsp. **scabra**

Philotheca trachyphylla (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon trachyphyllus F. Muell., Defin. Austral. Pl. 22 (June–July 1855); *Trans. Philos. Soc. Victoria* 1: 99 (Sept. 1855). *Type:* Snowy River near the Pinch Range, New South Wales, *F. Mueller* (*holo:* MEL 4531; *iso:* K).

Philotheca verrucosa (A. Rich.) Paul G. Wilson, *comb. nov.*

Eriostemon verrucosus A. Rich., Voy.Astrolabe Bot. pt. 2. Atlas tab. 26 (1833) with analysis; Sertum Astrolabianum 74 (1834). *Type:* "Crescit in Nova-Hollandia loco dicto baie Morton", Moreton Bay, Queensland [actually collected in Tasmania], (*n.v.*), see note.

? *E. dolabratus* H.G.L. Reichenbach, Ic. Bot. Exot. Cent. 2: 36 (1828). *Type citation:* "E Nova Hollandia", (*n.v.*).

E. obcordatus A. Cunn. ex Hook., *J. Bot. Hooker* 1: 254 (1834). *Type:* "About Hobart Town — *Mr Cunningham, Mr Lawrence*, 1831, (n.153) *R.C. Gunn*, (n.14)" (*syn:* K, *A. Cunningham* 17).

Notes. Moreton Bay is in Queensland, however, the plant illustrated in the protologue of *Eriostemon verrucosus* must have come from Tasmania. The French explorer, Admiral Dumont D'Urville, commander of the corvette L'Astrolabe, visited Hobart in December 1827 when the type could have been collected.

The application of the name *Eriostemon dolabratus* is uncertain and therefore it has not been taken up for this species.

Philotheca virgata (Hook. f.) Paul G. Wilson, *comb. nov.*

Eriostemon virgatus Hook. f., *J. Bot. Hooker* 2: 417 (1840). *Type:* Rocky Cape, Tasmania, 1837, *R.C. Gunn* 485 (*lecto:* K; *? isolecto:* NSW), see Wilson (1970).

Sect. 3. **Corynonema**

Philotheca sect. *Corynonema* (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon sect. *Corynonema* Paul G. Wilson, *Nuytsia* 1: 53 (1970). *Type: E. pungens* Lindl. [= *Philotheca pungens* (Lindl.) Paul G. Wilson].

Critical features. Branchlets pilosulose in furrows between leaf-decurrences. *Leaves* with tracheoids, exstipulate, linear or terete. *Flowers* solitary, axillary or terminal. *Petals* minutely papillose within, otherwise glabrous. *Staminal filaments* erect or inflexed, thick, abruptly apiculate at apex, glabrous or pilose; anthers minutely white-apiculate, eglandular. *Seed* somewhat reniform, plump, 2–4 mm long, with the attached (placental) endocarp sub-coriaceous and persistent; testa black, longitudinally striate, not easily separable into two layers, sclerotesta dominant, hilum short, narrowly oblong in centre of adaxial face; raphe covered with a glossy crustaceous layer. (Figure 6A–F)

A section of three species, two occurring in Western Australia and one in South Australia and Victoria.

Notes. The seed morphology alone readily distinguishes this section from the others in *Philotheca* and suggests that the three species are more closely related to each other than their floral and vegetative morphologies would indicate.

Philotheca fitzgeraldii (C.R.P. Andrews) Paul G. Wilson, *comb. nov.*

Eriostemon fitzgeraldii C.R.P. Andrews, *J. W. Austral. Nat. Hist. Soc.* no. 1: 37 (May 1904). *Type:* North of Esperance, Western Australia, October 1903, *C.R.P. Andrews* (*syn:* PERTH 01615513, 01615521).

E. apricus Diels & E. Pritzel, *Bot. Jahrb. Syst.* 35: 321 (Oct. 1904); *Phebalium apricum* (Diels) Ewart & B. Rees, *Proc. Roy. Soc. Victoria* ser. 2, 25: 111 (1912). *Type:* Near Gilmores, Western Australia, *L. Diels* 5267 (*iso*: PERTH 01615548).

E. gibbosus Luehm. ex Ewart, *Proc. Roy. Soc. Victoria* ser. 2, 20: 79 (1907). *Type:* Near Norseman, Western Australia, 1897, *J.D. Batt* (*holo:* MEL 4719).

Philotheca pinoides (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Eriostemon pinoides Paul G. Wilson, *Nuytsia* 1: 54 (1970). *Type:* Summit of Mt Peron, Western Australia, 26 August 1949, *C.A. Gardner* 9408 (*holo:* PERTH 1137247).

Philotheca pungens (Lindl.) Paul G. Wilson, *comb. nov.*

Eriostemon pungens Lindl. in Mitchell, Three Exped. E. Australia 2: 156 (1838); *Phelalium pungens* (Lindl.) Benth., Fl. Austral. 1: 338 (1863). *Type:* Mt Hope, Victoria, 28 June 1836, *T.L. Mitchell* 202 (*holo:* CGE; *iso:* MEL 4902).

Sect. 4. **Cyanochlamys**

Philotheca sect. *Cyanochlamys* (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon subgen. *Cyanochlamys* Bartl. ex F. Muell., Pl. Indig. Col. Victoria 1: 119 (1862). -- *Eriostemon* sect. *Cyanochlamys* (F. Muell.) F. Muell., Fragm. 9: 110 (1875). *Type: E. spicatus* A. Rich. [= *Philotheca spicata* (A. Rich.) Paul G. Wilson].

Critical features. Branchlets with stellate hairs. *Leaves* with tracheoids. *Inflorescence* a terminal cluster or raceme; pedicel with a pair of basal bracteoles or these gland-like. *Petals* thin, glabrous. *Staminal filaments* free, flattened, pilose; anther white-apiculate, not glandular. *Disc* a narrow ring around base of ovary. *Cocci* erect, apiculate or shortly rostrate. *Seed* sub-reniform, abaxial margin convex, adaxial margin straight; attached (placental) endocarp thin, caducous; aril slender, linear, along adaxial face, firmly attached to placental-endocarp and easily separated from seed; outer testa membranous; sclerotesta smooth; hilum superficial, linear; raphe small, sub-basal, covered by only a thin integument; chalaza near base of adaxial margin. (Figure 6G, H).

A section of two species, both endemic to Western Australia.

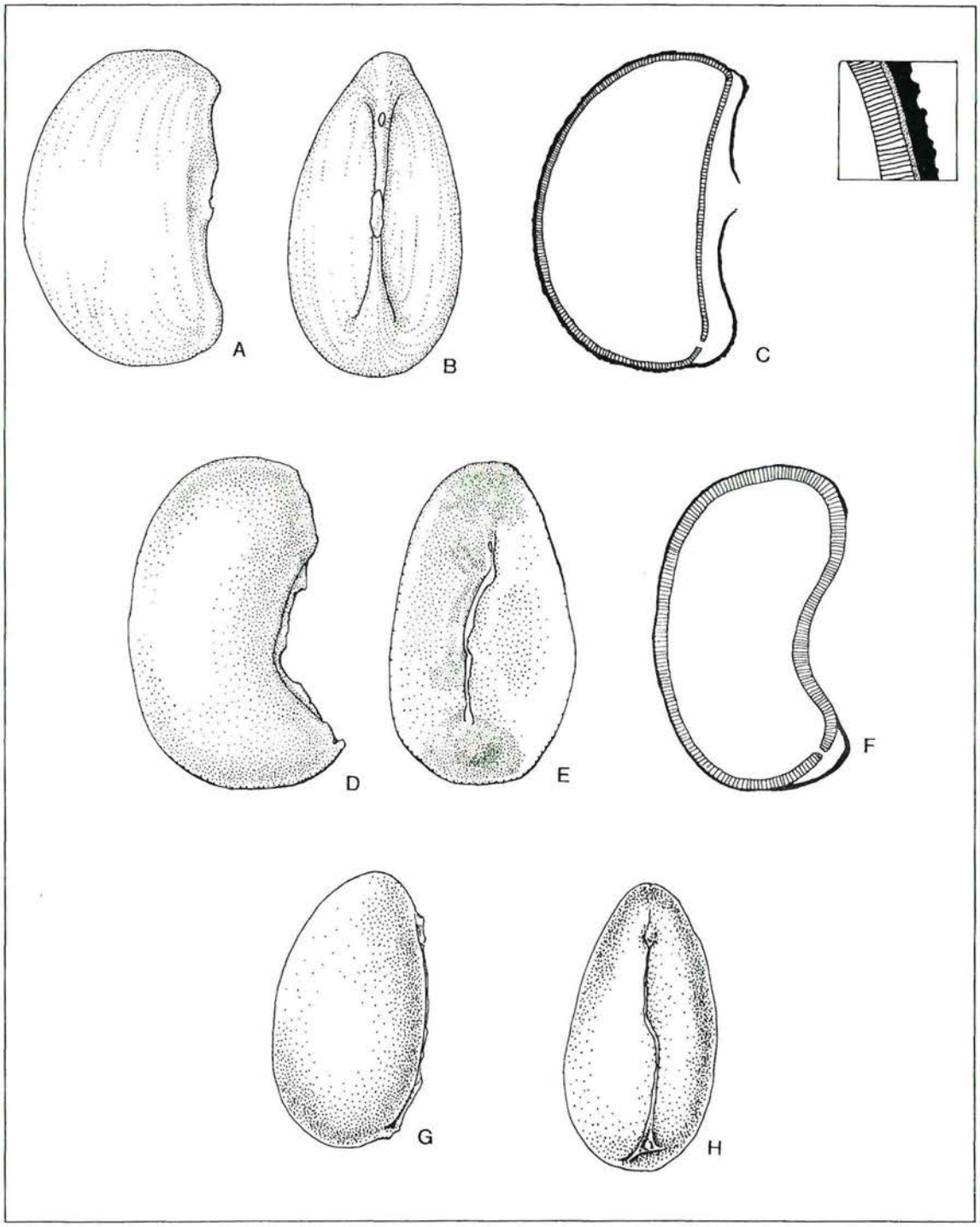

Figure 6 A–C. Seed of *Philotheca fitzgeraldii* (x10) from *C.A. Gardner* 2926 (PERTH). A – lateral view; B – view of adaxial surface; C – longitudinal radial section, with magnified section through testa. D–F. Seed of *Philotheca pinoides* (x10) from *C. Chapman* 3 Jan. 1971 (PERTH). D – lateral view; E – view of adaxial surface; F – longitudinal radial section. G, H. Seed of *Philotheca nodiflora* subsp. *lasiocalyx* (x10) from *A. Strid* 20961 (PERTH). G – lateral view of seed; H – view of adaxial surface.

Philotheca nodiflora (Lindl.) Paul G. Wilson, *comb. nov.*

Eriostemon nodiflorus Lindl., Sketch Veg. Swan-Riv. Col. 17(1839). *Type:* Swan River Colony, Western Australia, 1839, *J. Drummond s.n.* (*holo:* CGE).

Distribution. This species is endemic to the south-west of Western Australia.

Note. Four subspecies can be recognized.

1 Flowerheads 2–3 cm diam.; petals elliptic
2 Sepals glabrous (but ciliate) ..... subsp. **calycina**
2: Sepals pilose
3 Petals pilose outside ..... subsp. **latericola**
3: Petals glabrous outside ..... subsp. **nodiflora**
1: Flowerheads 1–1.5 cm diam.; petals obovate ..... subsp. **lasiocalyx**

a. Philotheca nodiflora subsp. **calycina** (Turcz.) Paul G. Wilson, *comb. et stat. nov.*

Eriostemon calycinus Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 22/2: 14 (1849). *Type:* Western Australia, *J. Drummond* IV coll. n. 93 (*holo:* KW; *iso:* TCD).

Distribution. Found near Wooroloo and Wagin in south-western Western Australia

Habitat. This subspecies grows in gravelly soil.

b. Philotheca nodiflora subsp. **lasiocalyx** (Domin) Paul G. Wilson, *comb. nov.*

Eriostemon nodiflorus var. *lasiocalyx* Domin, *Vestn. Kral. Ceske Spolecn. Nauk, Tr. Mat.-Prir.* 2: 54 (1923). – *E. nodiflorus* subsp. *lasiocalyx* (Domin) Paul G. Wilson, *Nuytsia* 1: 58 (1970). *Type:* Cranbrook to Warrungup, sandy plains, Mt Toolbrunup, Western Australia, *A.A. Dorrien-Smith* (*n.v.*).

Distribution. This subspecies occurs in southern Western Australia from Collie eastwards to Duke of Orleans Bay.

Habitat. Usually found growing in heathland on sandy loam.

c. Philotheca nodiflora subsp. **latericola** Paul G. Wilson, *subsp. nov.*

Ex affinite *P. nodiflora* subsp. *nodiflora* sed petalis extra longe-pilosis differt.

Typus: Near York, Western Australia, 28 September 1921, *P.A. Sargent* (*holo:* PERTH 00895830).

Similar to subsp. *nodiflora* but with petals that are long-pilose on their abaxial surface.

Selected specimen examined. WESTERN AUSTRALIA: 13 km S on Watershed Road off Brookton Highway, *R.J. Cranfield* 1977 (PERTH).

Distribution. Occurs in the Darling Range, Western Australia, between York and Bannister.

Habitat. Found growing on laterite and ironstone.

Etymology. The epithet refers to the plant's preferred habitat.

d. Philotheca nodiflora (Lindl.) Paul G. Wilson subsp. **nodiflora**

Eriostemon nodiflorus var. *subglabriflorus* Domin, *Vestn. Kral. Ceske Spolecn. Nauk, Tr. Mat.-Prir.* 2: 54 (1923). *Type:* no specimens cited (see note below).

Distribution. This subspecies occurs between Chittering and Bindoon in the Darling Range of Western Australia.

Habitat. Found along creeks or in seasonal swamps.

Notes. Domin derived the Latin descriptions of his two varieties from the English descriptions of the two 'forms' mentioned by Bentham (1863). Bentham did not name these 'forms' and he did not indicate to which of them the collections he cited belonged. Domin cited one collection under var. *lasiocalyx* but none under var. *subglabriflorus*.

Philotheca spicata (A. Rich.) Paul G. Wilson, *comb. nov.*

Eriostemon spicatus A. Rich., Voy. Astrolabe Bot. part 2, Atlas tab. 27 (1833) (with analysis); Sertum Astrolabianum 76 (1834). *Type:* "Nova-Hollandia" (*n.v.*).

E. racemosus Endl. *in* Endl. *et al.*, Enum. Pl. Huegel. 15 (1837). *Type:* Swan-River Colony, Western Australia, *K. Huegel* (*n.v.*, *ex descr.*).

E. ebracteatus Endl., *loc. cit. Type:* King George Sound, Western Australia, *K. Huegel* (*n.v.*, *ex descr.*).

E. effusus Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 22/2: 14 (1849). *Type:* Western Australia, *J. Gilbert* 95 (*holo:* KW).

Acknowledgements

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New species and nomenclatural changes in *Phebalium* and related genera (Rutaceae)

Paul G. Wilson

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Wilson, Paul G. New species and nomenclatural changes in *Phebalium* and related genera (Rutaceae). *Nuytsia* 12 (2): 267–288 (1998). *Phebalium* is considered to consist only of those species previously included in sect. *Phebalium*. The other three sections of *Phebalium* are either raised to generic status or referred to other genera: *Phebalium* sect. *Gonioclados* is united with *Rhadinothamnus*, *Phebalium* sect. *Eriostemoides* is united with *Nematolepis*, and *Phebalium* sect. *Leionema* becomes the genus *Leionema*. A key to genera that have been associated with *Phebalium* is provided.

