

Muelleria



Grevillea celata

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The date of distribution of **Volume 8, Number 2** was 30 March 1994

From the Editor

This edition of *Muelleria* will be the last in the present format. The journal was conceived as a commemorative periodical on the 26th January 1953, a day which marked a century since the appointment of Doctor F.J.H. Mueller as Victoria's first Government Botanist.

Muelleria was intended primarily as a vehicle to publish the work of officers of the National Herbarium of Victoria yet be wide enough in scope to accommodate papers from other sources and also from outside Victoria. Since the first number of the journal appeared on the 22 February 1956 it has certainly fulfilled these aims.

Muelleria volume 1 Number 1 was sponsored by a grant from the Maud Gibson Gardens Trust with Jim Willis as editor.

Prior to 1971 publication of *Muelleria* was on an irregular basis with a gap of about seven and a half years between volume 1 number 2 and volume 1 number 3. Since 1971 the journal has appeared on an annual basis and is circulated to over 400 individuals and institutions in all Australian States and Territories and to 55 overseas countries.

The editors of *Muelleria* have been:

Jim Willis (1956–1967) Volume 1 Numbers 1–3

Rex Filson (1969–1976) Volume 2 Numbers 1–4 and Volume 3 Numbers 1–3

Helen Aston (1977–1988) Volume 3 Number 4; Volume 4 Numbers 1–4; Volume 5 Numbers 1–5 and Volume 6 Numbers 1–6.

Don Foreman (1989–) Volume 7 Numbers 1–4; Volume 8 Numbers 1–3; *Volume 9* onwards.

Details of each number in Volumes 1–6, including distribution dates are given in *Muelleria* 6(6): 519–520 (1988). Dates of distribution for Volumes after Volume 6 appear on the verso of the contents page and in the cumulative contents pages issued at the completion of each volume.

It is appropriate that the new look *Muelleria* will first appear in 1996. This year marks the centenary of Mueller's death and the 150th anniversary of the establishment of the Royal Botanic Gardens, Melbourne.

Present exchange arrangements will not be affected by these changes.

Unformatted manuscripts for the first number of the new series of *Muelleria*, preferably on 3.5" diskette, using *Word for Windows* or a program which can be converted by this system, plus a one, double spaced hard copy with original illustrations, maps and photographs should reach the editor not later than 30th June 1995. Papers will be subjected to the normal referee process in addition to being reviewed by an editorial panel before acceptance.

D.B. FOREMAN
Editor *Muelleria*

A NEW SAXICOLOUS SPECIES AND NEW RECORDS OF *PORINA*
(LICHENISED ASCOMYCOTINA: TRICOTHELIACEAE) FROM
AUSTRALIA

P.M. McCARTHY*

ABSTRACT

McCarthy, P.M. A new saxicolous species and new records of *Porina* (lichenised Ascomycotina: Trichotheliaceae) from Australia. *Muelleria* 8(3): 265–268 (1995). — *Porina chloroticula* sp. nov. is described from rainforest in NE Queensland. *Porina malmei* P. M. McCarthy and *P. ulceratula* Zahlbr. are reported from Australia for the first time. Other recent collections of interesting saxicolous species of *Porina* are also noted.

INTRODUCTION

A recent conspectus of the saxicolous species of *Porina* Müll. Arg. in the Southern Hemisphere included descriptions and illustrations of most of the 39 species recognised (McCarthy 1993). Subsequently, field-work carried out by the author in Tasmania and Queensland resulted in new and noteworthy records including a specimen of *P. chloroticula* P.M. McCarthy which is described here.

THE SPECIES

1. *Porina aptrootii* P.M. McCarthy, *Bibliotheca lichenol.* 52: 29 (1993).

Porina aptrootii is a rather distinctive species with moderately large, black perithecia and a dark green to blackish thallus. It has been reported from its type locality in southern Tasmania and from south-western New Zealand (McCarthy 1993). A recent collection from aquatic rocks in northern Tasmania has an involucrellum which is not as uniformly dark as was previously observed; rather, a greenish black outer part is subtended by a progressively paler and ultimately hyaline inner layer. -

SPECIMEN EXAMINED

Tasmania — Cradle Mountain-Lake St Clair National Park, Cradle Valley, Dove R., alt. c. 800 m, on aquatic sandstone, 21 May 1993, P.M. McCarthy 647 & G. Kantvilas (MEL 1057469).

2. *Porina chloroticula* P.M. McCarthy *sp. nov.*

Thallus effusus vel determinatus, pallido griseoviridis vel atroviridis, 15–30 µm crassus, ecorticatus, K–. Algae 6–10(–12) × 6–10 µm. Perithecia hemisphaerica, superficialia, (0.14–)0.19(–0.26) mm diametro. Involucrellum atroviride, 20–25(–35) µm crassum, ad basim excipuli descendens. Centrum 0.1–0.16 mm diametro. Asci 60–74 × 7–9 µm. Ascosporae 3-septatae, (13.5–)16(–20) × (2.5–)3.1(–3.8) µm. Conidia 2–3 × 1 µm.

TYPUS: Australia, Queensland, Great Barrier Reef, Fitzroy I., 25 km E of Cairns, 16°56'S, 145°59'E, alt. 50–100 m, growing among bryophytes on a granite boulder in relict forest, Mar. 1988, A. & M. Aptroot 22384 [HOLOTYPE: MEL 1057424; ISOTYPE: MEL 1057425 (Aptroot 22376), Hb Aptroot].

Thallus epilithic, effuse to determinate, pale grey-green and inconspicuous to dark green, matt, 15–30 µm thick, filmy, continuous, smooth to minutely rugulose, somewhat gelatinous when wetted, ecorticate, K–. *Algae* subglobose to globose, 6–10(–12) × 6–10 µm. *Hyphae* 2–4 µm wide. *Prothallus* not apparent. *Perithecia* superficial, numerous, usually solitary. *Perithecial apex* rounded to slightly pointed. *Ostiole* inconspicuous or in a shallow depression. *Involucrellum* black, green-black in thin section, K–, hemispherical, subconical or subglobose, arching away from the excipulum, (0.14–)0.19(–0.26) mm diam., 20–25(–35) µm thick, extending to excipulum-base

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level. *Centrum* globose to depressed-ovate, 0.1–0.16 mm diam. *Excipulum* uniformly pale brown to, less commonly dark brown, 12–15 μm thick. *Paraphyses* unbranched, 0.8–1.2 μm wide. *Periphyses* absent. *Asci* elongate-cylindrical, with rounded or truncate ends, 60–74 \times 7–9 μm . *Ascospores* 3-septate, fusiform to elongate-fusiform, straight, slightly curved or faintly sigmoid, with rounded to subacute ends, irregularly biseriate in the asci, (13.5–)16(–20) \times (2.5–)3.1(–3.8) μm (60 measured); contents clear. *Conidiomata* moderately numerous, semi-immersed to almost superficial, olive brown above, pale brown below, 60–90 μm diam., with a convoluted conidiogenous layer. *Conidia* narrowly ellipsoid to fusiform, 2–3 \times 1 μm . (Fig. 1)

REMARKS

This lichen has a thin and inconspicuous K– thallus, very small perithecia with a thin K– involucrellum and short and exceptionally narrow ascospores. Although it is broadly similar to the cosmopolitan *P. chlorotica* (Ach.) Müll. Arg., that species has larger perithecia, a thicker, K+ reddish involucrellum, 75–90(–100) μm long asci and, among the Southern Hemisphere specimens examined by me, 3–5(–6) μm wide ascospores (McCarthy 1993).

Porina chlorotricula is known from granite and basalt in rainforest at two localities in NE Queensland, Australia.

ADDITIONAL SPECIMEN EXAMINED

Queensland — Atherton Tableland, by Kennedy Highway, 2.8 km SW of Barron R. crossing, Longlands Gap State Forest, Raspberry Creek, on shaded semi-aquatic basalt, 11 Sep. 1993, *P.M. McCarthy 855* (MEL).

3. *Porina crassa* P.M. McCarthy, *Bibliotheca lichenol.* 52: 41 (1993).

The type specimen of *P. crassa* consists of several small fragments (McCarthy 1993). Following the description of this species an opportunity arose to visit its type locality in NE Queensland where *P. crassa* was found to be very abundant on the steep, north-facing cliffs of a rainforest gorge. Many large colonies were observed, the smooth and thick, pale creamy brown thalli with immersed perithecia being particularly noticeable in the field.

SPECIMEN EXAMINED

Queensland — Atherton Tableland, 30 km WSW of Innisfail, Palmerston National Park, below Tchupala Falls and above Wallicher Falls, tributary of North Johnstone R., on shaded rocks in a rainforest gorge, 10 Sep. 1993, *P.M. McCarthy 815* (BRI, MEL).

4. *Porina malmei* P.M. McCarthy, *Bibliotheca lichenol.* 52: 70 (1993).

This lichen is reminiscent of the anti-tropical *P. guentheri* (Flotow) Zahlbr. However, its perithecia are very small and have a thin, black involucrellum and smaller ascospores (McCarthy 1993).

Porina malmei was found on semi-aquatic rocks in rainforest at two localities in SE Queensland. It was previously known only from its type locality in Rio Grande do Sul, southern Brazil.

SPECIMENS EXAMINED

Queensland — Lamington National Park, Green Mountains, near Border Track, below Boxlog Falls, Canungra Creek, on deeply shaded semi-aquatic basalt, 4 Sep. 1993, *P.M. McCarthy 736* (MEL); near Brisbane, D'Aguilar Range, Northbrook Creek, by Mt Glorious Road, on semi-aquatic rocks, 5 Sep. 1993, *P.M. McCarthy 754* (MEL).

5. *Porina mastoidea* (Ach.) Müll. Arg., *Bot. Jahrb.* 6: 399 (1885).

Porina mastoidea is a common and mainly corticolous lichen especially in the Neotropics; it has also been confirmed from the Philippines, Malaysia, Papua New Guinea and SE Queensland (McCarthy 1993). Saxicolous specimens are known from southern Brazil, Paraguay, Uruguay, Malaysia and, now, NE Queensland.

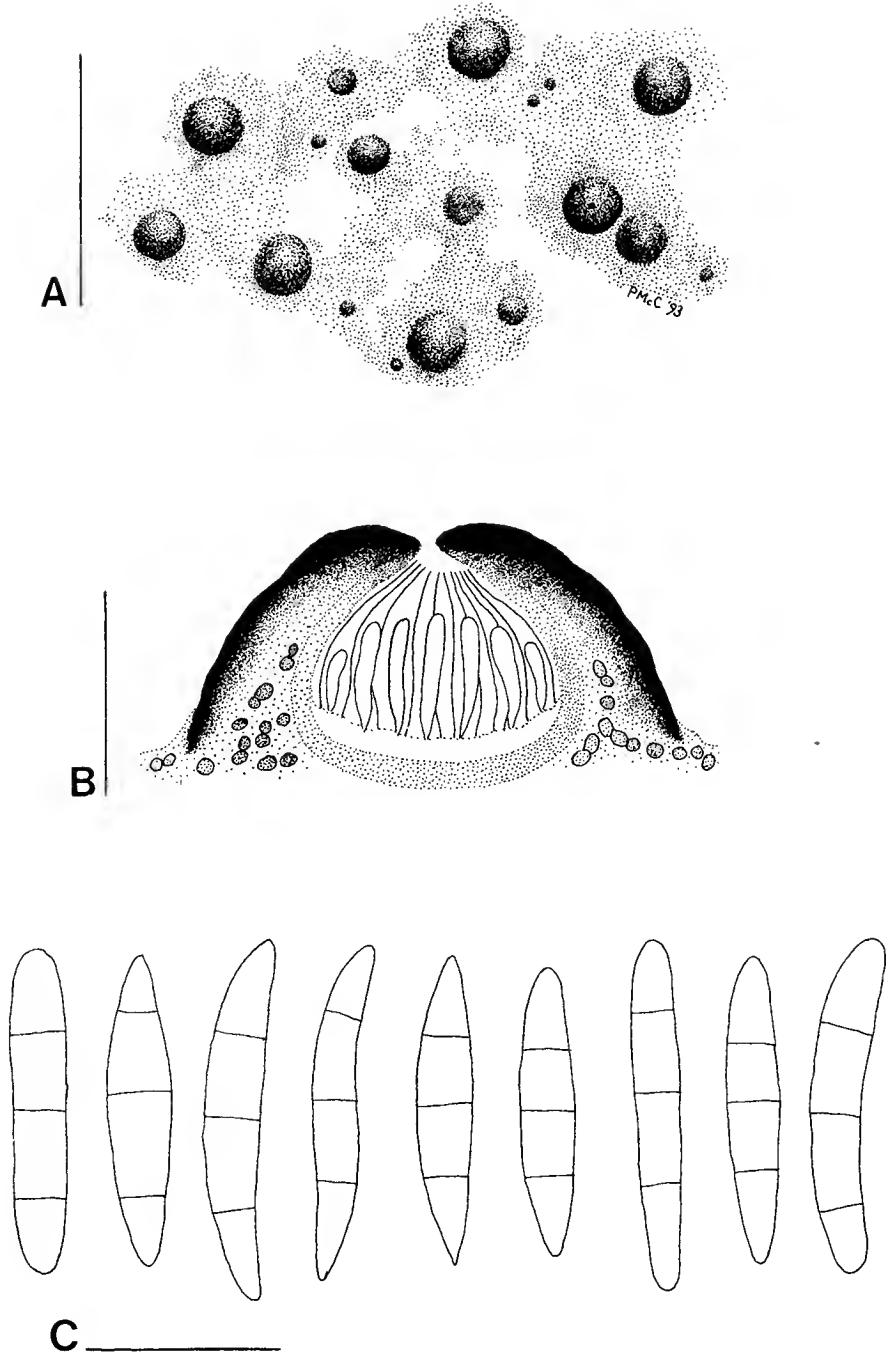


Fig. 1. *Porina chloroticula* (holotypus). a — habit of thallus and perithecia; scale 1 mm. b — vertical section of perithecium; scale 0.1 mm. c — ascospores; scale 10 μ m.

SPECIMEN EXAMINED

Queensland — Atherton Tableland, 2 km E of Millaa Millaa, Theresa Creek, below Millaa Millaa Falls, on semi-aquatic basalt. 10 Sep. 1993, P.M. McCarthy 832 (MEL).

6. *Porina tetracerae* (Afzel.) Müll. Arg., *Bot. Jahrb.* 6: 401 (1885).

This is a common, but mainly corticolous, pantropical species. However, saxicolous specimens have been collected in Western Samoa, Galápagos Is., Costa Rica, Paraguay, southern Brazil, West Africa and Tanzania (McCarthy 1993). Although it is known from bark in NE New South Wales and Queensland, the saxicolous ecotype had not previously been reported from Australia.

SPECIMEN EXAMINED

Queensland — Atherton Tableland, 30 km WSW of Innisfail, Palmerston National Park, below Tchupala Falls and above Wallicher Falls, tributary of North Johnstone R., on shaded rocks in rainforest, 10 Sep. 1993, P.M. McCarthy 819 (MEL).

7. *Porina ulceratula* Zahlbr., *Ark. Hydrobiol., Suppl.* 12: 734 (1934).

The type specimens of *P. ulceratula* have a thin, pale grey-brown thallus that almost completely overgrows the perithecia. The involucrellum is medium brown and the 3-septate ascospores are short and rather broad and have rounded ends and a thin gelatinous sheath (McCarthy 1993). The Australian specimen has a greyer thallus and the periphyses, which were sparse in the type specimens, are absent.

The first description of the semi-aquatic *P. ulceratula* was accompanied by a photograph of the type locality in Java (Zahlbruckner 1934). This showed a boulder-strewn creek in rainforest very similar to Babinda Creek in tropical Queensland from which this lichen was collected.

SPECIMEN EXAMINED

Queensland — Atherton Tableland, Bellenden Ker Range, 6 km W of Babinda, Babinda Creek, The Boulders, on shaded semi-aquatic rocks, 12 Sep. 1993, P.M. McCarthy 911 (MEL).

ACKNOWLEDGEMENTS

I thank Dr A. Aptroot for sending me specimens of *P. chlorotricula*. Financial support from Australian Biological Resources Study is gratefully acknowledged.

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NOTES ON AUSTRALIAN VERRUCARIACEAE (LICHENISED ASCOMYCOTINA). 4. *POLYBLASTIA* Massal.

P.M. MCCARTHY*

ABSTRACT

McCarthy, P.M. Notes on Australian Verrucariaceae (lichenised Ascomycotina). 4. *Polyblastia* Massal. *Muelleria* 8(3): 269–273 (1995). — *Polyblastia australis* sp. nov. is described from northern Tasmania where it grows on calcareous soil and moribund bryophytes. The aquatic *P. cruenta* (Körber) P. James & Swinscow and the calcicolous *P. dermatodes* Massal. are also reported from Tasmania.

INTRODUCTION

Polyblastia Massal. is a genus of mainly saxicolous, temperate to arctic-alpine lichens characterised by colourless to dark brown, submuriform to muriform ascospores. It is closely related to *Staurothele* Norman which produces hymenial algae and to *Thelidium* Massal. in the which the ascospores remain colourless and usually have only transverse septa.

In the late nineteenth century several corticolous species of *Polyblastia* were described, mostly from Queensland, by C. Knight, A. von Krempelhuber and J. Müller. Subsequently, Zahlbruckner (1921) transferred these taxa to his new and unrelated genus, *Polyblastiopsis* Zahlbr.

Zahlbruckner's genus may be inappropriate for some or all of the Australian taxa (McCarthy 1991a) currently attributed to it. In any case, *Polyblastia* is virtually unknown in the Southern Hemisphere and its occurrence in Australia was only recently confirmed when the calcicolous *P. cupularis* Massal. was reported from south-western Victoria (McCarthy 1991b). In the present contribution, *P. australis*, a new bryophilous and terricolous species, the aquatic *P. cruenta* and the calcicolous *P. dermatodes* are reported from Tasmania.

THE SPECIES

Polyblastia australis P.M. McCarthy sp. nov.

Thallus terricola et muscicola, effusus, pallidogriseus vel pallido griseoviridis, 30–60 µm crassus, ecortatus. Perithecia simplicia, plerumque superficialia, obpyriformia, nigra, (0.42–)0.52(–0.65) mm diametro. Excipulum externe fuscoatrum, interne pallidum. Periphyses 30–70 µm longae. Asci 8-spori, 90–125 × 35–45 µm. Ascospores submuriformes, pallidofuscae, (30–)45(–56) × (13–)17(–22) µm.

TYPUS: Australia, Tasmania, Vale of Belvoir, 5 km NE of Mayday Mount, near Vale R., 41°33'S, 146°53'E, alt. 850 m, on soil and moribund bryophytes in shallow crevices in a limestone outcrop, 21 May 1993, P.M. McCarthy 645 & G. Kantvilas (HOLOTYPUS: MEL 1057496; ISOTYPUS: HO).

Thallus terricolous and overgrowing moribund bryophytes, granular, effuse, matt, uneven, pale grey to pale grey-green, becoming vivid green when wetted, 30–60 µm thick, ecorticate. *Algae* green, globose, 6–10 µm diam. *Hyphae* 2–4 µm wide. *Prothallus* not apparent. *Perithecia* semi-immersed to superficial and attenuated at the base, numerous, lacking an involucrellum, dull black, obpyriform, with a minutely uneven surface, (0.42–)0.52(–0.65) mm diam. *Perithecial apex* usually somewhat flattened. *Ostiole* apical, in a shallow, 40–60 µm wide depression. *Centrum* globose to obpyriform, 0.25–0.45 mm diam. *Excipulum* brown-black in its outer half, becoming paler within, 40–70 µm thick at the base and sides, 60–90 µm thick near the apex. *Paraphyses* absent. *Periphyses* richly branched, 30–70 µm long. *Hymenial gel* Lugol's I+red-

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brown. *Asci* fissitunicate, clavate, 8-spored, $90\text{--}125 \times 35\text{--}45 \mu\text{m}$. *Ascospores* submuriform, pale brown at maturity, broadly ellipsoid to elongate-ellipsoid or elongate-fusiform, with 6–9 transverse septa, each loculus with (0–)1(–2) longitudinal or diagonal septa, $(30\text{--})45(–56) \times (13\text{--})17(–22) \mu\text{m}$ (80 measured); cell contents granulose, usually monoguttulate. (Figs 1 & 2)

REMARKS

This lichen is characterised by its substratum-preference, the thin, diffuse thallus, prominent and moderately large, obpyriform perithecia, 8-spored asci and pale brown, submuriform ascospores. Among other terricolous-bryophilous species, the Eurasian *P.*

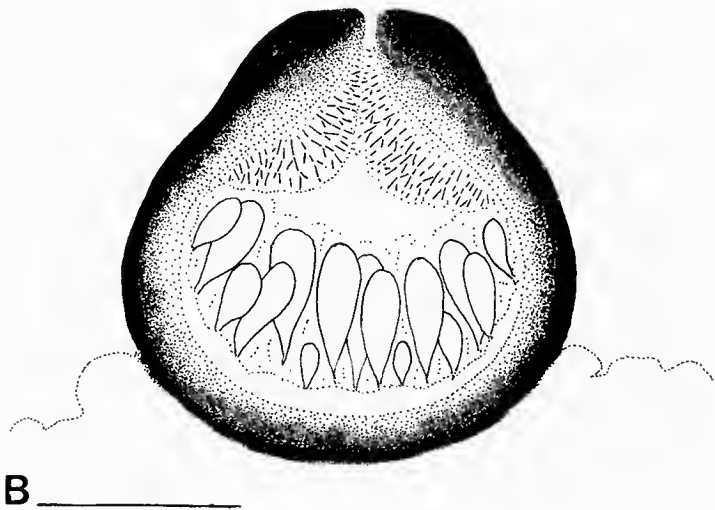
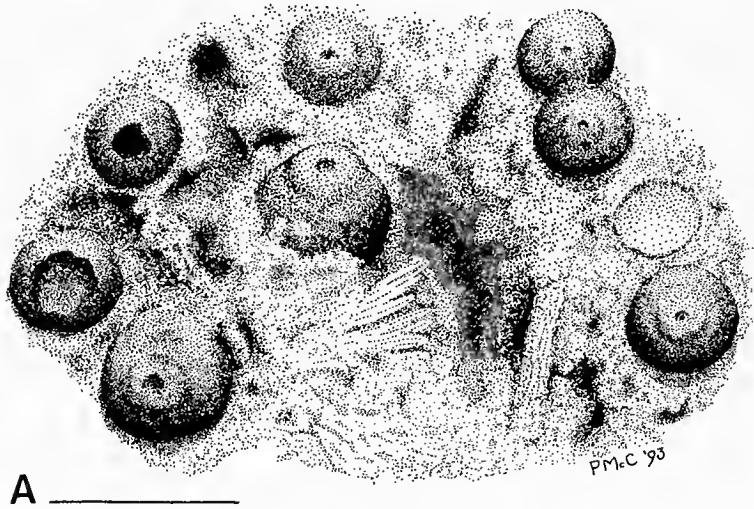


Fig. 1. *Polyblastia australis* (holotypus). a — habit of thallus and perithecia; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm.

gelatinosa (Ach.) Th. Fr. has a darker thallus and discontinuously smaller and more deeply immersed perithecia (Swinscow 1971, Purvis *et al.* 1992). The ascospores of *P. rouxiana* Vězda & Vivant become dark brown at maturity, the perithecia remain immersed and the thallus is blue-green and verruculose (Vězda & Vivant 1973), and, whereas the thalline morphology of the central European *P. philaea* Zschacke is similar to that of the Australian taxon, the perithecia are more deeply immersed, have an involucrellum enclosing the excipulum and ascospores that are fully muriform (Zschacke 1933, Wirth 1980).

Polyblastia australis is similar in appearance to *Agonimia tristicula* (Nyl.) Zahlbr. which is known from Europe and Macaronesia (Purvis *et al.* 1992) and has recently been reported from similar habitats in New South Wales (McCarthy 1991c). However, *Agonimia* has a minutely squamulose or granular thallus, a pseudoparenchymatous cortex with a papillose uppermost layer (clearly seen in *A. tristicula*) and a 3-layered perithecial wall.

The new lichen is currently known only from its type locality in northern Tasmania. It grows mainly on soil and detritus in shallow crevices of limestone outcrops and is associated with *Verrucaria* sp. and *Collema* sp.

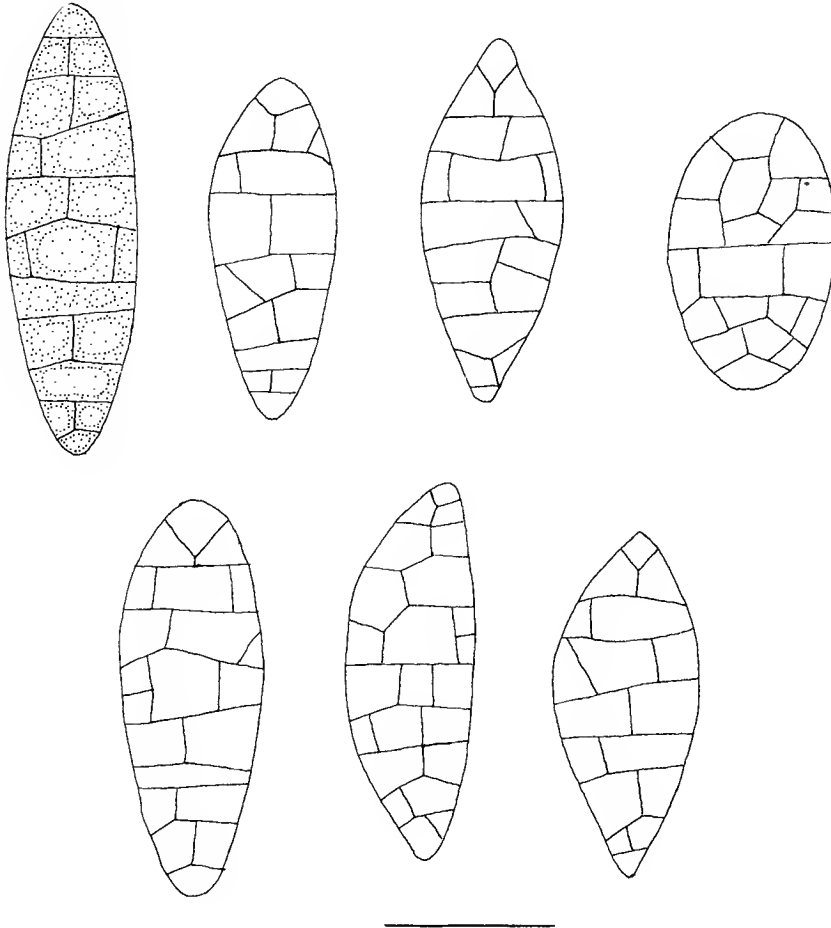


Fig. 2. *Polyblastia australis* (holotypus). ascospores; scale 20 μ m.

Polyblastia cruenta (Körber) P. James & Swinscow, *Lichenologist* 5: 110 (1971).

The thallus of *P. cruenta* is medium to dark grey-brown or greenish black, epilithic, continuous to sparingly rimose and 30–60 µm thick. When wetted it becomes rather gelatinous. Perithecia are very numerous, hemispherical to subglobose, usually covered by a thin thalline layer and (0.46–)0.66(–0.92) mm diam. The involucrellum has a black outer layer, but is hyaline to pale greenish brown within. The asci are broadly clavate, 8-spored and 170–220 × 75–90 µm, and the ascospores are muriform, ellipsoid, hyaline to pale brown and 52–81 × 31–42 µm.

Polyblastia cruenta is one of the more readily recognisable of aquatic pyrenocarpous lichens. Most other species are thin, dark, with inconspicuous perithecia and tend to be difficult to observe in the field, especially when wet. By contrast, the large prominent perithecia of *P. cruenta* allow it to be identified by touch, even when submerged. It is known from aquatic siliceous rocks in Arctic Eurasia and from upland and alpine areas of central Europe, the British Isles and North America (Swinscow 1971, Wirth 1980, Egan 1987, Purvis *et al.* 1992). The discovery of this otherwise boreal lichen in Tasmania follows that of the aquatic *Staurothele fissa* (Taylor) Zwackh (McCarthy 1993), and while the latter has since been observed in central and eastern Tasmania, neither has been seen on the Australian mainland.

This lichen inhabits aquatic dolerite boulders and bedrock in shaded fast-flowing creeks. It is by far the dominant species in the Arve River locality, west of Geeveston. Elsewhere it is associated with *Hymenelia lacustris* (With.) M. Choisy, *Lichina tasmanica* A. Henssen, *Porina aptrootii* P.M. McCarthy and *Verrucaria hydrela* Ach.

SPECIMENS EXAMINED

Tasmania — Hartz Mtns, Arve Falls, alt. 760 m, on aquatic dolerite, 19 May 1993, P.M. McCarthy 623 & G. Kantvilas (MEL 1057477); Arve R., by bridge on Arve Road, 8.5 km W of Geeveston, alt. 160 m, on aquatic dolerite boulders, 19 May 1993, P.M. McCarthy 621 & G. Kantvilas (HO, MEL 1057465); Central Plateau, Ouse R. at start of Liawenee Canal, alt. 1080 m, on exposed aquatic dolerite, 20 May 1993, P.M. McCarthy 633 & G. Kantvilas (MEL 1057455); Great Western Tiers, Meander R., alt. c. 760 m, on shaded aquatic dolerite, 22 May 1993, P.M. McCarthy 662 & G. Kantvilas (MEL 1057495).

Polyblastia dermatodes Massal., *Symm. Lich.*: 101 (1855).

The thallus of the Tasmanian specimen of *P. dermatodes* is endolithic in limestone and is outwardly visible as a pale grey to pale yellowish brown area. The 0.3–0.55 mm diam. perithecia are immersed in pits with only their black, plane to convex apices visible. They lack an involucrellum and have a concave to gaping ostiole and an excipulum that is dark brown to black above and concolorous or somewhat paler below. The asci contain 8 colourless, submuriform ascospores measuring 28–52 × 15–22 µm. The latter have 3–5(–7) transverse septa, with most loculi divided by a single longitudinal or diagonal septum.

Prior to the current report, *P. dermatodes* was known only from central and northern Europe (Zschacke 1933, Swinscow 1971, Wirth 1980, Clauzade & Roux 1985, Purvis *et al.* 1992). The Tasmanian specimen inhabits an exposed limestone outcrop in the northern uplands and grows with *Caloplaca* spp., *Placynthium nigrum* (Hudson) S. Gray, *Rinodina* sp., *Thelidium papulare* (Fr.) Arnold, *Verrucaria baldensis* Massal. *V. papillosa* Ach. and *V. nigrescens* Pers.

SPECIMEN EXAMINED

Tasmania — Vale of Bellevoir, 5 km NE of Mayday Mount, near Vale R., alt. 850 m, on limestone, 21 May 1993, P.M. McCarthy 699 & G. Kantvilas (MEL 1057502).

ACKNOWLEDGEMENTS

I am grateful to Dr G. Kantvilas for assistance in the field and to Australian Biological Resources Study for financial support.

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Manuscript received 3 December 1993.

NOTES ON AUSTRALIAN VERRUCARIACEAE (LICHENISED ASCOMYCOTINA). 5. *STAUROTHELE PALLIDOPORA* SP. NOV. FROM SOUTH-EASTERN QUEENSLAND

P.M. MCCARTHY*

ABSTRACT

McCarthy, P.M. Notes on Australian Verrucariaceae (lichenised Ascomycotina). 5. *Staurothele pallidopora* sp. nov. from south-eastern Queensland. *Muelleria* 8:(3): 275–277 (1995). — *Staurothele pallidopora* is described from the Bunya Mountains in south-eastern Queensland where it inhabits siliceous rocks in subtropical rainforest.

INTRODUCTION

Staurothele Norman, a genus of crustose, pyrenocarpous lichens with muriform ascospores and hymenial algae, is already represented in Australia by the anti-tropical and aquatic *S. fissa* (Taylor) Zwackh (McCarthy 1993). A second species was recently collected in the Bunya Mountains, south-eastern Queensland and is described here.

Staurothele pallidopora P.M. McCarthy, sp. nov.

Thallus epilithicus, rimosus, pallido griseus vel pallido griseobrunneus, 50–100 μm crassus. Perithecia fere omnino immersa, 0.35–0.65 mm diametro. Involucrellum fuscoatrum vel atrum, 40–95 μm crassum, ad basim excipuli descendens. Ostiolum pallidum. Centrum 0.22–0.36 mm diametro. Periphyses 25–40 \times 2–3 μm . Algae hymenii elongatae-cylindricae, (4–)6–10(–12) \times 1.5–2(–2.5) μm . Asci 8-sporeae. Ascosporeae muriformes, incoloratae vel pallidofuscae, (18–)23(–28) \times (9–)11.5(–14) μm .

TYPUS: Australia, Queensland, Bunya Mountains National Park, 50 m below Little Falls, 26°52'S, 151°35'E, on dry shaded siliceous rocks, 5 Sep. 1993, P.M. McCarthy 768 (HOLOTYPUS: MEL; ISOTYPUS: BRI).