In *Phebalium* four new species and one new subspecies are described: *P. appressum* Paul G. Wilson, *P. elegans*, *P. festivum*, *P. glandulosum* subsp. *nitidum*, and *P. laevigatum*. Also, one new name, *P. brevifolium* is published, and two new combinations are made.

In *Nematolepis* six new species combinations are made. In *Rhadinothamnus* two species and two infraspecific combinations are made. In *Leionema* one species, *L. ellipticum*, is described as new and 22 new species combinations and one infraspecific combination are made.

Introduction

For over 100 years, following Bentham (1863), the genus *Phebalium* (Rutaceae) has been widely regarded as a discrete taxon, for although Mueller (1875) united it with *Eriostemon* his classification has not been accepted.

In 1970 the genus was divided into four sections (Wilson 1970) but it was recognized that the species in three of the sections were more closely related to one or more species in other genera than they were to those in other sections of *Phebalium*. The situation appeared to be as follows:

1. *Phebalium* sect. *Phebalium* – closely related to *Microcybe* species.
2. *Phebalium* sect. *Eriostemoides* – closely related to *Nematolepis phebalioides.*
3. *Phebalium* sect. *Gonioclados* – closely related to *Rhadinothamnus euphemiae* and to *Chorilaena quercifolia.*
4. *Phebalium* sect. *Leionema* – with no close relatives.

These suggested relationships, which were largely based on floral characters, are now strongly supported by seed morphology which is distinct and uniform within each of the above groups.

The traditional classification obviously requires attention. The options that are available in order to provide a more natural classification are:

1. to unite under *Phebalium* all the closely related genera that are indicated above, or

2. to recognize that *Phebalium* consists of the species in sect. *Phebalium,* with or without the inclusion of *Microcybe*, and to transfer those species in sect. *Gonioclados* to *Rhadinothamnus*, and those in sect. *Eriostemoides* to *Nematolepis*, while sect. *Leionema* would be given generic status.

It has been decided to take the second course, in particular because each of the resultant genera is homogeneous and clearly distinct morphologically. *Microcybe*, which is closely related to *Phebalium* but differs in having sessile flowers and 2-carpellary ovaries, is retained as a distinct genus.

This paper is a precursor to an account of the genera that will be published in Volume 26 of the "Flora of Australia", therefore descriptions are only provided for newly recognized or newly circumscribed taxa.

Hilar strands of the seed

The ovaries and developing carpels in dried herbarium material of a number of genera in the Rutaceae tribe Boronieae were studied in order to establish the homology of certain characters evident on the seed.

In some genera of the Boronieae the seed possesses a cream-coloured ligament-like tissue on its adaxial surface between the micropyle and the chalazal opening. This tissue has the appearance when dry of a cartilaginous strand; it surrounds the hilum and extends, as a single thread, to the raphe. This cartilaginous material, which is here called the 'hilar strand', is shed on, or shortly after, the dispersal of the seed.

Hilar strands of identical form and origin are found in seed of the following taxa:

1. *Chorilaena* (Figure 1)
2. *Phebalium* sect. *Gonioclados*
3. *Rhadinothamnus euphemiae*
4. *Asterolasia p.p.*

From a study of stages in the development of ovules through to seed in the above taxa, and comparing these stages with similar stages in seeds of other members of the Boronieae, it became apparent that the hilar strand arises from the narrow portion of the outer testa (formed from the outer integument) that surrounds the hilum. In early stages of seed development the future strand is intimately fused to the rest of the outer testa but when nearly mature it becomes separated and eventually falls away from the seed.

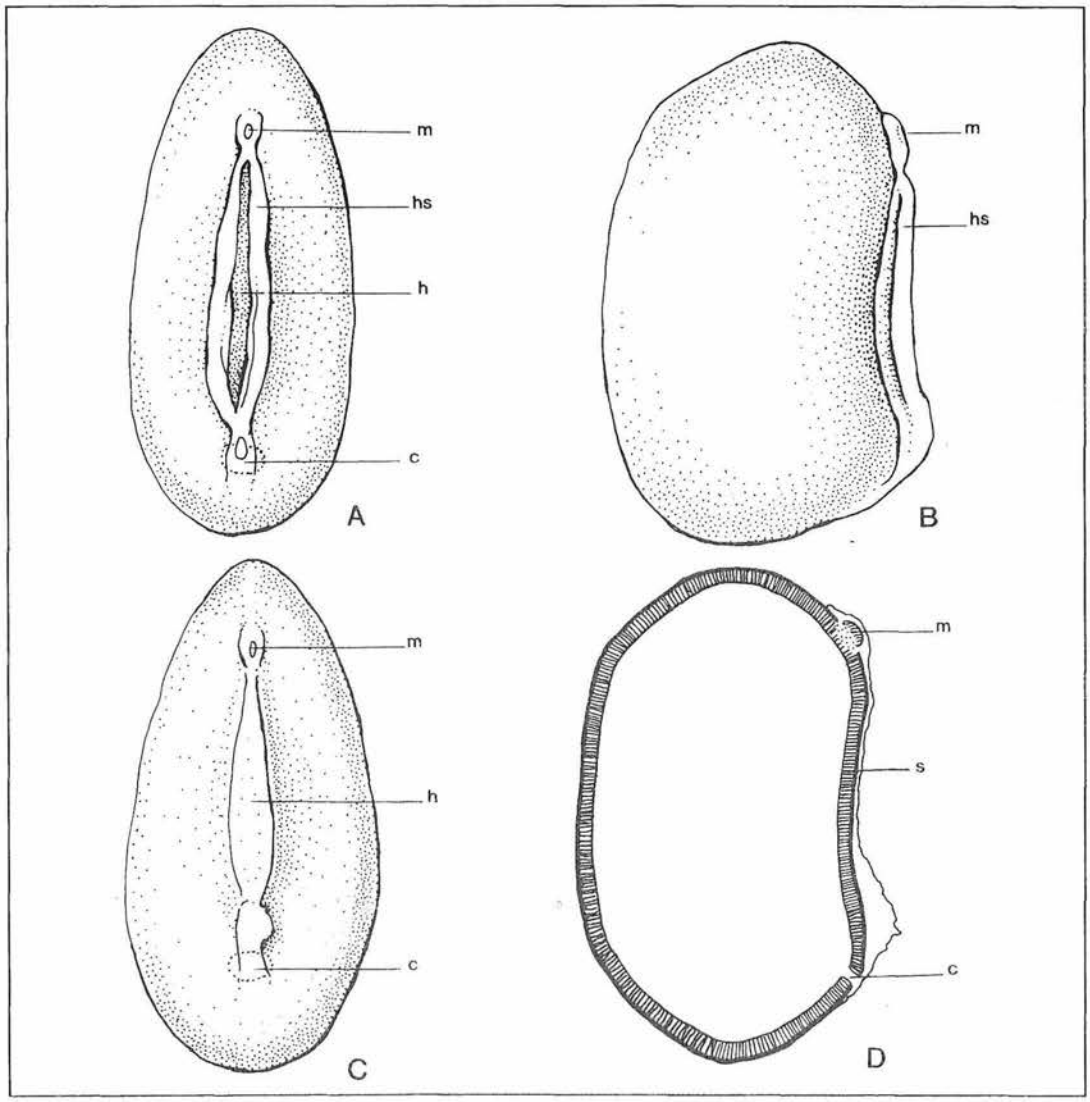

Figure 1. *Chorilaena quercifolia* seed (x15). A – adaxial surface with hilar strands attached; B – lateral view with hilar strands attached; C – adaxial surface without hilar strands; D – longitudinal radial section; c – chalazal aperture; h – hilum; hs – hilar strands; m – micropyle; s – sclerotesta. Drawn from *Paul G. Wilson* 3976 (PERTH).

In most genera of the Boronieae a pale line around the hilum can be observed in the developing ovule. In *Correa* this area remains pale in the mature seed. In *Boronia* sect. *Boronia* and in *Eriostemon* sect. *Erionema* this area becomes brittle (and usually glossy) and raised around an apparently sunken hilum. In *Philotheca* and in *Eriostemon* sect. *Nigrostipulae* the developing ovule has a brown ring around the hilum and raphe and this appears to develop into the hard cover to the raphe.

The hilar strand is therefore apparently homologous with the lips that surround the hilum and raphe in *Boronia* sect. *Boronia* and in *Eriostemon* sect. *Erionema*, and is homologous with the hard cover to the raphe that is found in *Drummondita*, *Geleznowia*, and *Eriostemon* sect. *Nigrostipulae*.

It is unlikely that the hilar strands arose independently in *Chorilaena* and in *Rhadinothamnus* since a close relationship between these genera is supported by other characters, e.g. the hemispherical calyx,

the valvate petals, and the non-glandular apiculum to the anthers. A relationship with *Asterolasia* is more remote since in that genus the calyx is extremely small, the petals are imbricate, and the anthers have a glandular apiculum.

Key to genera of the Phebalium group

1 Anthers basifixed, apex with a prominent spherical gland; bracteoles basal to pedicel and insignificant
2 Flowers pedicellate; sepals united; carpels 5 ..... **Phebalium**
2: Flowers sessile; sepals free or united; carpels 2 ..... **Microcybe**
1: Anthers versatile, without an apical gland; bracteoles medial or supra-medial on pedicel
3 Sepals united; anthers obtusely apiculate
4 Plants lepidote; flowers solitary or cymose ..... **Rhadinothamnus**
4: Plants with stellate hairs; inflorescence a 6-flowered umbel ..... **Chorilaena**
3: Sepals free; anthers retuse at apex
5 Plants lepidote; sepals imbricate; petals imbricate or united ..... **Nematolepis**
5: Plant glabrous or with simple or stellate hairs; sepals valvate; petals valvate or united ..... **Leionema**

Leionema

Leionema (F. Muell.) Paul G. Wilson, *gen. et comb. nov.*

Eriostemon sect. *Leionema* F. Muell., Pl. Victoria 1: 125 (1862). – *Phebalium* sect. *Leionema* (F. Muell.) Benth., Fl. Austral. 1: 337 (1863). *Type: Leionema bilobum* (Lindl.) Paul G. Wilson.

Eriostemon sect. *Chorilaenopsis* F. Muell., *op. cit.* 131. *Type: Eriostemon phylicoides* F. Muell. [= *Leionema diosmeum* (A. Juss.) Paul G. Wilson].

Shrubs, glabrous or with simple or stellate hairs. *Branches* smooth. *Leaves*, alternate, simple, sessile or shortly petiolate, glandular-punctate, smooth. *Flowers* terminal or axillary, cymose or solitary, pentamerous. *Pedicels* slender, medially bibracteolate. *Sepals* free. *Petals* free or united, valvate, elliptic, usually glabrous; apex inflexed. *Stamens* 10; filaments terete, glabrous; anthers versatile, loculi deeply separated at base, apex deeply retuse, terminal gland or apiculum absent. *Disc* usually present and forming a short gynophore. *Carpels* 5, glabrous or stellate-hairy, apex sterile. *Ovules* 2 per carpel. *Style* solitary, slender, glabrous, affixed to adaxial medial surface of carpels; stigma minutely lobed. *Seed* sub-reniform, *c.* 3 mm long, adaxial margin ± straight; outer testa thin, smooth; sclerotesta smooth; hilum linear to narrowly elliptic; raphe fleshy basal or sub-basal with a thin coriaceous to crustaceous glossy covering; chalazal opening basal or sub-basal, obscured by raphe; placental endocarp thick, persistent. (Figure 2)

Chromosome number. n=16 (Smith-White 1954).

A genus of 22 species, 21 in the eastern States of Australia and one in New Zealand.

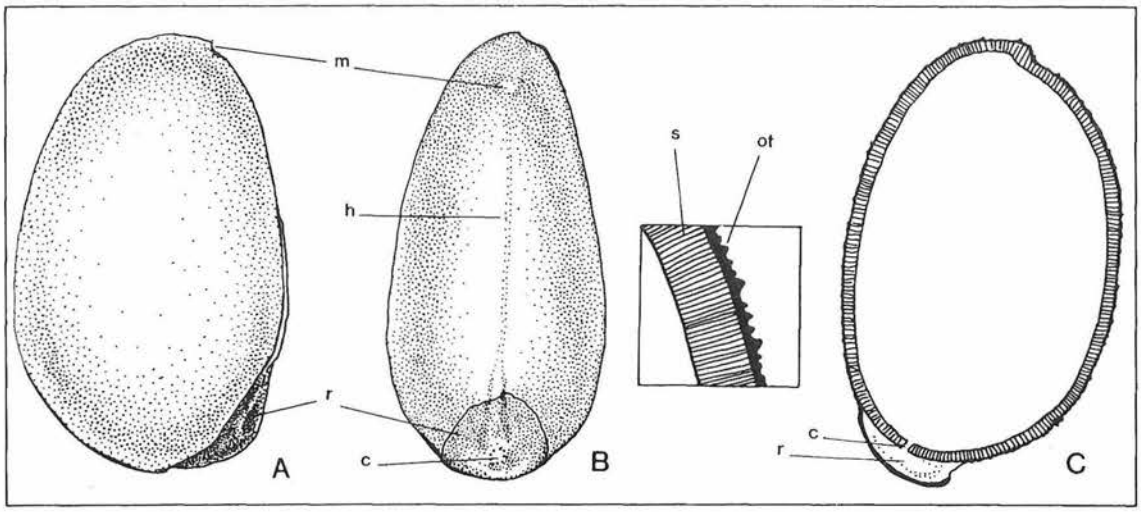

Figure 2. *Leionema lamprophyllum* seed (x10). A – lateral view; B – adaxial surface; C – longitudinal radial section with enlarged section through testa; c – chalazal aperture; h – hilum; m – micropyle; ot – outer testa; r – raphe; s – sclerotesta. Drawn from *F. Mueller s.n.* (MEL 4318)

Notes. The relationship of this genus to others in the tribe Boronieae is not clear, however, it appears to show no close affinity to *Phebalium s. str.*, to *Rhadinothamnus*, or to *Nematolepis*.

Leionema elliptica differs from the other members of the genus in leaf form, in having minutely apiculate anthers, and in having a divided disc. It is probably wrongly placed in this genus, but until fruit and seed are available its correct classification may not be apparent.

Leionema ambiens (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon ambiens F. Muell., Fragm. 6: 166 (1868). – *Phebalium ambiens* (F. Muell.) Maiden & E. Betche, Census New South Wales Pl. 116 (1916). *Type:* near Timbarra, New South Wales, *C. Stuart* 570 (*lecto:* MEL 4552) *fide* Wilson (1970).

Distribution. Occurs in the Guyra district in the extreme north-east New South Wales and near Wallangarra in south-east Queensland.

Leionema bilobum (Lindl.) Paul G. Wilson, *comb. nov.*

Phebalium bilobum Lindl. in T. Mitch., Three Exped. Australia 2: 177 (1838). – *Eriostemon hillebrandii* F. Muell. *nom. illeg.*, *Trans. Philos. Soc. Victoria* 1: 10 (1854) including *P. bilobum*. *Type:* Mt William, Victoria, 15 July 1836, *T. Mitchell* 249 (*holo:* CGE; *iso:* K, MEL).