Thallus crustose, epilithic, determinate, matt, \pm smooth, pale grey to pale grey-brown, richly rimose to areolate (mainly around perithecia), becoming greenish when wetted, 50–100 μm thick. Thallus ecorticate, but with an upper, alga-free layer, 10–20(–25) μm thick; cells hyaline, rounded to angular, 3–6(–7) μm wide. *Algae* green, globose, scattered throughout the middle and lower layers of the thallus, (3–)5–7(–10) μm diam. *Interstitial hyphae* 3–5 μm diam. *Prothallus* black and continuous or not apparent. *Perithecia* numerous, 2/3 immersed to almost entirely immersed in the thallus. *Perithecial apex* crateriform, 100–180 μm diam.; ostiole and periostiolar area pale grey-brown, surrounded by a black, involucrellar ring. *Involucrellum* 0.35–0.65 mm diam., brownish-black to black in thin-section, contiguous with the excipulum and 40–65 μm thick above, spreading below, 50–95 μm thick, and penetrating to excipulum-base level. Cells between the lower levels of the involucrellum and the excipulum globose, 3–6 μm diam., with pale to dark brown walls. *Centrum* globose to depressed-ovate, 0.22–0.36 mm diam. *Excipulum* uniformly medium to dark brown, 18–25 μm thick. *Periphyses* unbranched, tightly packed, 25–40 μm long, 2–3 μm wide, often with slightly swollen apices. *Paraphyses* absent. *Hymenial gel* Lugol's I+ red-brown. *Hymenial algae* elongate-cylindrical, (4–)6–10(–12) \times 1.5–2(–2.5) μm . *Asci* fissitunicate, clavate to cylindro-clavate, 8-spored, 65–90 \times 25–30 μm . *Ascospores* colourless to pale yellowish brown, narrowly to broadly ellipsoid, massed in the ascus, muriform, with 5–7 irregularly transverse divisions, each loculus with 1(–2) longitudinal or diagonal divisions, (18–)23(–28) \times (9–)11.5(–14) μm (50 measured); contents usually finely granular. *Conidiomata* not seen. (Fig. 1)

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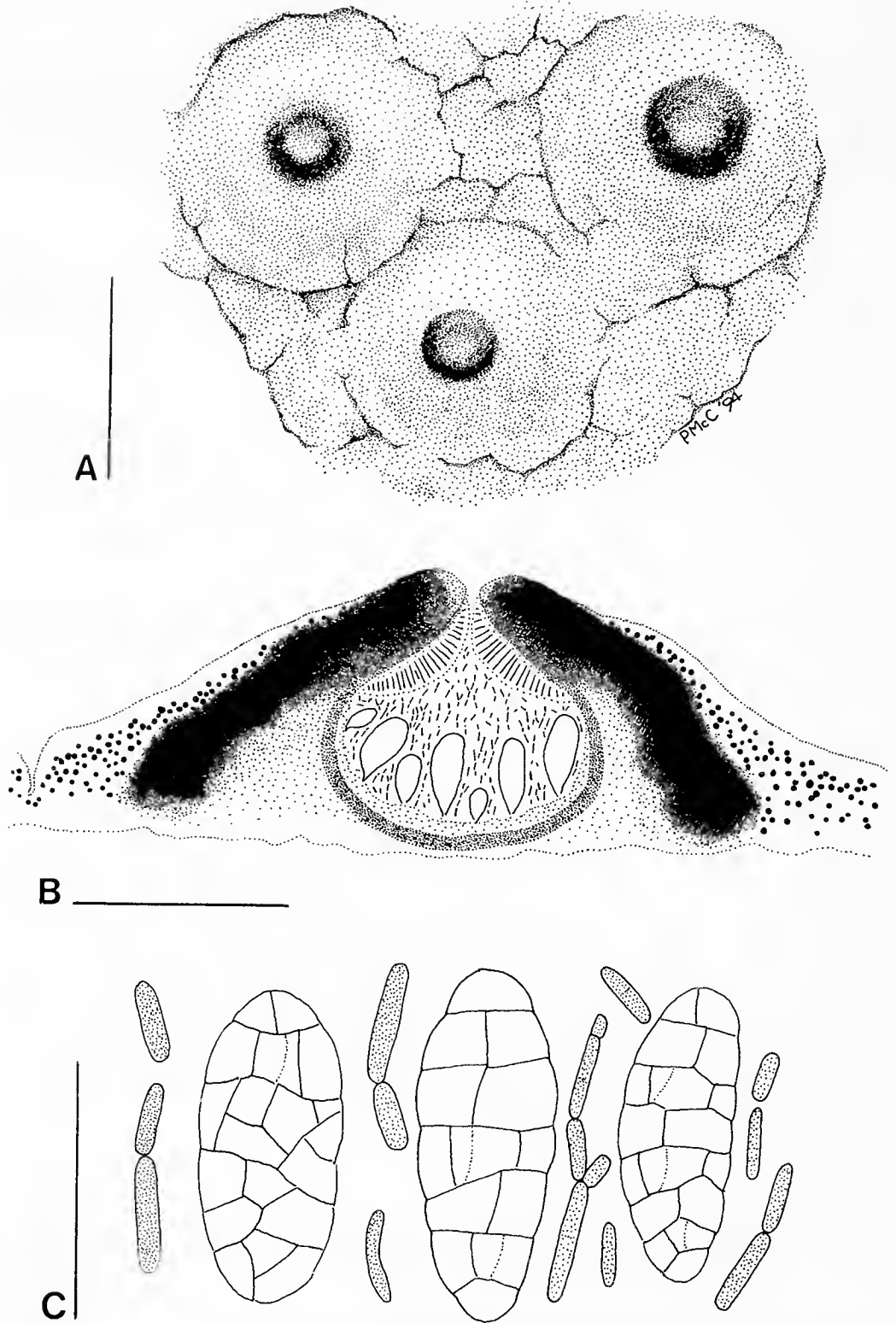


Fig. 1. *Staurothele pallidopora* (holotypus). a — habit of thallus and perithecia; scale 0.5 mm. b — vertical section of perithecium and adjacent thallus; scale 0.2 mm. c — ascospores and hymenial algae; scale 20 μ m.

REMARKS

The new lichen is characterized by the pale, epilithic thallus and immersed perithecia. The latter have a pale apex, a well-developed involucrellum, elongate hymenial algae, 8-spored asci and small, pale ascospores. It is related to *S. hymenogonia* (Nyl.) Th. Fr., a rather common lichen on dry limestone, chalk and mortar in temperate and cooler regions of the Northern Hemisphere. That species, however, has a mainly endolithic thallus, prominent and often pruinose perithecia with dark ostioles, larger ascospores and less elongate hymenial algae (Clauzade & Roux 1985, Purvis *et al.* 1992).

Staurothele pallidopora is known only from subtropical rainforest in the Bunya Mountains in south-eastern Queensland, Australia. The type specimens inhabit shaded, terrestrial rocks in association with *Strigula stigmatella* (Ach.) R.C. Harris, *Verrucaria* sp., *Porina* aff. *guentheri* (Flotow) Zahlbr. and *P.* aff. *hyperleptalea* P.M. McCarthy & Kantvilas. A second collection inhabited semi-aquatic basalt together with *Anisomeridium carinthiacum* (J. Steiner) R.C. Harris, *Hymenelia lacustris* (With.) M. Choisy, *Verrucaria hydrela* Ach. and *V. praetermissa* (Trevis) Anzi.

The specific epithet *pallidopora* refers to the pale perithecial ostiole which is highlighted by the darkness of the surrounding involucrellum.

ADDITIONAL SPECIMEN EXAMINED

Queensland — Bunya Mountains National Park, between Paradise Falls and Little Falls, on semi-aquatic basalt, 5 Sep. 1993, P.M. McCarthy 760 (MEL).

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SARCOLOBUS RUBESCENS (ASCLEPIADACEAE: MARSDENIEAE), A NEW SPECIES FROM PAPUA NEW GUINEA¹

PAUL I. FORSTER*

ABSTRACT

Forster, P.I. *Sarcolobus rubescens* (Asclepiadaceae: Marsdenieae), a new species from Papua New Guinea. *Muelleria* 8(3): 279–282 (1995). — *Sarcolobus rubescens* P.I. Forst. *sp. nov.*, from Madang Province, Papua New Guinea is described and illustrated, with notes on its affinities and habitat. A key is provided to the species of *Sarcolobus* in Papuasias.

INTRODUCTION

The genus *Sarcolobus* R.Br. occurs in Australia, Papuasias (Irian Jaya, Papua New Guinea, Solomon Islands), other parts of Malesia and some island groups in the Western Pacific (Forster 1991, 1992, 1993). Ten species were recognised for Papuasias in a recent revision (Forster 1991). During a collecting trip to Papua New Guinea in July 1992, flowering material of an additional and undescribed species of *Sarcolobus* was obtained. It is described here as a new species and an updated key to the species that occur in Papuasias is provided. The system of corona morphology proposed by Liede and Kunze (1993) is adopted here for the species description and species key.

TAXONOMY

Sarcolobus rubescens P.I. Forst., *sp. nov.*

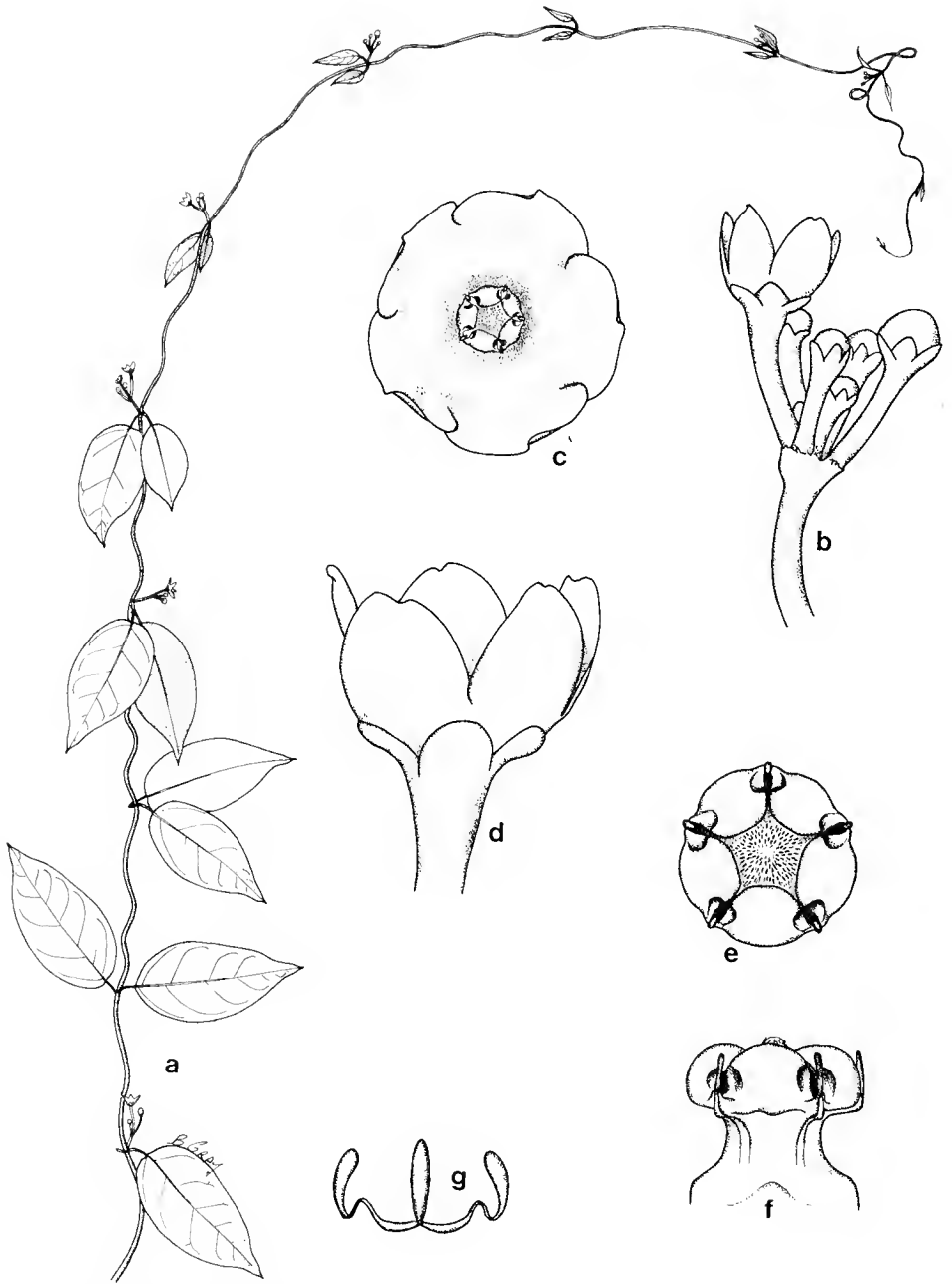
Affinis *S. globoso* subsp. *peregrino* (Blanco) Rintz a qua floribus perminoribus (5–7 mm diametro) lobis corollae triangularibus, pollinio ellipsoideo, praesentia coronae annularis, absentia coronae staminalis quinquelobata, differt.

TYPUS: Papua New Guinea, Madang Province — near Boroi Village No. 1, 4° 05'S, 144° 46'E, 15 July 1992, P.I. Forster 10932 & D.J. Liddle (HOLOTYPE: BRI, 2 sheets & spirit. ISOTYPE: K, L, LAE, MEL, QRS *distribuendi*).

Wiry vine to 4 or 5 m long, roots fibrous; latex white. *Stems* cylindrical, glabrous; internodes up to 110 mm long and 2 mm diameter. *Leaves* petiolate; petioles 5–8 mm long, c. 0.8 mm diameter, grooved along top and with scattered trichomes; lamina ovate to elliptic-ovate, up to 100 mm long and 50 mm wide, lateral veins 5 or 6 per side of midrib, ± glabrous; upper surface mid-green, venation weakly developed; lower surface pale green, venation well developed; tip mucronate to shortly acuminate; base rounded to weakly cordate; colleters 4 to 6 at base of lamina, subulate. *Inflorescence* umbelliform, up to 8 mm long; peduncle 5–6 mm long, 1–1.2 mm diameter, glabrous; bracts triangular, c. 0.2 mm long and 0.2 mm wide, glabrous, ciliate. *Flowers* c. 4 mm long, 5–7 mm diameter; pedicels 5–6 mm long, c. 1 mm diameter, glabrous. *Sepals* broadly ovate, 1.6–1.7 mm long, c. 1.2 mm wide, glabrous or with scattered trichomes, ciliate. *Corolla* flattened-campanulate, cream-yellow with reddish longitudinal striping; tube c. 2 mm long and 4 mm diameter, glabrous; lobes triangular-obovate, 2.6–2.8 mm long, 2.6–2.8 mm wide, externally glabrous, internally with a few cilia near the edges. *Corolline corona* absent. *Annular corona* comprising a ridge around the base of the staminal column. *Staminal corona* absent. *Staminal column* c. 1.5 mm long and 1 mm diameter, somewhat embedded in corolla at base; anther appendages truncate, c. 1 mm long; alar fissure c. 0.3 mm long, not continuing down staminal column below base

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¹ Christensen Research Institute Contribution No. 115.



Sarcolobus rubescens a — habit of flowering stem $\times 0.5$. b — inflorescence $\times 3$. c — face view of flower $\times 6$. d — side view of flower $\times 6$. e — face view of staminal column $\times 22$. f — side view of staminal column $\times 22$. g — pollinarium $\times 42$. From Forster 10932 & Liddle. Del. B. Gray.

of anthers. *Stylar-head* pentagonal, depressed-globose, c. 0.7–0.8 mm diameter. *Pollinaria* c. 0.32 mm long and 0.5 mm wide; pollinia ellipsoid, 0.18–0.21 mm long, 0.07–0.08 mm wide; corpusculum narrow-oblong, c. 0.32 mm long and 0.06 mm wide; caudicles c. 0.32 mm long and 0.03 mm wide, geniculate c. 0.23 mm from point of attachment to the corpusculum. *Fruit* and seed not seen. (Fig. 1)

ETYMOLOGY

The specific epithet is derived from the Latin word '*rubescens*' and refers to the colour of the striping on the corolla, viz. turning red.

DISTRIBUTION

Sarcolobus rubescens is known only from the type locality in Madang Province in Papua New Guinea. The area is poorly collected and further populations could be expected elsewhere in mangrove communities.

HABITAT NOTES

Sarcolobus rubescens grows as a slender liane over mangrove vegetation just above the daily zone of saltwater intrusion. Associated species include *Aegicerus corniculatum*, *Cynanchum carnosum*, *Finlaysonia obovata*, *Hoya pottsii*, *Hydnophytum mosel-yanum*, *Phyla nodiflora*, *Sarcolobus retusus* and *S. vittatus*.

AFFINITIES

The genus *Sarcolobus* is somewhat unique amongst Australian and Papuanian asclepiads in the frequent sympatry of related species. This situation is only approximated and much exceeded in the richly speciose genus *Hoya*. In the Papuanian mangrove-dwelling taxa of *Sarcolobus*, it is not unusual for *S. retusus*, *S. vittatus*, *S. oblongus* and *S. globosus* subsp. *peregrinus* to be sympatric in various combinations of two to three species. *S. rubescens* would appear to be a further example of this, as it is sympatric with *S. retusus* and *S. vittatus* at Boroï Village.

Sarcolobus rubescens appears to be most closely related to *S. globosus* subsp. *peregrinus* on morphological grounds, and has similarities in the flattened-campanulate corolla, the annular corona at the base of the staminal column, and the reddish longitudinal striping on the corolla. Notable differences from *S. globosus* subsp. *peregrinus* are the much smaller flowers with triangular corolla lobes, the ellipsoid pollinia, and the absence of a staminal corona of 5 lobes. Any suggestion of recent hybrid origin for *S. rubescens* can also be rejected as none of the characters described suggest intermediacy between *S. retusus* and *S. vittatus*.

KEY TO THE SPECIES OF SARCOLOBUS IN PAPUASIA

1. Anther wings extending down staminal column below anthers2
1. Anther wings not extending down staminal column below anthers4
2. Staminal corona absent **S. oblongus**
2. Staminal corona present3
3. Flowers < 3 mm diameter; staminal coronal lobes spatulate **S. spathulatus**
3. Flowers > 3 mm diameter; staminal coronal lobes lanceolate-ovate to oblong **S. globosus** subsp. **peregrinus**
4. Annular or corolline corona present5
4. Annular or corolline corona absent7
5. Corolline corona comprising 5 ridges in corolla throat terminating in 5 small free lobes; plant of mountains **S. kaniensis**
5. Corona either corolline comprising 5 ridges or bulges in corolla throat, or annular around the base of the staminal column; small free lobes on corolline corona absent6
6. Corona annular and comprising a ridge around the base of the staminal column **S. rubescens**

6. Corona corolline and comprising 5 small bulges just below top of corolla tube **S. vittatus**
7. Staminal corona absent; plant of mangroves **S. retusus**
7. Staminal corona present; plant of mountains or woodlands **8**
8. Leaf lamina ovate-elliptic; corolla lobes with ridging in centre towards base **S. porcatus**
8. Leaf lamina elliptic to lanceolate-ovate; corolla lobes without ridging in centre towards base **9**
9. Flower pedicels 5–10 mm long; flowers 8–10 mm diameter **S. hullsii**
9. Flower pedicels 1–4 mm long; flowers 3–4 mm diameter **10**
10. Tertiary venation in leaf lamina obscure below; corolla campanulate to weakly subrotate **S. brachystephanus**
10. Tertiary venation in leaf lamina reticulate and prominent below; corolla rotate **S. secamonoides**

ACKNOWLEDGEMENTS

The illustrations were drawn by B. Gray supported by a grant from the Joyce W. Vickery Scientific Research Fund of the Linnean Society of New South Wales. Field work in Papua New Guinea was made possible by the award of a Christensen Research Institute Fellowship in 1992 and Dr M. Jebb, Director of CRI at the time, is thanked for his assistance. Assistance with fieldwork in P.N.G. was provided by D.J. Liddle and T. Daniel (CAS). Translation of the diagnosis into Latin was undertaken by L.A. Craven (CANB) and P.D. Bostock (BRI).

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A NEW SPECIES OF *RYTIDOSPERMA* (POACEAE: ARUNDINAE) IN NEW SOUTH WALES AND VICTORIA

H.P. LINDER * & N.G. WALSH**

ABSTRACT

Linder, H.P. & Walsh N.G. A new species of *Rytidosperma* (Poaceae: Arundinae) in New South Wales and Victoria. *Muelleria* 8(3): 283–285 (1995). — A new subalpine species of *Rytidosperma* is described and illustrated. The features distinguishing it from its closest congeners *R. erianthum* and *R. tenuis* are outlined. The generic position of *Rytidosperma* with respect to *Danthonia* is briefly discussed.

INTRODUCTION

In the course of preparing an account of the Australian members of the tribe Arundinae for the *Flora of Australia* (HPL) and keys and descriptions of Victorian Poaceae (NW), the existence of a distinct, undescribed taxon became evident. Further descriptions, combinations and generic delimitations within the tribe, as well as a detailed justification of the proposed taxonomy, will appear in a larger work currently in preparation by HPL.

TAXONOMY

***Rytidosperma oreophilum* H.P.Linder & N.G.Walsh sp. nov.**

R. eriantho (Lindl.) Connor & Edgar et *R. tenui* (Steud.) Connor & Edgar affinis; a *R. eriantho* setis lateralibus (ad 3.5 mm) lobis lateralibus brevioribus, non glumam superantibus, lemmatis dorsalibus saepe pilis dispersis; a *R. tenui* paleis obovatis latis, dorsalibus pilosis, lemmatis nitentibus differt.

TYPUS: ACT, Slopes of Mt Gingera, Bimberi Range, alt. 1700 m a.s.l., 24 Jan. 1962, *R. Pullen 3041* (HOLOTYPE: CANB; ISOTYPE: L, A, BO, K, MEL, NE, NSW).

Caespitose perennial, 15–25 mm diam. at ground level, 15–45 cm high. *Leaf lamina* to 15 cm long, 1.5–2 mm wide, expanded, flat when dry, with scattered tubercle-based hairs (these extending to sheaths); ligule minutely ciliate, c. 0.1 mm long; hairs at orifice of sheath to c. 2 mm long. *Inflorescence* a raceme or slender panicle with 1 or 2 branches, contracted (but open at anthesis), obliquely ovate, 15–60 mm long, 10–40 mm wide; pedicels villous; spikelets 4–20, 12–17 mm long, usually with 5 or 6 florets; glumes acute or acuminate, 12–17 mm long, 2.5–3 mm wide, slightly exceeding florets, green with broad, purple margins, or entirely purplish, 5-veined; body of lemma 2.4–3.7 mm long, with hairs in discrete tufts arranged in 2 complete transverse rows; upper row of hairs 0.5–1 mm below sinus, with hairs 2–6 mm long, c. equalling the flattened part of lateral lobes; lower row of hairs 1.2–2 mm long, \pm reaching the upper row; lemma back between rows with scattered hairs, rarely quite glabrous between rows; lateral lobes of lemma 5.4–8.5 mm long (including setae of 2–3.3 mm); setae distinctly shorter than flattened portion of lobes; central awn 7.5–10 mm long, twisted in the basal 2.5–3.5 mm; palea obovate, 2.8–4.2 mm long, 1.2–1.8 mm wide, rounded at apex, slightly exceeding lemma sinus, glabrous except minute marginal cilia, and sometimes with slender tufts of hairs near the base. (Fig. 1)

REPRESENTATIVE SPECIMENS SEEN (24 specimens examined):

New South Wales (including ACT) — **Southern Tablelands:** Cabramurra Road, halfway between turnoff and Cabramurra, 25 Feb. 1955, *N.T. Burbidge 3908* (CANB); Mt Gingera, 17 Jan. 1958, *M.A. Gray 4478* (CANB); Blackfellows Gap, 24 Feb. 1959, *M.A. Gray 6346* (CANB); Lower N slope of Mt Gingera, Bimberi

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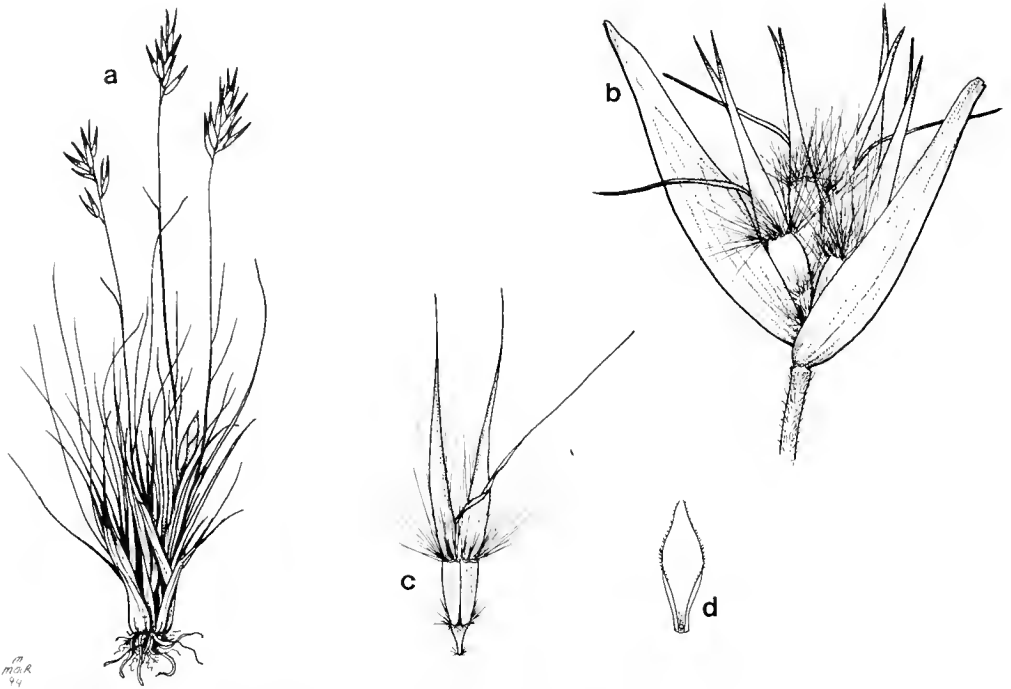


Fig. 1. *Rytidosperra oreophilum*. a — habit $\times 0.5$. b — spikelet $\times 4$. c — lemma, dorsal view $\times 4$. d — palea, ventral view $\times 4$. all from *Albrecht 1553* (MEL).

Range, 10 Jan. 1961, *R. Pullen 2550* (CANB); Mt Bimberi, near summit, 17 Mar. 1960, *M.A. Gray 5101* (CANB).

Victoria — Feathertop Razorbaek, Jan. 1955, *A. Costin s.n.* (CANB); Bogong High Plains, Feb. 1955, *A. Costin s.n.* (CANB); The Razorbaek, between Mts Feathertop and Hotham, 1 Feb. 1969, *L. Craven 1518* (CANB); 1 km west of Mt Maeleod on Buffalo Plateau, 26 Jan. 198, *N.G. Walsh 761* (MEL); Mt Bogong, Feb. 1923, *A.J. Tadgell s.n.* (MEL); Nunniong Plains Rd, between W7 and Horse Flat, 19 Jan. 1971, *A.C. Beauglehole 36266* (MEL, NSW); On traek below Snowy Range Airfield and Mt Reynard, 28 Jan. 1984, *D.E. Albrecht 145* (MEL, BR1); The Bluff, 26 Jan. 1985, *D.E. Albrecht 1553* (MEL).

DISTRIBUTION AND CONSERVATION STATUS

Occurs patchily along the Great Dividing Range and nearby mountains from Mt Gingera (c. 35 km south-west of Canberra) southward to the Snowy Range (c. 65 km north of Heyfield) in Victoria. It is locally common, and not considered threatened. Most of its habitat is contained within the Alpine National Park.

HABITAT

Rytidosperra oreophilum grows in grassland, open heathland or as scattered plants on rock outcrops (granite, basalt or sandstone/mudstone parent material) at or above c. 1600 m altitude.

ETYMOLOGY

The epithet is derived from Greek, meaning 'mountain-loving', from the species' habitat preference.

DISCUSSION

Specimens agreeing with *R. oreophilum* were regarded by Vickery (1956) as a form of *Danthonia eriantha* Lindl. (= *Rytidosperra erianthum* (Lindl.) Connor & Edgar) and most subsequent authors (e.g. Burbidge & Gray 1970, Willis 1970) appear to have

followed Vickery's assessment. Walsh (1994) regarded *R. oreophilum* as an alpine form of *Danthonia tenuior* Steud. (= *Rytidosperma tenuis* (Steud.) Connor & Edgar). Indeed, the northern populations show a stronger superficial resemblance to *R. erianthum*, whereas southern populations are closer to *R. tenuis*. It is possible that *R. oreophilum* is of hybrid origin between these two species. It is distinguished from *R. erianthum* by the setae on the lateral lobes of the lemma being much shorter than the flattened part of the lobes, always included within the glumes, the lemma often with scattered hairs between the two rows of hair-tufts, and the more compact ovate inflorescence. From *R. tenuis* it is recognized by the broader, obovate palea that is glabrous abaxially, and by the compact ovate (c.f. linear) inflorescence. In exposed conditions on rock outcrops, plants of *R. oreophilum* may resemble *R. alpicola* (Vickery) Connor & Edgar, a specialist in such habitats. *R. alpicola* is readily distinguished by the thicker, broader leaves, and the long, narrow palea that clearly exceeds the lemma sinus and approaches the level of the setiform part of the lateral lobes.

The placement of the new species in *Rytidosperma* rather than a more widely circumscribed concept of *Danthonia* follows a review of the Arundineae by one of us (HPL), in which at least some of the segregate genera commonly included in *Danthonia* are clearly distinct (see also Zotov 1963, Blake 1972, Connor & Edgar 1979, Clayton & Renvoize 1986), and will be recognized in the forthcoming treatment for the *Flora of Australia*.

ACKNOWLEDGEMENTS

We are very grateful to Mali Moir (MEL) for her illustration of *Rytidosperma oreophilum*.

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NOTES ON *PROTOGLOSSUM* (FUNGI: CORTINARIALES)

TOM W. MAY*

ABSTRACT

May, Tom. W. Notes on *Protoglossum* (Fungi: Cortinariales). *Muelleria* 8(3): 287–289 (1995). — The genus *Cortinomyces* Bougher & Castellano is superfluous and the species included therein should be placed in *Protoglossum* Masee. *C. effodiendus* (G.Cunn.) Bougher & Castellano is shown to be a synonym of *P. luteum* Masee.

INTRODUCTION

Bougher & Castellano (1993) introduced four new genera to accommodate mostly Australian species previously referred to *Hymenogaster* Vittad. Whilst the recognition of segregate genera is warranted, one of the new genera, *Cortinomyces* Bougher & Castellano, is illegitimate because its designated type (*Protoglossum luteum* Masee) is also the type of the earlier valid genus *Protoglossum* Masee. There is no doubt that *P. luteum* is the type of *Protoglossum* because it was the only species dealt with by Masee (1891) when he first described the genus. *Cortinomyces* is thus an obligate synonym of *Protoglossum*. Bougher & Castellano (1993) place seven species in *Cortinomyces*. The correct name for *Cortinomyces luteus* (Masee) Bougher & Castellano is *P. luteum*, *C. effodiendus* (G.Cunn.) Bougher & Castellano is treated here as a synonym of *P. luteum*, and new combinations in *Protoglossum* are proposed below for the other five species.

METHODS

Colour notations are from Munsell (1975; 1977). Observations on spores were made on small pieces of the tramal plates mounted in 3% KOH. Spore dimensions include neither ornamentation nor the hilar appendage. Q is the quotient of the length and the width of an individual spore.

NEW COMBINATIONS IN *PROTOGLOSSUM*

Protoglossum Masee, *Grevillea* 19: 97 (1891) TYPE: *P. luteum* Masee [only species].

Cortinomyces Bougher & Castellano, *Mycologia* 85: 277 (1993) *nom. superfl.* TYPE: *P. luteum* Masee [by designation].

1. ***Protoglossum cribbiae*** (A.H.Sm.) T.W.May *comb. nov.*

BASIONYM: *Hymenogaster cribbiae* A.H.Sm., *Mycologia* 58: 105 (1966) *nom. nov.* for *Gymnoglossum viscidum* J.W.Cribb non *H. viscidus* (Masee & Rodway) C.W.Dodge & Zeller (1934).

Cortinomyces cribbiae (A.H.Sm.) Bougher & Castellano *Mycologia* 85: 279 (1993).

Gymnoglossum viscidum J.W.Cribb, *Pap. Dept. Bot. Univ. Queensland* 3: 158 (1958).

2. ***Protoglossum niveum*** (Vittad.) T.W.May *comb. nov.*

BASIONYM: *Hymenogaster niveus* Vittad., *Monogr. Tuberc.* 24 (1831) [not seen, citation from Bougher & Castellano (1993)].

* National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Ave, South Yarra, Victoria, Australia 3141

Cortinomyces niveus (Vittad.) Bougher & Castellano, *Mycologia* **85**: 280 (1993) [as '(Cribb) Bougher & Castellano'].

3. *Protoglossum purpureum* (J.W.Cribb) T.W.May comb. nov.

BASIONYM: *Hymenogaster purpureus* J.W.Cribb, *Pap. Dept. Bot. Univ. Queensland* **3**: 127 (1956).

Cortinomyces purpureus (J.W.Cribb) Bougher & Castellano, *Mycologia* **85**: 280 (1993).

4. *Protoglossum violaceum* (Massee & Rodway) T.W.May comb. nov.

BASIONYM: *Hymenogaster violaceus* Massee & Rodway, in Massee, *Bull. Misc. Inform.* **1898**: 127 (1898).

Arcangeliella violacea (Massee & Rodway) C.W.Dodge, *Compar. Morph. Fungi* **487** (1928).

Dendrogaster violaceus (Massee & Rodway) G.Cunn., *Proc. Linn. Soc. New South Wales* **59**: 172 (1934).

Gymnoglossum violaceum (Massee & Rodway) G.Cunn., *New Zealand J. Sci. Technol.*, sect. B, **22**: 300 (1941).

Cortinomyces violaceus (Massee & Rodway) Bougher & Castellano, *Mycologia* **85**: 280 (1993).

5. *Protoglossum viscidum* (Massee & Rodway) T.W.May comb. nov.

BASIONYM: *Hysterangium viscidum* Massee & Rodway, in Massee, *Bull. Misc. Inform.* **1898**: 127 (1898).

Hymenogaster viscidus (Massee & Rodway) C.W.Dodge & Zeller, *Ann. Missouri Bot. Gard.* **21**: 642 (1934).

Cortinomyces viscidus (Massee & Rodway) Bougher & Castellano, *Mycologia* **85**: 280 (1993).

PROTOGLOSSUM LUTEUM AND HYMENOGASTER EFFODIENDUS

6. *Protoglossum luteum* Massee, *Grevillea* **19**: 97 (1891).

Hymenogaster luteus (Massee) G.Cunn., *Proc. Linn. Soc. New South Wales* **59**: 169 (1934) non Vittad. (1831).

Cortinomyces luteus (Massee) Bougher & Castellano, *Mycologia* **85**: 277 (1993).

Hysterangium atratum Rodway, *Pap. & Proc. Roy. Soc. Tasmania* **1919**: 112 (1920).

Hymenogaster atratus (Rodway) Zeller & C.W.Dodge, in C.W.Dodge & Zeller, *Ann. Missouri Bot. Gard.* **21**: 656 (1934).

H. effodiendus G.Cunn., *Trans. Roy. Soc. South Australia* **75**: 14 (1952) [new synonym].

C. effodiendus (G.Cunn.) Bougher & Castellano, *Mycologia* **85**: 279 (1993).

Following Bougher & Castellano (1993), *Hysterangium atratum* is accepted as a synonym of *P. luteum*, which species is distinguished from *P. viscidum* by its less elongate spores. Bougher & Castellano (1993) note that there is a 'very close similarity' of microscopic characters between *Hymenogaster effodiendus* (known only from the type from Glenelg R., Victoria) and *P. luteum*, but choose to keep the two species separate pending the availability of further collections.

The sole distinguishing character which Bougher & Castellano (1993) use to justify the recognition of *H. effodiendus* is the 'bright yellow peridium when young' in contrast to the peridium of *P. luteum* which they describe as 'copper red becoming dark brown'. In fact, Cunningham (1952) gives the colour of *H. effodiendus* as 'when fresh bright yellow, drying reddish brown', and in the original description of *P. luteum*, Massee (1891) mentions that the subterranean portion of the peridium is yellowish whilst the exposed portion is orange.

Four collections of *P. luteum* at MEL all have the distinctive subglobose to broadly ellipsoid spores [$9.5\text{--}13 \times 8\text{--}9(-10)\ \mu\text{m}$, $Q = 1.05\text{--}1.33(-1.44)$] described by Bougher & Castellano (1993) for that species. Amongst these collections, one (*T.W. May M352 & B.A. Fuhrer*) when fresh had the upper peridium reddish brown (2.5YR 3/6, 4/6, 5/6) and the lower peridium yellow (2.5Y 7/6–8/8), but is more or less uniformly yellow after freeze drying. In an air dried collection (*G. Beaton s.n.*) both yellow and reddish brown colours are present in dried material. Another collection (*T.W. May 1065 & B.A. Fuhrer*) is yellow in a photo of fresh material, and after air drying is orange brown. Collections of *P. luteum* thus show a range of combinations of yellow and reddish brown colours, presumably related to age and degree of exposure of the peridium, and to the method of preservation. *Hymenogaster effodiendus* has peridium colours which fall within this range, and given that its micro-characters are identical to those of *P. luteum* (Bougher & Castellano, 1993), there is insufficient hiatus to warrant its recognition.

COLLECTIONS EXAMINED

Victoria — **Victorian Volcanic Plain Region**: side track off Elbow Ford Rd., 2.9 km N Portland-Nelson Rd., 24 June 1991, *T.W. May 1065 & B.A. Fuhrer* (MEL); **Midlands Region**: side track off Skipton Rd., 14 miles from Ballarat, 26 June 1964, *G. Beaton s.n.* [incorrectly determined by Beaton as *Hymenogaster viscidus*] (MEL 1053589); Lerderberg State Park, Blue Gum Track, 4.5 km S O'Briens Track, 23 July 1983, *T.W. May M-352 & B.A. Fuhrer* (MEL); **Gippsland Plain Region**: Melbourne, Blackburn, Blackburn Lake, 1983, *T.W. May BL-49* (MEL).

ACKNOWLEDGEMENTS

I thank Bruce Fuhrer for helpful discussions. This research was supported by an Australian Biological Resources Study grant.

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BATRACHOSPERMUM ANTIPODITES SP. NOV.
(BATRACHOSPERMACEAE): A WIDESPREAD FRESHWATER RED ALGA
IN EASTERN AUSTRALIA AND NEW ZEALAND

TIMOTHY J. ENTWISLE*

ABSTRACT

Entwisle, Timothy J. *Batrachospermum antipodites* sp. nov. (Batrachospermaceae, Rhodophyta): a widespread freshwater red alga in eastern Australia and New Zealand. *Muelleria* 8(3): 291–298 (1995). — *Batrachospermum antipodites* is a widespread red alga in mountain streams of New Zealand and eastern Australia. It differs from all other members of the section *Batrachospermum* in having primary fascicles consisting entirely of cylindrical cells with an apical dilation; carpogonia 19–39 µm long, borne on a branch consisting of cells similar to (but shorter than) those in fascicles, and with a sessile and club-shaped trichogyne; and with gonimoblasts sparse, 1 (rarely 2) per whorl and 70–200 µm in diameter. Comparisons with various type materials and published accounts show this to be a unique combination of characters in the section. The sectional classification of *Batrachospermum* is again challenged, and further refinements are suggested.

INTRODUCTION

This is the fifth paper in a series on the freshwater red algae of the Australian region, comprising a reconnaissance survey of south-eastern Australia (Entwisle & Kraft 1984), the description of a new genus from eastern Australia (Entwisle 1989), a re-evaluation of the *Batrachospermum atrum* complex including the description of a new species (Entwisle 1992), and an historical review of the discovery of Batrachospermalean taxa in Australia and New Zealand (Entwisle 1993). Considerable collections of *Batrachospermum* have been located in Australian and New Zealand herbaria, stimulating an appraisal of species concepts (see also Entwisle 1993) and necessitating the establishment of a number of new taxa. As with the recent description of *B. diatyches* Entwisle (1992), the recognition of new taxa follows detailed comparison with existing type materials where possible and with all relevant published or unpublished data.

A distinctive taxon widespread in Australia and New Zealand has had a chequered nomenclatural history and in this paper it is finally given a legitimate and appropriate name.

MATERIALS AND METHODS

Procedures for preservation and examination of material are as in Entwisle (1992). Data for most taxa have been stored in DELTA format (Dallwitz 1980; Dallwitz *et al.* 1986) and comparisons with other Australian and New Zealand taxa as well as types were made using the INTKEY program.

SPECIES ACCOUNT

***Batrachospermum antipodites* Entwisle sp. nov.**

MISAPPLIED NAMES:

Batrachospermum ectocarpum auct. non Sirodot: Entwisle & Kraft, *Aust. J. Mar. Freshw. Res.* 35: 228 (1984).

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Batrachospermum boryanum auct. non Sirodot: Entwisle, *Proc. Roy. Soc. Victoria* 101: 42 (1989); see also Entwisle & Kraft, *Aust. J. Mar. Freshw. Res.* 35: 254 (note added in proof) (1984).

MANUSCRIPT NAME:

Batrachospermum novae-zealandiae ined. Skuja (see Entwisle 1993).

In sectio *Batrachospermo*, ad *B. gelatinoso* similis sed combinatione sequente characterum: fasciculi secundarii absentes (interdum presentes et ferentes antheridia in thallis veteribus); cellulae fasciculorum primariorum cylindricae delatatione apicali (parietes laterales plerumque, interdum leniter convexi), cellula distalis cylindrica apice rotundato, anguste obovata; rami-cellulae carpogoniales cellulis fasciculis ceteris similes sed breviores; carpogonium 19–30 μm longum, trichogonium sessile clavatum; gonimoblasti rari, 1 raro 2 per verticillum, 70–200 μm diametro.

HOLOTYPE: In cracks below ledge of large pool in Kondalilla Falls, Skene Creek, Kondalilla National Park, Qld, 26°40'S 152°52'E., 6 Sep. 1993, T.J. Entwisle 2236 [MEL 2020014 (air & silica-gel dried, spirit, microscope slide); ISOTYPE: BRI (dried)].

Chantransia-stage not seen. *Thallus* 1–5 cm long, red to dark greyish (purple when dry), flaccid, monopodial, apices obtuse; apical cell more or less flush with primary fascicles; old axes often denuded of fascicles; fascicle whorls 330–800 μm in diameter, globose to barrel- or disc-shaped, confluent or separated; internodes 230–400 μm long; axial cells 34–120 μm in diameter; rhizoidal filaments 5–8 μm in diameter, covering entire surface of axial cell; secondary fascicles absent (or rarely present in overmature, mostly denuded axes). *Primary fascicles* 2 or 3 per axial cell, somewhat audouinelloid, with more or less straight distal ends, without any clearly defined outer and inner cell layers, of 8–13 cell storeys; branching lateral, dichotomous or (sometimes) trichotomous, 3–7 times. Periaxial cell ovoid to cylindrical; proximal cell cylindrical with apical dilation at lateral branch insertion, 16–30 μm long, 3–5 μm in diameter; intermediate cells similar in shape to proximal cells (lateral walls rarely slightly convex), 11–32 μm long, 2–5 μm in diameter; fascicle distal cells cylindrical to obovoid (apex rounded), 6–9 μm long, 3–4 μm in diameter; hairs absent. *Monoecious*. *Spermatangia* borne on primary or rarely (in overmature thalli) on secondary fascicles, spherical, 5–8 μm in diameter. *Carpogonia* borne on (or in place of) primary fascicles (terminating percurrent branch of lateral); carpogonial branch more or less straight; carpogonium 5–8 cells from periaxial cell, subtended by 4–7 modified cells; modified cells barrel-shaped to ellipsoid, 6–7 μm long, 4–7 μm in diameter; involucre bracts arising from all (modified) cells subtending carpogonium, 1–2 cells long. *Carpogonium* more or less straight, 19–39 μm long; base symmetric, 3–5 μm in diameter; trichogyne sessile, club-shaped, 4–8 μm in diameter at broadest part. *Gonimoblasts* pedicellate, 1 or (rarely) 2 per whorl, in inner or outer cortex, centre 70–110 μm from node, globose, 70–200 μm in diameter, 0.5–1 times the whorl radius; filaments determinate, 4–5 cells long; post-fertilisation cells of carpogonial branch globose to barrel-shaped, or slightly constricted in middle; carposporangia obovoid, 10–18 μm long, 6–12 μm in diameter.

ILLUSTRATIONS

Figs 1–2; Entwisle & Kraft (1984), fig. 6 (as *B. ectocarpum*); Entwisle (1989), fig. 6E–G (as *B. boryanum*).

DIAGNOSTIC FEATURES

Secondary fascicles absent (rarely present and bearing spermatia in old thalli); cells of primary fascicles cylindrical with apical dilation (lateral walls usually parallel, occasionally slightly convex), distal cell cylindrical with rounded apex to narrowly obovate; carpogonial branch cells similar to other fascicle cells but shorter; carpogonium 19–39 μm long, trichogyne sessile and club-shaped; gonimoblasts uncommon, 1 or rarely 2 per whorl, 70–200 μm in diameter.

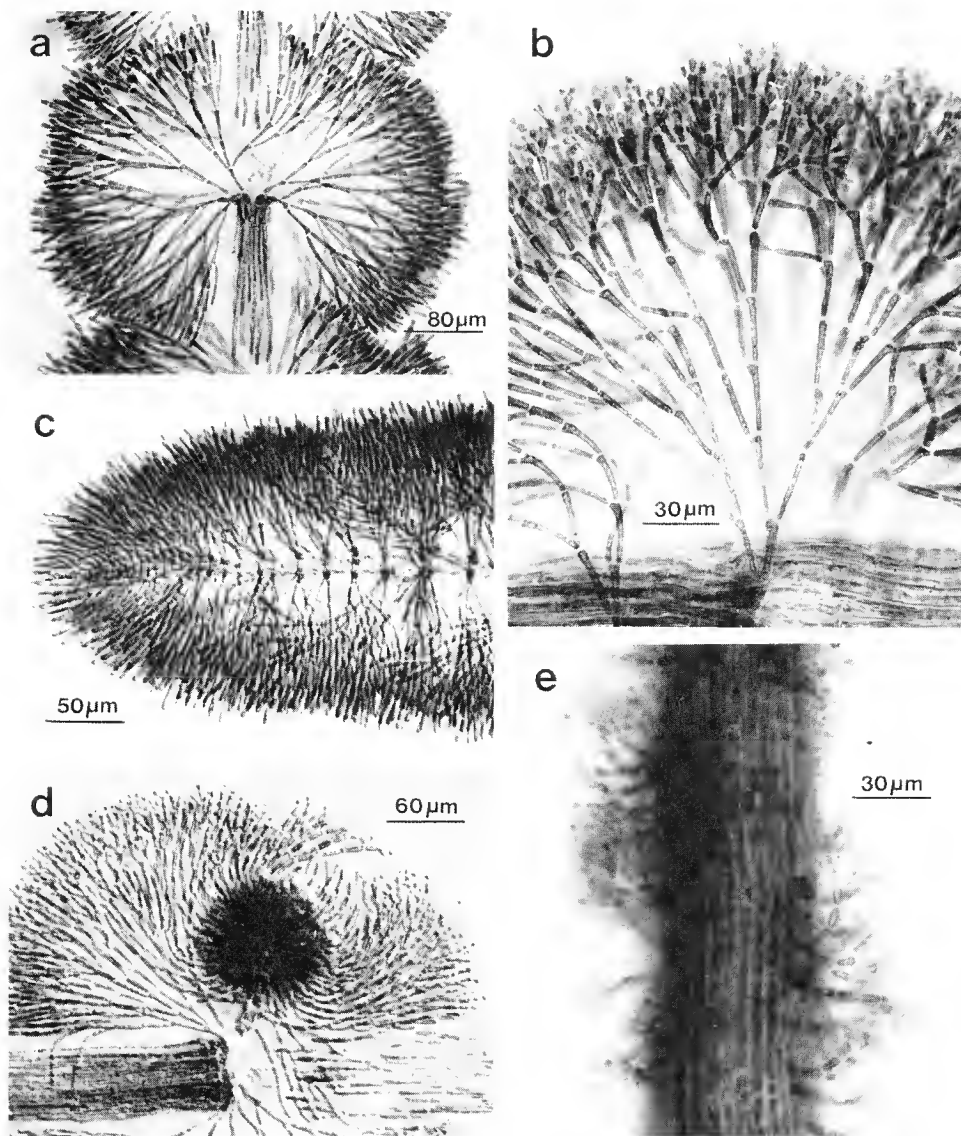


Fig. 1. Photomicrographs of *Batrachospermum antipodites*. a — whorl of fascicles. b — fascicle terminated by antheridia. c — apex of thallus. d — gonimoblast in whorl. e — secondary fascicles bearing antheridia in overmature thallus.

DISTRIBUTION & HABITAT

Widespread in mountain streams of eastern Australia (Qld, NSW, Vic. and Tas.) and New Zealand (North and South Islands), known thus far from 17–42°S and 145–175°E (Fig. 3). Usually growing in heavily-shaded gullies or in shaded parts of stream.

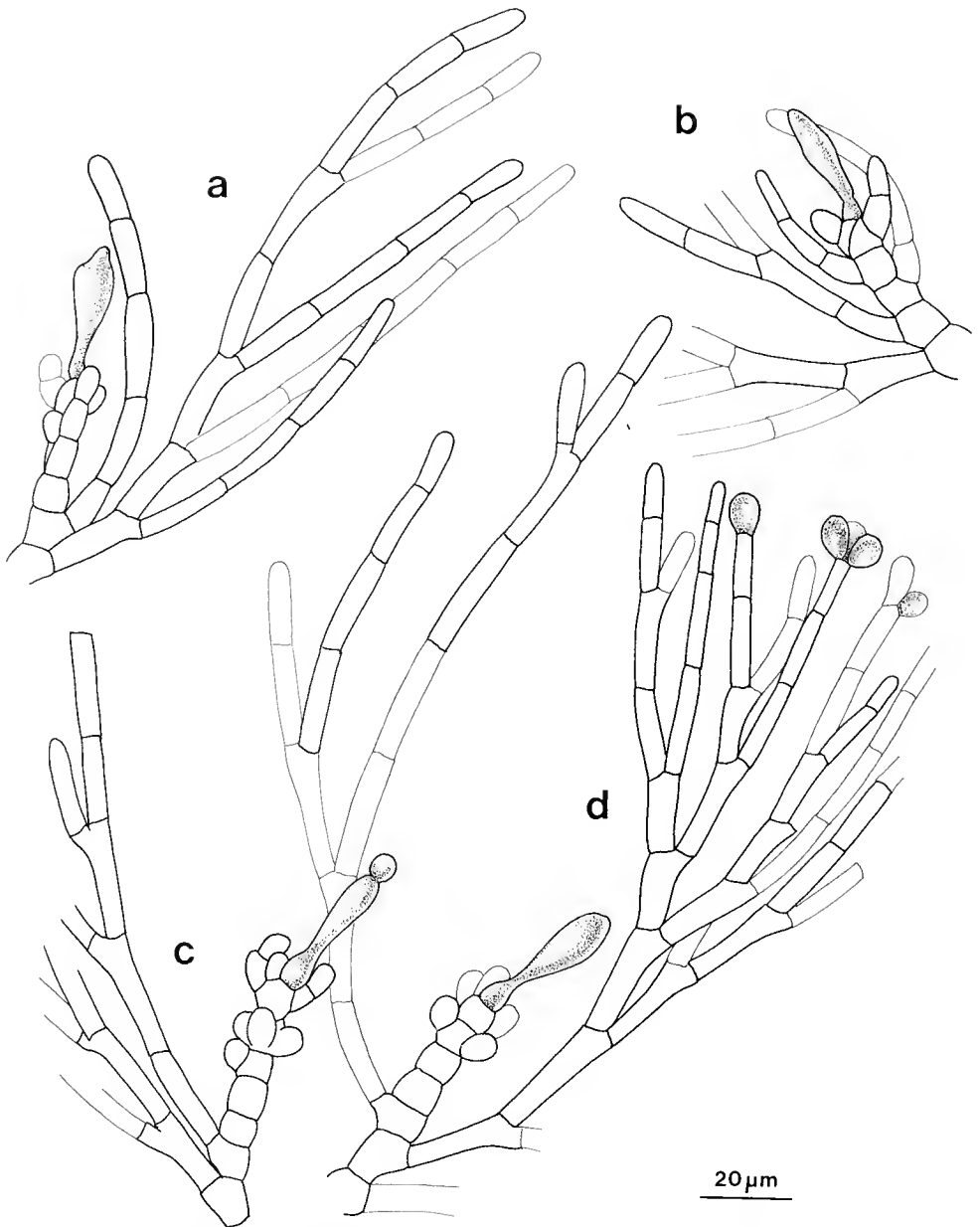


Fig. 2. Illustrations of *Batrachospermum antipodites* by H. Skuja (copied by Mali Moir). a — fascicle bearing carpegonium (shaded). b — carpegonial branch with carpegonium (shaded). c — carpegonial branch with spermatium attached to carpegonium (both shaded). d — fascicle bearing terminal antheridia (shaded) and a carpegonial branch with carpegonium (shaded).

SELECTED SPECIMENS EXAMINED (total examined = 40)

Australia. *South Australia* — Bones Ponds, near Mount Gambier, Oct. 1988, *M. Thurgate s.n.* (MEL). *Queensland* — Wallacha Falls, North Johnstone River tributary, 10 Sep. 1993, *T. Entwisle 2269* (MEL); Sunday Creek, Jimma State Forest, 16 June 1974, *A.B. Cribb 793.7* (BRI); Burnett Creek, Mt Barney area, 4 Sep. 1993, *T. Entwisle 2216* (MEL). *New South Wales* — Cowdroy Creek, Bodala State Forest, 5 Feb. 1991, *T. Entwisle 1866* (MEL); Red Cedar Creek, 9 Feb. 1991, *T. Entwisle 1951* (MEL). *Victoria* — trib. of Martins

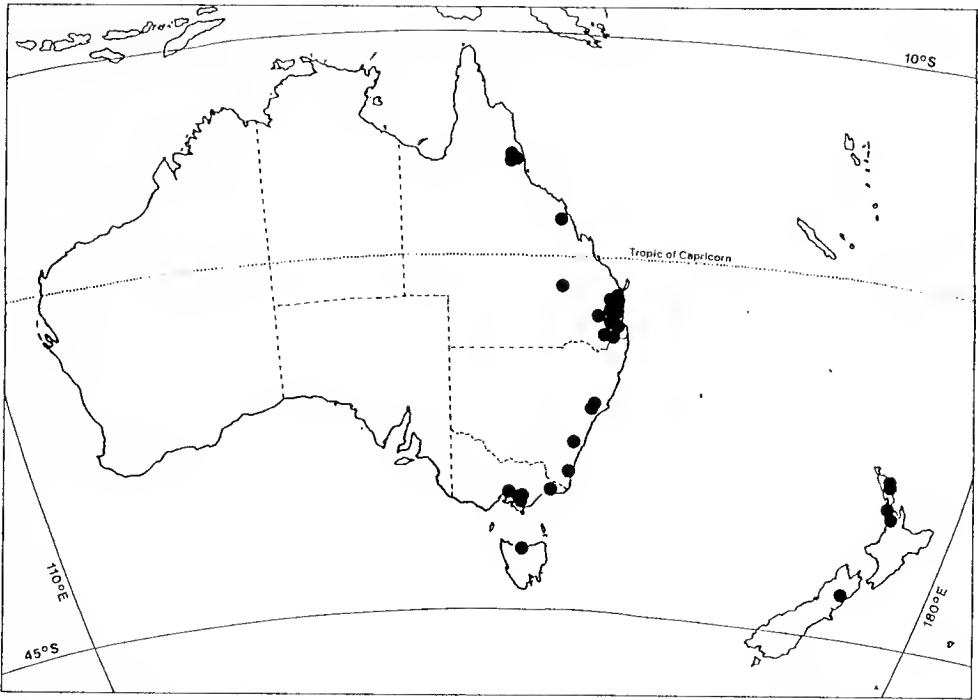


Fig. 3. Australia-New Zealand region showing the distribution of *Batrachospermum antipodites*.

Creek, Bonang Highway, 15 July 1990, *K. Thiele (T. Entwisle 1664)* (MEL); Sassafras Creek, Monbulk-Emerald Road, 24 Mar. 1987, *T. Entwisle 1139* (MEL). *Tasmania* — Cheshunt near Deloraine, Feb. 1855, *D. Lyall s.n.* (BM, NSW).

New Zealand. *North Island* — Maunu, near Whangerai, North Is., 7 Dec. 1934, *L. Cranwell s.n.* (AKU). *South Island* — Canterbury Plain, South Is., Dec. 1850, *D. Lyall s.n.* (BM).

Many types and representative collections were examined, and the following from the section *Batrachospermum* have relevance to this paper:

B. anatinum Sirodot, *Batrachospermes* 249 (1884). Ruisseau de Vau-de Meu, au patis Saint-Lazare, Monfort, 10.iv.1872, *Sirodot s.n.* (PC; lectotype).

B. anatinum Sirodot, *Batrachospermes* 249 (1884). Ruisseau de Vau-de Meu, au patis Saint-Lazare, Monfort, 10.iv.1872, *Sirodot s.n.* (PC; lectotype).

B. boryanum Sirodot, *C. R. Acac. Sci.* 79: 1366. Caniveau de la Trottainais, 12.v.1877, *Sirodot* (PC; lectotype); Brazil, 10.vii.1993, *M.R.A. Braga s.n.* (SP; representative collection).

B. cylindrocellulare Kumano, *Bot. Mag. Tokyo* 91: 100 (1978). Fort Iskander, Tasek Bera, Pehang, Malaysia, *S. Kumano s.n.*, 16.iv.1971 (Kobe University Herbarium; type).

B. ectocarpuum Sirodot, *Batrachospermes* 222 (1884), *nom. illeg.* St Germain Rivière d'Ille, 12.vii.1877, *S. Sirodot s.n.* (PC; representative collection).

B. fluitans Kerner, *Bot. Centralb.* 10: 362 (1882). Mühlau in ditione Oenipontana, Austria, *A. Kerner s.n.* (BM; syntype).

B. fruticosum Drew, *Ann. Bot.*, new ser., 10: 10: 340 (1946). Chee Dale, Derbyshire, England, 20.vi.1942, *Drew 1610b* (BM; isotype).

B. ludibundum var. *stagnale* Bory de St-Vincent, *Ann. Mus. Hist. Nat.* 12: 325 (1808), "*Batrachosperma ludibunda stagnale*". Marais des ouvrais de Bordeaux, Talence, an V, *Bory de St-Vincent s.n.* (PC; holotype).

ETYMOLOGY

From Middle English *antipodites* = an inhabitant of the antipodes (places directly opposite on the surface of the earth). The reference point is Europe, nomenclatural birthplace of the genus *Batrachospermum* and more or less opposite eastern Australia and New Zealand. This name was chosen to maintain the geographical spirit of Skuja's manuscript name for this taxon, 'novae-zelandiae' (now a somewhat misleading epithet).

HISTORICAL REMARKS

In 1850 David Lyall collected from a stream on the Canterbury Plains of New Zealand an alga which Joseph Hooker considered to be a new distribution record for the widespread *B. moniliforme* Roth (= *B. gelatinosum* (Linnaeus) de Candolle). Five years later, William Harvey reported the same species from northern Tasmania. In 1937, Heinrichs Skuja re-examined the New Zealand material and decided that it included two undescribed species, giving one the manuscript name *B. novae-zelandiae*. Skuja found further material of *B. novae-zelandiae* in collections from near Bay of Islands and Auckland (see Entwisle 1993 for further historical details). Skuja's *B. novae-zelandiae* and Harvey's *B. moniliforme* from Tasmania belong to *B. antipodites*.

In 1984, without knowledge of the collections mentioned above, I reported *B. ectocarpum* from near Melbourne, Australia (Entwisle & Kraft 1984). It appeared at that time to be a rare alga in south-eastern Australia (known from one locality only). As I collected further afield myself and gained access to the collections in Australian and New Zealand herbaria it soon became apparent that the alga was one of the most common species of *Batrachospermum* in the Australia-New Zealand region (Fig. 3). It became clear also that: this taxon is the same as the one Skuja called *B. novae-zelandiae*; it is different from *B. ectocarpum*, or indeed any described species; and Skuja once again was correct (cf. Entwisle 1992).

SPECIES RELATIONSHIPS

NORTHERN HEMISPHERE

Collections of *B. antipodites* examined in 1981 were referred to the apparently cosmopolitan *B. ectocarpum* Sirodot (*nom. illeg.*), a taxon with a tangled recent history. Sheath & Burkholder (1983) subsumed *B. ectocarpum* within *B. boryanum*, a change accepted in Entwisle & Kraft (1984; as a note added in proof) and Entwisle (1989). Compère (1991), however, considered these two taxa distinct, pointing out that *B. ectocarpum* was a later synonym of *B. stagnale* (Bory de St-Vincent) Hassall. More recently Vis *et al.* (1995) referred representative collections of *B. ectocarpum* to *B. anatinum*, a taxon distinct from *B. boryanum* and *B. stagnale*. *Batrachospermum stagnale* was included by Vis *et al.* (1995) in the apparently cosmopolitan *B. gelatinosum*. *Batrachospermum antipodites* also falls within the circumscription of *B. gelatinosum sensu* Vis *et al.* (1995), although the gonimoblasts are generally larger (70–200 µm cf. 40–139 µm in diam.). However *B. antipodites* has a vegetative structure which could never be confused with *B. boryanum*, *B. stagnale*, *B. anatinum*, *B. gelatinosum*, *B. ectocarpum*, or indeed any of the taxa circumscribed in Bory de St-Vincent (1808) or Sirodot (1884). Vegetative cell morphology was not used in the analysis of Vis *et al.* (1995) but the cylindrical fascicle cells of *B. antipodites* are consistent (and distinctive) throughout its range in Australia and New Zealand.

Within the section *Batrachospermum*, *B. cylindrocellulare* from Malaysia is the most similar in fascicle-cell morphology but it has abundant secondary fascicles, spermatia on shortened branchlets (these may be comparable with the spermatia on secondary fascicles of older thalli of *B. antipodites*) and pedicellate, ovoid to ellipsoid trichogynes. *Batrachospermum fluitans* Kerner from Austria has a fascicle structure somewhat reminiscent of *B. antipodites* but that species has broader (6–14 µm diam.) fascicle cells which are more ellipsoid or obovoid than cylindrical, and longer (42–65 µm) carpogonia subtended a branch of longer (11–38 µm) cells. The type of *B. fruticosum* Drew (= *B. confusum* (Bory de St-Vincent) Hassall *emend.* Vis *et al.* 1995), from England, is also vegetatively similar to *B. antipodites*, but has narrower (10–30 µm diam.) axial cells, irregularly inflated rhizoidal filaments, spermatia on involucre bracts, and once again broader (6–14 µm diam.) fascicle cells.

SOUTHERN HEMISPHERE

Batrachospermum antipodites appears to be restricted to eastern Australia and New Zealand. No plants of this morphology were found in a reconnaissance survey of

Western Australia and none have been reported from South America (Necchi 1990) or from initial forays in southern Africa (e.g. by M.-A. Joska, University of Cape Town).

Batrachospermum boryanum sensu Necchi (1990), from Brazil, is similar in general dimensions and has no or few secondary fascicles, but there are 1–4 gonimoblasts per whorl, the fascicle cells are cylindrical to elliptical (distal cells elliptical) and the trichogynes are generally smaller (13–25 μm cf 18–39 μm long).

Batrachospermum breutelii Rabenhorst from South Africa has some cylindrical-celled fascicles at the base of the thallus but is otherwise quite different from *B. antipodites* (in particular, in its distinctive tetrads of carpospores; Sheath & Whittick 1995).

The first collection of *B. antipodites* from New Zealand (see historical remarks above) also included material of another species, to which Skuja gave the manuscript name *B. campyloclonum* (Entwisle 1993). This taxon will be dealt with more fully in a later publication, but like *B. antipodites* it has sparse gonimoblasts. Unlike *B. antipodites*, however, and in common with most taxa in the section *Batrachospermum*, the fascicle cells are not cylindrical. Plants probably referable to *B. anatinum sensu* Vis *et al.* (1995) have been collected in the 'antipodean' region, but only from the New Zealand.

SECTIONAL CLASSIFICATION

With its straight, 4–7-celled, carpogonial branch, the symmetrical carpogonium and sessile trichogyne, and the pedicellate gonimoblast of determinate filaments, *B. antipodites* must be included within the section *Batrachospermum* (Necchi & Entwisle 1990). The only generally accepted character of this section that it lacks, is the 'numerous' gonimoblasts per whorl (see e.g. Bourrelly 1985, Mori 1975, Kumano 1993): *B. antipodites* (and '*B. campyloclonum* Skuja *ined.*' as mentioned above) has only one, or rarely two, gonimoblasts per whorl. Kumano (1979) apparently drew attention to the lack of correlation between frequency and position of gonimoblasts in a whorl, but he has continued to use gonimoblast frequency to define the section *Batrachospermum* (Kumano 1993). The interpretations of Sirodot (1884) and Israelson (1942), that the number of gonimoblasts per whorl is 'variable' or 'usually numerous', respectively, seem more appropriate.

Trichogyne shape and attachment partly characterize the section *Batrachospermum* (Kumano 1993). Trichogynes of this section are sessile (see Sheath *et al.* 1986 for definition of 'sessile' vs 'pedicellate') and vary in shape from ovoid or urn-shaped, to ellipsoid, to club-shaped. Sections *Hybrida*, *Turfosa* and *Virescentia*, which like section *Batrachospermum* have straight or curved carpogonial branches bearing carpogonia without a basal protuberance, have trichogynes either pedicellate or sessile, and conical, cylindrical or ellipsoid in shape. While there is obviously some overlap, trichogyne shape and attachment may be sufficient to correctly place a specimen in the section *Batrachospermum*. *Batrachospermum antipodites*, with its sessile, club-shaped trichogynes, nestles comfortably within the section *Batrachospermum*.

Many authors (Sirodot 1884, Israelson 1942, Bourrelly 1985, Kumano 1993) use the relative size of the gonimoblast — small vs large — to help separate section *Batrachospermum* from the sections *Hybrida*, *Turfosa* and *Virescentia*. However there is considerable overlap in this feature. To use as an example the published data summarized by Necchi (1990), gonimoblasts of section *Batrachospermum* are 210 μm or less in diameter while those of the latter group are 90 μm or more. The gonimoblasts of *B. antipodites*, at 70–200 μm in diameter, fall almost entirely within the overlap zone. Gonimoblast size clearly has limited use as a diagnostic character for the section *Batrachospermum*.

An additional problem encountered during this study was the distinction between section *Batrachospermum* and section *Aristata*. Although the monophyly of section *Batrachospermum* is yet to be tested, most authors (except e.g. Kumano 1993 who retains the section *Helminthoidea*) accept the definition recounted by Necchi & Ent-

wise (1990). However, the circumscription of section *Aristata*, based largely on the presence of a 'long', 'differentiated' filament subtending the carpogonium, needs refinement. A species such as *B. equisetifolium* Montagne with carpogonia borne on branches similar in length to those of *B. antipodites*, and hardly more 'differentiated', is unquestionably included in the section *Aristata* by most authors (e.g. Kumano 1993, Sheath *et al.* 1994). Because *B. equisetifolium* also produces 'rosette-like, hypogynous cells', Kumano (1993) has further segregated it into the subsection *Macrosporum*. This arrangement is not particularly satisfying, but I am reticent to tinker further with the infrageneric classification of *Batrachospermum* before morphological and molecular phylogenies have been tested.