E. hillebrandii var. *longifolius* F. Muell., *Trans. Philos. Soc. Victoria* 1: 10 (1854). *Type:* Mt William, Victoria, November 1853. *F. Mueller* (*syn:* MEL 4608, 4616, 4617).

P. truncatum Hook.f., Fl. Tasm. 1: 64 t. 9 (1855). *Type:* Flinders Island, Tasmania, *R. Gunn* 1947 (*syn:* HO).

E. serrulatus F. Muell., Fragm. 1: 4 (1858). *Type:* Bunip-Bunip Creek, Victoria, *F. Mueller* (*holo:* MEL 4620; *iso:* K).

Distribution. Occurs in Victoria in The Grampians, Central Highlands, and west Gippsland; in Tasmania on the mainland and on islands in Bass Strait.

Leionema carruthersii (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon carruthersii F. Muell., *Victorian Nat.* 7: 46 (1890). – *Phebalium carruthersii* (F. Muell.) Maiden & E. Betche, Census New South Wales Pl. 116 (1916). *Type:* Moruya, New South Wales, *W. Bauerlen* 564 (*lecto:* MEL 4638; *isolecto:* MEL 4639) *fide* Wilson (1970).

Distribution. Occurs in the Batemans Bay to Bega district of New South Wales.

Leionema coxii (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon coxii F. Muell., *Australas. Chem. Druggist* 7: 64 (Dec. 1884). – *Phebalium coxii* (F. Muell.) Maiden & E. Betche, Census New South Wales Pl. 116 (1916). *Type:* Braidwood district, New South Wales, *W. Baeuerlen* 199 (*holo:* MEL 4649; *iso:* NSW 70184).

Distribution. Occurs chiefly in the Budawang Range in south-eastern New South Wales.

Leionema dentatum (Sm.) Paul G. Wilson, *comb. nov.*

Phebalium dentatum Sm. *in* Rees, Cyclop. 27: (1814). *Type:* "Brought by Gen. Grose from some part of New Holland, and communicated to us by A.B. Lambert Esq" (*holo:* LINN).

P. salicifolium A. Juss., *Ann. Sci. Nat. (Paris)* 4: 472 (1825). *Type:* Port Jackson, New South Wales, *anon.* (*n.v.*).

Eriostemon umbellatus Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 22/2: 15 (1849). – *P. umbellatum* (Turcz.) Turcz., *op. cit.* 25/2: 160 (1852). *Type:* 125 miles [*c.* 200 km] from Sydney, New South Wales, *W. Stephenson* (*holo:* KW photo seen).

Distribution. Occurs in New South Wales chiefly near the coast from Illawarra north to Port Stephens, and also in the Gibraltar Range.

Leionema diosmeum (A. Juss.) Paul G. Wilson, *comb. nov.*

Phebalium diosmeum A. Juss., *Ann. Sci. Nat. (Paris)* 4: 472 (1825). – *P. phylicoides* Sieber ex Spreng. *nom. illeg.*, Syst. Veg. 4 pt 2: 1640 (1827), superfluous name based on above. – *Eriostemon phylicoides* F. Muell. *nom. illeg.*, Fragm. 1: 107 (1859). *Type:* Port Jackson, New South Wales, comm. J. Gay (*iso:* K).

Chorilaena angustifolia F. Muell., *Trans. Philos. Soc. Victoria* 1: 10 (1854) [as *angustifolio*]. *Type:* Argyle County [i.e. Goulburn district], New South Wales, *anon.* 826 (*holo:* MEL 4680; *iso:* K, MEL 4812).

Distribution. Occurs near the south-east coast of New South Wales.

Leionema elatius (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon elatior F. Muell., Fragm. 1: 181 (1859). – *Phebalium elatius* (F. Muell.) Benth., Fl. Austral. 1: 340 (1863). *Type:* Near Tenterfield, New South Wales, *C. Stuart* 153 (*holo:* MEL 4700).

Distribution. Occurs in north-east New South Wales and extreme south-east Queensland.

Notes. Two subspecies are recognized.

a. Leionema elatius (F. Muell.) Paul G. Wilson subsp. **elatius**

Distribution. Occurs in ranges in north-east New South Wales north of Bulahdelah, and in the extreme south-east of Queensland.

b. Leionema elatius subsp. **beckleri** (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon beckleri F. Muell., Fragm. 9: 109 (1875). – *P. beckleri* (F. Muell.) Engler *in* Engler & Prantl, Nat. Pflanzenfam. III 4: 141 (1890); *Phebalium elatius* subsp. *beckleri* (F. Muell.) Paul G. Wilson, *Nuytsia* 1: 105 (1970). *Type:* McLennan's Creek, Clarence River, New South Wales, *H. Beckler* (*holo:* MEL 4589; *iso:* NSW 69929).

Distribution. Known from a small area in the McPherson Range, Queensland and north-eastern New South Wales.

Notes. A plant from Hungryway Creek, Colo, New South Wales, referred to as '*Phebalium* species A' by Weston & Porteners (1991), may be a hybrid since it has deformed flowers and apparently sterile anthers. Although it most closely resembles *L. elatius* the latter species has not been recorded from the Colo area.

Leionema ellipticum Paul G. Wilson, *sp. nov.*

Ramuli laeves, nitidi, glabri. Folia glabra, chartacea, elliptica, ad 5 cm longa, 2 cm lata, integra, obtusa, in petiolem 5 mm longa ad basim attenuata. Inflorescentia terminalis, cymosa, multiflora, c. 2 cm longa, sparse puberula pilis simplicibus vel fasciculatis tectis; bracteolae caducae; pedicelli 1–2 mm longi. Flores glabri; sepala prope basim breviter connata, carnosa, deltata, c. 0.8 mm longa; petala valvata, crassa, anguste oblonga, c. 4.5 mm longa, 1.3 mm lata, manifeste carinata, alba, ad apicem incrassata et leviter inflexa; stamina petala breviter superantia, filamentis gracilibus, teretibus, antheris cordatis, c. 1.2 mm longis, obtuso mucronatis; ovarium glabrum; stylus teres petalis leviter brevior.

Typus: Mountain in north-east Queensland [precise locality withheld], 25 December 1991, *K.R. McDonald* (*holo:* BRI 520388).

Shrub to 2 m high. *Branchlets* smooth, glossy, glabrous, somewhat angular when dry due to ribs decurrent from leaf bases. *Leaves* glabrous; lamina chartaceous, pinnately veined, pellucid-dotted, elliptic, to 5 cm long, 2 cm wide, entire, obtuse, narrowed at base into a petiole to 5 mm long. *Inflorescence* terminal, cymose, multiflowered, *c.* 2 cm long, sparsely puberulous with simple and

fasciculate hairs; pedicels 1–2 mm long; bracteoles caducous. *Flowers* glabrous. *Sepals* 5, very shortly united at base, fleshy, deltate, *c.* 0.8 mm long. *Petals* valvate, thick, firm, narrowly oblong, *c.* 4.5 mm long, 1.3 mm wide, strongly keeled, white; apex thickened and slightly inflexed. *Stamens* glabrous; filaments slender, terete, shortly exceeding petals; anthers cordate, *c.* 1.2 mm long, bluntly mucronulate. Gynophore *c.* 0.5 mm high, deeply 10-grooved. *Ovary* barrel-shaped, *c.* 1.3 mm high, glabrous or with a few minute hairs, terminal 1/3 solid; style fixed to near base of carpels, terete, slightly shorter than petals. *Fruit* not seen.

Specimens examined. Known only from the type collection.

Distribution. North-east Queensland.

Habitat. Windswept shrubland on top of mountain.

Etymology. The epithet is derived from the Latin *ellipticus* and refers to the elliptical shape of the leaves.

Notes. This species is only known from the type collection. The flowers are similar to those of other species of *Leionema* except for the anthers which are bluntly mucronulate (not retuse) and for the gynophore which is deeply grooved. These anomalous characters suggest that it is incorrectly placed in this genus although neither T. Hartley (CANB pers. comm.), nor I can suggest a more appropriate one. I consider that it would be inadvisable for it to be described as a new monotypic genus while fruiting material is lacking.

Leionema equestre (D.A. Cooke) Paul G. Wilson, *comb. nov.*

Phebalium equestre D.A. Cooke, *J. Adelaide Bot. Gard.* 10: 241 (1987). *Type:* Kangaroo Island, South Australia, *B.M. Overton* 435 (*iso:* PERTH).

Distribution. Endemic to Kangaroo Island, South Australia.

Leionema gracile (C.T. White) Paul G. Wilson, *comb. nov.*

Phebalium gracile C.T. White, *Proc. Roy. Soc. Queensland* 50: 69 (1939). *Type:* Mt Greville, Queensland, *C.T. White* 9947 (*holo:* BRI 011387).

Distribution. Occurs in extreme south-east Queensland where it is apparently restricted to the summits of Mt Moon and Mt Greville.

Leionema hillebrandii (J.H. Willis) Paul G. Wilson, *comb. nov.*

Phebalium hillebrandii J.H. Willis, *Victorian Nat.* 73: 195 (1957). – Based on *Eriostemon hillebrandii* var. *brevifolius* F. Muell. *nom illeg., Trans. Philos. Soc. Victoria* 1: 10 (1854). *Type:* Mt Lofty Ranges, South Australia, *F. Mueller* (*lecto:* MEL 4590) *fide* J.H. Willis *loc. cit.*

Distribution. Occurs in the Mt Lofty Ranges of South Australia.

Leionema lachnaeoides (A. Cunn.) Paul G. Wilson, *comb. nov.*

Phebalium lachnaeoides A. Cunn. *in* Field, Geog. Mem. New South Wales 332 (1825). – *Eriostemon phylicifolius* var. *lachnaeoides* (A. Cunn.) F. Muell. ex C. Moore *nom. illeg.*, Handb. Fl. New South Wales 43 (1893). *Type:* Blackheath, Blue Mountains, New South Wales, 1822, *A. Cunningham* 56 (*holo:* K; *iso:* BRI, MEL).

Distribution. A rare species occurring on rocky outcrops in the Blue Mountains, New South Wales.

Notes. This species is similar to some variants of *L. phylicifolium* but it can be distinguished from them principally by the presence of only one flower in the axillary cymes.

Leionema lamprophyllum (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon lamprophyllus F. Muell., *Quart. J. Pharm. Soc. Victoria* 2: 43 (1859). – *Phebalium lamprophyllum* (F. Muell.) Benth., Fl. Austral. 1: 340 (1863). *Type:* mountains on the Macalister River, Victoria, January 1859, *F. Mueller* (*holo:* MEL 4784; *iso:* AD, K, NSW).

Distribution. Occurs in the Dividing Range of eastern New South Wales, from Rylstone southwards, and in eastern Victoria.

Leionema microphyllum (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon microphyllus F. Muell., *Trans. Philos. Soc. Victoria* 1: 99 (1855). *Type citation:* On the low coast ranges of Spencer's and St. Vincent's Gulf. *Type:* Encounter Bay, South Australia, 27 September, *F. Mueller* (*lecto:* MEL 4628) lectotype here chosen.

Phebalium brachyphyllum Benth., Fl. Austral. 1: 341 (1863). – *Eriostemon brachyphyllus* (Benth.) Tate, Handb. Fl. Extratr. S. Austral. 24 (1890). *Type:* Encounter Bay and near Coffin Bay, South Australia, *F. Mueller* (*syn:* K, MEL 4628).

Distribution. Occurs in southern Eyre Peninsula, South Australia, east to far western Victoria.

Leionema montanum (Hook.) Paul G. Wilson, *comb. nov.*

Phebalium montanum Hook., *J. Bot. (Hooker)* 1: 255 (1834). – *Eriostemon montanus* (Hook.) F. Muell., Pl. Indig. Col. Victoria 1: 129 (1862). *Type:* Western Mountains, Tasmania, *R. Gunn* 283 & *R. Lawrence* 321 (*syn:* K).

Distribution. Occurs in the mountains of north-east Tasmania.

Leionema nudum (Hook.) Paul G. Wilson, *comb. nov.*

Phebalium nudum Hook., *Icon. Pl.* 6: t. 568 (1843). – *Eriostemon nudus* (Hook.) F. Muell., Fragm. 1: 181 (1859). *Type citation:* New Zealand; Owae, on the east coast of the northern Island, *Mr. Colenso*, 1838 (n. 56). Hokeanga, *Edgerley*. *Type:* Owae, New Zealand, *Colenso* 56 (*syn:* K).

Distribution. North Island, New Zealand.

Note. This is the only member of the genus that is found outside of Australia.

Leionema obtusifolium (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Phebalium obtusifolium Paul G. Wilson, *Nuytsia* 1: 107 (1970). *Type:* Upper reaches of Alice Creek, about 8 miles [*c.* 13 km] north of Helidon, Queensland, August 1963, *F.D. Hockings* (*holo:* BRI 042851).

Distribution. Occurs in the Helidon and Ravensbourne areas of south-east Queensland.

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

Eriostemon oldfieldii F. Muell., Fragm. 1: 3 (1858). – *Phebalium oldfieldii* (F. Muell.) F. Muell. ex Benth., Fl. Austral. 1: 340 (1863). *Type:* Mount La Perouse, 27 February 1857, *A. Oldfield* & *C. Stuart* 1875 (*holo:* MEL 4822; *iso:* K).

Distribution. Endemic to mountains near the west coast of Tasmania.

Leionema phylicifolium (F. Muell.) Paul G. Wilson, *comb. nov.*

Phebalium phylicifolium F. Muell., *Trans. & Proc. Victorian Inst. Advancem. Sci.* 1: 32 (1855). – *Eriostemon phylicifolius* (F. Muell.) F. Muell., Fragm. 1: 105 (1859). *Type:* Munyang Mountains [Snowy Mountains], also on the Snowy River, New South Wales, January 1855, *F. Mueller* (*lecto:* MEL 4888; *isolecto:* K) *fide* Paul G. Wilson (1970).

Distribution. Occurs in the mountains of eastern Victoria and of the extreme south-east of New South Wales.

Notes. See notes under *L. lachnaeoides*.

Leionema ralstonii (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon ralstonii F. Muell., Fragm. 2: 101. t. 14 (1860). – *Phebalium ralstonii* (F. Muell.) Benth., Fl. Austral. 1: 339 (1863). *Type:* Twofold Bay, New South Wales, *F. Mueller* (*holo:* MEL 4945; *iso:* K, MEL 4946).

Distribution. Occurs in the Bega to Eden district of New South Wales.

Leionema rotundifolium (Endl.) Paul G. Wilson, *comb. nov.*

Eriostemon rotundifolius Endl. *in* Endl. *et al.*, Enum. Pl. Huegel 15 (1837). – *Phebalium rotundifolium* (Endl.) Benth., Fl. Austral. 1: 341 (1863). *Type:* Mount Dangar, Hunters River, New South Wales, *A. Cunningham* 55 (*iso:* K, MEL 4954).

Distribution. Occurs in the Howell and Torrington districts of north-east New South Wales and in the extreme south-east of Queensland.

Leionema sympetalum (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Phebalium sympetalum Paul G. Wilson, *Nuytsia* 1: 116 (1970). *Type:* Near Olinda, New South Wales, 2 September 1951, *L.A.S. Johnson* (*holo:* AD 96434202; *iso:* NSW, PERTH 01617079).

Distribution. Occurs in the ranges near Rylstone, New South Wales.

Leionema viridiflorum (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Phebalium viridiflorum Paul G. Wilson, *Nuytsia* 1: 117 (1970). *Type:* Belougery Mountain, Warrumbungle Range, New South Wales, 28 May 1948, *E.F. Constable* (*holo:* NSW 6277; *iso:* MEL 4949).

Distribution. Occurs in Mt Kaputar and Warrumbungle Range National Parks, New South Wales.

Nematolepis

Nematolepis Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 25(2): 158 (1852). *Type: N. phebalioides* Turcz.

Phebalium sect. *Eriostemoides* Endl., Gen. Pl. 1156 (1840). *Type: Eriostemon squameus* Labill. [= *Nematolepis squamea* (Labill.) Paul G. Wilson].

Symphyopetalon J. Drumm. ex Harv., *Hooker's J. Bot. Kew Gard. Misc.* 7: 54 (1855). *Type: S. corraeoides* Harv. [= *Nematolepis phebalioides* Turcz.].

Lepidote *shrubs* or small *trees*. *Branchlets* smooth or verrucose. *Leaves* alternate, simple, ± flat, shortly petiolate, glandular-punctate, smooth. *Flowers* axillary, cymose or solitary, pentamerous. *Bracteoles* two, near middle of pedicel or apical and immediately subtending the fleshy floral receptacle. *Sepals* free, imbricate. *Petals* imbricate (united in *N. phebalioides*), lepidote or glabrous. *Stamens* 10, free; filaments flattened terete, glabrous or basally stellate-hairy; anthers versatile, loculi deeply separated at base, apex slightly retuse, not glandular. *Disc* prominent. *Carpels* 5, with a short, sterile apex. *Ovules* 2 per carpel. *Style* solitary, terete, affixed to adaxial medial surface of carpels. *Stigma* scarcely lobed. *Seed* broadly ellipsoid to sub-reniform, 2–2.5 mm long, adaxial margin straight; outer testa thin, coriaceous, smooth, satin-like; sclerotesta smooth; hilum superficial, narrowly elliptic; raphe small, somewhat cartilaginous, situated between base of hilum and chalazal aperture, covered by thin coriaceous layer that is continuous with outer testa; chalazal aperture on lower adaxial face; aril linear; placental endocarp membranous, deciduous. (Figure 3)

Chromosome number. n=16 (Smith-White 1954, Stace & Armstrong 1992).

A genus of seven species endemic to Australia.

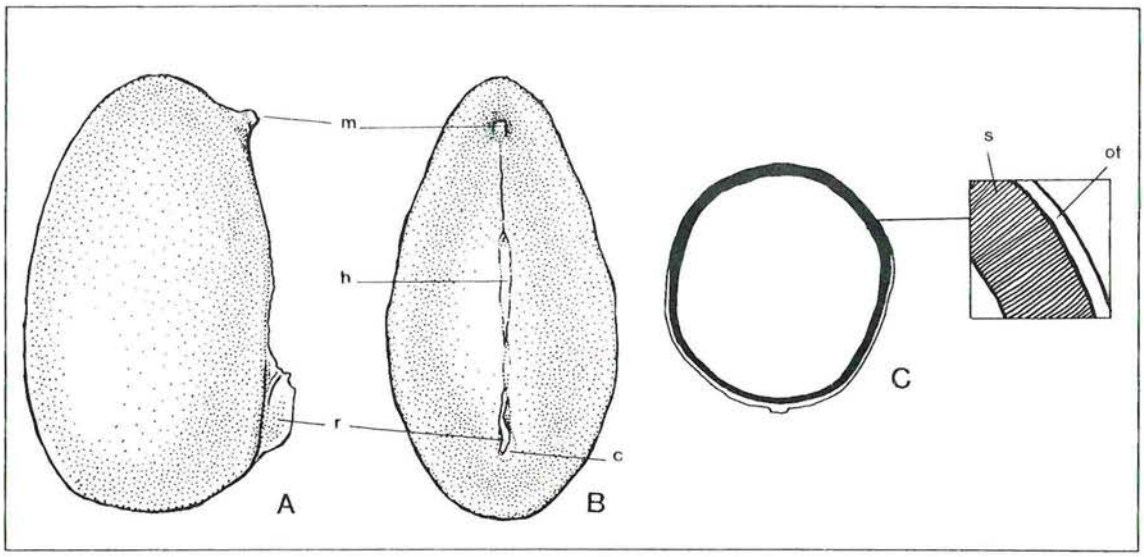

Figure 3. *Nematolepis squamea* seed (x25). A – lateral view; B – adaxial surface; C – transverse section with enlarged section through testa; c – chalazal aperture; h – hilum; m – micropyle; ot – outer testa; r – raphe; s – sclerotesta. Drawn from *F.A. Rodway* 1179 (NSW).

Nematolepis elliptica (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Phebalium ellipticum Paul G. Wilson, *Nuytsia* 1: 341 (1974). *Type:* Big Badja Mountain, New South Wales, *J.P. Baker* 907 (*holo:* NSW; *iso:* CANB, K, MEL, PERTH 01616587).

Distribution. Occurs in the ranges east of Cooma, New South Wales.

Nematolepis frondosa (N.G. Walsh & Alb.) Paul G. Wilson, *comb. nov.*

Phebalium frondosum N.G. Walsh & Alb., *Muelleria* 6: 405 (1988). *Type:* Eastern Victoria [precise locality withheld], *D.E. Albrecht* 2875 (*holo:* MEL).

Distribution. Known only from the upper slopes of a mountain in eastern Victoria.

Nematolepis ovatifolia (F. Muell.) Paul G. Wilson, *comb. nov.*

Phebalium ovatifolium F. Muell., *Trans. Philos. Soc. Victoria* 1: 99 (1855). – *Eriostemon ovatifolius* (F. Muell.) F. Muell., Fragm. 1: 103 (1859). *Type:* In the alpine parts of the Munyang Mountains, New South Wales, *F. Mueller* (*lecto:* MEL 4828) *fide* Wilson (1970).

Distribution. Occurs in the Snowy Mountains of New South Wales.

Nematolepis phebalioides Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 25(2): 158 (1852). *Type:* Swan River Colony, Western Australia, *J. Drummond* 5th coll. n. 194 (*holo:* KW, photo seen; *iso:* K, TCD).

Symphyopetalon corraeoides J. Drumm. ex Harv., *Hooker's J. Bot. Kew Gard. Misc.* 7: 54 (1855). *Type:* Near Middle Mt Barren, *J. Drummond* 194 (*holo:* TCD; *iso:* K).

Distribution. Occurs towards the south coast of Western Australia from Dumbleyung east to Israelite Bay.

Nematolepis rhytidophylla (Alb. & N.G. Walsh) Paul G. Wilson, *comb. nov.*

Phebalium rhytidophyllum Alb. & N.G. Walsh, *Muelleria* 6: 402 (1988). *Type:* Wog Wog Mount, New South Wales, *D.E. Albrecht* 2333 (*holo:* MEL 1553279; *iso:* PERTH 1617044).

Distribution. Occurs on the plateau between Wog Wog and White Rock Mountains in far south-east New South Wales.

Nematolepis squamea (Labill.) Paul G. Wilson, *comb. nov.*

Eriostemon squameus Labill., Nov. Holl. Pl. Sp. 1: 111, t.141 (1806). – *Phebalium argenteum* Smith *nom. illeg.*, *in* Rees, Cyclop. 27: n.3 (1814) as to name only. – *Phebalium billardieri* A. Juss. *nom. illeg.*, *Mem. Soc. Hist. Nat. Paris* 2: 134 (1825). – *Phebalium squameum* (Labill.) Engl., Nat. Pflanzenfam. III 4: 141 (1896). *Type:* "Habitat in capite Van-Diemen", Tasmania (?*iso:* MEL 5025, 5026).

Distribution. Widespread in eastern Australia.

Notes. Three subspecies are recognized.

a. Nematolepis squamea (Labill.) Paul G. Wilson subsp. **squamea**

Phebalium elatum Cunn. *in* B. Field, Geog. Mem. New South Wales 331 (1825). *Type:* in the vicinity of Spring Wood, New South Wales, *A. Cunningham* (*holo:* K).

Distribution. Occurs in south-eastern Queensland, coastal New South Wales, Victoria, and Tasmania.

b. Nematolepis squamea subsp. **coriacea** (Paul G. Wilson) Paul G. Wilson, *comb. nov.*

Phebalium squameum subsp. *coriaceum* Paul G. Wilson, *Nuytsia* 1: 94 (1970).

Type: Between Haidinger Range and Mt Wellington, Victoria, March 1861, *F. Mueller* (*holo:* MEL 4833; *iso:* K).

Distribution. Only known from eastern Victoria in the mountains near the head of the Macallister River and from near Wulgulmerang.

c. Nematolepis squamea subsp. **retusa** (Hook.) Paul G. Wilson, *comb. nov.*

Phebalium retusum Hook., *J. Bot. (Hooker)* 1: 254 (1834). – *P. billardieri* var. *retusum* (Hook.) Hook.f., Fl. Tasm. 1: 63 (1855). – *Phebalium squameum* subsp. *retusum* (Hook.) Paul G. Wilson, *Nuytsia* 1: 94 (1970). *Type:* Tasmania, 1831, *T. Scott & R.W. Lawrence* (*syn:* K photo seen).

Distribution. Occurs in north-eastern Tasmania.

Notes. This subspecies grades into the variant of the typical subspecies that is found in north-east Tasmania. It is evidently closely related to the subsp. *coriacea* from Victoria. Superficially it is similar to *N. ovatifolia* but it differs in having a glabrous (not lepidote) ovary and in not having sub-floral bracteoles.

Nematolepis wilsonii (N.G. Walsh & Alb.) Paul G. Wilson, *comb. nov.*

Phebalium wilsonii N.G.Walsh & Alb., *Muelleria* 6: 399 (1988). *Type:* Near Mt Grant, Victoria, *N.G. Walsh* 1494 (*holo:* MEL 1540265; *iso:* PERTH 009055069).

Distribution. Known only from the type locality in the Central Highlands of Victoria.

Phebalium

Phebalium Vent., Jard. Malm. 2: 102(1805). – *Eriostemon* sect. *Phebalium* (Vent.) F. Muell., Pl. Victoria 1: 129 (1862). – *Phebalium* sect. *Euphebalium* Benth. *nom. inval.*, Fl. Austral. 1: 337 (1863). – *Crowea* sect. *Phebalium* (Vent.) Baillon, Dict. Bot. 11: 277 (1886). *Type: P. squamulosum* Vent.

Shrubs ± covered when young with a lepidote indumentum. *Branches* often glandular verrucose. *Leaves* alternate, simple, sessile or shortly petiolate, glandular-punctate, often glandular-verrucose. *Flowers* terminal to branches, solitary or umbellate, pentamerous. *Bracteoles* basal to pedicels and insignificant. *Calyx* 5-lobed, lepidote outside. *Petals* free, imbricate, elliptic, white, yellow, or pink, lepidote outside, apex not inflexed. *Stamens* 10; filaments slender-terete; anthers basifixed, loculi totally united, apex rounded with a spherical terminal gland. *Disc* not apparent. *Carpels* 5, lepidote, apical portions solid. *Ovules* 2 per carpel. *Style* terete, affixed to adaxial medial surface of carpels; stigma small with shortly spreading lobes. *Seed* oblong-reniform; surface longitudinally striate or corrugate due to the fine corrugations of the sclerotesta; outer testa membranous, black; hilum linear; raphe small, fleshy and shrivelled, situated in lower half of adaxial face, covered by membranous layer that is continous with outer testa; chalazal aperture on lower adaxial face; aril linear; placental endocarp thin, caducous. (Figure 4)

Chromosome number. n=16, 32 (Smith-White 1954).

A genus of 25 species endemic to Australia.

Notes. This genus, as circumscribed in this paper, is closely related to *Microcybe* Turcz. which is distinguished by its sessile flowers, small free or united sepals, and bicarpellary ovary. The seeds of the two genera are similar.

Phebalium appressum Paul G. Wilson, *sp. nov.*

Ramuli sparse glanduloso tuberculati. Folia densa, sessiles, erecta, ad ramulum adpressa, cordato ovata, c. 2 mm longa, 1.5 mm lata, crassa, arcte revoluta, supra aliquantum applanata, infra rotundata, laeves, virides, glabra vel sparse argenteo lepidota. Flores terminales, solitarii vel binati; pedicellus brevis, crassus, c. 1 mm longus. Calyx c. 1.5 mm altus, profunde deltato lobatus, extra ferrugineo lepidotus.

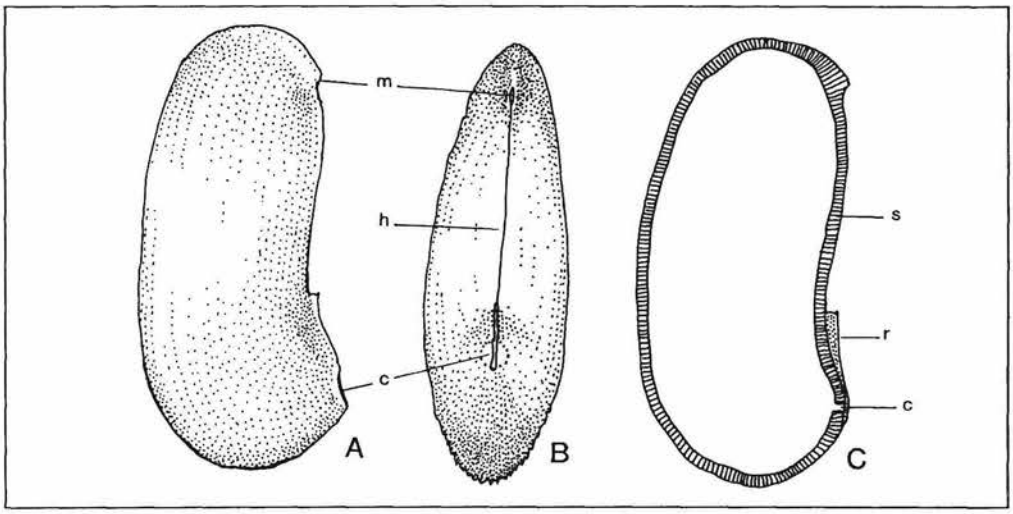

Figure 4. *Phebalium nottii* seed (x15). A – lateral view; B – view of adaxial surface; C – longitudinal radial section; c – chalazal aperture; h – hilum; m – micropyle; r – raphe; s – sclerotesta. Drawn from *Lazarides & Story* 113 (CANB).

Typus: North of Coolgardie [precise locality withheld], Western Australia, 16 July 1991, *Shreeve & Spencer s.n.* (*holo:* PERTH 4150120).

Rounded *shrub* to 1 m high. *Branchlets* silvery-lepidote, sparsely glandular-tuberculate. *Leaves* sessile, dense, erect and appressed to branch, cordate-ovate, *c.* 2 mm long, 1.5 mm wide, thick, closely revolute, somewhat flat above, rounded below, smooth, green, glabrous or sparsely silvery-lepidote. *Flowers* terminal, solitary or paired; pedicel short and thick, *c.* 1 mm long, densely ferruginous-lepidote, subtended by several narrowly cuneate bracteoles *c.* 0.5 mm long. *Calyx c.* 1.5 mm long, deeply deltate-lobed, ferruginous-lepidote outside. *Fruit* not seen.

Distribution. Known only from the type locality which is in the Coolgardie Botanical District (Beard 1980).

Habitat. Yellow sand plain. Growing in an area that had been refilled with local soil after mining.