ACKNOWLEDGEMENTS

Thanks to Orlando Necchi Jr (UNESP, Câmpus de São José do Rio Preto) for his helpful comments on the manuscript; to Alain Couté for access to the collections of PC; to the Maud Gibson Trust, Melbourne Water and the Sydney-Illawarra-Blue Mountains Water Board for financial assistance to visit PC; to Mali Moir the map and for her reproduction of the drawings by Heinrich Skuja; to Torbjörn Willén (Uppsala University) for access to the unpublished notes and illustrations of Heinrich Skuja; and to Neville Walsh for his Latin translation of the diagnosis.

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TWO NEW SPECIES OF *MONOTOCA* (EPACRIDACEAE) ENDEMIC IN VICTORIA

DAVID ALBRECHT*

ABSTRACT

David Albrecht, Two new species of *Monotoca* (Epacridaceae) endemic in Victoria. *Muelleria* 8(3): 299–306 (1995). — *Monotoca oreophila* and *Monotoca billawinica* are described and illustrated, with notes on distribution, conservation status, habitat and relationships with other species of *Monotoca*.

INTRODUCTION

A revision of the genus *Monotoca* is currently being completed and it is apparent that several segregate taxa are without epithets. This paper validates two new names so that they may be included in a treatment of the genus for the forthcoming *Flora of Victoria*.

The two species described herein have female and functionally male flowers on separate plants. In female flowers the stamens are reduced to antherless staminodes. Floral measurements are based on fresh or rehydrated material and it should be noted that some shrinkage occurs when flowers dry. The terminology used to describe inflorescence structures largely follows Briggs and Johnson (1979). The term seasonal growth unit (SGU) refers to the shoot or system of shoots formed within a single growing season and arising from an axis formed in a previous growing season. The first few 'juvenile' leaves within a SGU are often broader, more obtuse apically and differently shaped than leaves that appear subsequently. These leaves are not considered in the descriptions. For consistency, leaf descriptions are based on leaves taken from the middle section of the previous seasons SGU as are measurements of leaf density. When uniflorescences are spicate, the length of the primary axis of the uniflorescence (hereafter called the peduncle) is measured as the distance between the base of the peduncle and the lowermost bract (sterile or fertile).

TAXONOMY

Monotoca oreophila Albr. sp. nov.

Monotoca ellipticae (Smith) R.Br. et *Monotoca alberti* R.Br. affinis ab ambabus conflorescentibus blastotelicis et gemmis hornotinis majoribus differt: ab *M. ellipticae* foliis brevioribus angustioribus congestioribus, tubo corollae et anthera brevior et habitatione montano vel subalpino, et ab *M. alberti* corolla alba vel crema et foliis congestioribus differt.

TYPUS: Victoria, Snowfields, Mt Wellington summit, 13 Dec. 1988, *D.E. Albrecht 3728* [HOLOTYPE (functionally male): MEL 2016696; ISOTYPI (functionally male): HO, NSW; PARATYPE (female): MEL 2018951; ISOPARATYPI: HO, NSW.]

Densely foliose non-lignotuberous shrub, procumbent to erect, 0.2–2.5 m high; bark persistent, ultimately rough and fissured; current seasons branchlets brown, reddish-brown or maroon, with an indumentum of minute stiff spreading hairs 0.05–0.1 mm long or almost glabrous, glabrescent by second year. *Leaves* dense (5–15 per cm), ascending or spreading, leaving prominent scars after abscission, convex, lanceolate to elliptic, 3.8–11 mm long, 1.4–2.8 mm wide, upper surface green and glabrous, lower surface distinctly whitish (due to numerous wax-covered papillae) and usually with conspicuous \pm branched subparallel-palmate veins; margins slightly recurved; apical mucro 0.2–0.6 mm long, weakly pungent; petiole 0.5–1.1 mm long, glabrous on both surfaces. *Overwintering SGU buds* large, enclosing SGU axis with flower buds and

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rudimentary leaves; scales glumaceous, tinged reddish-brown, later turning brown. *Conflorescence* consisting of single-flowered axillary uniflorescences (lacking a subsidiary rudimentary bud) borne along the proximal section of current seasons SGU, leafy portion of SGU growing out while plants still flowering, SGU meristem very rarely aborting and the conflorescence simulating a short raceme; peduncles 0.2–1.7 mm long, \pm puberulent; bracts caducous or persistent and leaf-like; bracteoles 0.5–1.1 mm long, inserted immediately or shortly below the sepals; female and functionally male flowers on separate plants. *Sepals* 5, 0.6–1 mm long, ciliolate. *Corolla* 5-lobed, whitish-cream, campanulate, slightly compressed laterally in bud with the lobes imbricate distally, 1.4–2.5 mm long in male flowers including tube 0.4–0.8 mm long; 1.1–1.9 mm long in female flowers including tube 0.4–0.6 mm long; lobes spreading or recurved, \pm slightly thickened at apex, glabrous or very rarely sparsely papillose. *Anthers* 0.8–1.2(–1.3) mm long, attached at or above the midpoint on short filaments, exerted from the corolla tube of male flowers, not becoming deeply concave abaxially after dehiscence; stamens reduced to filaments in female flowers. *Nectary* annular, 0.1–0.3 mm long, \pm slightly lobed. *Ovary* 1-locular, tapering to a short style and small lobed stigma, together 0.7–1

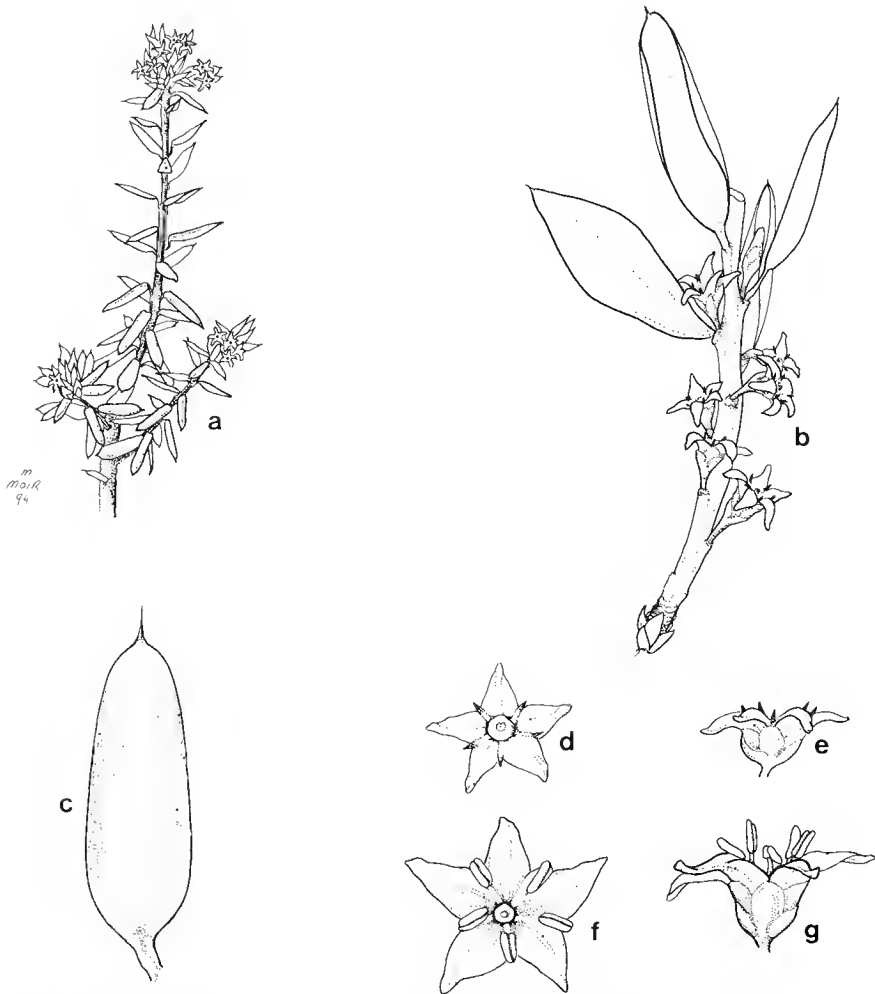


Fig. 1. *Monotoca oreophila*. a — flowering branch, $\times 1$. b — proximal part of conflorescence with single-flowered uniflorescence, $\times 4$. c — leaf, $\times 10$. d & e — female flower, $\times 6$. f & g — functionally male flower, $\times 6$. All drawn from D.E. Albrecht 3728.

mm long. *Drupe* red-orange when fully ripe, ovoid, 2.2–3 mm long (excluding style). (Fig. 1)

FLOWERING PERIOD

November to January

FRUITING PERIOD

January to April

ETYMOLOGY

The specific epithet is derived from the Greek *oreo-*, mountain-, and *phileo*, I love, referring to the habitat in which the species is found.

REPRESENTATIVE SPECIMENS (51 specimens examined)

Victoria — 1.6 km SE of the summit of Mt Useful, 12 Dec. 1988, *D.E. Albrecht* 3727 (MEL 2016695, HO, BRI, AD, K, MO); 1 km SE of Mt Kernot, Baw Baw Plateau, 15 Dec. 1981, *N.G. Walsh* 891 (MEL 628515); Mt Wellington, just N of summit, 20 Nov. 1980, *N.G. Walsh* 924 (MEL 628606, NSW, CBG, HO 64096, BRI 303211); Summit area of Mt Kent, 18 Mar. 1992, *N.G. Walsh* 3418 (MEL 2018972, NSW); 200 below Mushroom Rocks, Mt Erica, 29 Nov. 1990, *J. Davies & K. Lester s.n.* (MEL 2014372, HO, AD); Ellery Creek, c. 1 km S of Mt Tyers, Apr. 1991, *J. Davies s.n.* (MEL 2015518); Nelson's Crag (The Watchtower), c. 7 km E of Snowy Range airstrip, 13 Dec. 1988, *D.E. Albrecht* 3729 (MEL 2016697, CBG, NSW); Baw Baw alpine reserve, top of Big Hill, 7 Dec. 1984, *I. Salasoo* 1 (MEL 668601).

DISTRIBUTION AND CONSERVATION STATUS

Monotoca oreophila is a Victorian endemic, occurring on relatively few mountains in the Snowfields natural region (Conn 1993) from Mount Baw Baw northeast to Mount Kent (Fig. 2). Gullan *et al.* (1990) regarded this taxon as rare in Victoria. All eight populations presently known occur in biological reserves though most are very localised and some consist of few plants.

HABITAT

Monotoca oreophila is exclusively a montane-subalpine species occurring at altitudes of 1000–1620 m. All known sites are rocky, often with surface boulders. Occurrences of *M. oreophila* do not appear to be associated with a particular rock type, as populations occur on granodiorite, sandstone, rhyolite and conglomerate.

Most populations occur under an open canopy of eucalypts though occasionally trees are absent and the vegetation is of a heathland or shrubland structure. Associated *Eucalyptus* species are *E. pauciflora*, *E. glaucescens*, *E. kybeanensis* and rarely also *E. delegatensis* and *E. nitens*. Frequently associated understorey species include *Tasmanian vickeriana*, *Leucopogon gelidus*, *L. macraei*, *Olearia megalophylla* and *Dianella*

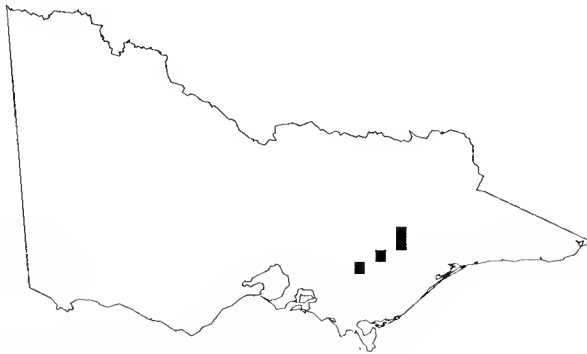


Fig. 2. Distribution of *Montoca oreophila*.

tasmanica. The more exposed and drier cliff edge population at Nelsons Crag supports a different range of associated species including *Grevillea miqueliana*, *Leptospermum brevipes*, *Monotoca scoparia*, *Westringia senifolia*, *Callistemon pallidus* and *Derwentia perfoliata*.

NOMENCLATURE

Monotoca oreophila is listed by Ross (1993) as *M. sp. aff. elliptica* (Alps). Reference to this entity dates back to Bentham (1868), who assigned specimens to either a small-flowered mountain population of *M. elliptica* (Smith) R.Br. (based on *F. Mueller's* specimen from the Baw Baws) or to his new taxon *M. scoparia* (Smith) R.Br. var. *submutica* (based on *F. Mueller's* specimen from Mount Useful).

Mueller's Mount Useful specimen is one of two collections cited by Bentham in the protologue of *M. scoparia* var. *submutica*, the other being a collection of C. Stuart's gathered on Mount La Perouse in Tasmania. The two collections are discordant. Jarman and Crowden (1978) elevated Bentham's variety to specific rank as *M. submutica*, and recognised two Tasmanian varieties, the var. *autumnalis* being described as new. They cite Stuart's specimen from Mount La Perouse (housed at K) as the holotype of the basionym *M. scoparia* var. *submutica*. An additional two specimens collected by Stuart on Mount La Perouse and seen by Bentham are housed at the National Herbarium of Victoria (MEL). In the strict sense Stuart's specimen at Kew is not the holotype but one of several syntypes representing two different elements. Fortunately Stuart's collection conforms more closely to the protologue than does Mueller's specimen from Mount Useful because the leaves are 'scarcely mucronate'. In order to extricate the Mount Useful specimen from *M. submutica sensu stricto* so that the entity it represents can be described, one of Stuart's Mount La Perouse specimens housed at MEL is here selected as the lectotype of *M. submutica* (*M. scoparia* var. *submutica*).

Monotoca submutica (Benth.) S.J. Jarman, *Pap. Proc. R. Soc. Tasm.* 112: 1 (1978).

BASIONYM: *Monotoca scoparia* (Smith) R.Br. var. *submutica* Benth., *Fl. Austral.* 4: 231 (1868). LECTOTYPE (here selected): Ascent of Mount La Perouse, Tasmania, 1877, C. Stuart (MEL 74671).

DISCUSSION

Plants in all but one population have a low stature, rarely exceeding 1 m high. The Mt Useful population is comprised of unusually tall plants to 2.5 m high, but are typical in all other respects.

Monotoca oreophila has been confused with *M. submutica*, *M. scoparia* and *M. elliptica s. lat.*, but only bears a particularly close relationship to the latter. *M. oreophila* is readily distinguished from *M. submutica* by the pungent rather than innocuous leaf apices, strictly single-flowered uniflorescences and by the anthers that do not become strongly concave abaxially after the pollen is shed. *M. scoparia* differs from *M. oreophila* in several characters including the presence of a lignotuber, spicate uniflorescences and male corollas with the tube longer than (rarely almost equal to) the lobes.

The combination of strictly single-flowered uniflorescences, pungent leaves, single-celled ovaries and red fruit in *M. oreophila* suggest a close relationship with *M. elliptica s. lat.* The taxonomy of *M. elliptica* is still unresolved but there appears to be some merit in resurrecting *M. albens* R.Br. at some taxonomic level for the small-flowered populations occurring along the eastern edge of the New South Wales southern tablelands from Mt Imlay north to the Blue Mountains. *M. elliptica s. str.* occurs exclusively in near-coastal areas from north-eastern Tasmania to north of Sydney. Further evidence possibly corroborating the close relationship between *M. oreophila*, *M. 'albens'* and *M. elliptica* comes from their relationship with a particular species of butterfly. Despite there being no overlap in the distributional ranges of *M. oreophila*, *M. 'albens'* and *M. elliptica*, all three taxa are important food plants for the larvae of *Neolucia mathewi* (Mathew's Blue Butterfly). Based on current knowledge the larvae of *N. mathewi* appear to be restricted exclusively to the *M. oreophila*-*M. 'albens'*-*M. elliptica* group despite the presence of several other species of *Monotoca* within its range.

Further field searches for the occurrence of *Neolucia mathewi* on other species of *Monotoca* are required to test this hypothesis.

M. oreophila differs from both *M. elliptica* s. str. and *M. 'albens'* in features of the confluence and overwintering SGU buds. In *M. oreophila* the axis of the confluence is blastotelic, so that the leafy portion of the current SGU grows out before or during anthesis. Exceptionally rarely do a few confluences simulate a short raceme due to the SGU meristem aborting. In *M. elliptica* and *M. 'albens'*, most or all confluences simulate racemes. These raceme-like confluences are either terminated by a flower and all bracts are caducous, or sometimes the axis extends just beyond the uppermost uniflorescence and the uppermost bracts and/or leaves are short, broad and persistent. These axes contribute little to seasonal extension growth. Few if any confluences are blastotelic (exceptionally rarely blastotelic and raceme-like confluences equal in proportions, but then longer leaves exceeding 11 mm long), most extension growth being attributable to sterile SGU's.

Correlated with confluence structure is the size of the overwintering SGU buds. In *M. oreophila* the SGU buds just prior to shooting are large, tinged reddish-brown and enclose the SGU axis with flower buds and rudimentary leaves. In *M. elliptica* and *M. 'albens'* the SGU buds just prior to shooting are smaller, brown and usually enclose only the SGU axis with flower buds.

M. oreophila further differs from *M. elliptica* s. str. in having denser, shorter (3.8–11 mm long, cf. 9–23 mm long) and narrower leaves (1.4–2.8 mm wide, cf. 2.4–6.5 mm wide); shorter corolla tubes (in male flowers 0.4–0.8 mm long, cf. (0.8–)1–1.5 mm long); shorter anthers (0.8–1.2 (–1.3) mm long, cf. (1.1–)1.2–1.9 mm long); and in habitat preference (montane-subalpine, cf. coastal). *M. oreophila* further differs from *M. 'albens'* in having white-cream rather than generally pale yellow-green corollas and in its leaves that are denser (5–15 per cm, cf. 3–8 per cm) and slightly shorter (longest leaves < 11 mm long, cf. usually > 11 mm long).

Monotoca billawinica Albr., sp. nov.

Monotoca glaucae (Labill.) Druce affinis sepalis et corolla et antheris longioribus et colore fructus differt; ab *Monotoca scoparia* (Smith) R.Br. habitu robustiore, lignotubere absente, foliis latioribus et inflorescentia dissimili differt.

TYPUS: Victoria, Grampians, near the start of the Mt Thackeray walking track, Victoria Range, 37°18'20"S, 142°20'E, 3 April 1988, D.E. Albrecht 3536 [HOLOTYPE (functionally male): MEL 712598; ISOTYPI (functionally male): MEL 712597, HO, K, NSW; PARATYPE (female): MEL 712599; ISOPARATYPI: HO, K, NSW.

Densely branched non-lignotuberous shrub or small tree 2–4.5 m high; bark persistent, ultimately rough and fissured; current seasons branchlets brown or reddish-brown, glabrous or with an indumentum of minute stiff spreading hairs c. 0.05 mm long, ± glabrescent by second year. *Leaves* erect to spreading, flat to convex, elliptic, rarely lanceolate or oblanceolate, (7–)9–17(–26) mm long, (2.1–)2.3–4(–4.2) mm wide, rigid, lower surface distinctly whitish (due to numerous wax covered papillae) with branched subparallel-palmate veins; margins entire, plane to slightly recurved; apical mucro 0.6–1.7 mm long, pungent; petiole (0.8–)1–2.1 mm long, glabrous on abaxial surface. *Confluence* consisting of single-flowered axillary uniflorescences (lacking a subsidiary rudimentary bud) and/or 2–8-flowered (plus rudimentary bud) axillary spicate uniflorescences borne on current seasons SGU; lowermost spikes (1.4–)1.7–5(–6) mm long including peduncle (0.2–)0.6–2.7 mm long, proximal sterile bracts absent or very rarely 1–2 present; when uniflorescences spicate bracts persistent on spike axis, the lowest 0.5–1.1 mm long, when uniflorescences single-flowered bracts caducous or persistent and leaf-like; bracteoles (0.7–)0.8–1.4 mm long, inserted immediately or shortly below the sepals; female and functionally male flowers on separate plants. *Sepals* 5, (1.2–)1.3–1.8(–1.9) mm long, ciliate. *Corolla* 5-lobed, whitish-cream, campanulate, 2.4–3.1 mm long in male flowers including tube 1–1.8 mm long; 1.6–2.3 mm long in female flowers including tube 0.7–1.2 mm long; lobes finally recurved, glabrous or occasionally papillose adaxially, c. equal in length to the tube. *Anthers* 1.2–1.9 mm long,

attached above the midpoint on very short filaments, exerted from the corolla tube at maturity and tending to block the throat of the tube, not becoming deeply concave abaxially after dehiscence; stamens reduced to filaments in female flowers. *Nectary* annular, 0.2–0.5(–0.65) mm long, shallowly lobed. *Ovary* 1-locular, tapering to a short style and small lobed stigma, together 0.9–1.3(–1.5) mm long. *Drupe* orange-red when fully ripe, ovoid to spherical, c. 2.5–3 mm long (excluding style), 2.3–3.3 mm wide. (Fig. 3)

FLOWERING PERIOD
February to April

FRUITING PERIOD
November to April

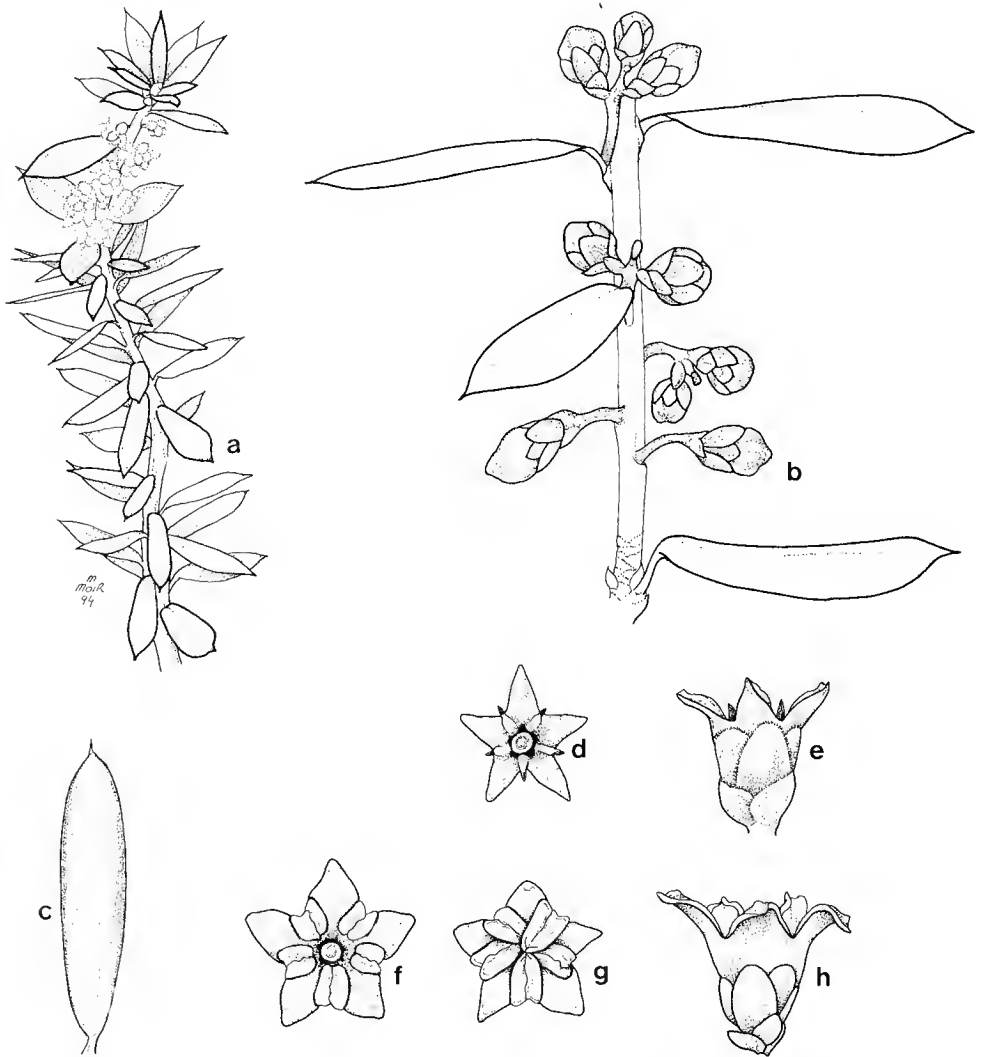


Fig. 3. *Monotoca billawinica*. a — flowering twig, $\times 1$. b — proximal part of confluence with single-flowered and spicate uniflorouscences, $\times 4$. c — leaf, $\times 3$. d & e — female flower, $\times 6$. f, g, h — functionally male flower (f — immature, g — mature), $\times 6$. All drawn from D.E. Albrecht 3536.

ETYMOLOGY

The specific epithet is derived from *Billawin*, the local Koorie name for the Victoria Ranges in the western Grampians (Gariwerd) where the species is most abundant.

REPRESENTATIVE SPECIMENS (61 specimens examined):

Victoria — Grampians: Victoria Range, Victoria Range road at junction of Mt Thackeray track, 3 Nov. 1987, *M.G. Corrick 10268* (MEL 1575576, CBG, HO); Victoria Range, on top, Victoria Range track, 1972, *A.C. Beaglehole 43296* (MEL 517468, AD 97821337); Victoria Range, in ravines near summit of Castle Rock, 11 Dec. 1966, *J.H. Willis s.n.* (MEL); Victoria Range, c. 1 km SW along the Victoria Range track from the intersection with the Victoria Range Rd, 4 Apr. 1988, *D.E. Albrecht 3540* (MEL, HO, CBG, AD, BRI); Victoria Range, Victoria Range track c. 2.5 km SW of gate at junction leading to Victoria Range road, 20 Apr. 1987, *M.G. Corrick 10222* (MEL 688979, HO, CBG, NSW); Mt Difficult area, 2.8 km on 308° T. from boat ramp at SW of Lake Wartook, 15 Oct. 1986, *J. Westaway 357 & A.F. Pyrke* (MEL 112395); Mt Difficult Range West, lower slopes on SW side of Lake Wartook near Chinamans track, 2 Nov. 1988, *M.G. Corrick 10430* (MEL 1559801, NSW, HO); Mt Difficult area, 450 m W. of intersection of Carters track and Longpoint fire line, 15 Oct. 1986, *J. Westaway 366 & A.F. Pyrke* (MEL 112396); 3 km N. of Cranges, 2 Apr. 1988, *D.E. Albrecht 3530* (MEL, HO, CANB).

DISTRIBUTION AND CONSERVATION STATUS

Monotoca billawinica is a Grampians endemic (Fig. 4), where it is restricted to two rather small areas — on summit ridges of the Victoria Range from the Chimney Pot north to Mt Thackeray, and in the Mt Difficult Range to the east of Wartook Reservoir. Population sizes throughout its range are variable and although its entire range is within the Grampians National Park, and in places it is locally abundant, it should be regarded as rare. Applying the coding system of Briggs and Leigh (1989) *M. billawinica* is assigned a risk code of 2RCa.

As *M. billawinica* lacks a lignotuber it is likely to be fire sensitive and therefore is potentially threatened by too frequent fires. Observations on the impact of successive wildfires on populations of *M. elliptica* (another non-lignotuberous species) in Royal National Park near Sydney suggests that populations can disappear from areas if they are burnt too frequently. As parts of the Grampians are subject to rather frequent fires, careful consideration must be given to the impact of fire on this species.

HABITAT

Monotoca billawinica occurs at altitudes ranging from 280–950 m, although it is most plentiful at the higher end of this spectrum. All populations occur on sandstone, and edaphic conditions range from poor soil development with abundant surface rocks to fairly well developed sandy loams. Structural vegetation types supporting populations of *M. billawinica* include shrubland, woodland and wet or dry sclerophyll forest. A diverse range of understorey species occur with *M. billawinica* and frequently associated overstorey species include *Eucalyptus baxteri*, *E. obliqua* and *E. alaticaulis*.



Fig. 4. Distribution of *Monotoca billawinica*.

DISCUSSION

Monotoca billawinica is the entity listed as *M. sp.* (Grampians) by Ross (1993). This species will be examined in more detail in a forthcoming paper dealing with morphometrics and phytochemistry of *Monotoca* species with single-celled ovaries, pungent leaves and spicate uniflorouscences.

Monotoca billawinica closely resembles the allopatric *M. glauca* (Labill.) Druce, and has been confused with the sympatric *M. scoparia* (Smith) R.Br. From *M. glauca* it differs in having longer sepals (1.2–1.9 mm long, cf. 0.6–1.3 mm long); longer corollas (in male flowers 2.5–3 mm long, cf. 1.5–2.2 mm long); longer anthers (1.3–1.8 mm long, cf. 0.6–1.1 mm long); distal leaves with petioles that are glabrous (cf. usually puberulent) on the abaxial surface; and fruit that are red-orange (cf. translucent greyish) when fully ripe and have a longer maturation period.

Monotoca billawinica differs from *M. scoparia* in its more robust habit (*M. scoparia* not exceeding 2m high); absence of a lignotuber; longer peduncles (lowermost spikes with peduncles 0.6–2.7 mm long, cf. usually < 0.6 mm long); usual absence of sterile bracts towards base of peduncle in lower spikes (rarely 1 present, cf. usually 2 present); exerted anthers (cf. usually enclosed or half-exserted); broader leaves (usually 2.3–4.2 mm wide, cf. usually 1–2.6 mm wide); and in its leaf flavonoids. The two species are known to hybridise.

ACKNOWLEDGEMENTS

For helpful discussions, collections and the Latin diagnoses I am particularly indebted to Neville Walsh. Nigel Quick kindly assisted with information on butterfly relationships, and Mali Moir skilfully prepared the accompanying illustrations. Jim Ross, Tom May, Pauline Ladiges, Trevor Whiffin and Kevin Thiele also assisted in various ways. For help with field work and special collections I sincerely thank Cath Daniels, Stan Parfett, John Westaway, Margaret Corrick, John Davies and Karen Lester.

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GOMPHOLOBIUM INCONSPICUUM (FABACEAE: MIRBELIEAE), A NEW SPECIES FROM SOUTH-EASTERN AUSTRALIA

MICHAEL D. CRISP*

ABSTRACT

Crisp, Michael D. *Gompholobium inconspicuum* (Fabaceae: Mirbelieae), a new species from south-eastern Australia. *Muelleria* 8(3): 307–310 (1995). — *Gompholobium inconspicuum*, occurring along the eastern side of the ranges from the central coast of New South Wales to eastern Gippsland in Victoria, is described as new. It is distinguished from its parapatric (more northerly) relative *G. uncinatum* by its greenish yellow petals, subulate recurved stipules, and earlier flowering season.

GOMPHOLOBIUM INCONSPICUUM

***Gompholobium inconspicuum* Crisp, sp. nov.**

Gompholobium sp. B, Wiccek, *Fl. New South Wales* 2: 470 (1991).

Habitu humile diffusum, foliis foliolis tribus linearibus uncinatis, caulibus juvenibus fere glabris sed dense tuberculatis, floribus parvis (c. 1 cm longis) et carina glabra *G. uncinato* Cunn. ex Benth. maxime simile, differt petalis citrinis, stipulis visibilibus subulatis recurvis, florescentia a mense Iulio ad mensem Septembrem.

TYPUS: New South Wales, Central Coast, c. 15 km N of Windsor, Blaxland Ridge, 0.5 km W of turn-off from Putty Rd, 33°28'S, 150°48'E, 1 Aug. 1994, M.D. Crisp 8542 (HOLOTYPE: CBG; ISOTYPE: BRI, CANB, GAUBA, K, L, MEL, MO, NSW).

Shrubs with diffuse wiry erect, spreading or prostrate stems to 45 cm long; branches terete, glabrate, densely tuberculate. *Leaves* scattered, subsessile, digitately trifoliate; leaflets ascending, linear, with an acuminate recurved apex, recurved margins, tapered to the base, 3–10 mm long, 0.2–1 mm broad, lacking visible veins, rather thick, grey-green; petioles appressed, 0.3–1 mm long; petiolules pulvinate, minute (c. 0.2 mm long); stipules subulate, 0.2–0.5 mm long. *Inflorescences* numerous, terminal, each a raceme with 1–2(3) flowers; peduncle tuberculate, 0–3 mm long, bearing a few sterile bracts below the subtending bracts; pedicel smooth, 2–6 mm long, with a pair of bracteoles near the base; bracts and bracteoles subulate, 0.5–1.5 mm long. *Buds* ellipsoid, apiculate, not ridged at junction of valvate calyx-lobes. *Flowers* inconspicuous, seldom opened fully. *Calyx* 5–6 mm long, divided to within 1 mm of base into 5 equal triangular acuminate lobes with ciliolate margins, lead-grey externally. *Standard* partly conduplicate at anthesis, very broad- to depressed-ovate, emarginate, 7–9 mm long including the 0.5–1 mm claw, 8–12 mm broad, lemon-yellow adaxially, lead-grey abaxially; wings narrow-obovate to somewhat spatulate, 5–7 mm long including the 0.5 mm claw, 1–3 mm broad, with an adaxial lobe at the base, lemon-yellow; keel obovate to elliptic, 6.5–7.5 mm long including the 1.5 mm claws, 3–3.5 mm broad, green, with an adaxial lobe at the base. *Stamens* 10, free, uniform; filaments filiform; anthers versatile, with a conspicuous brownish connective. *Gynoecium* glabrous, 7 mm long including 0.7 mm stipe and 2 mm style; style strongly incurved; stigma terminal, minute, papillate; ovary narrow-cylindric, obtuse at apex, tapered to base; ovules 12–20 in two rows on thick reflexed funicles. *Pod* oblong-ellipsoid, turgid, 8–11 mm long, 6–7 mm diam., smooth, light brown infused with lead-grey; immature seed ellipsoid with a strong radicular lobe, c. 1.2 mm long, c. 0.8 mm diam.; testa minutely rugulose, blistered around hilum; aril absent. (Fig. 1)

FLOWERING PERIOD

From July (in the north) until September (in the south and on the tablelands).