Conservation status. The solitary collection is from an area subject to a mining lease which suggests that the species may be in need of protection. CALM Conservation Code for Western Australian Flora: Priority One.

Etymology. The specific epithet refers to the leaf position.

Notes. This species differs from the other eleven members of the *Phebalium microphyllum* complex in leaf shape and in the usually solitary flowers which have very short and thick pedicels.

Phebalium brevifolium Paul G. Wilson, *nom. et stat. nov.*

Phebalium tuberculosum subsp. *brachyphyllum* Paul G. Wilson, *Nuytsia* 1: 72 (1970). *Type:* Great Victoria Desert, camp 59, near Queen Victoria Spring, Western Australia, 22 September 1891, *R. Helms* (*holo:* AD 96350150; *iso:* MEL 4811, NSW 69582).

Notes. This species is only found in an area around Queen Victoria Spring in the Great Victoria Desert of Western Australia. It is here isolated from other species of *Phebalium* and shows no evidence of intergradation.

Phebalium elegans Paul G. Wilson, *sp. nov.*

Ramuli lepidoti, glanduloso tuberculati. Folia divaricata, atro-viridia, cuneata, retusa, crassa, c. 5mm longa, 2–3 mm lata, glanduloso tuberculata, marginis recurva, glanduloso undulata, supra glabra, infra argenteo- vel ferrugineo-lepidota. Inflorescentia 2–5-floris; pedicelli graciles, 5–10 mm longi. Calyx c. 1.5 mm altus. Petala late elliptica, 4–5 mm longa, alba.

Typus: 9 km WSW of Point Pleasant, Fraser Range, Western Australia, 20 September 1980, *K. Newbey* 7536 (*holo:* PERTH 00909726).

Spreading *shrub* to 90 cm high. *Branchlets* spreading, lepidote, glandular-tuberculate. *Leaves* spreading, shortly petiolate, dark green; lamina cuneate, retuse, thick, *c.* 5 mm long, 2–3 mm wide, glandular-tuberculate (at least when dry), margins recurved and glandular-undulate, upper surface glabrous, lower surface silvery- or ferruginous-lepidote. *Inflorescence* a terminal umbel of 2–5 flowers; pedicels slender, 5–10 mm long, lepidote. *Calyx c.* 1.5 mm high, silvery- to ferruginous-lepidote outside, divided two-thirds into deltate lobes. *Petals* broadly elliptic, 4–5 mm long, white, silvery- to ferruginous-lepidote outside. *Fruiting cocci* broadly oblong, *c.* 3 mm high, rounded at apex with a small spreading apiculum on outer angle.

Distribution. Southern Western Australia from Mt Day (120 km west of Norseman) east to the Fraser Range, Coolgardie Botanical District (Beard 1980).

Selected specimens examined. WESTERN AUSTRALIA: 96 km E of Norseman, *D.E. Albrecht* 4032 (PERTH); 98 km E of Norseman, *R.J. Cranfield* 10065 (PERTH); 9 km E of Norseman, *C.A. Gardner* 14222 (PERTH); Mt Day, *K.R. Newbey* 5273 (PERTH).

Habitat. In well-drained sandy or granitic loam on rocky slopes.

Flowering period. July to September.

Conservation status. This species is not recorded from a reserve, however, it is found over a wide area of pastural land and vacant crown land and is not in need of protection.

Etymology. The specific epithet refers to the elegant appearance of the shrub as has been noted by collectors.

Affinities. This species corresponds most closely to the polymorphic *Phebalium tuberculosum* but it differs in having long slender pedicels, a cuneate leaf (not linear-terete), and a small calyx.

Notes. None of the eleven species in what may be considered the *Phebalium microphyllum* - *P. tuberculosum* group can be satisfactorily discriminated since each exhibits a different variant at each different locality and each appears to hybridize with those of the group it comes into contact. A similar situation occurs in *P. elegans* which at its eastern extreme is silvery lepidote and at its western extreme ferruginous lepidote. The western variant may grade to the south and east into *P. obovatum.*

Phebalium festivum Paul G. Wilson, *sp. nov.*

Folia coriacea, oblonga vel late elliptica, 2–3 mm longa, 1–1.5 mm lata, ad apicem rotundata, supra convexa fere laevia, ad margines recurva et leviter crenulata, infra argenteo lepidota. Umbellae parvae, sessiles; pedicelli c. 1.5 mm longi. Calyx breviter hemisphericus, 1–1.5 mm altus, laevis, argenteo vel ferrugineo lepidotus, ad marginem undulatus vel truncatus. Petala alba, extra ferrugineo lepidota.

Typus: Flagstaff Hill, 5.5 miles (*c.* 8.8 km) north of Eaglehawk, Victoria, 30 September 1952, *R. Melville* 1254 (*holo:* MEL 520053; *iso:* K, *n.v.*).

Shrub c. 0.6 m high. *Branchlets* slender, smooth. *Leaves* coriaceous, oblong to broadly elliptic, 2–3 mm long, 1–1.5 mm wide; apex rounded; upper surface convex and almost smooth; margins recurved and slightly crenulate; lower surface silvery-lepidote. *Flowers* in small sessile umbels terminal to branchlets; pedicels *c.* 1.5 mm long. *Calyx* shortly hemispherical, 1–1.5 mm high, smooth, silvery- to ferruginous-lepidote, margin undulate to truncate. *Petals* elliptic, 2.5 x 1.5 mm, white, ferruginous-lepidote outside.

Selected specimens examined. VICTORIA: Gobarup Flora Reserve, *A.C. Beauglehole* 68931 (MEL); Painswick, near Dunolly, *M.E. Phillips*, 18 Mar. 1961 (AD); Tarnagulla State Forest, 28 Aug. 1979, *P.G. Smith* (MEL).

Distribution. Found near Bendigo in western Victoria.

Habitat. Usually found growing in open eucalypt forest.

Etymology. The epithet *festivum*, refers to the pleasant aspect of the plant when in flower.

Notes. Phebalium festivum differs from *P. obcordatum* Benth., to which species the collections had previously been referred, principally in the shape of the leaves and in their smooth slightly convex upper surface which lacks a medial groove, while in addition, the petals of *P. festivum* are white within, whereas in *P. obcordatum* they are yellow.

Phebalium glandulosum Hook. *in* T. Mitch., J. Exped. Trop. Australia 199 (1848). *Type: c.* 11 miles [17 km] south of Mt Owen near head of Maranoa River, Queensland, 16 June 1846, *T.L. Mitchell* 331 (*holo:* K; *iso:* MEL 4751).

Notes. This is a widespread and variable species. Three subspecies were recognized by Wilson (1970) who noted that large-leaved variants of subsp. *glandulosum* occurred in the Warrumbungle Range and at Mulgowen Station south of Bourke. Both of these variants probably warrant recognition, however, recent collections show that the plants from the Mulgowen locality are morphologically similar to a variant of subsp. *glandulosum* found in central and northern Queensland which approaches the type in leaf-size. On the other hand the variant found in the Warrumbungle Range is geographically and morphologically disjunct from other populations of the species and can be readily circumscribed, it is described below as subsp. *nitidum*.

a. Phebalium glandulosum subsp. **nitidum** Paul G. Wilson, *subsp. nov.*

Phebalio glanduloso subsp. *glanduloso* similis sed foliis grandioribus plerumque 2–3 cm longis, 3–5 mm latis, apice truncatis parum retusis, supra convexis secus costam leviter depressis nec canaliculatis differt.

Typus: Warrumbungle Mountains, New South Wales, 25 May 1948, *E.F. Constable* (*holo:* NSW 6462).

Branchlets sparsely glandular-verrucose. Leaves shortly (2–3 mm) petiolate; lamina narrowly oblong or narrowly oblong-elliptic, mostly 2–3 cm long, 3–5 mm wide; margin crenate and glandular-verrucose; base cuneate; apex truncate and slightly retuse; upper surface convex with shallow depression over midrib, glabrous, glossy, smooth or sparsely glandular-verrucose; lower surface smooth apart from the sparsely verrucose prominent midrib, fawn lepidote. Pedicels slender, 5–7 mm long. Calyx hemispherical, glandular-verrucose, *c.* 2 mm high including the broadly triangular lobes *c.* 0.7 mm long.

Specimens examined. NEW SOUTH WALES: Head of Tooraweenah Creek, Warrumbungle Mountains, *L.A.S. Johnson & E.F. Constable* (NSW 20490); Mt Naman, 34 km SW of Coonabarabran, *H. Streimann* 761 (PERTH).

Distribution. Endemic to the Warrumbungle Range in north-eastern New South Wales.

Habitat. Evidently confined to rocky basalt slopes.

Etymology. The epithet is derived from the Latin word *nitidus* which means shining and refers to the upper surface of the leaves.

Notes. This subspecies has much larger leaves than typical subsp. *glandulosum* but it is similar to the large-leaved variant of that subspecies which grows in the Gunderbooka Range south of Bourke in central New South Wales. The two subspecies may be readily distinguished by the appearance of the upper surface of the leaves; in subsp. *glandulosum* there is a sharp depressed line over the midrib whereas in subsp. *nitidum* there is a gentle depression. In addition, the leaves of subsp. *nitidum* are glossy above when mature whereas in the Gunderbooka Range variant the mature leaves are dull and often retain a sparse lepidote cover.

Phebalium laevigatum Paul G. Wilson, *sp. nov.*

Lamina folio anguste oblonga, 12–15 mm longa, 1.5–2.0 mm lata, obtusa, integra, supra convexa, glabrescens, nitida, laevis vel leviter canaliculata, infra lepidota et manifeste costata. Inflorescentia c. 7-flora; pedicelli graciles, *c.* 4 mm longi. Calyx c. 1.5 mm altus, ad dimidium in lobis deltatis divisus. Petala late elliptica, 4–5 mm longa, flava vel alba, extra ferrugineo-lepidota.

Typus: 48 km ESE of Merredin, Western Australia, *N.N. Donner* 4600 (*holo:* PERTH 896632).

Erect slender *shrub* to 1 m high. *Branchlets* glandular-tuberculate. *Leaves* ascending; petiole 2 mm long; lamina narrowly oblong, 12–15 mm long, 1.5–2 mm wide, obtuse, margin entire; upper

surface convex, glabrescent, sparsely silvery-lepidote, glossy when mature, glandular-punctate, smooth or faintly channelled; lower surface silvery-lepidote with prominent midnerve. *Umbels* of *c.* 7 flowers; pedicels slender, *c.* 4 mm long. *Calyx c.* 1.5 mm long, ferruginous-lepidote, divided half way into deltate lobes. *Petals* broadly elliptic, 4–5 mm long, yellow to white, ferruginous-lepidote outside.

Selected specimens examined. WESTERN AUSTRALIA: 30 miles [48 km] E of Merredin, *P.R. Jefferies* 631004 (PERTH); 8.5 km NW of Wialki, *F. & M. Mollemans* 3369 (PERTH); Chandler near Campion, *R.D. Royce* 2060 (PERTH).

Distribution. Occurs in the Merredin–Bullfinch area of southern Western Australia.

Habitat. Grows principally in sand heath with *Acacia*.

Conservation status. This species is widespread, and evidently not under threat.

Etymology. The epithet is from the Latin word *laevigatus,* which means smooth and polished, and here refers to the appearance of the leaves.

Notes. This species had been assumed (Wilson 1970) to represent a stage in the introgression between *P. microphyllum* and *P. tuberculosum*, but it is now evident that it is a distinct taxon which is found in areas where neither of the other two species occurs.

Phebalium megaphyllum (Ewart) Paul G. Wilson, *stat. et comb. nov.*

Eriostemon tuberculosus var. *megaphyllus* Ewart, *Proc. Roy. Soc. Victoria* ser. 2, 19: 39 (1907). – *Phebalium tuberculosum* subsp. *megaphyllum* (Ewart) Paul G. Wilson, *Nuytsia* 1: 72 (1970). *Type:* Cowcowing, Western Australia, September 1904, *M. Koch* 1330 (*holo:* MEL 4545).

Notes. This taxon is found in the Wubin to Southern Cross area of Western Australia; it was earlier (Wilson 1970) considered to be sufficiently similar to the lectotype of *Pebalium tuberculosum* as to warrant only infraspecific status. However, further study has shown that the two are consistently different in leaf and flower characters; furthermore, the areas of distribution of *P. tuberculosum* and *P. megaphyllum* do not overlap and therefore they do not hybridize in nature with each other, although each hybridizes with some other species of *Phebalium*.

Phebalium obovatum (Paul G. Wilson) Paul G. Wilson, *stat. nov.*

Phebalium lepidotum var. *obovatum* Paul G. Wilson, *Nuytsia* 1: 74 (1970). *Type:* Between Israelite Bay and Point Culver, Western Australia, *G. Maxwell* (*holo:* MEL 4801).

Notes. This taxon is found in the far south-east corner of Western Australia. When first described the few collections seen were insufficient to clearly establish its status. Field studies over the past thirty years suggest that it warrants recognition as a distinct species.

Rhadinothamnus

Rhadinothamnus Paul G. Wilson, *Nuytsia* 1: 197 (1971). *Type: R. euphemiae* (F. Muell.) Paul G. Wilson.

Phebalium sect. *Gonioclados* Paul G. Wilson, *Nuytsia* 1: 96 (1970). *Type: Rhadinothamnus anceps* (DC.) Paul G. Wilson.

Silvery-lepidote *shrubs*. *Branches* smooth. *Leaves* alternate, simple, shortly petiolate. *Flowers* cymose or solitary and axillary. *Pedicel* medially bibracteolate. *Calyx* patelliform or hemispherical, undulately lobed. *Petals* free, elliptic, valvate, slightly inflexed at tip, lepidote outside, white. *Staminal filaments* flattened in lower part, terete above, glabrous; anthers versatile, base cordate, apex obtuse, with a non-glandular apiculum, white. *Disc* short. *Carpels* 5, glabrous or lepidote, with or without a short sterile apex. *Ovules* 2 per carpel. *Style* solitary, terete, attached to adaxial medial surfaces of carpels; stigma not or scarcely lobed. *Seed* narrowly reniform or bluntly ellipsoid; outer testa membranous, dark brown, smooth; sclerotesta smooth; hilum superficial, narrowly elliptic, bordered by cartilaginous strands (hilar strands); raphe similar to hilar strands in texture, sub-basal, covered by membranous layer that is continuous with outer testa; aril linear, fleshy, situated between hilar strands, readily detached.

A genus of three species endemic to Western Australia.

Notes. The genus *Rhadinothamnus* was established to accommodate the species *Nematolepis euphemiae* (syn. *Phebalium euphemiae*) that appeared to be anomalous in both of the genera into which it had been placed. When the genus was first described, comment was made on its close relationship to the species in *Phebalium* sect. *Gonioclados*, but the species in this section were not concurrently transferred to the new genus. This action is now taken.

Some of the characters that serve to discriminate *Rhadinothamnus* are found in the seed, in particular the manner in which cartilaginoid strands surround the hilum. These characters are described and discussed above. Refer to Figure 1, the seed of *Chorilaena,* which is the same as that for *Rhadinothamnus.*

Rhadinothamnus anceps (DC.) Paul G. Wilson, *comb. nov.*

Phebalium anceps DC., Prodr. 1: 719 (1824). – *Eriostemon anceps* (DC.) Spreng., Syst. Veg. 2: 322 (1825). *Type:* "Nouvelle Hollande, cote orientale (Port du Roi Georges)" [King George Sound, Western Australia], *fide* Jussieu, Mem. Soc. Hist. Nat. Paris 2: 134 (1825) (*holo:* G-DC).

Distribution. Occurs in the south-west of Western Australia.

Rhadinothamnus euphemiae (F. Muell.) Paul G. Wilson, *Nuytsia* 1: 198 (1971). – *Nematolepis euphemiae* F. Muell., Fragm. 3:149 t. 25 (Apr. 1863). – *Phebalium euphemiae* (F. Muell.) C.A. Gardner, Enum. Pl. Austral. Occ. 70 (1931). *Type:* Near Cape Arid, Western Australia, *G. Maxwell* (*iso:* K).

Phebalium baxteri Benth., Fl. Austral. 1: 345 (30 May 1863). – *Nematolepis baxteri* (Benth.) Engler *in* Engler & Prantl, Nat. Pflanzenfam. III 4: 145 (1896). *Type:* South coast, Western Australia, *W. Baxter* (*holo:* K).

Distribution. Occurs near the south coast of Western Australia from the Eyre Range east to Mt Ragged.

Rhadinothamnus rudis (Bartl.) Paul G. Wilson, *comb. nov.*

Phebalium rude Bartl. *in* Lehm., Pl. Preiss. 1: 172 (1845). *Type:* Baldhead, Western Australia, *L. Preiss* 2038 (*iso:* MEL 4981, 4960).

Distribution. Occurs near the south coast of Western Australia from Albany east to near Esperance.

Notes. Three subspecies are recognized.

a. Rhadinothamnus rudis (Bartl.) Paul G. Wilson subsp. **rudis**

P. bilobum Bartl. *nom. illeg., loc. cit., non* Lindl. (1838). – *Eriostemon bilobum* F. Muell., Fragm. 1: 102 (1859). *Type:* Konkoberuphills [Mt Melville], Western Australia, *L. Preiss 2039* (*iso:* MEL 4979).

Distribution. Occurs near the south coast of Western Australia between Point Irwin and Cape Arid, but also recorded in 1898 from Mount Barker.

b. Rhadinothamnus rudis subsp. **amblycarpus** (F. Muell.) Paul G. Wilson, *comb. nov.*

Eriostemon amblycarpus F. Muell., Fragm. 1: 102 (1859). – *Phebalium amblycarpum* (F. Muell.) Benth., Fl. Austral. 1: 345 (1863). – *Phebalium rude* subsp. *amblycarpum* (F. Muell.) Paul G. Wilson, *Nuytsia* 1: 98 (1970). *Type:* Fitzgerald River, Western Australia, *G. Maxwell* 935 (*holo:* MEL 4556).

Distribution. Occurs near the south coast of Western Australia, and somewhat inland, from Nyabing east to near Esperance.

Notes. The subspecies *rudis* and *amblycarpus* are distinguished by their leaf shape and ovary type (lepidote in subsp. *rudis* and glabrous in subsp. *amblycarpus*). They usually have separate though at times adjacent areas of distribution, however, in the Fitzgerald River area are found plants with the foliage of subsp. *amblycarpus* but with a lepidote ovary; these plants may represent an intergrade between the two subspecies.

c. Rhadinothamnus rudis subsp. **linearis** (C.A. Gardner) Paul G. Wilson, *comb. nov.*

Phebalium lineare C.A. Gardner, *J. Roy. Soc. Western Australia* 27: 180 (1942). – *P. rude* subsp. *lineare* (C.A. Gardner) Paul G. Wilson, *Nuytsia* 1: 98 (1970). *Type:* Mt Ragged, Western Australia, *C.A. Gardner* 2864 (*holo:* PERTH 01617052).

Distribution. Known from the Russell Range of south-eastern Western Australia.

Conservation status. This subspecies is evidently local in its distribution which is, however, totally within a National Park. CALM Conservation Code for Western Australian Flora: Priority Four.

Acknowledgement

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SHORT COMMUNICATIONS

Taxonomy of *Diplopeltis huegelii* (Sapindaceae)

During the floristic survey of the Swan Coastal Plain (Gibson *et al.* 1994) it became apparent that species from a wide range of genera and families have variants occurring on the Tamala Limestones near the west coast, which are distinct from those occurring on the granites and laterites of the Darling Range. These variants are disjunct as there are no populations occurring in between on the Bassendean sands and alluvial soils of the central and eastern parts of the coastal plain. Preliminary studies indicate that many of these disjunct variants appear to be morphologically distinct at the subspecific level from each other.

One of the species which has a distinctive limestone race is *Diplopeltis huegelii*. The taxonomy of the genus *Diplopeltis* Endl. (Sapindaceae) was revised by George & Erdtman (1970) who divided *D. huegelii* into a northern (*D. huegelii* var. *subintegra*) and southern (*D. huegelii* var. *huegelii*) race, based on differences in the lobing and pubescence of the leaves, but did not recognize the Darling Range race. This taxonomy was followed by West (1985).

The coastal and Darling Range races of *Diplopeltis huegelii* differ in the degree of lobing of the leaves and in the inflorescence size (Figure 1). They also occur on different soils, calcareous versus loams and clays.

All three variants deserve equal recognition. Since they are geographically and ecologically separated, with no apparent intergradation in morphology, they are best treated as subspecies, not varieties. New combinations are required.

A key, modified from that of West (1985), to the three subspecies is presented below:

1 Leaves divided or deeply lobed, usually pubescent
  2 Leaf lobes deep and almost reaching midrib along entire length of leaf lamina. Inflorescence compact ..... subsp. **huegelii**
  2. Leaf lobes mostly shallow, only the basal ones deep. Inflorescence branches loose ..... subsp. **lehmannii**
1. Leaves entire or shortly lobed near apex, pubescent only on margins and midrib, sometimes glabrous ..... subsp. **subintegra**

Diplopeltis huegelii Endl. subsp. **huegelii**

Leaves divided or deeply lobed, the lobes almost reaching to midrib along entire length of lamina, usually sparsely pubescent on all surfaces. *Inflorescence* compact, few-branched, usually 10–15(25) cm long. (Figure 1A,B)

Distribution and habitat. Occurs on near-coastal limestone soils between Dongara and Mandurah.

Diplopeltis huegelii subsp. **lehmannii** (Miq.) Keighery, *comb. et stat. nov.*

Diplopeltis lehmannii Miq. (Miquel 1845: 224). *Type:* Darling Range, Western Australia, 9 August 1839, *L. Preiss* 1282 (*holo:* W *n.v.*, photograph seen; *iso:* MEL).

Leaves distinctly lobed but the lobes mostly shallow, only deeply divided at base, usually pubescent only along margins of the leaves. *Inflorescence* loose, open, up to 30 cm long. (Figure 1C,D)

Specimens examined (all PERTH). WESTERN AUSTRALIA: Red Hill, *T.E.H. Aplin* 285, 316, 323; Badgingarra, *J.S. Beard* 1864; Forrestfield, *R.J. Cranfield* 176, 896; Karalee, *C.F. Davies* 748; Serpentine National Park, *B. Evans* 87; Bullsbrook, Nov. 1961, *C.A. Gardner s.n.*; New Norcia, *C.A. Gardner* 8684; SW of Encabba, *A.S. George* 9623; Serpentine Falls, 1 Nov. 1970, *A.S. George s.n.*; Darling Range, 21 Oct. 1897, *R. Helms s.n.*; Arrowsmith River, Drummonds Crossing, *R. Johnson* 3339; 37 km E of Fitzgerald River crossing on Ravensthorpe to Esperance Road, 29 Oct. 1972, *G.J. Keighery s.n.*; 60 mile peg on Toodyay to Goomalling road, *K.F. Kenneally* 201; Wooroloo, *M. Koch* 1448; Maddington, 15 Sep. 1909, *A. Morrison s.n.*; Wongan Hills, *P. Roberts* 682; Cut Hill, York, 15 Oct. 1922, *O. Sargent s.n.*; Swan View, 25 Oct. 1900, *A Morrison s.n.*; Red Hill, *R. Spujit* 6965, 7179.

Distribution and habitat. This subspecies extends from the Arrowsmith River, inland to York and south to Serpentine on granite, clay or lateritic soils. Apparently isolated populations occur at Karalee near Southern Cross (*C.F. Davies* 748) and east of Ravensthorpe (*G.J. Keighery s.n.*). These are remarkably disjunct from all other populations and require re-collecting to determine their presence and/or status.

Notes. Several northern collections of this subspecies (*R. Johnson* 3339 and *A.S. George* 9623) were previously listed as intermediates between subsp. *huegelii* and subsp. *subintegra*. A large number of collections held in PERTH of this subspecies are cited, to enable duplicates of these collections elsewhere to be determined.

Diplopeltis huegelii subsp. **subintegra** (A.S. George) Keighery, *stat. nov.*

Diplopeltis huegelii var. *subintegra* A.S. George (George & Erdtman 1970: 102). *Type:* 2 miles [3 km] west of Eradu on Geraldton to Mullewa road, Western Australia, *E. M. Scymgeour* 1446 (*holo:* PERTH 01598287).

Leaves entire or shortly lobed near apex, pubescent only on margins and midrib or sometimes glabrous. *Inflorescence* compact, usually less than 5 cm long.

Distribution and habitat. Occurs on sands between the Murchison River and Geraldton.

Acknowledgements

The curators of MEL and W allowed the author to examine or borrow photographs of type collections of *Diplopeltis*.

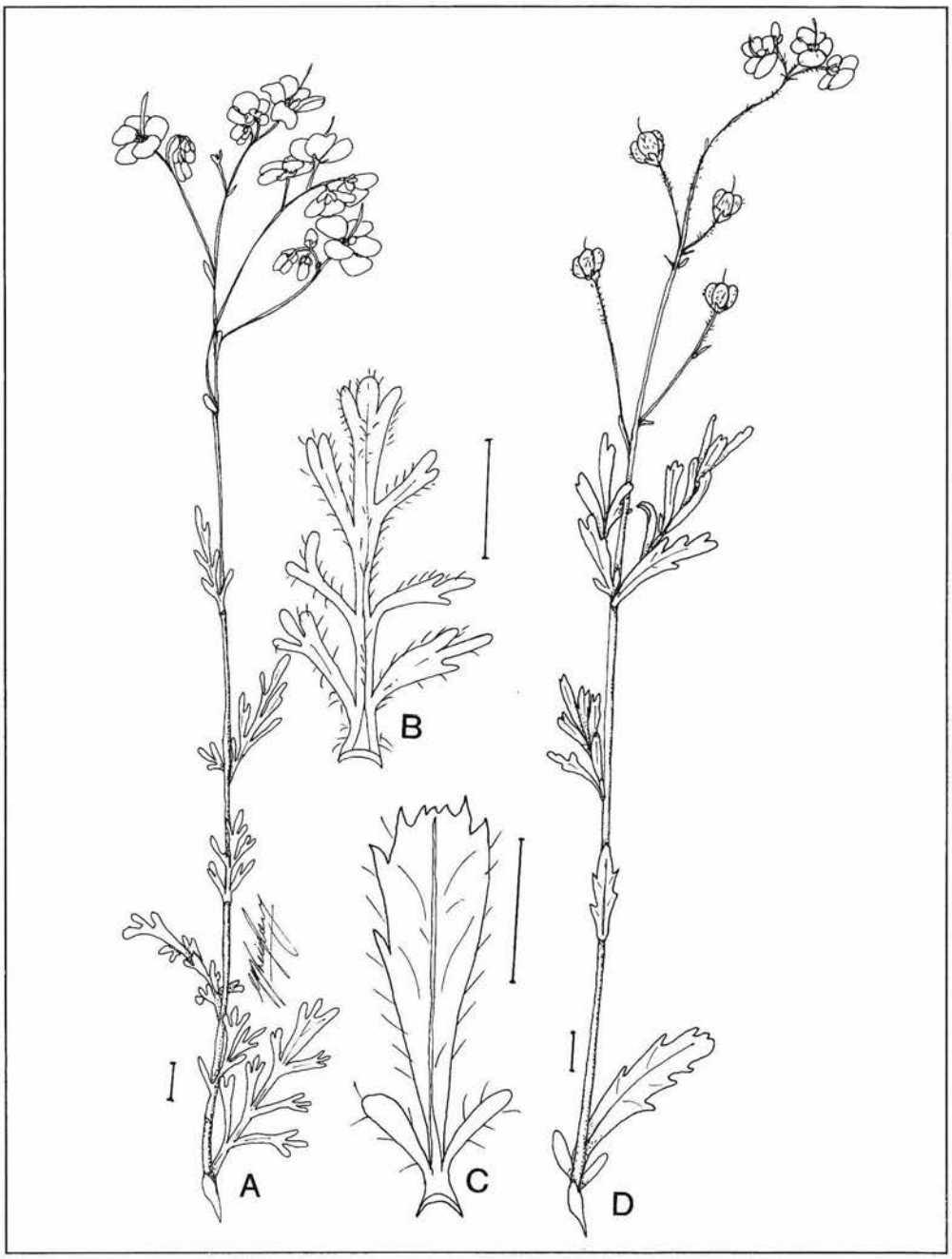

Figure 1. A,B. *Diplopeltis huegelii* subsp. *huegelii*. A – flowering branch, B – leaf.; C,D. *D. huegelii* subsp. *lehmannii*. C – flowering branch, D – leaf. Scale bar = 10 mm. Drawn from *G.J. Keighery* 15324 (A,B) and *T.E.H. Aplin* 316 (C,D).

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G.J. Keighery

Department of Conservation and Land Management, Western Australian Wildlife Research Centre, PO Box 51, Wanneroo, Western Australia 6065.

A new subspecies of *Grevillea variifolia* (Proteaceae)

During a floristic survey of the limestone hills and outcrops forming Cape Range peninsula in Western Australia (Keighery & Gibson 1993), it became apparent that *Grevillea variifolia* contains two distinct leaf variants that are geographically separated. The type form occurs on the massive Tertiary limestones of Cape Range. The other occurs south and east of the Range on the Pleistocene limestones of the Rough Range and the Quaternary calcarenite ridges between Coral Bay and Cape Cuvier, where the climate is more arid (Keighery and Gibson 1993). Plants from these low outcrops have smaller, harder leaves with pungent triangular points rather than broad shallow lobing between the more numerous points of leaves from Cape Range. These variants are considered to be morphologically and geographically distinct and are worthy of taxonomic recognition.

In their comprehensive treatment of the genus *Grevillea*, Olde & Marriott (1995a,b) foreshadowed the taxonomic recognition of geographic leaf variants in *Grevillea acuaria* F. Muell. ex Benth., *G. nudiflora* Meisn., *G. oncogyne* Diels and *G. pectinata* R. Br., without noting rank. They did recognize geographic leaf variants in *Grevillea apiciloba* F. Muell., *G. biformis* Meisn., *G. curviloba* McGill., *G. didymobotrya*, *G. diversifolia* Meisn., *G. manglesii* (Graham) Planch., *G. nana* C.A. Gardner, *G. patentiloba* F. Muell., *G. pauciflora* R.Br., *G. rigida* Olde & Marriott, *G. sarisa* S. Moore, *G. shuttleworthiana* Meisn. and *G. thyrsoides* Meisn. at the subspecies level. In only one case, did they treat a leaf form as a separate species, distinguishing *Grevillea evanescens* Olde & Marriott from *G. obtusifolia* Meisn. They saw only limited material of *Grevillea variifolia* and commented (Olde & Marriott 1995b: 217) that the species showed "some variation in leaf size, shape, degree of division and colour". Therefore, since geographic variation in leaf characters appears widespread in the genus and is usually accorded subspecies rank, this rank is adopted here.