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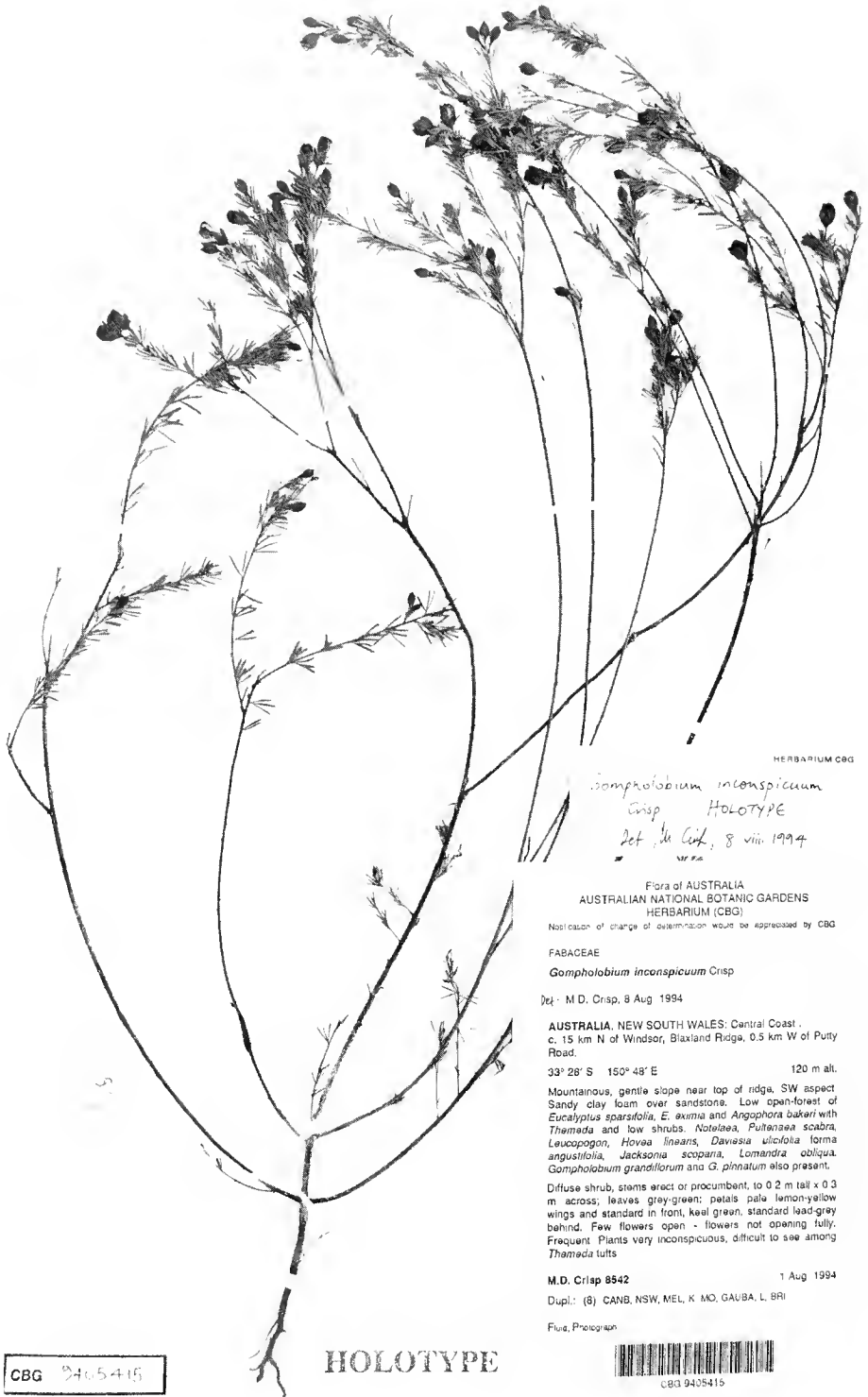


Figure 1. The holotype of *Gompholobium inconspicuum*.

FRUITING PERIOD

September to ?November.

ETYMOLOGY

The specific epithet is from the Latin for inconspicuous, and refers to the plant as well as its flowers. At the type locality, plants were so inconspicuous among the *The-medea* tufts that it took me 45 minutes to begin finding them, even though many proved to be present.

SPECIMENS EXAMINED

New South Wales — Kanimbla Valley, 28 Sep. 1962, *C. Burgess s.n.* (CBG 009617, MEL 233954); Marulan, 17 Oct. 1962, *C. Burgess s.n.* (NSW 282568); Howes Valley Post Office, 7 Sep. 1963, *C. Burgess s.n.* (CBG 001371); Mogo State Forest, 1975, *Batemans Bay Forestry Office 196* (NSW); SW corner of Castlereagh State Forest, off the Northern Road, 13 Sep. 1984, *R. Coveny 11880 & S. Goodwin* (CBG, NSW); Cullulla, c. 15 miles [24 km] by road SSW of Bungonia, 22 Sep. 1965, *D.J. McGillivray 1443* (NSW); Bungonia to Marulan, 16 Sep. 1953, *C.W.E. Moore 2601* (NSW); Marulan to Tallong, 19 Sep. 1953, *C.W.E. Moore 2604* (NSW); 9 miles [15 km] W of Kingswood [between Windsor and Kingswood], 13 Aug. 1960, *M.D. Tindale s.n.* (NSW 282561); Blaxland Ridge, N of Windsor, 15 July 1961, *L.H. Williams 2A-C* (NSW); Kanimbla Valley, Sep. 1963, *L.H. Williams s.n.* (NSW 282565); 4 miles [6.5 km] N of Tinda Creek on Windsor-Singleton rd, Sep. 1963, *L.H. Williams s.n.* (NSW 282558); Howes Valley, 55 miles [88.5 km] S of Singleton on the Putty Rd, 12 Sep. 1963, *L.H. Williams s.n.* (NSW 282560).

Victoria — East Gippsland, c. 2 km SW of Yambulla Peak, 9 Sep. 1988, *N.G. Walsh 2134, D. Albrecht & J. Westaway* (CBG, MEL, NSW); East Gippsland, Upper Genoa River, c. 2 km upstream from Yambulla Creek confluence, 21 Oct. 1987, *N.G. Walsh 1819* (CBG, MEL).

DISTRIBUTION AND CONSERVATION STATUS

Along the coast and eastern scarp of the ranges from the Putty Road area on the Central Coast of New South Wales to the Genoa River in far East Gippsland, Victoria. Known populations are few and scattered, with most collections coming from either the Putty Road or the Marulan-Bungonia area in New South Wales. However, the plants are so difficult to see, even when in flower, that it would be premature to declare the species rare or threatened. At the type locality the population appears to be large, with approximately one plant per square metre over a moderate-sized area.

HABITAT

On poor sandy, gravelly, rocky or clayey soils derived from sedimentary rock, usually sandstone. Associated vegetation is open (dry sclerophyll) eucalypt forest with shrubby understorey. The type locality is the upper south slope of a low ridge with sandy clay soil over sandstone. There, *G. inconspicuum* is mixed with *Themeda triandra* tufts under a low open-forest of *Eucalyptus sparsifolia*, *E. eximia*, *Allocasuarina littoralis* and *Angophora bakeri*, with scattered understorey shrubs including *Acacia* spp., *Daviesia ulicifolia*, *Gompholobium grandiflorum*, *G. pinnatum*, *Hakea* sp., *Hovea linearis*, *Leucopogon* sp., *Lomandra obliqua*, *Lomatia silaifolia*, *Notelea* sp. and *Pultenaea scabra*.

AFFINITY

This species has been known for about 40 years, and for most of that period has been recognised as closely related to, but distinct from *G. uncinatum*. Features held in common by these species, and which together distinguish them from their congeners, include a low, diffuse habit, trifoliolate leaves with linear uncinuate leaflets, glabrous but densely tuberculate young stems, small flowers c. 1 cm long, and a glabrous keel. These species have a parapatric distribution, with *G. uncinatum* extending from the Blue Mountains north to south-east Queensland. *Gompholobium uncinatum* differs in having more or less red petals, and in appearing to lack stipules. In addition, it flowers later, from November until early summer.

Gompholobium minus and *G. ecostatum* also appear rather similar to *G. inconspicuum*, but both differ in having larger flowers and more or less dense, short spreading hairs along the stems. In addition, *G. minus* has ridges at the junction of the calyx-lobes

in bud, whilst *G. ecostatum* has apricot to orange-red petals. *Gompholobium glabratum* is superficially similar, but has pinnate leaves with 5 or more lobes.

Among the related species discussed above, only *G. ecostatum* has visible stipules, and they are spreading. Thus, the strongly recurved stipules are the most distinctive feature of *G. inconspicuum*.

A key distinguishing all the above species except *G. ecostatum* appears in Wiecek (1991).

ACKNOWLEDGEMENT

I wish to thank the curators of CBG, MEL and NSW for the loan of specimens.

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GREVILLEA CELATA (PROTEACEAE), A NEW SPECIES FROM CENTRAL EASTERN GIPPSLAND, VICTORIA

W.M. MOLYNEUX*

ABSTRACT

Molyneux, W.M. *Grevillea celata* (Proteaceae), a new species from central eastern Gippsland, Victoria. *Muelleria* 8(3): 311–316 (1995). — *Grevillea celata* is described and named and distinguished from *G. alpina* Lindley and *G. chrysophaea* F. Mueller ex Meisner, species with which it has been confused by various authors. Morphological variation, affinities, ecology, and conservation status are discussed.

INTRODUCTION

Several authors have noted the existence of a distinctive *Grevillea* in the Bruthen region, assigning it to either *G. alpina* Lindley (e.g. Willis 1972: 46) or to *G. chrysophaea* F. Mueller ex Meisner (e.g. McGillivray 1993: 270–1), or to both taxa (Costermans 1981: 162, in circumscription and maps). The taxon has been informally known for some years as “*G. sp. nov. Nowa Nowa*”, from a nearby locality.

The author has made observations of this taxon in the field since 1978, observing especially its modes of regeneration, and polymorphism in flower morphology and flower colour, and in leaf shape and size. These observations, together with detailed measurements of live and herbarium material of all three species, are detailed below and provide evidence for recognition of this taxon as a distinct species. Some diagnostic features are not readily apparent from dried herbarium specimens and their label data; this difficulty probably underlies the uncertainty of diagnosis and assignment of this taxon in the past.

Polymorphism within the taxon does exist, with some apparently unstable character states; it is possible that this species is of relatively recent hybrid origin. The most typical form has red and yellow flowers, and type material has been selected from a large population of this form as being the most representative.

Definition of morphological characters and states follows that of McGillivray (1993).

TAXONOMY

Grevillea celata Molyneux, *sp. nov.*

G. alpinae Lindley et *G. chrysophaea* F. Mueller ex Meisner affinis sed surculis radicibus, confloribus centiis magis ramosis, forma amplitudine stato nectarii, et pistilis longioribus saepe differt.

TYPUS: Victoria: East Gippsland Botanical Region: Colquhoun State Forest, 13.15 km east north east along Dead Horse Creek Road, from the turnoff on the Bruthen-Buchan Road, c. 5.5 km south east of Bruthen; Map reference: Bairnsdale 8422, 840306; 13 Oct. 1993, *W.M. Molyneux* (HOLOTYPE: MEL; ISOTYPE: AD, BRI, CANB, K, NSW, PERTH)

Upright and open to low and dense shrub 0.4–1.8 m tall, suckering from roots; branchlets shortly tomentose with mixed white and fawn hairs. *Juvenile leaves* pink or tan, soon becoming green. *Adult leaves* mostly spreading or rarely ascending, shortly petiolate, simple and entire, oblong-elliptical to broadly elliptical or broadly linear, often subconvex upwards in cross section, (15–)20–44(–58) mm long, (4–)7–18 mm wide; petiole 0.5–1.5 mm long; base attenuate; apex softly mucronate to apiculate; margins irregularly wavy, recurved to loosely revolute, seldom obscuring the lower surface; upper surface tuberculate with a scattering of short hairs, dull green or yellow-

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green; lower surface tomentose, the hairs mainly white with an admixture of lightly ferruginous ones, hairs variably straight or twisted; venation brochididromous, obvious on upper surface, less so below due to indumentum. *Conflorescences* mainly terminal, usually on short lateral branchlets, or occasionally axillary on older wood, floral rachis apically decurved or deflexed or rarely straight, simple or up to 3-branched with no common peduncle, (2-)4-8-flowered, forming a loose cluster, centrifugal (basipetal); peduncles (1-)2-3(-7) mm long, rachis 1-5 mm long, both with an open indumentum of short mixed hairs, the hairs mainly white with some lightly ferruginous; *bracts* triangular to broadly linear, 1.8-2.5 mm long, 1.2-1.4 mm wide, tomentose outside with white hairs overlain by more erect lightly ferruginous hairs on and near the margins and mid-line, glabrous inside except along the margins and at the tip, deciduous when buds are *c.* 3 mm long. *Pedicels* 4-9 mm long, tomentose with white and lightly ferruginous hairs (the proportions variable), pedicels ascending at *c.* 35°-45° to the rachis. *Torus* oblique at 25°-40°, more or less square in plan view (i.e. distinctly angled below the tepal sutures), 1.7-2.2 mm across. *Perianth* often tardily deciduous, dilated at the base, obliquely oblong to ovate, often with pronounced ribbing of the tepal mid-lines especially below the curve, (3-)4.8-7.0(-8) mm across, outer surface with an open short irregular indumentum of white and lightly ferruginous hairs, inner surface glabrous in the basal 2-3 mm then densely bearded for *c.* 2 mm towards the curve with retrorse white hairs distributed evenly on the dorsal and ventral tepals, then with scattered white hairs above the beard; limb obliquely ovoid, 2-3 mm long, 2.2-4 mm wide, tepals (often only the dorsal pair) variably horned with a short villous appendage (sometimes scarcely apparent); dorsal tepals (13-)14-16(-18) mm long. *Nectary* conspicuous, at *c.* 45° to the pedicel, arcuate-rectangular to oblong in plan view, 1.3-2.5 mm long, 1.8-2.5 mm wide, 0.2-0.7 mm thick, margin entire or irregular, sometimes concave and cupping the base of the ovary. *Pistil* 18-20(-25) mm long; *ovary* sessile, 2-2.5 mm long, villous; ovules attached at about the midpoint between the basal and medial positions; *style* dorsally villous in the lower half with mixed white and ferruginous hairs and with the distribution and density of indumentum somewhat variable, ventral side glabrous or with a few scattered hairs; style-end lateral, 1.4-1.9 mm thick, tapering gradually into the style, base not concurrent with the style. *Pollen-presenter* elliptical to almost round, 2.8-4.0 mm long, 2.0-3.2 mm wide, face shallowly concave to slightly convex, with the margins often thickened; stigma slightly and distally off-centre. *Fruits* follicular, obliquely oblong-ellipsoid to ovoid-ellipsoid, 12-14 mm long, 5-8 mm wide, tomentose, surface beneath indumentum usually granulose and irregularly longitudinally ribbed; style persistent; pericarp *c.* 0.25 mm thick; suture opening to 4-6 mm wide; opened fruits often retained until following flowering season. *Seeds* narrowly elliptical, *c.* 9 mm long, 3 mm wide, 1.9 mm thick; outer face convex, irregularly rugose and granulate; inner face more or less flat; seed curved inwards to both ends, each end with a prominent pulvinus 0.9-1.5 mm long; elaiosome irregularly triangular, *c.* 2 mm long, *c.* 1.3 mm wide at base. (Fig. 1)

SPECIMENS EXAMINED

Victoria — East Gippsland Natural Region: Bruthen-Buchan Road *c.* 8 miles [13 km] from Bruthen, July 1942, *W. Hunter* (MEL); West of Nowa Nowa, 15 Nov. 1992, *W. Molyneux* (MEL, NSW 117361); Stony Creek on Bruthen-Buchan Road, 23 Sep. 1969, *K.C. Rogers* (MEL); "Foggy" [Boggy?] Creek, *c.* 13 km east of Bruthen, *c.* 1937, *F. Robbins* (MEL); Reformatory Road, *c.* 1.55 km north from junction with Bruthen-Buchan Road, *c.* 14.5 km east of Bruthen, 13 Oct. 1989, *W. Molyneux* (MEL); west side of Stony Creek, west of Nowa Nowa, 13 Dec. 1991, *W. Molyneux* (MEL).

ETYMOLOGY

The specific epithet is from the Latin *celatus*, hidden or concealed within, referring to the previous confusion of the taxon with both *G. alpina* and *G. chrysophaea*.

VARIATION

Flower-colour variation appears to be a feature of the species, and is detailed under Flower Colour (below); all the colour variations there noted, except the lemon-yellow, occur in all populations surveyed. The species also shows considerable variation



Fig. 1. Flowering and fruiting twig of *Grevillea celata* showing copious nectar flow. Scale bar = 1 cm.

(especially as compared with its presumed closest relatives — see under Affinities, below) in flower size, particularly in perianth width.

FLOWERING PERIOD

Flowering has been observed from July to December, and in late January and in February.

FLOWER COLOUR

Typically the perianth is red in the basal half, shading to yellow from the curve to the apex of the tepals, and the style is green at the base, shading to pink or cherry-red in the apical third with a green style-end. Type material was selected as having flowers of this colour pattern, as being the most representative of (and apparently dominant in) all populations observed.

Flower colour is however, variable, even within populations that appear to be wholly root-suckering and therefore probably clonal. An example of the latter is the population (measuring *c.* 40 m²) from which the Type material was selected; within this population, perianth colour may be red basally and yellow apically as above, or (respectively) red and white, pink and white, or apricot and white. A single plant with plain lemon-yellow perianths was found about 100 m from the Type population, the only instance seen of this colour. Style colour varies mainly in regard to the intensity and extent of reddish coloration in the apical third; the lemon-perianth variant has the style light green throughout.

Variation of this scale in flower colour is not uncommon in *Grevillea*, and comparable variation has been observed in the closely related species *G. alpina*, and in the less-closely related *G. arenaria sens. str.*, among others.

AFFINITIES

From comparative morphology, *G. celata* is apparently most closely related to *G. alpina* and *G. chrysophaea*. Table 1 indicates some key diagnostic character states for the three species.

It is possible that *G. celata* is a relatively recent and partially stabilised product of hybridization between these two species. It is now geographically isolated from the nearest known occurrences of both, being c. 120 km from *G. alpina* (on the lower northern slopes of the Victorian Alps above Mt Beauty, where forming hybrid, often root-suckering swarms with *G. lanigera*), and c. 70 km from *G. chrysophaea* (which appears to have its easterly limit in the area of Bullock Head Creek Road, off the Dargo Road). *G. celata* (allowing for the polymorphisms noted) breeds true from seed.

Table 1. Comparison of *G. celata* with related species.

Character	<i>G. celata</i>	<i>G. alpina</i>	<i>G. chrysophaea</i>
Habit	shrub, root suckering	shrub, single stemmed not root suckering, not lignotuberous	shrub, single stemmed not root suckering, not lignotuberous
Leaves: size:	15–58 mm long, 4–18 mm wide	3–30 mm long, 0.8–10 mm wide	9–55 mm long, 3–21 mm wide
venation:	brochididromous obvious	not brochididromous, mostly only midvein obvious	brochididromous obvious
Conflouescence	simple or branching up to three times, 2 to 8 flowers	simple or branching up to 2 times, 2 to many flowers	simple or branching up to 2 times, 2 to 12 flowers
Floral bracts	triangular or broadly linear, c. 1.8–2.5 mm long, 1.2–1.4 mm wide, glabrous inside except for tip, deciduous when buds c. 3 mm long	triangular or linear, c. 0.5–4 mm long, 0.3–0.8 mm wide, glabrous inside except for tip, often persistent till late bud development	subovate, acute, or linear, c. 1.8–3 mm long, 0.8–1.5 mm wide tomentose inside for c. top one-third, deciduous when buds c. 3 mm long
Flower colour	red & yellow, red & white, pink & white, apricot & white, often suffused, or lemon in one collection	red & yellow, red & white, yellow & white, pink & white, yellow, orange, mauve	primarily golden or with green patches around dorsal suture, often suffusing into the base
Nectary	conspicuous, angled at c. 45° to pedicel, arcuate, occasionally convex, margin entire or irregular, no nectary hairs present, c. 1.3–2.5 mm high, 1.8–2.5 mm wide, 0.2–0.7 mm thick	conspicuous, ± perpendicular to pedicel, arcuate, mostly linguiform and tapering, entire or tridentate, regularly curving into dilated perianth, nectary hairs present sometimes, c. 1.2–2.9 mm high, 0.4–2.5 mm wide, 0.2–0.4 mm thick	not conspicuous, angled at c. 45° to pedicel, short often thick pulvinus-like or broadly v-shaped, nectary hairs present sometimes, c. 0.5–1.3 mm high, 1.5–2.5 mm wide, 0.25–0.4 mm thick
Perianth: internal beard:	positioned both dorsally & ventrally with long white backward directed hairs, c. 5 mm across, 2 mm deep and 2–3 mm from base of perianth	less dense in the backward facing dorsal hairs, the ventral ones denser and more or less erect, c. 4 mm across, 2 mm deep and 2.5–4 mm from base of perianth	less dense dorsally than ventrally, both facing backward, c. 4 mm across, 2.5 mm deep and 2.5 mm from base of perianth
Pistil	18–25 mm long	10–20.5 mm long	15–22 mm long

Note: Regarding the distribution of *G. chrysophaea*,

McGillivray (1993: 271) mentions Tallarook and Merton as localities for that species, however, from both field work and an inspection of herbarium material this author suggests that it is *G. alpina* which occurs at these localities.

Both these related taxa are variable for certain characters, especially for flower colour in *G. alpina* as well as perianth size and shape as it is in *G. chrysophaea*. In these two species, variability of these characters tends to be between, not within, populations.

Root-suckering is not reliably recorded in either *G. alpina* or *G. chrysophaea*; McGillivray's (1993: 270) reference to occasional root-suckering in the latter species results from his inclusion of *G. celata* within it, and occasional reports of root-suckering in the former always appear to involve hybridization or intergrading with *G. lanigera*.

DISTRIBUTION

Known only from Victoria from the Colquhoun State Forest in central eastern Gippsland, east and south-east of Bruthen. (Fig. 2)

HABITAT AND ECOLOGY

The species grows on orange-red capping siliceous sands of apparently Tertiary age (McAndrew & Marsden, 1973) with low humus levels, and on and around small, low-relief Devonian-Silurian granitic outcrops in granitic sand. The species is apparently absent from the black, high-humus Tertiary sands that often abut the preferred soils. Not all granite outcrops in the area carry the species, and it is apparently absent from more southerly outcrops of the same granite formation at lower altitudes; these however are more fire-prone and heavily colonised by denser, taller species such as *Kunzea ericoides* and *Pomaderris* spp.

Known populations of *G. celata* range in elevation from 240 to 290 m a.s.l.

The forests in which *Grevillea celata* is found are classifiable as dry sclerophyll, with *Eucalyptus* and *Acacia* being the dominant genera. Proteaceae is also well represented, and there is a broad understorey of small to medium and ground-covering sclerophyllous plants by a number of genera.

A comprehensive list accompanies the holotype at MEL.



Fig. 2. Distribution of *Grevillea alpina* (★), *Grevillea celata* (+) and *Grevillea chrysophaea* (●). Major waterways separating the most easterly populations of *G. chrysophaea* from *G. celata* are 1 Mitchell and Dargo Rivers, 2 Nicholson River and 3 Tambo River

REPRODUCTION

Recent observations (Molyneux, Sept. and Oct. 1993), of areas burnt the previous summer, show new growth from root-suckers, and this appears to be a common means of regeneration in all populations, possibly as a selected response to high fire frequencies. Mature fruits and seedlings are also not uncommon.

Pollination is probably both ornithophilous (White-naped Honeyeaters, *Meliphreptus lunatus* Veillot, were observed in the vicinity), and entomophilous (numbers of unidentified native bees were seen). The flowers produce copious nectar.

The author has noted several instances of a number of seedlings growing within a few millimetres of each other. It is likely that these are germinating within an ants nest. Similar observations are noted by Makinson (1993: 357) for *G. wilkinsonii*.

The author has noted, in a number of *Grevillea* species, that the seed is avidly collected by ants. Seed and elaiosome predation in *Grevillea* is poorly documented, but in the case of *G. ramosissima* near Goulburn, N.S.W., the author observed ants probing half-open fruits and removing the seeds before they fell, and transporting the seeds to their nest. Clumped new seedlings emerging from ant nests were observed at the same site. It seems probable that ant-mediated seed transport and burial is significant for reproduction in the case of *G. celata* also. Successful germination would suggest that the ants do not damage the testa, but are perhaps using the waxy margins and elaiosome as a food source or for other purposes.

CONSERVATION STATUS

Currently known populations are scattered through, and confined to, Colquhoun State Forest. The area is subject to rotational logging and wild and controlled fires. A conservation code of 2Vi is recommended, following Briggs and Leigh (1989), meaning that the species is of restricted distribution with a total range of less than 100 km, should be considered vulnerable, and is inadequately represented in conservation reserve (since the State Forest is a multiple-use regime with the possibility of significant disturbance).

ACKNOWLEDGEMENTS

My thanks to Don McGillivray for his encouragement and advice in determining the status of *G. celata*; Bob Makinson of the Australian National Herbarium, Canberra for numerous discussions based on his experience with the genus, and for suggesting substantial amendments to improve the original MS; Neville Walsh of the National Herbarium of Victoria for the Latin diagnosis and assistance in finding a suitable epithet; Jenny Pena and Ben Millbourne for assistance with proof-reading and mark-up; Peter Zimmermann for preparing the map; and Sue Forrester who typed the original MS, prepared the drawing, and spent much time with me on field work.

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TWO NEW SPECIES OF EPACRIDACEAE FROM VICTORIA

Y. MENADUE & R.K. CROWDEN*

ABSTRACT

Y. Menadue R.K. Crowden. Two new species of Epacridaceae from Victoria. **Muelleria** 8(3): 317–321 (1995). — *Richea victoriana* sp. nov. from the Baw Baw region is described and illustrated. Its affinity with *R. gunnii* Hook. f., a Tasmanian endemic, is discussed. *Epacris celata* sp. nov. from eastern Victoria and southern NSW, is described and illustrated. Its affinity with *E. breviflora* Stapf. and *E. petrophila* Hook. f. is discussed.

INTRODUCTION

The taxon here described as *Richea victoriana* was first brought to our attention in 1979 when it was collected by R.K. Crowden and examined by Y. Menadue in a chemotaxonomic survey of *Richea* R.Br. for her B.Sc. honours project. The results of this survey will be published later in the year in a revision of *Richea*. The frequency and relative concentration of substituted flavonols in the three species (*R. victoriana*, *R. gunnii* and *R. continentis*) relevant to this paper clearly separate these taxa. Walsh (1987) referred to the new taxon as *R. gunnii* Hook.f. in its first literature appearance and all plants subsequently have been designated as *R. aff. gunnii*.

The *Epacris* species was first collected by the authors in 1984 but its identification has created difficulties for much longer, being variously referred to as *E. breviflora* or *E. petrophila*.

These species are described as part of an ongoing general review of both genera and so that they may be included in the *Flora of Victoria*.

TAXONOMY

Richea victoriana Y. Menadue, sp. nov.

Richea gunnii Hook.f. affinis sed habitu grandi et ramosissimo, foliis longioribus latioribus tortisque, inflorescentia floribus plus numerosis, axe glabro et nectario destituta differt.

TYPUS: Victoria, Nine Mile Rd, 0.5 km N of Block 10 Rd, Thompson River headwaters, 40 km E of Warburton, alt. 1010 m., 37° 47'S, 146° 10'E (GR 4258–58205) 26 Dec. 1992, J. Davies (HOLOTYPE: HO 308233; ISOTYPE: MEL)

Erect, multi-branched shrub 0.3–2 m high, older branches bare of leaves with prominent annular scars. *Leaves* clustered near the top 10–40 cm of branches; imbricate and spreading, narrowly triangular, (3)–5–10 cm long, 5–11 mm wide, flat to concave; tapering to a pungent acute apex; base sheathing stem to 1 cm deep; lamina lacks distinct shoulder as leaf passes into sheathing base but margin becomes undulate in that area producing a twist in the leaves, margins scabrous. *Inflorescence* terminal, erect, slender panicles, 3–13 cm long, internodes upto 1 cm long; lateral floral branches glabrous, upto 1.5 cm long, bearing 3–20 flowers, subtended by bracts differing from leaves in having distinct shoulder and broad base to sheath the flowers, reducing in size distally, caducous. *Flowers* on short pedicels c. 1 mm long with narrow linear bracteoles, 2–4 mm long arising from the pedicels. *Sepals* 4–5, creamy-white, depressed ovate c. 1.6 mm long, 1.8 mm wide, obtuse. *Corolla* white, operculum narrowly ovoid-conical, 3–4 mm long, 1.5–2 mm wide above incision layer. *Stamens* 5–6; filaments 2–3.5 mm long, attached near top of anthers; *anthers* 1–1.5 mm long, opening by longitudinal slit. *Style* 1.5–2 mm long, 2/3 length of stamens, tapering; *stigma* indistinct; ovary globose, c. 1 mm diam. *Nectary scales* absent. *Capsule* 2–3 mm diam.; *seeds* oblong-elliptic, reticulate. (Fig. 1.)

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Fig. 1. *Richea victoriana* Y. Menadue. From the holotype.

ETYMOLOGY

This is a new endemic species for the state of Victoria so it is appropriate to name it after the state.

OTHER SPECIMENS EXAMINED

Victoria — from type locality, 15 May 1984, *R.K. Crowden s.n.* (HO 308263); 8 Feb. 1989, *R.K. Crowden & Y. Menadue s.n.* (HO 308264); 26 Dec. 1992, *J. Davies s.n.* (HO 308234); Upper Thompson River catchment, Newlands Rd extension, 4 km W from Rocky Knob, 7 Dec. 1981, *N.G. Walsh 694* (MEL); Thompson Forest Wildlife Reserve, 24 Nov. 1982, *A.C. Beaglehole ACB 71727 & C.M. Beardsell* (MEL); c. 50 m S

of J.W. McMahon Ski Lodge, SE slope of Mt Erica, 7 Dec. 1984, *I. Salasoo* 6 (MEL); 5 km NNE Mt Margaret, upstream from crossing of Blue Range Road on Storm Ck, 23 Mar. 1985, *S. Forbes* 2820 (MEL); Near Scout Hut between Mt Erica summit and carpark, 13 July 1985, *D.E. Albrecht* 1846 (MEL); Upper Thompson R. at Newlands Rd Crossing, Jan. 1992, *J.B. Davies s.n.* (HO 132105):

DISTRIBUTION

The Baw Baw plateau and the Blue Range, between Marysville and Taggerty.

ECOLOGY

Locally abundant in wet heath or scrub land and on the fringes of cool temperate rainforest where it usually grows near streams or bogs with *Epacris paludosa* R.Br. and *E. microphylla* var. *rhombifolia* L. Fraser & Vickery (*E. coriacea* Cunn. ex DC. *sensu* Ross 1990). The main flowering period is between late November and early January. This species may produce adventitious roots from the lower stems and has the ability to layer.

DISCUSSION

The collections of *Richea victoriana* were previously referred to as *R. aff. gunnii* and the taxon does show affinity with *R. gunnii* in that both lose leaves early and have clear annular leaf scars and they grow in the same kind of environment. However *R. victoriana* is distinct in several characters. It differs in its habit, being a much larger more robust plant. Its leaves are considerably longer (5–10 cm) and wider (5–11 mm), and have a distinctive twist to them. The shorter (3–6 cm), narrower (5–7 mm), more rigid leaves of *R. gunnii* grow in a swirling arrangement around the stem. The inflorescence of *R. victoriana* has lateral branches bearing many more flowers (3–20) than *R. gunnii* (3–5). Individual flowers are similar although in *R. victoriana* the operculum is narrower, the filaments are attached to the top of the anthers and there are no nectary scales. Also the axis and lateral branches of the inflorescence are glabrous, but are minutely pilose in *R. gunnii*. *R. victoriana* inflorescence matures basipetally whereas *R. gunnii* matures acropetally.

There is only one other *Richea* occurring in Victoria and NSW and that is *Richea continentis*. This was described by B.L. Burt (1941) as a distinct taxon where it was previously thought to be *R. gunnii*. It is clearly different in habit, forming compact multi-branched shrubs, it does not have distinct annular scars and it has a narrow, elongated inflorescence and it matures acropetally.

Epacris celata R.K. Crowden, *sp. nov.*

Epacris petrophila et *E. breviflora* affinis sed foliis rotundioribus planioribusque, apice obtuso vel mucrone brevi, et foliis margine incrassato conspicuoque.