Taxonomy

Grevillea variifolia C.A.Gardner & A.S.George, *J. Roy. Soc. W. Australia* 46: 129–130 (1963). *Type:* Cape Range, near number 3 well, 2 June 1961, *A.S. George* 2477 (*holo:* PERTH 1137859).

Grevillea variifolia C.A.Gardner & A.S.George subsp. ***variifolia***

Mature leaves with a petiole 3–6 mm long; lamina usually oblanceolate to narrowly cuneate, 17–43 mm long (usually greater than 25 mm), 15–22 mm wide; apex usually obtuse, rarely acute or pungent with 3–7 subsidiary points.

Other specimens examined. WESTERN AUSTRALIA: Cape Range, 18 Aug. 1956, *K. McWhae s.n.* (PERTH); Charles Knife Rd, Cape Range, *A.S. George* 1340 (PERTH); Charles Knife Rd, Cape Range, *Hj. Eichler* 22581 (AD, PERTH); Vlaming Head, *A.S. George* 1369 (PERTH); Cape Range, *W. Rogerson* 424, 297 (PERTH); 1 mile [1.6 km] S of Vlaming Head, *A.S. George* 2577 (PERTH); Walk trail between Shothole Canyon and Charles Knife Rd, *S. Moore* 217 (PERTH); Cape Range, *H. Demarz* 5789 (PERTH); Sandy Bay, Learmonth track, *T. Tapper* 10 (PERTH); 200 m N of Milyering Visitors Centre, Cape Range, *R. Karniewicz* 007 (PERTH); Mandu Mandu Gorge, *G.J. Keighery* 12858 (PERTH).

Distribution and habitat. North-west Western Australia in the Carnarvon Botanical District. Confined to the massive Tertiary limestones of the Cape Range.

Conservation status. Many populations in Cape Range National Park.

Flowering period. June to September.

Grevillea variifolia subsp. ***bundera*** G.J. Keighery, *subsp. nov.*

A *Grevillea variifolia* affinis differt a foliis duris, lobis triangularibus, lobis pungentibus.

Typus: 15.6 km north of Coral Bay turnoff on Exmouth Road, Western Australia, 25 August 1992, *G.J. Keighery & N. Gibson* 323 (PERTH 04055217).

Mature leaves with a petiole *c.* 2 mm long; lamina normally triangular, 11–15 mm long, to 8 mm wide, rigid, with up to 5 lobes, each lobe with a pungent mucrone 2–4 mm long. (Figure 1)

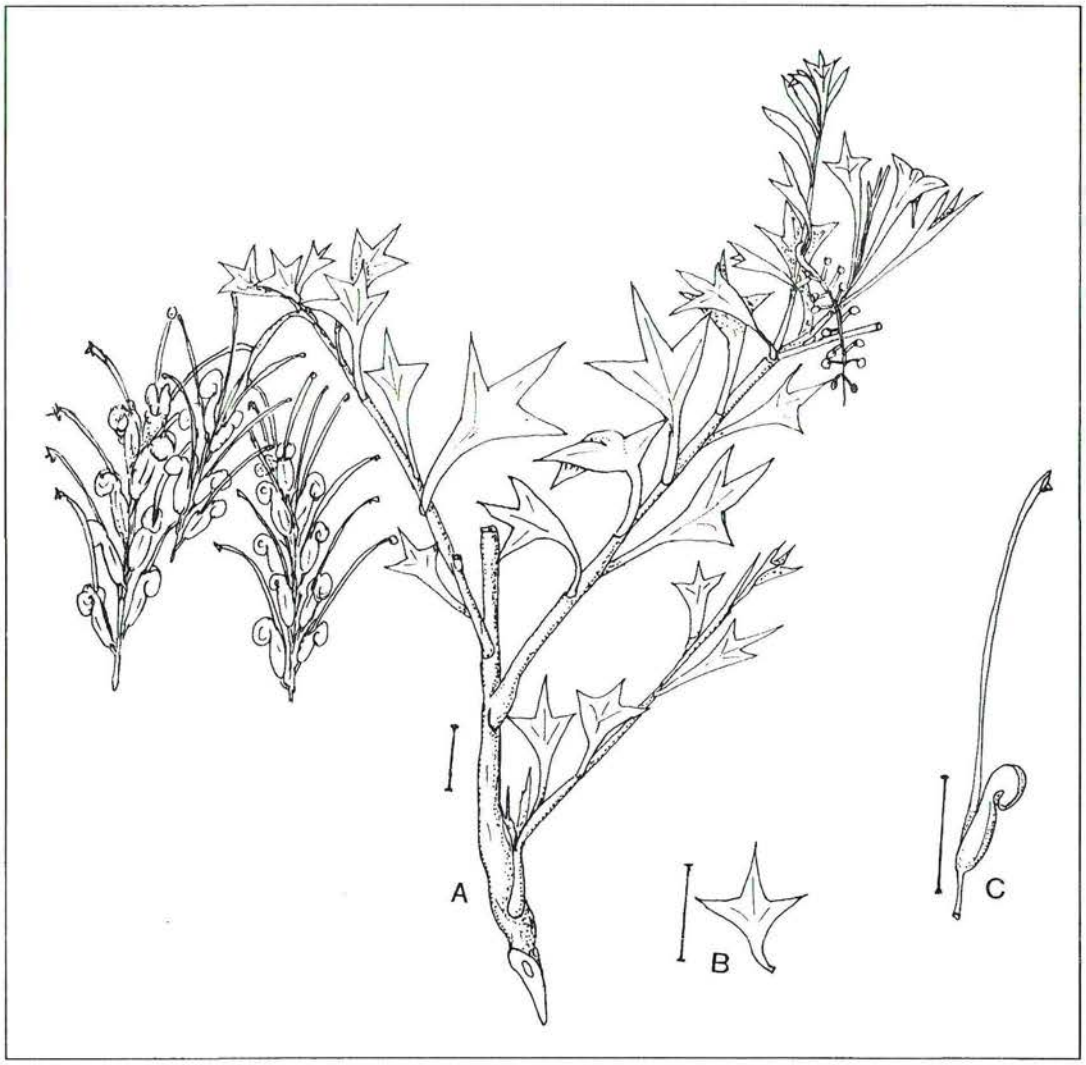

Figure 1. *Grevillea variifolia* subsp. *bundera*. A – flowering branch, B – leaf, C – flower. Scale bar = 10 mm. Drawn from the type population, voucher *G.J. Keighery & N. Gibson* 323.

Other specimens examined. WESTERN AUSTRALIA: Warroora Track, *H. Demarz* 11758 (Kings Park, PERTH); 79 miles [127 km] S of Learmonth, *A.S. George* 2404 (PERTH); Learmonth Road, 22 miles [35 km] N of Warroora turnoff, *A.S. George* 3286 (PERTH); Gnaraloo, *Gready* 4 (PERTH); 60 km N of North West Coastal Highway on Exmouth Road, *E. Wittwer* 1756 (KPBG, PERTH); 15 miles [24 km] N of Warroora turnoff, *J.S. Beard* 2530 (KPBG, PERTH); Rough Range, *G.J. Keighery & N. Gibson* 300 (PERTH).

Distribution and habitat. North-west Western Australia in the Carnarvon Botanical District. Confined to Quaternary Bundera calcarenites and Pleistocene limestones (Rough Range), usually overlain by recent red sand between Cape Cuvier and Rough Range.

Conservation status. Widespread and probably not in danger, but is not known from any conservation reserve.

Flowering period. May to September, with one collection in April. When surveyed in April 1996 no plants were flowering; flowering may depend on cyclonic rain.

Etymology. Named after the Quaternary Bundera calcarenites to which this taxon is a common and distinctive component of the shrub flora.

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G.J. Keighery

Department of Conservation and Land Management, Wildlife Research Centre, PO Box 51, Wanneroo, Western Australia 6065.

Two new synonyms in the genus *Pityrodia* (Lamiaceae subfamily Chloanthoideae)

In a revision of the genus *Pityrodia* R. Br. (Lamiaceae subfamily Chloanthoideae) by Munir (1979), the following five new names were published for taxa that occur in Western Australia: *Pityrodia augustensis* Munir, *P. chorisepala*, *P. glabra*, *P. glutinosa* and *P. ovata*. All of Munir's descriptions of these new taxa were based on very limited material. Subsequent collections have increased the number of specimens available for study, providing a much better basis for assessing the morphological variation and taxonomic status of these taxa. Since they are still known from relatively few collections, all of these taxa currently have conservation priority.

During identification of material for a flora survey of the Shark Bay area (Trudgen & Keighery 1995), it was discovered that *Pityrodia glabra* and *P. glutinosa* are synonymous. A recent examination of herbarium material from the northern arid zone of Western Australia has shown that *P. chorisepala* and *P. ovata* are also synonymous. In each case the two names were published simultaneously, so neither has priority. This paper reduces *P. glabra* and *P. ovata* to synonymy.

Recent collections of *Pityrodia augustensis* have confirmed that it is a very morphologically distinct species with an extremely restricted range. This species has been adequately surveyed and is now classed as Declared Rare.

Taxonomy

Pityrodia chorisepala Munir (Munir 1979: 63–65). *Type:* South of Mongrel Downs Station, Northern Territory, 4 August 1976, *P.K. Latz* 6543 (*holo:* AD, *n.v.*, illustration seen; *iso:* see notes below, *n.v.*).

Pityrodia ovata Munir (Munir 1979: 118–120). *Type:* 10 miles [16 km] west of McLarty Hill oil camp, Western Australia, 4 July 1968, *J.S. Beard* 5686 (*holo:* PERTH 00999733; *iso:* PERTH 00999741).

Illustrations. The holotype of *Pityrodia chorisepala* is illustrated in Figure 19 and the holotype of its synonym *P. ovata* in Figure 37 of Munir (1979).

Other specimens examined (all PERTH). WESTERN AUSTRALIA: Site 2 (18° 55' S, 123° 14' E), near Edgar Range, 9 Aug. 1976, *K.F. Kenneally* 5560; Site 1 (18° 53' S, 123° 43' E), near Edgar Range, 12 Aug. 1976, *K.F. Kenneally* 5606.
NORTHERN TERRITORY: 12 miles [19 km] W of Sandy Blight Junction, 26 July 1967, *A.S. George* 8921.

Distribution. Occurs in the far south of the Northern Botanical Province and in the north of the Eremean Botanical Province of Western Australia, extending *c.* 600 km from near Edgar Range east to the Western Australian border, and also extending slightly into Northern Territory.

Habitat. Recorded in red sand, on dunes or spinifex plains, with one record (*J.S. Beard* 5686) of the habitat as 'tree steppe'.

Phenology. Flowers and fruits recorded July to August.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Two. Known from three localities in Western Australia and two in Northern Territory. This species has a fairly wide range of over 600 km in a remote area where there is little botanical collecting, so may occur at many more locations than are presently known. It was reported to be rare at one of the Northern Territory locations but there is no indication of population size for any of the Western Australian specimens.

Notes. Isotypes of *Pityrodia chorisepala* are cited (Munir 1979: 63) for AD, CANB, NT and PERTH but no specimen has been lodged in the type collection at PERTH to date. Munir based his description of *Pityrodia chorisepala* on two specimens from Northern Territory and that of *P. ovata* on a single collection from Western Australia. Two additional specimens collected from west and east of Edgar Range were seen later by Munir, who annotated the western one as *P. chorisepala* and the eastern one as *P. ovata* in 1980. It was evident from these extra collections that both taxa occurred in Western Australia and that their geographic ranges overlapped.

Munir (1979: 120) indicated that *Pityrodia ovata* was very similar to *P. chorisepala* but differed in "its leaves being honey-combed underneath, not contracted at the base, covered all over with short gland-tipped hairs; leaves and inflorescence lax, not crowded towards the apex; pedicel short, ± 1 mm long; calyx-lobes obtuse with rounded tip". The only consistent difference found in the current study was that all the leaves of specimens annotated by Munir as *P. ovata* have an indumentum predominantly of short simple glandular hairs, with non-glandular dendritic hairs restricted to the veins and margins, whereas in specimens annotated as *P. chorisepala* only the upper 'floral' leaves have this type of indumentum and the lower leaves are densely covered throughout by non-glandular dendritic hairs. Consequently the leaves of *P. ovata* specimens tend to show the veins more clearly on the undersurface. Both groups of specimens have leaves contracted at the base into a very short petiole, both have the calyx lobes varying from obtuse to acute, and there is no difference between them in the degree of laxity of the leaves and inflorescences. The single character difference of leaf indumentum is not sufficient to maintain the two taxa as distinct species.

Pityrodia chorisepala is chosen here, in preference to *P. ovata* as the name for this species, partly because it has been more widely used and partly because it appears to be a more suitable name. One of the specimens (*K.F. Kenneally* 5560) has the leaves mostly obovate rather than ovate, so use of the epithet *ovata* could be misleading.

Although the corolla appears glabrous outside, all specimens have a few minute simple glandular hairs on the lobes. Flower colour is recorded for one of the specimens (*K.F. Kenneally* 5560) as "white with red spots in throat", while two other records only mention the white colour.

Pityrodia glutinosa Munir (Munir 1979: 84–86). *Type:* About 175 km north of Geraldton, Western Australia, 2 October 1966, *E.A. Shaw* 608 (*holo:* AD, *n.v.*, illustration seen; *iso:* PERTH 01608320).

Pityrodia glabra Munir (Munir 1979: 51–54). *Type:* 7 miles [11 km] along Tamala road from Hamelin–Denham road, Western Australia, 26 August 1969, *A.S. George* 9561 (*holo:* PERTH 00999725; *iso:* AD, *n.v.*).

Illustrations. The holotype of *Pityrodia glutinosa* is illustrated in Figure 26 and a specimen of its synonym *P. glabra* in Figure 15 of Munir (1979).

Other specimens examined (all PERTH). WESTERN AUSTRALIA: 200 m up track to N of Useless Loop road, 8.7 km W of Denham–Hamelin road, 22 Aug. 1991, *A.H. Burbidge* 4636; SE of Coolcalalaya Station, beside State Barrier Fence, 18.5 km SE of gas pipeline, 28 Aug. 1990, *A.H. Burbidge* 4791; *c.* 50 miles [80 km] N of Mary Springs Homestead, North West Coastal Highway, 14 Sep. 1960, *S. Davies*; 8 km on Tamala road, 28 Aug. 1985, *H. Demarz* 10685; 39 km N of Murchison bridge, 7 Aug. 1987, *H. Demarz* 11754; 135 km N of Northampton, 14 July 1964, *D.W. Goodall* 1195; *c.* 30 km NW of Tamala homestead, 20 July 1988, *G.J. Keighery & J.J. Alford* 2007; 8.8 km W along Useless Loop road from Denham–Hamelin road, 23 Aug. 1994, *G.J. Keighery & N. Gibson* 1273; 425 mile peg on North West Coastal Highway [182 km N of Geraldton], 3 Nov. 1965, *F. Lullfitz* 4331; 436 miles on North West Coastal Highway [200 km N of Geraldton], 2 Oct. 1966, *E.M. Scrymgeour* 1476.

Distribution. Occurs in the far north of the South West Botanical Province of Western Australia, extending from Nanga Station south-east to west of Lake Nerramyne Station.

Habitat. Pityrodia glutinosa occurs in a shrub layer often dominated by a *Eucalyptus* mallee woodland or sometimes by *Calothamnus*. The northern populations, from Nanga Station, are from red sandy soil over limestone, in a habitat known as the Tamala System (Beard 1976), while the southernmost population near Lake Nerramyne Station is recorded on a slightly elevated flat with orange sand. No habitat details are recorded for the intermediate populations except for one specimen collected from a sand dune.

Phenology. Flowers and fruits recorded July to November.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority Three. Known from at least eight localities over a range of *c.* 190 km, but not from any conservation reserves.

Notes. Although *Pityrodia glabra* and *P. glutinosa* were named in the same publication, no direct comparison was made between them except in the key, where they were separated at couplet 28 on the basis of leaf characters, the leaves described as "sessile, entire, slightly recurved along the distal margins" for *P. glutinosa* and "subsessile, distally dentate, flat" for *P. glabra* (Munir 1979: 9). In the illustration (Figure 26) provided for *P. glutinosa*, the leaves appear to be subsessile and dentate, although not as prominently dentate as some of the leaves illustrated (Figure 15) for *P. glabra*. An examination of the herbarium specimens has revealed that the mature leaves are shortly petiolate and dentate in both taxa and the degree to which the margins are recurved depends partly on how well the specimens have been pressed.

Pityrodia glutinosa is chosen here as the name to use for this species, rather than *P. glabra*, because it has been applied to the majority of the specimens and because the epithet *glutinosa* is more accurately descriptive for the taxon than is the epithet *glabra*.

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B.L. Rye

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

M.E. Trudgen

C/- Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Status and identification of *Goodenia filiformis* (Goodeniaceae)

Goodenia filiformis R.Br. (Goodeniaceae), a small erect to ascending herb from the south-west of Western Australia, has for a number of years been confused with *G. pulchella* Benth. This communication highlights information useful in distinguishing between the two taxa, alleviating confusion in previous treatments.

Carolin's (1992) treatment of *Goodenia* in the "Flora of Australia" has *G. filiformis* as known only from the type collection, collected by Robert Brown in 1801 "between Princess Royal Harbour and [West] Cape Howe, near King George Sound". After receiving the type collection from the British Museum (BM), the authors have determined that seven specimens housed under the name *G. pulchella* at the Western Australian Herbarium (PERTH) are in fact *G. filiformis* [1]. All of the specimens originate from the vicinity of Albany, the same area as where the type was collected. *Goodenia filiformis* and *G. pulchella* seem to both commonly occur in winter-wet depressions, but *G. pulchella* has a much wider range (Figure 1).

Of the seven specimens of *G. filiformis* currently in the Western Australian Herbarium (PERTH) only one is from a nature reserve (Millbrook Nature Reserve north of Albany). This means that the species should be considered for Priority Three listing, as Poorly Known Taxa. Further fieldwork will be required to determine the exact range of *G. filiformis*.

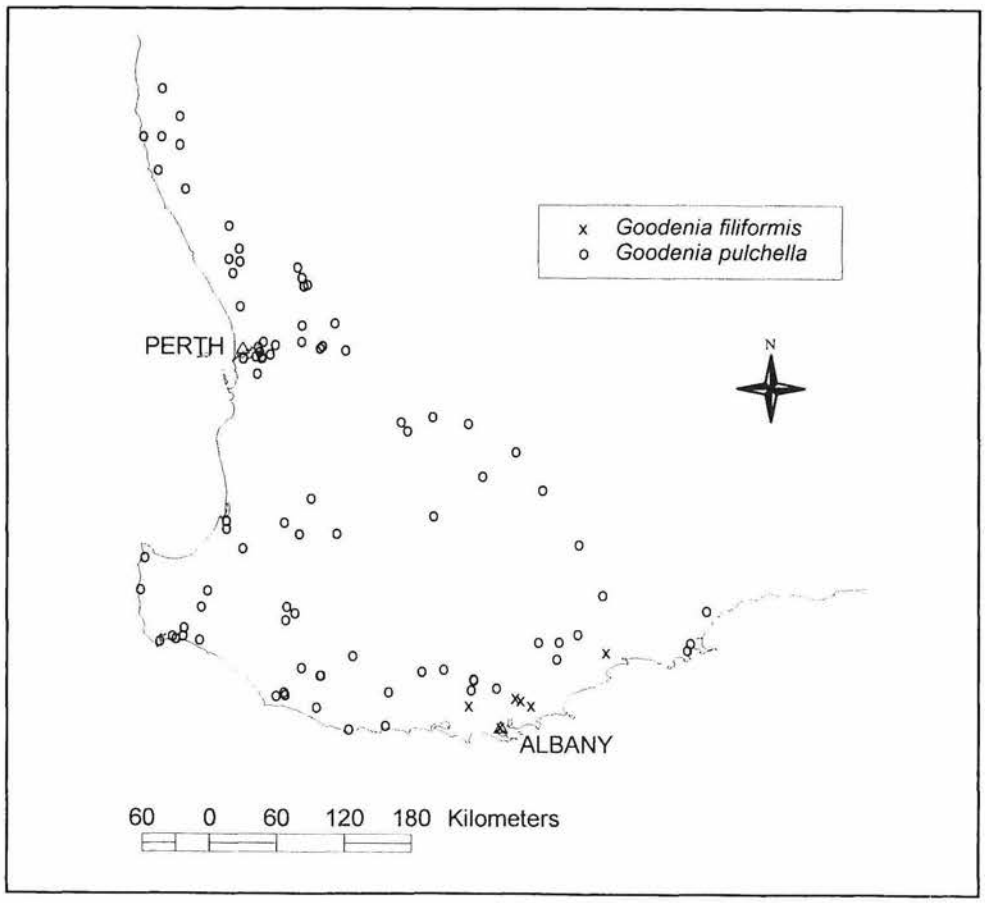

Figure 1. Distribution of *G. filiformis* and *G. pulchella* in the south-west of Western Australia.

[1] R.C. Carolin (1992) did not examine the material the authors have determined as *Goodenia filiformis*.

Table 1 shows the principal morphological differences distinguishing *G. filiformis* and *G. pulchella*. Key indicators, which are height, leaf and sepal shape combined with geographic restriction, separate the taxa.

Table 1. Principal morphological features distinguishing *Goodenia filiformis* and *G. pulchella*.

	G. filiformis	*G. pulchella*
Height	to 25 cm	to 35 cm
Leaves		
shape	linear-terete	narrowly ovate
margin	entire	entire to crenate-dentate
width	*c.* 1 mm	greater than 1 mm
Sepals		
shape	ovate	narrowly oblong
length	1.5–2 mm	2–3 mm
Indusium	*c.* 0.7 mm long	0.8–1 mm long

The "Flora of the Perth Region", pre-dating Carolin's (1992) treatment, contains an illustration (Marchant *et al.* 1987) of a plant under the name *G. filiformis*. Unfortunately the illustration does not include the basal leaves, making identification difficult. As most illustrations for the flora were drawn from fresh material collected in the region, and the sepals are narrowly oblong, the specimen used is most likely *G. pulchella*.

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L.W. Sage
C/- Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.

J.P. Pigott
Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.

The name *Leptorhynchos linearis* and the type of *Leptorhynchos* (Asteraceae)

The generic name *Leptorhynchos* Less. (Asteraceae) was based on two species names, *L. squamatus* (Labill.) Less. and *L. linearis* Less. These two names as currently circumscribed have been applied to species that are sufficiently different as to question their being congeneric. Since both names have, at different times, been proposed as type of the genus their correct application is of particular importance.

History

When Christian Lessing (1832) described the genus *Leptorhynchos* he included two taxa, *L. squamatus* and *L. linearis*. The former name was based on *Chrysocoma squamata* Labill. (Labillardière 1805) [incorrectly cited as *Conyza squamata*], a species found by Labillardière on the south coast of Tasmania; there is no doubt about the application of this name since it was adequately described and illustrated and an isotype is present in Australia (MEL 1543432). The latter name was based on a specimen present in the herbarium of C.S. Kunth that had been collected by C. Gaudichaud-Beaupré at Port Jackson, Sydney, New South Wales. Lessing's description of *L. linearis* was very brief and due to a typographical error indicated that the leaves were only 1½" [lines] long (*c.* 3 mm) an error repeated by de Candolle (1838) while it was evidently intended to state that they were 1½" [inches] long (*c.* 36 mm).

Kunth died in 1850 and his herbarium passed to the state herbarium in Berlin (Stafleu & Cowan 1979). Here the type of *L. linearis* was seen by O.W. Sonder who considered that it was conspecific with *L. squamatus* and who published the new combination *L. squamatus* var. *linearis* (Less.) Sond. (Sonder 1853: 500). He stated that he had seen the specimen of *L. linearis* in the Berlin herbarium that had been earlier examined by Lessing ("Compar. spec. Lessingian. in herb. Berol.").

George Bentham (1867), in writing up the genus *Leptorhynchos* for the "Flora Australiensis", overlooked Sonder's comment and synonymy and applied the name *L. linearis* in the sense of *L. nitidulus* DC. (de Candolle 1838) while the latter name he incorrectly placed in synonymy under *L. squamatus*.

Ferdinand Mueller evidently had doubts about Bentham's treatment of these species for he appears to have written to Prof. A.W. Eichler in Berlin requesting information on the type of *L. linearis*. Eichler passed the request to Paul Ascherson who was professor of botany in the University of Berlin. A copy of Ascherson's reply to Mueller (dated 3 May 1880) is attached to a sheet of *L. squamatus* in the National Herbarium, Melbourne (sheet MEL 248910). The essence of Ascherson's letter is that the only specimen of *L. linearis* in the Berlin herbarium is that of the type of the name and that it was identical to a specimen of *L. squamatus* collected by Ferdinand Mueller at Port Phillip in 1876. Ascherson returned to Mueller a portion of this Port Phillip collection and also sent several achenes that were extracted from the the type of *L. linearis* in Berlin. These achenes are in a packet labelled "Achänen von Originalexpl. [Exemplar] von *L. linearis* Less." which is also mounted on sheet MEL 248910; they have the same morphology as those found in the type of *L. squamatus* and are different from those found in *L. nitidulus*, in particular in the size, shape, and density of the teeth towards the base of the pappus bristles (see Figure 1). Since the Berlin Herbarium was largely destroyed in the war of 1939–1945, the loose achenes on sheet MEL 248910 are presumably all that remain of the type of *L. linearis*.

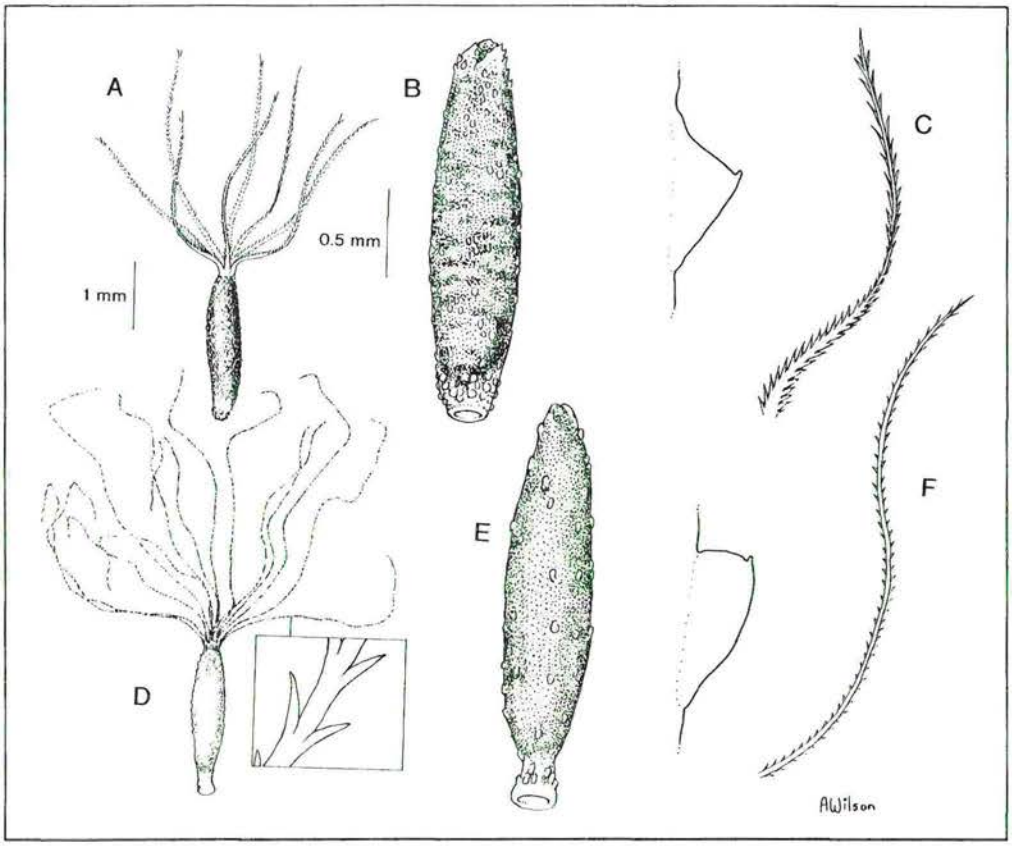

Figure 1. A–C. *Leptorhynchos squamatus*. A – achene with pappus. B – achene with enlargement of papilla. C – pappus bristle. D–F. *Leptorhynchos nitidulus*. D – achene with pappus. E – achene with enlargement of papilla. F – pappus bristle. A–C from *E. Gauba* (CANB 015420); D–F from *R. Melville* 2854 (MEL).

This information, and his own recognition of the correct application of the name *L. nitidulus,* evidently led Mueller to adopt the name *L. nitidulus* in place of *L. linearis* in his "Systematic Census of Australian Plants" (1882), but without an explanation. This name change was accepted by Moore (1893), Rodway (1903), and Maiden & Betche (1916), all of whom assumed that both *L. linearis* and *L. nitidulus* applied to the same species and that the latter should be used (even though the former was the first to be published), although none of these authors indicated the reasons for their actions. This lack of documentation presumably led Ewart (1931), Curtis (1963), and Willis (1973) to continue with the misapplication of the name *L. linearis*, while Jacobs & Pickard (1981) and Everett (1992) followed Maiden & Betche in using the name *L. nitidulus,* but again without an explanation.

Leptorhynchos squamatus is widespread and somewhat variable. The taxonomy of this variation is currently being investigated by Christina Flann (MEL) and until this study has been completed a formal recognition of infraspecific taxa would be premature.

Lectotypification of *Leptorhynchos*

Since it is now established that the names *Leptorhynchos squamatus* and *L. linearis* apply to the same species, lectotypification of the genus is not of such importance. However, the suggestion by Farr *et al.* (1979) that Pfeiffer (1874) may have lectotypified it on *L. squamatus* can possibly not be

substantiated since all Pfeiffer did was to list the one species [as '*Conyza squamata*'] under the generic name. The first undoubted lectotypification appears to have been made by Anderberg (1991) who chose *L. linearis* [= *L. squamatus*] as the type and it is this lectotypification that I am following, as did Greuter *et al.* (1993).

Acknowledgement

The illustration was kindly prepared by Annemarie Wilson.

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Paul G. Wilson

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.

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 Endangered Flora Consultative 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 Endangered Flora Consultative 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 1: 17 February 1998

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).