Typus: Victoria, Bogong High Plain, Watchbed Creek, 10 Feb. 1993, *R.K. Crowden & Y. Menadue* (HOLOTYPE: HO 308232; ISO TYPE: MEL)

An erect to spreading shrub, 20–60 cm high, young stems red-brown, ridged with raised leaf scars, pubescent; old stems dark grey-brown with flaking bark, scars inconspicuous. *Leaves* erect to spreading, elliptical or obovate, 2–4 mm long, 1.4–2.5 mm wide, glabrous; lamina flat rarely slightly concave, 1–3 veined, mid-rib conspicuous; apex broadly acute to obtuse, blunt or with short mucro; base broadly to narrowly acute; margin entire, distinctively thickened, scabrid in young leaves; *petiole* appressed upto 1 mm long glabrous or sparsely ciliate. *Flowers* few 7–8 mm diam., clustered at ends of branches, peduncle 1–2 mm long; *bracts* red-tinged ovate, margins ciliate; sepals red-tinged, 2.5–3 mm long, c. 1 mm wide, ovate-lanceolate, acute, margins ciliate; *corolla* white, campanulate 2 mm diameter in the throat, tube 1–1.5 mm long, lobes spreading 2–3 mm long, apex obtuse; corolla caducous. *Stamens* 5, *anthers* visible in the throat, projecting inwards, c. 1 mm long, on filaments equally long, attached in centre; *stigma* rounded, below the level of anthers; style short and slender c. 0.5 mm long; *ovary* glo-

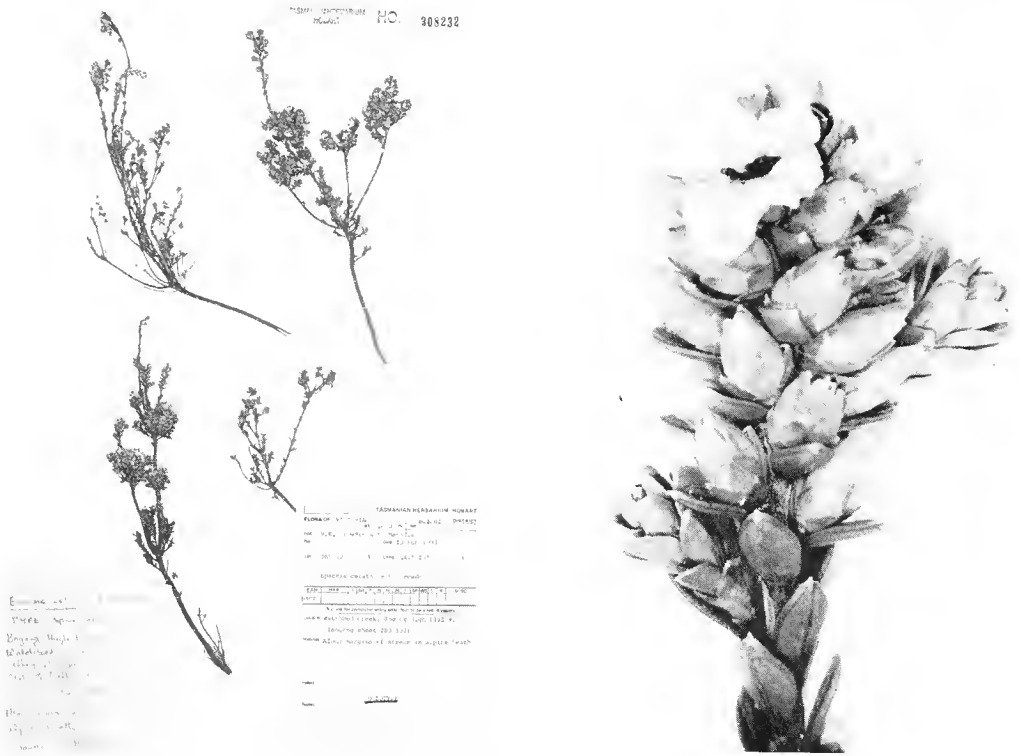


Fig. 2. *Epacris celata* R.K. Crowden. a — From the holotype. b — Close-up of part of this specimen showing typical leaf with thickened margin and small mucro.

bose, glabrous c. 1 mm in diameter; nectary scales truncate 1/4 ovary length. *Capsule* 2 mm diameter, seeds reniform and reticulate. (Fig. 2)

ETYMOLOGY

This plant is named because of its inconspicuous nature. It is usually hidden amongst other species and only noticed when in flower.

OTHER SPECIMENS EXAMINED

New South Wales — Kosciusko Nat Park nr 3-mile Dam, SW of Kiandra, 19 Jan. 1983, *M. Willis s.n.* (MEL 642770); Green Hole 12 km ENE of Kydra, 27 Dec. 1985, *P. Beesley 362 & D. Binns* (HO 110157).

Victoria — Bogong High Plains, 2.2 km west of Marm Pt, 4 Jan. 1982, *R.J. Adair 1415* (MEL); Bogong High Plains, Sister Species Gully, 2.2 km NW of Mt Cope, 8 Jan. 1983, *R.J. Adair 1424* (MEL); Buckety Plain c. 5 km ESE Mt Cope, 12 Jan. 1982, *R.K. Crowden & Y. Menadue s.n.* (HO 308236); Snowy Ra., Enclosure Plateau, 3km NE of Mt. Reynard, 23 Jan. 1993, *D. Albrecht s.n.* (HO 308235); Bentley Plains c. 3 km E of Mt Nugong Trig Pt, 28 Dec. 1984, *D.E. Albrecht 1356* (MEL); Falls Creek, Eastern end of weir on Rocky Valley Storage, 19 Oct. 1990, *S.J. Forbes 762, R. Adair & M. Gray* (MEL, NSW); Bogong High Plains, Watchbed Ck nr gate on Mt Nelse Rd c. 3 km SW Mt Nelse, 13 Jan. 1982, *S.J. Forbes 791, R. Adair & M. Gray* (MEL); 3.5 km NE Mt Jim on Cope Ck, SE Pretty Valley Pondage, 14 Jan. 1982, *S.J. Forbes 815, R. Adair & M. Gray* (NSW); Guy's Hut on Bryces Plains, N of Snowy Plains, 31 Dec. 1959, *J.B. Muir 1000* (MEL); 200 m towards Falls Ck from cattle grid on Omeo-Falls Ck Rd, approx. 100 m south of road, 1 Jan. 1982, *H. van Rees 297* (MEL, NSW); Cobungra, Dec 1928, *H.B. Williamson s.n.* (MEL).

DISTRIBUTION

In Victoria on the Snowy Range at Mt Wellington and Mt Reynard, on Bogong High Plains and extending eastwards to Cobungra and Mt Nujong. In NSW in the

Kioscusko region at Perisher Gap and Kiandra, and in the Wadbilliga National Park.

ECOLOGY

Occurs in wet places or along stream banks in alpine heath usually with dense *Empodisma minus*. It is associated with *BaECKea gunniana*, *Epacris paludosa*, *E. microphylla* and *Richea continentis*.

At lower altitudes it occurs on poorly drained skeletal soils in heaths and open forests.

DISCUSSION

Epacris celata belongs to a group of *Epacris* having very similar campanulate flowers clustered in heads. Members of this group are separated only on vegetative features. It has previously been referred to as *E. petrophila* or *E. breviflora* but differs from both in several leaf characters. *E. celata* has rounder leaves (length to width ratio is 1.5) than *E. petrophila* (l:w = 1.7) and *E. breviflora* (l:w = 1.8), flatter leaves and a rather smooth, conspicuous margin that is rarely serrulate. *E. petrophila* has leaves more appressed to the stem, distinctly keeled, an inflexed acute apex with a blunt mucro and its leaf margin is serrulate. *E. breviflora* has leaves more spreading and often recurved distally. Its apex is acute or acuminate, drawn out to a pungent mucro but with no distinct shoulder. The new species has a rounded, blunt apex or a rounded apex with a short mucro as an extension of the main vein. *E. breviflora* usually has larger leaves (range 5–10 mm) and *E. petrophila* usually has smaller leaves (1.1–3.3 mm) than *E. celata*. The lower altitude specimens of *E. celata* have leaves longer and more elliptic than from higher altitude specimens.

ACKNOWLEDGEMENTS

We thank John Davies for providing flowering material for the *Richea victoriana* type and for his observations, and David Albrecht for fresh specimens of *E. celata* and his comments. Also thanks to Gintaris Kantvilas for assistance with the Latin diagnoses and the National Herbaria of Victoria and New South Wales for access to collections.

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NEW SAXICOLOUS SPECIES OF *STRIGULA* Fr. (LICHENISED
ASCOMYCOTINA: STRIGULACEAE) FROM AUSTRALIA AND NEW
ZEALAND

P.M. MCCARTHY*

ABSTRACT

McCarthy, P.M. New saxicolous species of *Strigula* Fr. (lichenised Ascomycotina: Strigulaceae) from Australia and New Zealand. *Muelleria* 8(3): 323–329 (1995). — The saxicolous *Strigula australiensis* sp. nov. and *S. minutula* sp. nov. are described from Queensland, Australia, and *S. johnsonii* sp. nov. is described from the South Island of New Zealand. *Strigula australiensis* and *S. johnsonii* are unusual in that they have muriform ascospores.

INTRODUCTION

Species of *Strigula* have crustose thalli with *Cephaleuros* or *Trentepohlia* as the photobiont and perithecia that are characterised by simple or branched paraphyses, cylindrical, fissitunicate asci with a non-amyloid apex, a distinct ocular chamber and 1-septate to muriform ascospores. Conidiomata may be of two types and produce either minute, simple microconidia or larger, septate macroconidia. The latter usually have apical gelatinous appendages and their septation tends to mirror that of the ascospores.

Although most species are foliicolous in tropical and subtropical regions (Lücking 1992, Santesson 1952 and others), a comparatively small, but increasing number of corticolous and saxicolous taxa have been recognised (Harris 1975, Bricaud & Roux 1991, Purvis *et al.* 1992, Etayo 1993, Roux & Bricaud 1993, Canals *et al.* 1995). In Australasia, saxicolous specimens of *S. stigmatella* (Ach.) R. C. Harris were recently reported from eastern New South Wales (McCarthy 1993a) and Queensland (McCarthy 1994) and a calcicolous lichen from New Zealand, previously known as *Porina rhod-inula* Zahlbr., was re-identified as *S. affinis* (Massal.) R. C. Harris (McCarthy 1993b).

The present contribution follows the collection of saxicolous specimens of *Strigula* in coastal areas of eastern Queensland and the South Island of New Zealand. Two of the three species described here are unusual in that they produce submuriform and muriform ascospores. Such septation is already known in a small number of non-foliicolous *Strigula* species including the North American, corticolous *S. submuriformis* (R.C. Harris) R.C. Harris (Harris 1973) and a southern European, calcicolous *species* (Canals *et al.* 1995).

THE SPECIES

Strigula australiensis P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, obscure pallido viridigriseus vel pallido griseobrunneus, (30–)60(–100) μm crassus. Algae *Trentepohlia*, 7–14 \times 6–12 μm . Perithecia semiimmersa vel 2/3-immersa. Involucrellum (0.32–)0.44(–0.58) mm diametro. Paraphyses simplices vel leviter ramosae. Asci fissitunicati, cylindrici, 68–93 \times 17–22 μm . Ascospores submuriformes, (23–)29(–36) \times (7–)9.5(–11.5) μm . Microconidia simplices, 2–3 \times c. 0.8 μm . Macroconidia submuriformes, (19–)23.5(–30) \times (6–)7.5(–9) μm .

TYPUS: Australia, Queensland, 13 km SE of Innisfail, 3 km NE of Mena, Utchee Creek, by Utchee Falls, 17°38'24"S, 145°56'19"E, on shaded semi-aquatic basalt, 12 Sep. 1993, P.M. McCarthy 936 (HOLOTYPUS: MEL 1057469; ISOTYPUS: BRI).

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Thallus crustose, epilithic, effuse to determinate, continuous to sparingly rimose, pale greenish-grey to pale grey-brown, smooth to minutely and irregularly uneven, matt, ecorticate, (30–)60(–100) μm thick. *Algae Trentepohlia*; cells broadly ellipsoid to globose, 7–14 \times 6–12 μm . *Hyphae* 2–3 μm wide. *Prothallus* not apparent. *Perithecia* semi-immersed to 2/3 immersed, usually solitary, occasionally paired, moderately to very numerous. *Perithecial apex* plane or convex. *Ostiole* inconspicuous or in a shallow, 60–100 μm wide depression. *Involucrellum* greyish-black in surface view, brown-black to black in thin section, dimidiate or extending to excipulum-base level, (0.32–)0.44(–0.58) mm diam., 30–60 μm thick towards the apex, 60–90 μm thick at the base, K–. *Centrum* broadly ovate to depressed-ovate, 0.2–0.32 mm diam. *Excipulum* uniformly hyaline to very pale brown, 15–20(–25) μm thick. *Paraphyses* simple to sparingly branched (especially near their apices), not anastomosing, septate, long-celled, 1–1.5 μm thick; cells frequently guttulate. *Periphyses* absent. *Asci* fissitunicate, 8-spored, broadly to elongate-cylindrical, 68–93 \times 17–22 μm ; lateral walls *c.* 1 μm thick; apex rounded, 3–6 μm thick, with an ocular chamber 1–3 μm broad and 1–2 μm tall, convex to tuberculate; walls and apex IKI–; ascoplasma IKI+ red-brown. *Ascospores* hyaline, elongate-ellipsoid to elongate-fusiform, submuriform, with 7–9(–11) transverse septa, each loculus with (0–)1(–2) longitudinal or diagonal septa, often with a 2–3 μm thick gelatinous sheath when immature, irregularly biseriolate in the asci, (23–)29(–36) \times (7–)9.5(–11.5) μm (91 measured). *Conidiomata* of two types: 1) 60–100 μm diam., black above, colourless below, with a simple conidiogenous layer and fusiform microconidia of 2–3 \times *c.* 0.8 μm ; 2) 0.19–0.24 mm diam., black above, colourless below, with narrowly cylindrical or narrowly ellipsoid, submuriform macroconidia of (19–)23.5(–30) \times (6–)7.5(–9) μm , mostly with convex to acuminate, gelatinous appendages at their apices, growing obliquely from the tips of short, unbranched, *c.* 3 μm wide conidiophores. (Fig. 1).

REMARKS

Strigula australiensis is characterised by moderately large perithecia and submuriform ascospores and macroconidia which, because they are broader than those of taxa described heretofore, are concomitantly more abundantly septate. Moreover, not only has the New Zealand taxon *S. johnsonii* larger perithecia, its ascospores are discontinuously longer and fully muriform (see below).

This lichen appears to be confined to shaded basalt and granite in warm-temperate and tropical rainforest in eastern Australia. It has been collected in two localities in south-eastern Queensland and in the north-east of the state on and below the Atherton Tableland. This disjunction corresponds with one of climate and land-use in the central coastal region of Queensland between latitudes 26°S and 21°S. Thus the Great Dividing Range dissipates, precipitation is lower, agriculture is more intensive and rainforest all but disappears. Above latitude 21°S, however, the coastal areas are more mountainous and, thus, topography together with heavy summer rains support rainforest and its associated lichens.

ADDITIONAL SPECIMENS EXAMINED

Queensland — Lamington National Park, Green Mountains, near Border Track, above Elabana Falls, Canungra Creek, on semi-aquatic basalt, 4 Sep. 1993, *P.M. McCarthy* 733 (MEL 1057466); Bunya Mountains National Park, just above Paradise Falls, on dry shaded rocks beside creek, 5 Sep. 1993, *P.M. McCarthy* 771 (MEL 1057468); Atherton Tableland, 30 km WSW of Innisfail, Palmerston National Park, below Tchupala Falls and above Wallicher Falls, tributary of North Johnstone R., on dry shaded basalt, 10 Sep. 1993, *P.M. McCarthy* 815B (MEL 1057471); Atherton Tableland, Bellenden Ker Range, 6 km W of Babinda, Babinda Creek, The Boulders, on shaded granite beside creek, 12 Sep. 1993, *P.M. McCarthy* 909 (MEL 1057473).

Strigula johnsonii P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, nitidus, argenteogriseoviridis, (30–)50–80(–100) μm crassus. *Algae Trentepohlia*, (6–)8–15(–20) \times (6–)8–13(–16) μm . *Perithecia* semiimmersa vel immersa. *Involucrellum* (0.42–)0.6(–0.82) mm diametro. *Paraphyses* simplices vel leviter ramosae. *Asci* fissitunicati, cylindrici, 110–160 \times 28–38 μm . *Ascospores* muriformes, fusiformes vel elongatae-fusiformes, (37–)49(–63) \times (10–)15(–19) μm . *Conidia* non vidi.

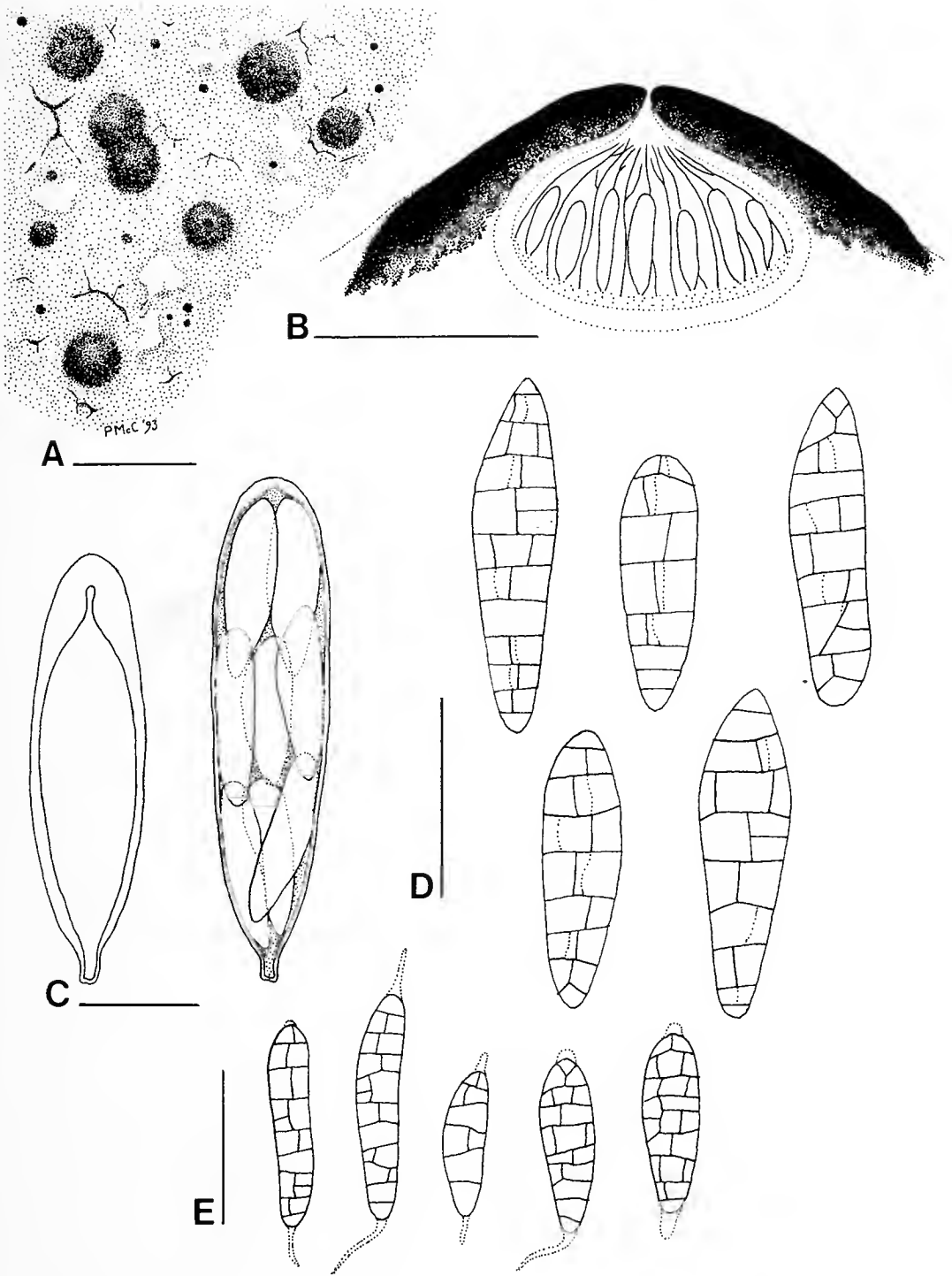


Fig. 1. *Strigula australiensis* (a-d, holotypus; e, MEL 1057471). a — habit of thallus, perithecia and conidiomata; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — immature and mature asci. d — ascospores. e — macroconidia; scales c-e 20 μ m.

TYPUS: New Zealand, South Island, North Otago, Leith Valley, below Morrisons Creek, on rounded volcanic stones in bank of flood-prone stream, 30 June 1993, *P.N. Johnson* 757 (HOLOTYPE: CHR 494632; ISOTYPUS: MEL 1057470).

Thallus crustose, epilithic, continuous to sparingly rimose, pale silvery greyish green, smooth to minutely uneven, glossy to dull (older thalli), (30–)50–80(–100) μm thick. Although lacking a cortex, the uppermost *c.* 10 μm is free of algae. *Hyphae* 2–3 μm wide. *Algae Trentepohlia*; cells broadly ellipsoid to globose, (6–)8–15(–20) \times (6–)8–13(–16) μm . *Prothallus* not apparent. *Perithecia* semi-immersed to almost entirely immersed, moderately numerous, usually solitary. *Perithecial apex* rounded or subconical. *Ostiole* inconspicuous or in a shallow, 60–100 μm wide depression. *Involucrum* brown-black, dimidiate or extending to excipulum-base level, (0.42–)0.6(–0.82) mm diam., 50–100 μm thick, K–. *Centrum* broadly ovate to depressed-ovate, 0.28–0.44 mm diam. *Excipulum* uniformly hyaline in thin section, 20–30(–35) μm thick. *Paraphyses* persistent, simple to very sparingly branched, not anastomosing, septate, 1–1.5(–2) μm thick. *Periphyses* absent. *Asci* fissitunicate, 8-spored, cylindrical, 110–160 \times 28–38 μm ; lateral walls *c.* 1 μm thick; apex rounded, 3–6(–8) μm thick, with an ocular chamber, 3–5 μm broad and 1–2 μm tall, convex to hemispherical; walls and apex IKI–; ascoplasma IKI+red-brown. *Ascospores* hyaline, fusiform to elongate-

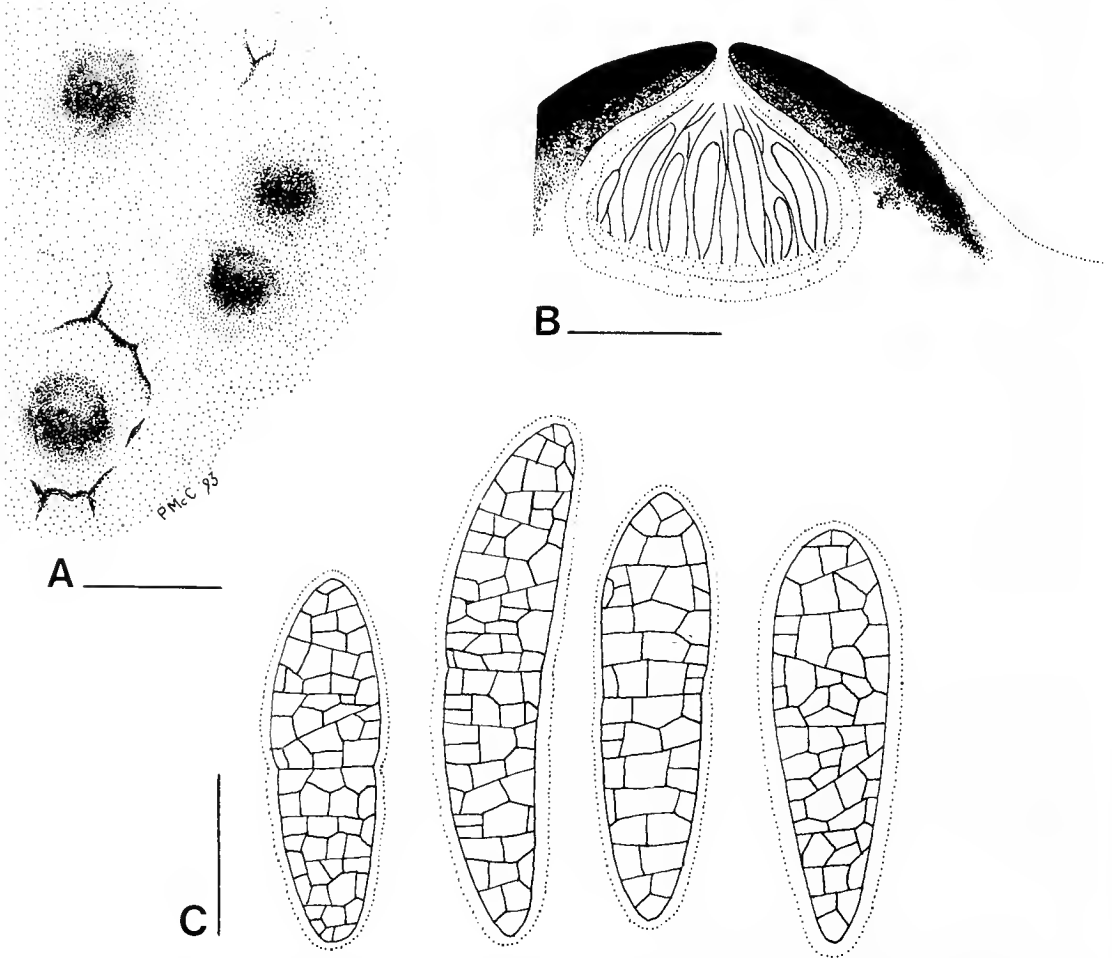


Fig. 2. *Strigula johnsonii* (isotypus). a — habit of thallus and perithecia; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — ascospores; scale 20 μm .

fusiform, muriform, with 10–17 transverse septa, each loculus with (1–)2–3 longitudinal or diagonal septa, with rounded or somewhat pointed apices and a (2–)3–4(–6) μm thick gelatinous sheath, irregularly biseriate in the asci, usually constricted at the primary septum, (37–)49(–63) \times (10–)15(–19) μm (119 measured). *Conidiomata* not seen. (Fig. 2)

REMARKS

Strigula johnsonii has a very pale, mainly glossy thallus, large perithecia and, most significantly, ascospores that are larger and more richly septate than those of any other species. It is named in honour of Dr Peter N. Johnson of Dunedin who, in recent years, has collected many interesting pyrenocarpous lichens in New Zealand.

This lichen inhabits shaded, seasonally-inundated rocks and is known from two localities in south-eastern New Zealand.

ADDITIONAL SPECIMEN EXAMINED

New Zealand: *South Island* — North Otago, Bethunes Gully, below Mt Cargill, grid ref. I44/198837, alt. 135 m, on shaded volcanic boulders in flood-prone incised stream, 20 June 1993, *P.N. Johnson 732* (CHR, MEL 1057475).

Strigula minutula P.M. McCarthy *sp. nov.*

Thallus epilithicus, continuus vel leviter rimosus, pallidoviridis vel griseoviridis. Algae *Trentepohlia*, 5–10(–14) \times 5–8 μm . Perithecia prominentia, thallo tecto. Involucrellum (0.15–)0.21(–0.28) mm diametro, 20–30(–40) μm crassum. Paraphyses simplices vel leviter ramosae. Asci fissitunicati, elongati-cylindrici, 45–58 \times 6–8 μm . Ascospores 1-septatae, (6–)8(–10) \times (2–)2.5(–3.5) μm . Macroconidia 1-septata, 4.5–7.5 \times 2–2.5 μm .

TYPUS: Australia, Queensland, Bunya Mountains National Park, between Paradise Falls and Little Falls, 26°52'S, 151°35'E, on deeply shaded aquatic and semi-aquatic rocks, 5 Sep. 1993, *P.M. McCarthy 759* (HOLOTYPE: MEL 1057467; ISOTYPE: BRI).

Thallus crustose, epilithic, determinate, continuous to sparingly rimose, pale green to dark grey-green, often slightly darker near the margin, smooth, somewhat glossy, ecorticate, (25–)40(–60) μm thick. *Algae Trentepohlia*; cells broadly ellipsoid to subglobose, 5–10(–14) \times 5–8 μm . *Hyphae* 2–3 μm wide. *Prothallus* not apparent. *Perithecia* very numerous, prominent, but partly or almost entirely overgrown by a (10–)15–25(–30) μm thick thalline layer, usually solitary, hemispherical, subglobose or subconical. *Ostiole* usually inconspicuous. *Involucrellum* brown-black, extending to excipulum-base level, (0.15–)0.21(–0.28) mm diam., 20–30(–40) μm thick, K–. *Centrum* broadly ovate to subglobose, 0.08–0.17 mm diam. *Excipulum* medium to dark brown, 10–15 μm thick. *Paraphyses* simple to sparingly branched, c. 1 μm thick. *Periphyses* absent. *Asci* fissitunicate, 8-spored, elongate-cylindrical, 45–58 \times 6–8 μm ; lateral walls c. 1 μm thick; lateral walls and apex IKI–; apex rounded, 2–3 μm thick, with a 1–2 μm broad and 1–2 μm tall, convex to tuberculate ocular chamber; ascoplasma IKI+red-brown. *Ascospores* hyaline, elongate-ellipsoid to elongate-fusiform, 1-septate, more-or-less uniseriate in the asci, (6–)8(–10) \times (2–)2.5(–3.5) μm (50 measured). *Conidiomata* 80–130 μm diam., black above, pale to dark brown below, with a simple conidiogenous layer of 12–20 \times 1 μm hyphae. *Macroconidia* 1-septate, elongate-ellipsoid to cylindrical, 4.5–7.5 \times 2–2.5 μm , growing obliquely from the tips of short, unbranched conidiogenous hyphae, with variously developed, apical gelatinous appendages. *Microconidia* not seen. (Fig. 3)

REMARKS

The thallus of *S. minutula* is comparatively dark and the very small perithecia are at least partly covered by a thalline layer and contain elongate-cylindrical asci with extremely small, 1-septate ascospores. Even smaller macroconidia are also produced. The diminutive ascospores set this lichen apart from most other *Strigula* species, its novelty being confirmed by the overgrowth of the perithecia by a thalline layer and its unusual habitat.

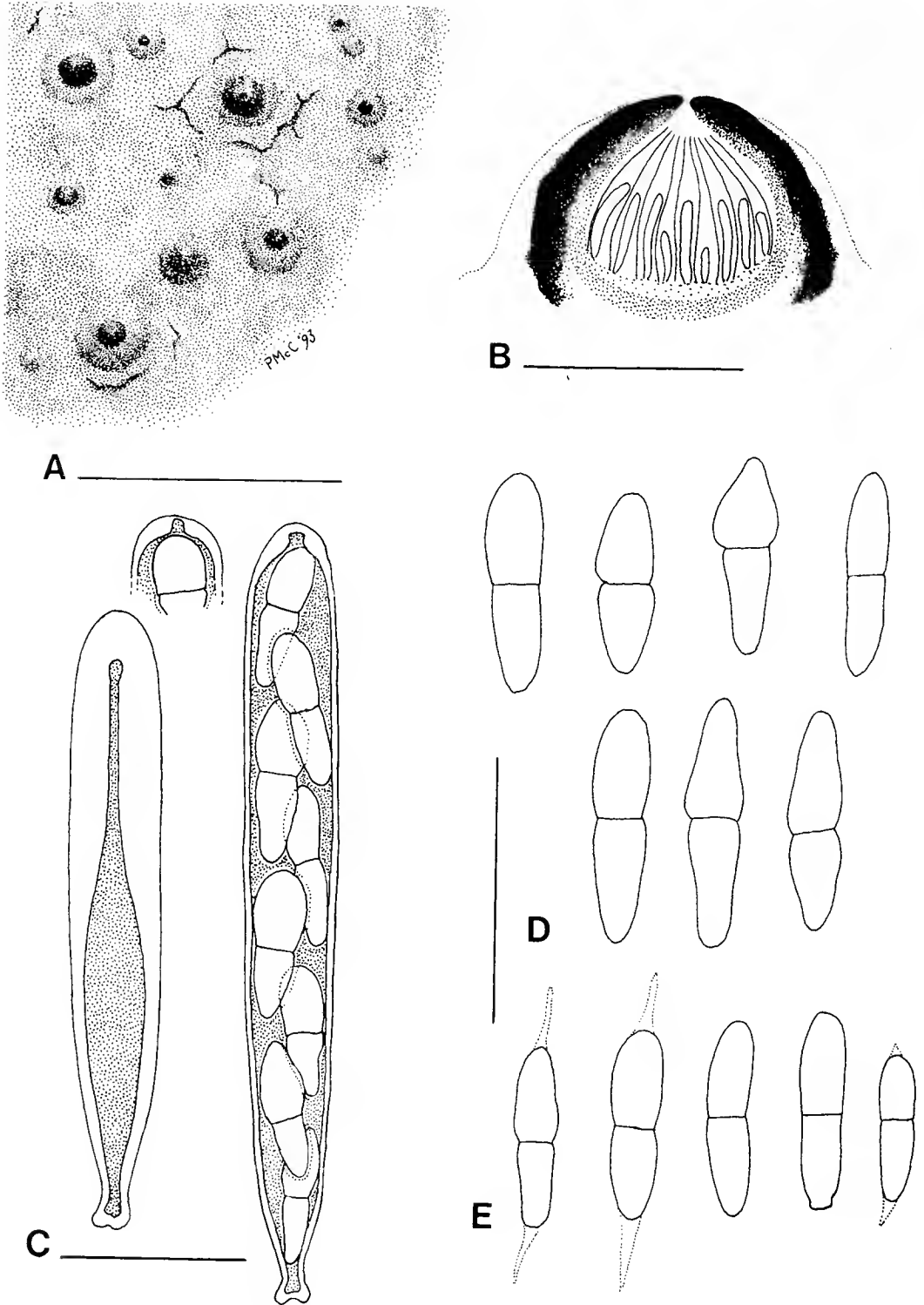


Fig. 3. *Strigula minutula* (holotypus). a — habit of thallus, perithecia and conidiomata; scale 1 mm. b — vertical section of perithecium; scale 0.2 mm. c — ascospores. d — immature and mature asci. e — macroconidia; scales c-e 10 μ m.

The new lichen is represented by a large, fecund collection from deeply shaded aquatic rocks in rainforest in south-eastern Queensland. The Bunya Mountains are a compact and lichenologically remarkable region, dominated by upland rainforest and surrounded by intensively farmed plains. The aquatic and adjacent saxicolous lichen floras are exceptionally diverse and include *Clathroporina eminentior* (Nyl.) Müll. Arg., *Hymenelia lacustris* (With.) Choisy, *Strigula australiensis* P.M. McCarthy, *Anisomeridium sp.*, and *Staurothele pallidopora* P.M. McCarthy, and at least four aquatic *Verrucariae*.

ACKNOWLEDGEMENTS

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A REVISION OF THE TUBEROUS-ROOTED SPECIES OF *TRIGLOCHIN* L.
(JUNCAGINACEAE) IN AUSTRALIA

HELEN I ASTON*

ABSTRACT

Aston, Helen I. A revision of the tuberous-rooted species of *Triglochin* L. (Juncaginaceae) in Australia. *Muelleria* 8(3): 331–364 (1995). — All but one, *Triglochin dubium* R.Br., of the tuberous-rooted species of *Triglochin* L. are endemic to Australia. Floras of this century have commonly embraced all species within *T. procerum* R.Br., either without any distinction or as varieties or stated synonyms, although *T. dubium* and *T. pterocarpum* Fitzgerald have sometimes been maintained as distinct from *T. procerum*. In this revision, based chiefly on the morphology of vegetative features and of mature fruits and carpels, eight species are recognised, namely *T. alcockiae* Aston, *T. dubium* R.Br., *T. huegelii* (Endl.) Aston, *T. lineare* Endl., *T. microtuberosum* Aston, *T. multifractum* Aston, *T. procerum* R.Br. and *T. rheophilum* Aston. No infraspecific taxa are recognised but the variability remaining within the greatly reduced circumscription of *T. procerum* warrants further investigation. Lectotypes are designated for *T. lineare* Endl., *T. procerum* R.Br., *T. procerum* var. *eleutherocarpum* Benth., *T. pterocarpum* Fitzgerald, *Cycnogeton huegelii* Endl. and the generic name *Cycnogeton* Endl. A new combination, *T. huegelii* (Endl.) Aston (basionym *Cycnogeton huegelii* Endl.) is made. *T. procerum* var. *gracile* Mich. is redefined to exclude *T. lineare* Endl. from its circumscription, *T. procerum* var. *gracile pro parte*, excl. *T. lineare* being placed as a nomenclatural synonym under *T. dubium*. *T. procerum* var. *eleutherocarpum* Benth. is placed as a new taxonomic synonym under *T. huegelii* and *T. pterocarpum* Fitzgerald is upheld as a taxonomic synonym under *T. dubium*.

INTRODUCTION

All but one of the tuberous-rooted species of *Triglochin* L. are endemic to Australia where their combined distribution (Fig. 1) is widespread in aquatic habitats. The one exception, *T. dubium* R.Br., has its greatest distribution within Australia but also extends to New Guinea.

The eight species recognised here have been commonly embraced within the circumscription of *T. procerum* R.Br. and four of them were only recently described in a precursor paper (Aston 1993). This precursor should be used in conjunction with the current revision.

Amongst recent investigations of tuberous-rooted *Triglochin*, Robb & Ladiges (1981), working with Victorian populations, demonstrated links between chromosome ploidy levels and fruit morphology. The entities they distinguished are readily related to species included in the current paper (see under Chromosomes below). McDonell (1969), working with populations in an area of central-coastal New South Wales bounded by Kurnell, Camden, Richmond and Newcastle, distinguished four entities in which she linked growth-form (of leaves) with carpel number and fruit shape. Unfortunately no voucher collections were preserved to assist with the taxonomic interpretation of her results and I find that insufficient detail and the exclusion of some characters makes identification of her entities ("growth-forms") inconclusive. It is most likely that entity 1 = *T. procerum* (eastern variant), 2 = *T. microtuberosum*, 3 = *T. procerum* (excluding the eastern variant) and 4 = *T. rheophilum*. Keighery (1975) investigated breeding systems in species from south-western Western Australia, presumably *T. huegelii* and *T. lineare* although published as varieties of *T. procerum* [*sens. lat.*]. His experiments with covered and uncovered inflorescences produced equal seed set by self-pollinated and cross-pollinated plants. There was no fruit development or

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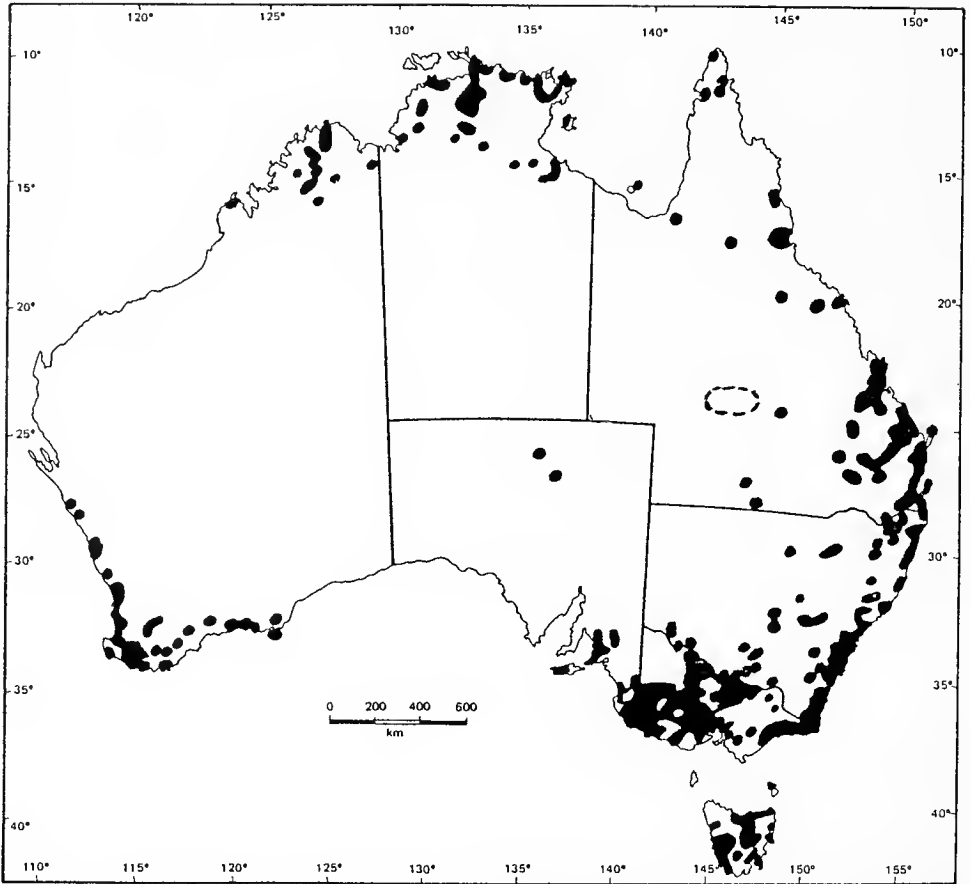


Fig. 1. Distribution of the tuberous-rooted species of *Triglochin* within Australia. The dashed ellipse represents an approximate locality.

seed set by six buds bagged after emasculation (all from the same species), indicating that the species was not apomictic. McDonnell (1969) also found both self-fertility and cross-fertility of inflorescences in experiments with New South Wales plants. Rea (1992) and Rea & Ganf (in press) report the effects of water level changes on *T. procerum* (excluding the eastern variant) in Bool Lagoon, south-east South Australia. They emphasise the rapid response time to depth changes, the morphological plasticity of the species and the changes in biomass allocation between leaves and tubers with changing water levels.

The tuberous-rooted species form a natural grouping based on their thickened, woody, fibre-covered rhizomes and their conspicuous storage tubers terminal on the roots. These subterranean features are quite unlike those of other species currently placed in *Triglochin* and could possibly be used as a distinguishing character applicable at generic rank. If further studies within the family supported such a generic distinction then the name *Cynogeton* Endl. should be reinstated. See 'Notes — Typification' under *T. huegelii* (Endl.) Aston.

MATERIALS AND METHODS

This revision is based upon the morphological examination of herbarium collections from all major Australian herbaria and upon extensive examination of plants in the field. Where necessary for nomenclatural reasons, additional type collections have

been received on loan from overseas herbaria. Unfortunately all Juncaginaceae at W, where Endlicher's types would be expected, was destroyed during the second world war (Riedl 1981).

Dried herbarium collections from the past have provided much data although many are often incomplete. The taxonomically important rhizomes and tubers are usually lacking, and the essential infructescences are also frequently absent. Mature fruits, which readily fall from the pedicels, have often rolled from sheets over the years unless originally placed in retaining packets.

I have not yet been able to conduct field observations on *Triglochin huegelii*, *T. lineare*, or the western variant of *T. procerum* found in South Australia and Tasmania. However, much information on all other taxa has been gained from extensive field work in Victoria and south-eastern New South Wales, from a brief period on the Dampier Peninsula, Western Australia, and from spasmodic sightings in southern Queensland. Measurement ranges, particularly for leaves, scapes and infructescences, were made in the field and complete plants obtained. Tubers, flowers, mature fruits, and leaf cross sections were preserved in 70% ethyl alcohol for later examination. Information on habit, variability within populations, and other relevant points cited in the species accounts were noted.

ASSESSMENT OF MORPHOLOGICAL CHARACTERS

All measurements and descriptions of both vegetative and reproductive parts are taken from plants bearing inflorescences or infructescences.

Rhizomes — Rhizomes are almost invariably broken when dug from the soil so that differences in lengths should be disregarded. Diameters given apply to the woody rhizome itself and exclude the fibrous coating. Diameters are generally greater in the species which inhabit deeper and more permanent waters, e.g. *T. multifructum* and *T. procerum*, and lesser in species of ephemerally inundated areas, e.g. *T. alcockiae*. Accordingly, although diameter differences between species appear to be correlated with the length of available growing time, there is probably also some genetic basis for them. With care, the rhizome diameter of mature plants may be of use in identification.

Roots and Tubers — These need to be considered in relation to each other. The tubers are storage organs only, not reproductive, changing in number and in mass with changing water depth (Rea & Ganf, 1994; Rea 1992). They vary from the small, near-globular ones about 5 mm long on short roots characteristic of *T. microtuberosum* to the large, long-cylindrical ones to 145 mm long on long roots characteristic of *T. procerum* (Fig. 2). Ratios for tuber length:tuber diameter and for root length:tuber length, as well as actual measurements and descriptions of tuber shapes are given in the text. Although there is overlap between species, tuber size and shape appears to be genetically controlled within certain ranges for each species and distinguishes some from others. Root and tuber combination is diagnostic for *T. microtuberosum*.

Tubers shrink upon drying, hence measurements have been made on fresh and/or spirit material for all taxa seen in the field. Where measurement from dried material has been necessary, subjective allowance has been made for shrinkage.

Leaves — Slender species such as *T. alcockiae* and *T. lineare* generally have shorter and narrower leaves than others which are more robust but there is considerable overlap in leaf length and width between species. Sheath length in relation to leaf length is of no taxonomic value.

The cross-sectional shape of the lower portion of the leaf and the comparative width of the basal sheaths are important in distinguishing some species. These characters have been expressed by referring to transverse sections of leaves cut at a level approximately 3 cm below the top of the sheath (Fig. 3). In such a section, the leaf varies from almost linear or very thinly plano-convex as in *T. rheophilum* to sub-cylindrical or near-cylindrical as in *T. microtuberosum*, the eastern variant of *T. procerum*, and the north-western plants of *T. dubium*. These sections also show the sheath width in relation to the width of the central portion of the leaf, e.g. each sheath extending only to

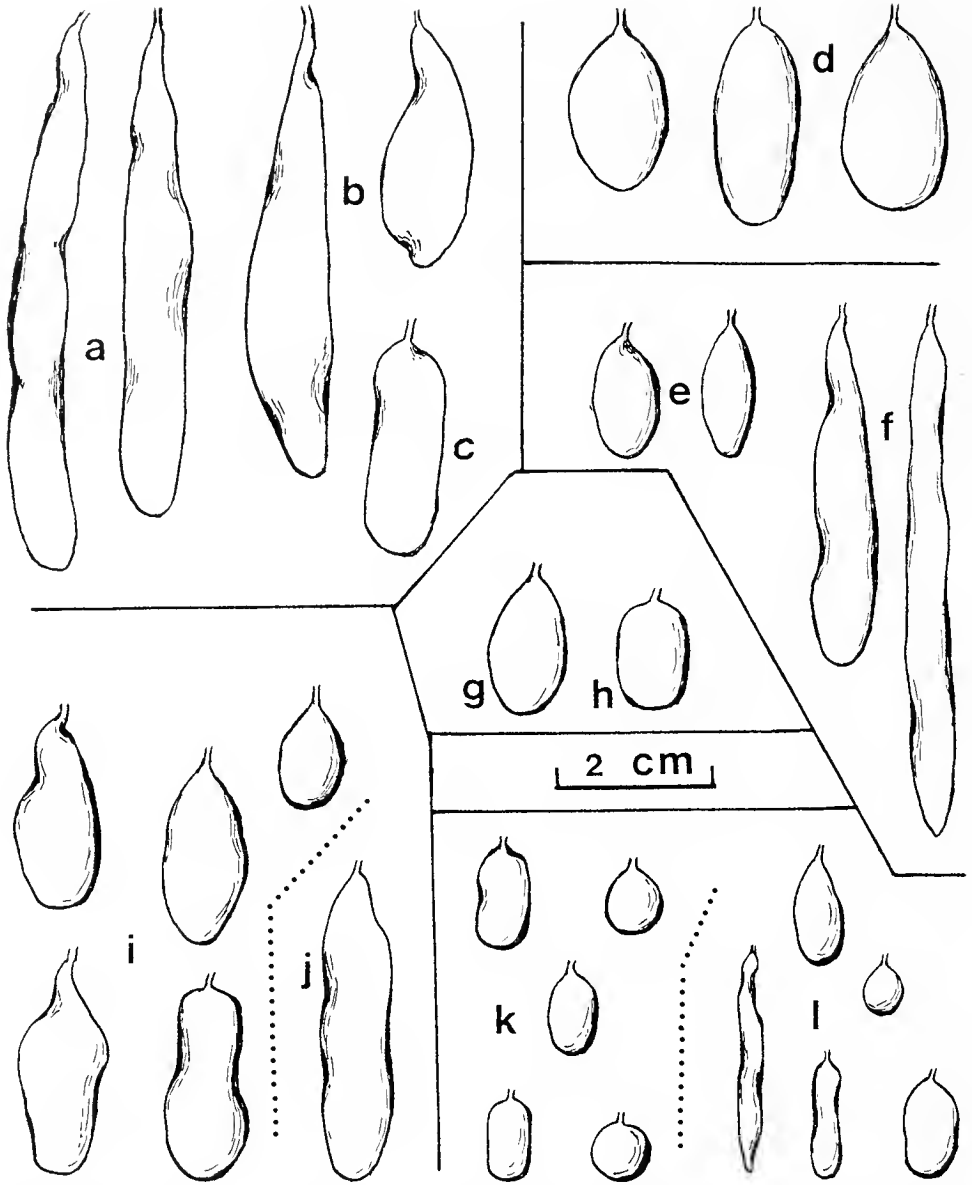


Fig. 2. Tubers. a-c *Triglochin procerum*. d — *T. dubium*. e-f — *T. rheophilum*. g-h — *T. alcockiae*. i-j — *T. multifractum*. k-l — *T. microtuberosum*, including unusually elongated tuber from the Morpeth population (l). (All drawn from *Aston numbers* (MEL, spirit): a — 2840; b — 2780; c — 2832; d — 2745; e — 2838; f — 2824; g — 2722; h — 2709; i — 2797; j — 2781; k — 2816; l — 2792)

a quarter of the width across the central portion of the leaf in *T. rheophilum*, but the two sheaths of *T. microtuberosum* touching to overlapping across the centre. Ratios and percentages are used in the species descriptions in an attempt to quantify leaf cross-sectional shape and the proportional values of sheath width.

The submerged foliage of *T. rheophilum* is distinctive. With other species, foliage is emergent but the emerged portions vary from floating to erect, sometimes within the same species. Thicker, more turgid leaves (e.g. eastern variant of *T. procerum*) are usually erect, or erect with outcurved extremities, whereas thinner, flaccid leaves (e.g.

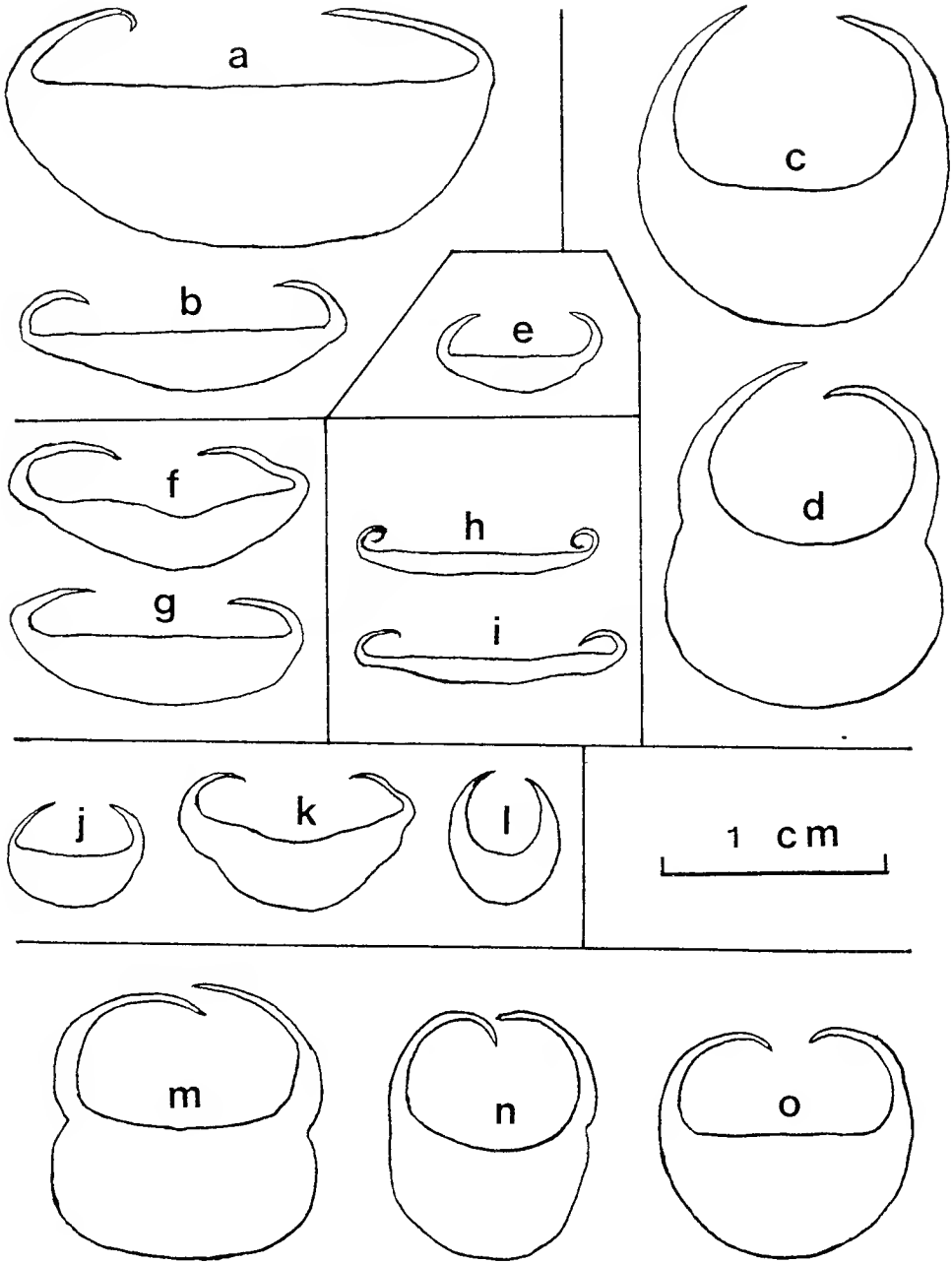


Fig. 3. Leaves, outline of T.S. about 3 cm below the sheath summit. a-b — *Triglochin procerum*, excluding eastern variant. c-d — *T. procerum*, eastern variant. e — *T. alcockiae*. f-g — *T. multifructum*. h-i — *T. rheophilum*. j-l — *T. dubium*, from south-eastern Australia (j-k) and the Kimberley (l). m-o — *T. microtuberosum*. (All drawn from Aston numbers (MEL, spirit): a — 2832; b — 2690; c — 2825; d — 2836; e — 2705; f — 2781; g — 2779; h — 2824; i — 2842; j — 2804; k — 2787; l — 2696; m — 2685; n — 2792; o — 2816)

T. alcockiae) are usually floating. Differences in growth-form are largely specifically or infraspecifically linked and therefore appear to be largely genetically controlled. However, factors such as age and environmental conditions are influential in modifying leaves. Rea (1992), experimenting with *T. procerum* at Bool Lagoon, South Australia, found that new leaves produced with changing water levels adjust their length and width according to depth, increasing both measurements as water deepens. At constant water levels, leaves were erect when mature and later arched over so that the tips touched the water surface. Seedling leaves were narrow, thin and floating.

Stems — Dimensions vary from the more slender to the most robust species but are not specifically distinct. Their morphological characters are taxonomically insignificant.

Flowers — My initial examination of floral parts from field observations and from spirit-collected material failed to show significant diversity between species, except for the number of carpels present and perhaps also for the size and shape of stigmatic hairs. Accordingly I have virtually omitted floral parts from this study, but whenever possible I have continued to collect them as an integral part of all spirit collections made. Carpel number for each species has always been ascertained from flowers as some species commonly abort carpel development, causing fruits to be unreliable indicators of the number of carpels initially present in each flower.

A scanning electron microscope study of stigmas could possibly provide useful taxonomic information. B.L. Rye, in Marchant *et al.* (1987; 2: 722), gives differences in the length of anthers between *T. huegelii* (as *T. procerum* var. *eleutherocarpa*) and *T. lineare* (as *T. procerum* var. *procerum*) but I have not seen either fresh or spirit material of these species.

Infructescences — Infructescence dimensions are never diagnostic but are helpful in distinguishing some species. For example, *T. alcockiae* and *T. multifractum* have infructescences of similar diameter but, except in a few extremes, of dissimilar length. The shorter, and therefore comparatively wider, infructescences of the former species are almost always distinguishable from the long slender infructescences of the latter on dimensions alone. When dimensions are coupled with the size, shape, spacing and number of mature fruits, the infructescences are unmistakable.

Infructescences with mature fruits along their whole lengths have been used for measurements. Diameters were measured across the widest portion of each infructescence from fruit apex to fruit apex but excluding any portions of fruits or carpels which protruded excessively beyond the general outline of an infructescence. As mature fruits readily fall, numbers were obtained for each infructescence by counting the pedicels found on each rachis. To give quantitative expression to the density of fruits, the number of fruits counted was divided by the rachis length for each infructescence. For species where fruit density is very much reduced along the basal portion of the infructescence this portion was excluded when calculating the density.

The rachis and/or pedicels of most species are usually cream-green or green but sometimes may be tinged or deeply coloured in maroon or cyclamen shades. However, *T. multifractum* characteristically has the rachis and pedicels coloured maroon-cyclamen, often deeply so. Pedicel length is generally similar for all species but is sometimes much longer and more slender in *T. rheophilum*. At such times it is an aid to identification.

Fruits and Mature Carpels — The shape, size, number and freedom or attachment of carpels in the mature fruit, and hence the characteristics of the whole fruit, are of major diagnostic significance. Descriptions of these parts are therefore detailed.

Mature carpels are described as spiralled or twisted when they exhibit lateral rotation and straight when they do not. Spiralled carpels usually produce fruits which also appear twisted. Each carpel may possess three longitudinal ridges, one dorsal and two lateral or shoulder ridges; the surface between a lateral ridge and the ventral edge of a carpel is termed a lateral face. Ridges may be obscure to well-pronounced, the variation being expressed quantitatively from measurements made on transverse sections cut approximately midway along carpel lengths (Fig. 4). The carpels of a fruit may be free, as in *T. dubium* and *T. huegelii*, or variably connate along their ventral edges as in

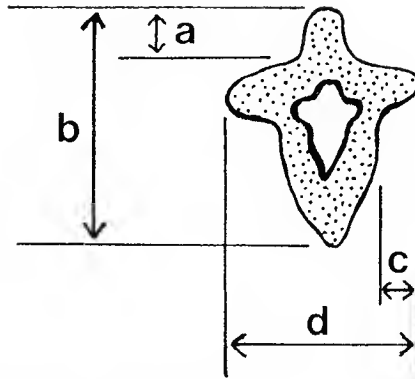


Fig. 4. Mature carpel in transverse section, diagrammatic. a = length of dorsal ridge. b = carpel depth. c = length of lateral ridge. d = carpel width.

other species. The length for which a carpel is connate has been termed the attachment length of the carpel (e.g. Fig. 5, b & d) and this is expressed as a percentage of the total carpel length. Total carpel length includes the stylar beak as this is frequently not demarcated from the remainder of the carpel.

CHROMOSOMES

Robb & Ladiges (1981) reported a simple polyploid series, $2n = 16, 32, 64$, in their chromosome counts on collections of the *Triglochin procerum* aggregate from Victoria. Their counts correspond to $2n = 16$ for *Triglochin multifractum*, 32 for *T. microtuberosum* and 64 for *T. rheophilum* and *T. procerum* (excluding the eastern variant). With *T. procerum* three of the eight collections which they examined produced counts of $2n = 62$ or 63 , rather than 64, an aberrance which may be due to the difficulty of counting or may relate to the great morphological variation found within this entity.

The collections used by Robb & Ladiges did not include what is described here as an eastern variant of *T. procerum*. However, *Constable 5969* and *Briggs NSW 80707* are this variant and both have in the past (undated) been annotated with chromosome counts by B.G. Briggs. Her count for *Constable 5969* is $2n = c. 60-64$, and for *Briggs NSW 80707* is $2n = 46-48$. This latter count is the first report of a hexaploid within the polyploid series. The possession of both hexaploid and octoploid chromosome numbers by the eastern variant of *T. procerum* may be related to its very variable fruit morphology. See 'Morphological Variation' and 'Field Observations' under *T. procerum*.

The count of $2n = 32$ ascribed to *T. procerum* by Briggs (1966) for the collection NSW 65826 [= *Constable 4946*] actually refers to a collection of *T. microtuberosum*. This is consistent with the findings of Robb & Ladiges.

The chromosome numbers of other species treated in this revision are unknown.

USES

Tubers of at least *T. dubium* and *T. procerum* are known to have been a staple food of aboriginal people in northern and south-eastern Australia respectively (see *T. dubium*, field observations, and Gott 1982, 1993).

T. dubium and *T. microtuberosum* have been found heavily grazed by cattle and *T. multifractum* similarly grazed by sheep where stock had gained access to populations following falls in water levels (pers. obs.).

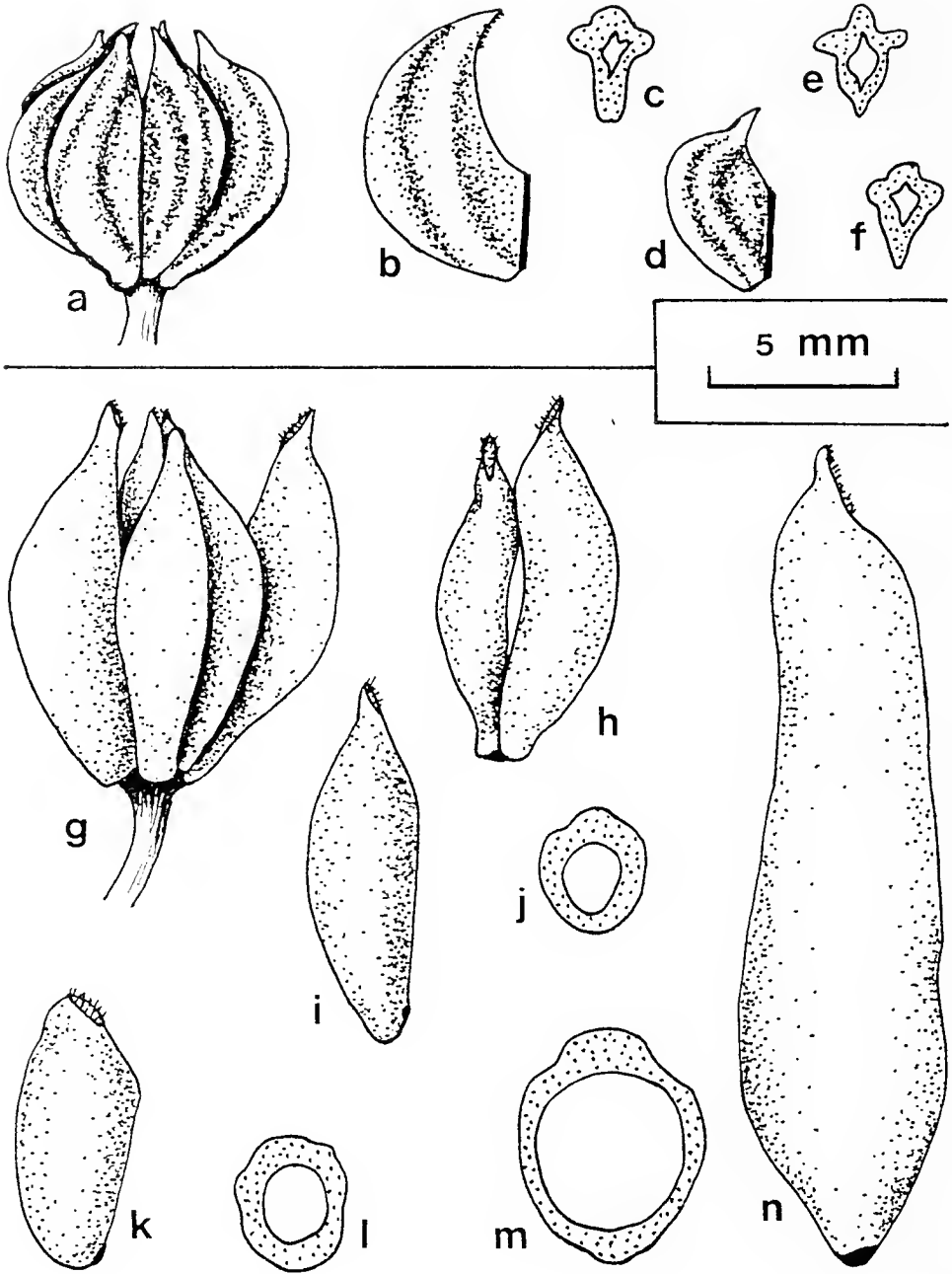


Fig. 5. Fruits and mature carpels. Attachment length shown by a thickened line on carpels in lateral view. a-f — *Triglochin alcockiae*, from western Victoria (a-c) and from Dandenong, Victoria (d-f). a — fruit, lateral view. b-c — carpel, lateral view and T.S. d — carpel, lateral view. e-f — carpels in T.S. g-n — *Triglochin dubium*, from Victoria (g-l) and from Dampier Peninsula, Western Australia (m-n). g-h — fruits with 5 and 2 mature carpels, lateral view. i-j — carpel, lateral view and T.S. k-l — carpel, lateral view and T.S. m-n — carpel, T.S. and lateral view. (a-c — from *Aston* 2722. d-f — from *Aston* 2852. g-j — from *Aston* 2778. k-l — from *Aston* 2804. m-n — from *Aston* 2696)

TAXONOMY

Triglochin L., *Sp. Pl.* 338 (1753). LECTOTYPE: *T. palustre* L., *fide* Britton, *N. American Fl.* 17: 41 (1909).

Description for tuberous-rooted species only — *Perennial, aquatic herbs. Rhizomes* thick, woody, densely covered with fibres formed from the bases of the vascular bundles of otherwise decayed leaves, bearing simple roots which frequently terminate in storage tubers; rhizomes often with several short adjacent branches forming a clustered root-stock. *Leaves* radical, arising in tufts from the rhizome, more or less linear, flattened distally, becoming thickened and spongy toward the base in most species, sometimes subcylindrical throughout, sheathed proximally, emergent in most species with the emergent portions erect to floating; sheath open, never ligulate or auriculate. *Stems* simple, axillary within the leaf tufts, erect to reclining, elliptic depressed-obovate or circular in cross section but irregularly so. *Inflorescence* a terminal raceme, ebracteate, few- to many-flowered, usually dense and spike-like. *Pedicels* shorter than the flowers or fruits, persistent, spreading to upcurved in fruit. *Flowers* small, bisexual, trimerous, often near-sessile, protogynous. *Perianth* segments 6, in 2 similar, alternate whorls, deciduous, concave, each segment incurved over an anther. *Stamens* 6, each inserted on the base of a perianth segment and semi-enveloped by it, the segment and anther falling together after anthesis; anther near-sessile, as broad as or broader than long, 2-locular, longitudinally and retrorsely dehiscent. *Gynoecium* superior, of (2 or)3–6(–8) free to united carpels; central carpophore absent; ovules 1 per carpel, anatropous. *Style* adaxially terminal, short and thick, appearing as a tapered continuation of the ovary, erect to outcurved in flower, often forming a prominent beak in fruit. *Stigma* sessile, elongated, adaxially lateral along the apical portion of the style, papillate to finely hairy. *Fruiting carpels* follicle-like but indehiscent, 1-seeded, free to closely adpressed, forming distinctively shaped fruits, all separating and falling at maturity. *Seed* narrowly elliptic, basal, erect.

KEY TO THE TUBEROUS-ROOTED SPECIES OF TRIGLOCHIN L.

1. Tubers small, mostly 4.5–13 mm long, often near-globular, clustered closely beneath the rhizome; fruits 7–9.6 mm long, very broadly obovoid with base contracted and stalk-like; mature carpels (5 or)6, ventrally attached; dorsal surface of mature carpel \pm flat, shallowly indented, or shallowly rounded, never keeled or ridged **T. microtuberosum**
1. Tubers mostly larger, ellipsoid or obloid to narrowly so or long-cylindrical, distanced from the rhizome; fruits not as above; mature carpels keeled or ridged (except in *T. dubium*) 2.
2. Mature carpels free 3.
2. Mature carpels ventrally attached along at least one-fifth of their length (length includes the styler beak) 4.
3. Mature carpels straight, not incurved, smooth, \pm circular in cross-section, erect to semi-ouspread in fruit **T. dubium**
3. Mature carpels straight or somewhat twisted, strongly incurved, dorsally and laterally ridged, \pm obtrullate in cross-section, erect or somewhat twisted and usually overlapping in fruit because of their curvature **T. huegelii**
4. Leaves linear, usually submerged and isolateral, thin-textured; leaf-sheaths narrow, mostly tightly inrolled with the width of each usually less than one quarter of the leaf width (as seen in T.S. c. 3 cm below the sheath summit); plant of clear-flowing streams **T. rheophilum**
4. Leaves linear-tapered, emergent, dorsiventral, spongy in texture; leaf-sheaths broader, gradually incurved, the width of each usually one third or more of the leaf width, both sheaths often overlapping 5.
5. Fruits small, usually 3–5 mm long and globular in outline or to 8.5 mm long and more ellipsoid, c. 230–1000 per infructescence, tightly touching, 14–27 on each centimetre of

- rachis length; mature carpels each with a prominent narrowly obtuse dorsal keel and two prominent lateral (shoulder) keels **T. multifractum**
5. Fruits not as above, c. 1–320 per infructescence, mostly loosely or not touching, 2.6–11 (or -18 on western variant of *T. procerum*) on each centimetre of rachis length; mature carpels each with variably prominent to near-absent dorsal and lateral keels6.
6. Tubers usually elongated, narrow-ellipsoid to cylindrical, less frequently ellipsoid to obovoid, 20–145 mm long, length 2.5–20 times diam.; plants usually robust, sometimes slender, with leaves 5–41 mm wide, scape 4–23 mm diam., infructescence 17–42 mm diam.; fruits very variable **T. procerum**
6. Tubers ± ellipsoid or globular to obovoid, 8–30 mm long, length 1–3.7 times diam.; plants slender, with leaves 1–12 mm wide, scape 1–6 mm diam., infructescence 7–19 mm diam.7.
7. Fruits globular to depressed-globular in outline, usually broader than long; mature carpels characteristically ventrally attached along only the lower 20%–39% of the carpel length (length includes the stylar beak), but attached to 59% in the more easterly Victorian populations **T. alcockiae**
7. Fruits ellipsoid to ellipsoid-obloid in outline, longer than broad; mature carpels characteristically ventrally attached along 46%–72% of the carpel length, sometimes as little as 27% **T. lineare**

Triglochin alcockiae Aston, *Muelleria* 8: 85 (1993). TYPE: “Victoria, c. 38 km (straight line) south-west of Horsham. Swamp at north end of Toolondo Reservoir. 36°59’S, 141°56’E. 9 Nov. 1988, H.I. Aston 2705”. HOLOTYPE: MEL 705957. ISOTYPES: AD, BRI, CANB, CBG, HO, K, MEL 705956 & 705962 & 705963 & spirit material, NSW, PERTH.

Original Description — see also under Notes below — *Rhizomes* vertical, 1.7–7 cm long × 7–10 mm diam., bearing short fine soft fibres to 2 cm long, rarely to 11 cm. *Tubers* ellipsoid, obloid or globular to oblanceolate or obovate, 8–20(–28) mm long × 5–12 mm diam. (length 1.0–3.0 times the diam.), terminating roots 5–35 mm long; each root 0.3–2.3 times as long as its tuber. *Leaves* (6–)26–91 cm long × (1–) 2–8 mm wide, dorsiventral, medium-green and glossy above, paler beneath, bending below the water surface, the emerged portions floating and maintaining contact with the water along their whole length (or sometimes held semi-erect by surrounding herbage), ± linear, flat to slightly plano-convex in T.S., shortly tapered, obtuse, moderately thickened and spongy toward the base, sheathed over the lower 16%–38% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: narrowly plano- to concavo-convex, width 3.8–4.3 times the thickness; each side of sheath 2.1–2.6 mm wide, equal c. 34%–45% of the leaf width. *Stems* in fruit 28–81 cm long (including the infructescence) × 1.3–5.9 mm diam. *Rachis* 1.0–2.6 mm diam. at base, gradually tapered upwards; rachis and pedicels pale cream-green or the rachis (occasionally also the pedicels) pale to deep maroon-red. *Infructescence* (0.6–)2–13.5 cm long (= 5%–28% of the total stem length) × 11–19 mm diam. *Pedicels* often upcurved, 1.2–3.5 mm long. *Fruits* loosely touching to shortly spaced, (1–)8–67 per infructescence, 3–8 per 1 cm of rachis length, globular to depressed globular in outline, usually broader than long, 5.6–8.7 mm long × 6.6–9.9 mm diam. *Carpels* (5 or)6, in fruit straight and erect or the upper portions partly spiralled around each other and then giving a semi-twisted appearance to the fruit, all maturing or 1 or 2 (occasionally to 5) aborted, 5.6–8.5 mm long × 1.3–3.0 mm wide × 2.3–4.1 mm deep; ventral edges attached only over the lower portions; attachment length = 20%–39% of the carpel length; lateral faces ± flat to slightly concave or convex, mostly not adpressed; dorsal ridge broad-rounded, 10%–22% of carpel depth; shoulder ridges rounded, 17%–26% of carpel width. (Figs 2g-h, 3e, 5a-f)

SELECTED ADDITIONAL SPECIMENS EXAMINED (not cited in Aston, 1993; total additional = 5)

Victoria — Greens Road, c. 3.5 km SE of Dandenong railway station, 30 Nov. 1992, *Aston 2852* (AD, CANB, K, MEL, NSW); Lal Lal, c. 250 m NW of the railway station, 4 Dec. 1992, *Aston 2855* (AD, K, MEL, NSW).

DISTRIBUTION (Fig. 6)

South Australia (Kangaroo Island, South Lofty Ranges, and south-east region), Victoria (typically south-western, extending east to about Dandenong), and Tasmania except in the north-west.

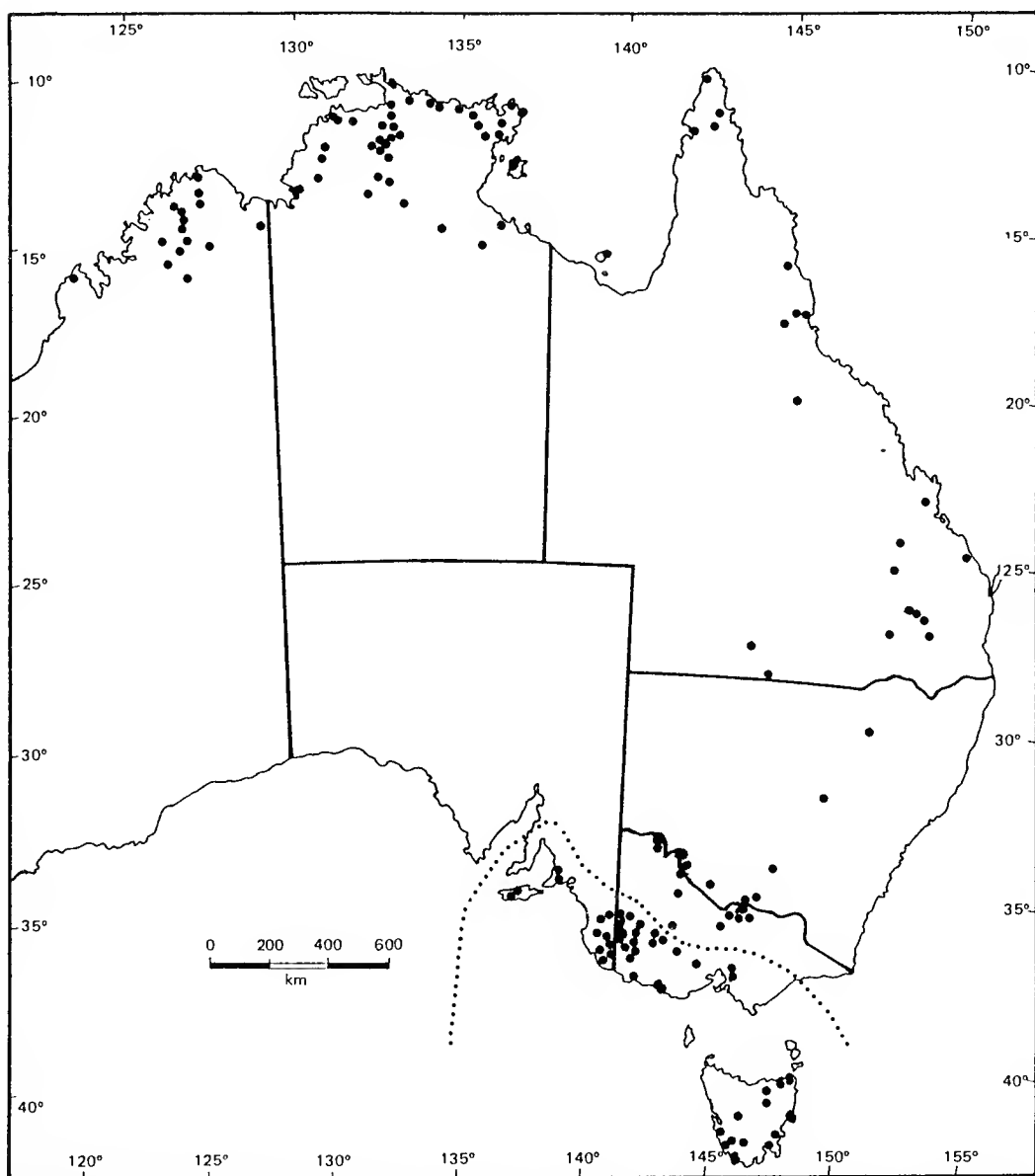


Fig. 6. Distribution of *Triglochin alcockiae* (below dotted line), and the Australian distribution of *T. dubium* (above dotted line).

NOTES

See Aston (1993) for fuller information on this species.

Recent discoveries have expanded the known Victorian range of *T. alcockiae* beyond that given in Aston (1993), extending it eastwards to the vicinity of Dandenong. Material from these eastern populations has extended the range of some measurements given in the original description, but generally only slightly so. In other respects, except for the variations which follow, plants of the more easterly populations fit the original description given above.

The major variation is in the attachment length of the mature carpels. This length is usually much greater than that previously reported, being (12.5%–)39%–49%(–59%) of the carpel length compared with 20%–39% originally reported for more westerly populations. Because of this feature, most mature fruits have straight, non-spiralled, closed carpels, so that the fruit breadth more or less equals the length. Fruits also tend to be somewhat smaller (4.7–7.5 mm long compared with 5.6–8.7 mm in other populations; 4.9–7.4 mm diam. cf. 6.6–9.9 mm). Dorsal ridges vary from broad-rounded as originally described to narrowly obtuse and quite pronounced, namely to 32% of the carpel depth, compared with 10%–22% measured from other populations.

DIAGNOSIS

A comparatively small and slender species with distinctive fruits and partially distinctive tubers. Mature fruits are comparatively few, 1–67 per infructescence, to 8.7 mm long and 9.9 mm diam., usually somewhat broader than long (but see Notes above), globular to depressed-globular in outline with rounded to narrowly obtuse dorsal ridges. Fruiting carpels are ventrally attached only over the lower 20%–39% of the carpel length in most populations (sometimes to 59%; see Notes above). The free upper portions of the carpels may be partially spiralled around each other. Of the (5 or)6 carpels in the developing fruit all mature or frequently 1 or 2, sometimes more, may abort.

Tubers are distinctively smaller and plumper than those of the sympatric *T. procerum* but can resemble those of some of the allopatric species of *Triglochin*.

Triglochin dubium R.Br., *Prodr. Fl. Nov. Hollandiae* 343 (1810). — *T. procerum* var. *dubium* (R.Br.) Benth., *Fl. Austr.* 7: 169 (1878). — *T. procerum* var. *gracile* Micheli in A.DC & C.DC., *Monogr. phan.* 3: 108 (1881) *pro parte*, excl. *T. lineare* Endl., *nom. illeg.*, *nom. superfl.*, **syn. nov.** TYPE: “(T.) v.v.”, R. Brown. HOLOTYPE: Bentham, *op. cit.*, stated “I find no specimen in Brown’s herbarium...” [i.e. at BM]. Currently, types have not been located at BM, E, G, G-DC, K, M, P, UPS, or W. See Notes below.

Triglochin pterocarpum Fitzgerald, *J. Proc. Roy. Soc. W. Australia* 3: 110 (1918). TYPE: “Isdell and Charnley Rivers (W.V.F.)” [= Kimberleys, W. Australia]. LECTOTYPE (here designated): “Isdell River, 4 miles below Mt Barnett homestead, North Western Australia, W.V. Fitzgerald 1037, June 1905” (NSW 6965)!. ISOLECTOTYPE: “Isdell River 4 miles below Mt Barnett homestead, W.V. Fitzgerald 1037, June 1905” (PERTH 00993018)! REMAINING SYNTYPE: “Charnley River Lat. 16° 17’, W.V. Fitzgerald 1414, Aug 1905” (PERTH 00993026)! Types not located at B, BM, E, K, PRE. See Notes below.

Triglochin procerum ‘*dubium*’, Aston *in litt.*

Description from extra-tropical material — *Rhizomes* semi-horizontal to vertical, 2–8 cm long × 5–12 mm diam., bearing fine soft fibres 2–7 cm long. *Tubers* near-globular to ellipsoid to broad-oblong to broad-obovoid, 11–38 mm long × 7–14 mm diam. (length (1–)1.2–3.8 times the diam.), terminating roots (8–)20–80(–106) mm long; each root 1–4(–5.3) times as long as its tuber. *Leaves* 31–75 cm long × 3.5–15 mm wide at widest part of the blade, dorsiventral, deep glossy green above, mid yellowish-green beneath, the emerged portions semi-erect or with the extremities recurved and sometimes floating on the water surface, sometimes the emerged portions fully floating without losing contact with the water, ± linear but gradually narrowed above the sheath then gradually widening and finally tapered distally, acute, thickened and spongy toward the base, sheathed over the lower 21–34% of the leaf length. *T.S. leaf* about 3 cm below the sheath

summit: narrowly plano- to concavo-convex, width 2.5–3.8 times the thickness; each side of sheath 2.1–4.3 mm wide, equal c. 25%–38% of the leaf width. *Stems* in fruit (27–)55–94 cm long (including the infructescence) \times 2–8 mm diameter. *Rachis* 1–3(–4.5) mm diam. at base, gradually tapered upwards; rachis and pedicels light to medium green, the pedicels sometimes tinged maroon-red, rarely both rachis and pedicels maroon-cyclamen. *Infructescence* (4–)8–27 cm long (= 14%–38% of the total stem length) \times 13–25 mm diameter. *Pedicels* 1.3–3.5(–5) mm long, slender, upcurved. *Fruits* loosely to not touching, mostly directed upwards at about 45°–60° angle, (15–)39–250 per rachis, 5–9 per 1 cm of rachis length, variable in outline but usually \pm obtriangular when three or more carpels mature, 8.3–10.5 mm long \times 5.5–8.8 mm diameter. *Carpels* (2 or)3(–6), \pm straight, lanceoloid ellipsoid or obloid, erect to semi-outspread in fruit, 1–6 maturing, often some aborted, 7.4–10.5 mm long \times 2.2–3 mm wide \times 2.75–3.7 mm deep; carpels free or very shortly attached at the base; attachment length = 0%–3%(–5%), very rarely to 13.5%; lateral faces rounded, not adpressed; dorsal ridge absent to inconspicuous, broadly rounded (0%–17% of carpel depth); shoulder ridges absent, the whole carpel \pm circular in cross-section. (Figs 2d, 3j-k, 5g-l)

Description from tropical material — As for extra-tropical description except for comparisons and additions given here. See also Notes — Geographical Variation below.

Tubers sometimes smaller, 8–21 mm long \times 4–10 mm diameter. *Leaves* narrow, <1–6 mm wide, shaped as above or terete to semi-terete or almost filamentous. *Stems* tending narrower, 1–4 mm diameter. *Infructescence* tending longer, 11–38 cm long. *Fruits* more spaced, 2.6–4 per 1 cm of rachis length; for size see carpels. *Carpels* mostly much larger and more narrowly lanceoloid, the largest 20.2–21.1 mm long \times 3.3–3.7 mm wide \times 4.15–4.45 mm deep when mature, some apparently maturing when only 11–12 mm long. (Figs 3l, 5m-n)

SELECTED SPECIMENS EXAMINED (total examined = 134)

Western Australia — Bobby Creek, 11 km ENE of Beagle Bay township, 10 Apr. 1988, *Aston 2699* (DNA, MEL, NSW, PERTH); King Edward River, old CRA campsite, 1 km S of ford on track to abandoned Mitchell River homestead, 5 Jun. 1987, *Edinger 259* (BRI, MEL, PERTH); 110 km NW from Mt Elizabeth Station on track to Bachsten Creek, 30 Jun. 1987, *Molyneux & Forrester s.n.* (MEL); 5 km SSE of Kununurra, 10 Mar. 1978, *Pajjmans 2304* (CANB).

Northern Territory — c. 33 km E of Goodparla Station, 26 Feb. 1973, *Adams & Lazarides 3108* (CANB, DNA); c. 37 km SSE of Jabiru, 30 Mar. 1981, *Craven 6640* (CANB, DNA, MEL); East Alligator River, 16 Feb. 1973, *Dunlop 3274* (CANB, DNA); 45 km SE of Ramingining, Arnhem Land, 18 Jun. 1989, *Dunlop 8488* (DNA); Warlock Ponds, 1 Apr. 1981, *Henshall 3730* (CANB, MEL); 12 km SW of Twin Falls, 25 May 1980, *Lazarides 8988* (BRI, CANB, MEL).

Queensland — Dawson Highway, c. 9 km WSW of Moura, 7 Sept. 1983, *Aston 2496* (BRI, MEL); Coconut Creek, c. 32 km S of Weipa, 10 Dec. 1981, *Clarkson 4180B* (BRI, CANB, MEL, NSW); Jardine River, at the road ford, 4 Sep. 1985, *Clarkson 6263* (BRI, MEL); Theodore road, c. 18 km N of Taroom, 19 May 1981, *Jacobs 4124* (NSW); Paroo River crossing W of Eulo, on road to Thargomindah, 27 Mar. 1976, *Purdie & Boyland 272* (BRI); Miara, c. 30 km NW of Bundaberg, 21 Apr. 1977, *Sharpe 2243* (BRI).

New South Wales — Bingera Creek, c. 7 km N of Tooleybuc, Victoria, 16 Dec. 1988, *Aston 2732* (MEL, NSW); Wangamong Creek, at crossing of the Berrigan to Oaklands road, 12 Nov. 1989, *Aston 2787* (MEL, NSW); 36 miles SW of Dubbo on Peak Hill road, 28 Nov. 1969, *Coveny 2520* (MEL); Jimaringle, 40 km NE of Barham, 10 Dec. 1971, *Trounce s.n. NSW228856* (NSW).

Victoria — Wimmera Highway, c. 16.5 km W of St Arnaud, 19 Dec. 1988, *Aston 2745* (AD, BRI, CANB, MEL); Lalbert Creek, at crossing of the Lalbert to Culgoa road, 5 Nov. 1989, *Aston 2778* (BRI, MEL); c. 6.5 km ESE of Nathalia, 5 Jan. 1990, *Aston 2805* (MEL, NSW); North entrance to Wallenjoe Swamp Game Reserve, 5 Jan. 1990, *Aston 2807* (MEL); Kings Billabong, 7 km SE of Mildura, 5 Dec. 1981, *Browne 69* (MEL).

DISTRIBUTION (Fig. 6)

In Australia, occurs from the Kimberley in Western Australia across northern Northern Territory to Cape York Peninsula and eastern coastal Queensland, extending inland in southern Queensland, New South Wales (central and south-western slopes; south-west plains), and Victoria (central-northern and Murray River areas, south to about St Arnaud and west to about Mildura).

Also occurs in New Guinea (Steenis 1949; Leach & Osborne 1985).

HABITAT

In Victoria and New South Wales *T. dubium* occurs in shallow still ephemeral fresh water to 50 cm deep, usually in swamps, creeklets and floodplains and on surrounding saturated soils left by receding waters; also reported amongst dense *Typha* in a roadside ditch and in flooded rice crops. It is typically in sites dominated or edged by *Eucalyptus camaldulensis* (River Red Gum) or by *E. largiflorens* (Black Box) and *Muehlenbeckia florulenta* (Lignum), in semi-natural to grazed pasture settings, on sticky grey clay, sandy-clay, or loamy clay, overlain with shallow silt or sand. Associated species include *Azolla* spp., *Damasonium minus*, *Ludwigia peploides*, *Marsilea drummondii*, *Myriophyllum* spp., *Nymphoides crenata*, *Ottelia ovalifolia*, *Potamogeton tricarinatus*, *Utricularia australis*, sedges such as *Cyperus difformis* and *Eleocharis acuta*, and herbaceous grassland weeds.

In Western Australia and the Northern Territory *T. dubium* occurs also in saturated soils or still shallow water of ephemeral swamps and floodplains but also is found commonly in still pools (to 2 m deep) or slowly to strongly flowing fresh water of seasonal or perennial streams; also reported in freshwater seepage. It grows on sand, sandy-loam, dark mud, or heavy grey and black clay soils (sometimes strongly humic) or amongst sand gravel and rocks on streambeds. Sites include *Timonius timon*/*Melaleuca viridiflora*/*Pandanus* overstorey, *M. leucadendron*/*Barringtonia acutangula* woodland and "tall riparian forest". Associated species reported are *Pseudoraphis spinescens*, *Xyris* and *Utricularia*.

Queensland plants occur in varied habitats and on varied soils as do those of Western Australia and the Northern Territory. Sites include *Eucalyptus tetradonta* open forest, *Casuarina cristata* ssp. *cristata* woodland, *Melaleuca* swampland, cleared Brigalow scrub, sedge/grass swampland and *Nymphaea gigantea* waterhole/claypan.

Altitude c. 50–170 m in Victoria and southern New South Wales, with one record (*Coveny 2520*) of 300 ± 40 m from south-west of Dubbo in the latter State. The only four altitude records available for other States range from 8–200 m.

In Victoria and New South Wales, flowers recorded (Oct. or) November to February and fruits (Oct. or) November to March. In Western Australia and the Northern Territory, flowers and fruits recorded every month except September. Queensland records spaced, but apparently flowers and fruits in all months.

NOTES

Typification of *T. dubium* — Robert Brown described *T. dubium* from material he collected at coastal and island sites in area "(T.)". This area embraces two regions, one approximately between Bowen and Gladstone, eastern Queensland, and the other around the Gulf of Carpentaria, from Prince of Wales Island, Cape York, Queensland, to Arnhem Bay, Arnhem Land, Northern Territory (Stearn 1962). The exact type locality is not known and apparently Brown's descriptive manuscripts at the British Museum (BM) do not include his account of this taxon (Burbidge 1955). Although Brown's published description of *T. dubium* is brief, it leaves no doubt that his name applies to the taxon circumscribed here. Without having undertaken extensive field work in northern and north-eastern Australia and because of the variability in northern Australian material (see Geographical Variation below), I believe it best not to select a neotype at this stage.

Typification of *T. procerum* var. *gracile* — In his account of *T. procerum* var. *gracile*, Micheli included two distinct species, citing "(*T. lineare* Endl.; *T. dubium* Brown ex specimine in herb. Brown in Brit. Mus. scrvato)". The meagre varietal description could be applied to either of the cited species although, because of its reference to the flowers being remote on the spike, it perhaps favours *T. dubium*. As Micheli directly refers to Brown's specimen preserved at the British Museum, that specimen(s) must be regarded as the type of Micheli's varietal name and it is necessary to exclude *T. lineare* Endl. from the circumscription of that variety.

In the paragraph beneath his account of the variety Micheli cites several collections. However, it is evident from the content that this paragraph, the final one in his account of *T. procerum* R.Br. *sensu lato*, refers to that species overall (as circumscribed

by Micheli) and is not part of the varietal account. It is incorrectly included by Chapman (1991b; p. 2905) as part of the type citation for *T. procerum* var. *gracile*.

It is puzzling why Micheli referred directly to Brown's specimen of *T. dubium* in the British Museum, rather than to just the species name *T. dubium*, when publishing his variety *T. procerum* var. *gracile* in 1881. It suggests that he saw Brown's specimen although Bentham had not been able to locate it three years earlier for his publication of the priorital name, *T. procerum* var. *dubium*. Apparently none of Brown's original material exists today although, in my discussion of the typification of *T. procerum* R.Br., I have suggested that two very meagre collections mounted with the lectotype of *T. procerum* may actually be part of the type collection of *T. dubium*.

Type description of *T. pterocarpum* — The published description of *T. pterocarpum* Fitzgerald differs in one important respect from Fitzgerald's handwritten manuscript description held at the British Museum (BM). I have seen a copy of the manuscript and this clearly gives the length of the perianth segments as "1-1 1/2 lin. [linea] long". This measurement is equivalent to c. 2.1-3.15 mm and fits the taxon. The published description erroneously gave perianth segment length as "1-1 1/2 in.", i.e. equivalent to c. 25-38 mm, a gross oversize.

Geographical Variation — Plants from tropical Australia exhibit extremes of leaf and carpel variation not found in those from southern areas. They often have narrow, terete or semi-terete leaves only mildly flattened over the distal portions. When totally submerged, leaves may be <1 mm wide, flaccid and almost filamentous. When more or less linear, the leaves are narrower than, or in the narrower range of, similar shaped leaves from extra-tropical material.

Mature carpels from tropical plants are usually much larger and often more narrowly lanceoloid than those from southern plants. Near-mature carpels (10-)15-19 mm long occur on both Western Australian and Northern Territory specimens and apparently would have lengthened a little before maturing and falling naturally. The largest mature carpels seen, c. 20-21 mm long, are from more or less terete-leaved plants from the Kimberley (Aston 2696).

A terminal anther appendage is sometimes present on tropical plants, e.g. minute on *Lazarides* 8988, pronounced on *Dunlop* 3274 and *Henshall* 3730. This character has been investigated on only some collections but it can be either present or absent on different plants of similar vegetative morphology.

Although the most extreme, narrow, terete-leaved, large-carpelled plants of the Kimberley superficially look very different to the broadest, flattened-leaved, small-fruited plants of Victoria, the gradation and overlap between these extremes is considerable throughout the intervening geographical range. There seems to be no consistent link between different morphological characters sufficient to warrant taxonomic segregation.

DIAGNOSIS

The free, straight, narrowly lanceoloid to obloid carpels which virtually lack dorsal and lateral ridges and are more or less circular in cross section are distinctive. Those from northern Australia, particularly from the Kimberley, which reach 20 mm or so in length also exceed the size attained by the carpels of any other *Triglochin* species.

FIELD OBSERVATIONS

Apart from the distinctive fruits, *T. dubium* is noticeably different from *Triglochin multifructum* when found growing with that species in south-eastern Australia. See Aston 1993, p.94.

Fruit development can be extremely rapid. At one site near Beagle Bay, Western Australia, most fruits throughout the population were just commencing development when first examined (Aston 2697). Four days later most fruits were half developed, being 10-12 mm long (Aston 2699). A.H. Marshall of Waaia, near Numurkah, Victoria, reported (*in litt.*, July 1992) that with locally-collected fruits he "can grow a plant from seed up to setting seed in five months. If kept in water [plants] will grow all the year round and flower in autumn as well as in spring".

Marshall also reported (*in litt.*, Sept. 1992) that populations in essentially grazing farmland in the Nathalia district, Victoria, can withstand cropping at intervals. For one such population (*A.H.M. s.n.*, 15 Oct. 1989) the rhizomes and tubers are too deep to be affected by the soil disturbance of cropping and plants “just take off” from subterranean parts when it gets wet enough. Plants can remain dormant underground for several years until conditions are suitable and can produce leaves but not flower if water does not cover them. The depression occupied by this population is inundated to a depth of at least 2 metres for a couple of weeks in years of big floods.

T. dubium has been found heavily grazed by cattle (*Aston 2804*, Katamatite, Victoria).

Three collections from Western Australia and the Northern Territory report that the tubers are eaten by aboriginal people. *Smith 85.34* (Beagle Bay, W.A.) states “Edible tubers eaten raw or after warming in hot ashes”. *Reeve 120* (Nangalala to Gattji, N.T.) states “Tubers eaten after cooking”.

Triglochin huegelii (Endl.) *Aston comb. nov.*

Cynogeton huegelii Endl., *Ann. Wiener Mus. Naturgesch.* 2: 211 (1839, not Dec. 1838). TYPE: “In fluvia Cygnorum (Upper Swan-River) legit Carolus L.B. Hugel.” TYPE MATERIAL: No specimens located at BM, K, LD, M, S, or W. LECTOTYPE (here designated): *Iconogr. gen. pl.* VII: t.73 (1839). “Habitat in Novae Hollandiae colonia Swan-River. (Hugel.)”. See discussion under notes below.

Triglochin procerum var. *eleutherocarpum* Benth., *Fl. Austr.* 7: 168 (1878), **syn. nov.**. TYPE: “W. Australia, *Drummond, n. 314, Preiss, n. 2405*; Blackwood and Tweed Rivers and Port Gregory, Oldfield.” LECTOTYPE (here designated): Swan River, *Drummond 314* (K)! ISOLECTOTYPES: (BM, MEL 720277)! REMAINING SYNTYPES: Port Gregory, W. Australia, *Oldfield* (K, MEL 720279)! Blackwood River, W. Aust., *Oldfield* [623 has been added to Oldfield’s original label] (K)! Tweed River, W. Australia, *Oldfield* [623 has been added to Oldfield’s original label] (MEL 720278)! *Preiss 2405* (LD!, MEL 720280!, S — photocopy!).

Rhizomes (available on only one collection) to c. 14 mm diam., bearing moderately coarse fibres to 10 cm long. *Tubers* (available on two collections only) ellipsoid to obovoid, 8–25 mm long \times 4.5–8 mm diam. (length 1.8–3 times the diam.), terminating roots 20–30 mm long; each root 2.0–3.0 times as long as its tuber. *Leaves* 38–89 cm long \times 3–20 mm wide, dorsiventral, with floating extremities at least on plants growing in deeper water [collector’s notes], sheathed over the lower 26%–34% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: not available from fresh or spirit material; apparently plano-convex with sheaths not touching. *Stems* in fruit 45–130 cm long (including the infructescence) \times 3–9 mm diam. *Rachis* 1.5–6 mm diam. at base, gradually tapered upwards. *Infructescence* 5.5–46 cm long (= 18%–37% of the total stem length) \times 12–23 mm diam. *Pedicels* 0.5–4 mm long, spreading to upturned. *Fruits* usually well-spaced (by up to 4.5 cm) on basal portion of rachis but elsewhere loosely touching, (16–)40–166 per infructescence, 2.8–5.3 per 1 cm of rachis length, \pm globular in outline but distorted by the varied ways in which the free carpels spread or overlap, 8.5 mm long \times 6.0 mm diam. (5–9 mm \times 5–10 mm when dry). *Carpels* (2 or) 3–6, in fruit erect or very slightly twisted, strongly incurved and usually overlapping each other, 1–6 maturing, often 2–4 aborting, 6.0–8.7 mm long \times 1.3–2.3 mm wide \times 2.1–3.5 mm deep (but the length 9.0–14.1 mm when measured around the carpel curvature); carpels free; lateral faces \pm flat; dorsal ridge prominent (12%–25% of carpel depth), narrow-rounded; shoulder ridges conspicuous (15%–20% of carpel width), narrow-rounded. (Fig. 7a-f)

SELECTED SPECIMENS EXAMINED (total examined = 35)

Western Australia — Blackwood River, Bridgetown, 11 Dec. 1961, *Aplin 1365* (PERTH); Lake Sappings, Albany, 30 Sep. 1984, *Cranfield 4937* (CANB, MEL, PERTH); c. 2 km NW of junction of Regan Ford and Gin Gin Brook East roads, 30 Nov. 1974, *Halliday 176* (AD, MEL, PERTH); Helena River, 16 Oct. 1977, *Seabrook 355* (CANB, PERTH); Kerridale Swamp N of Augusta, 16 Nov. 1982, *Strid 21528* (PERTH).

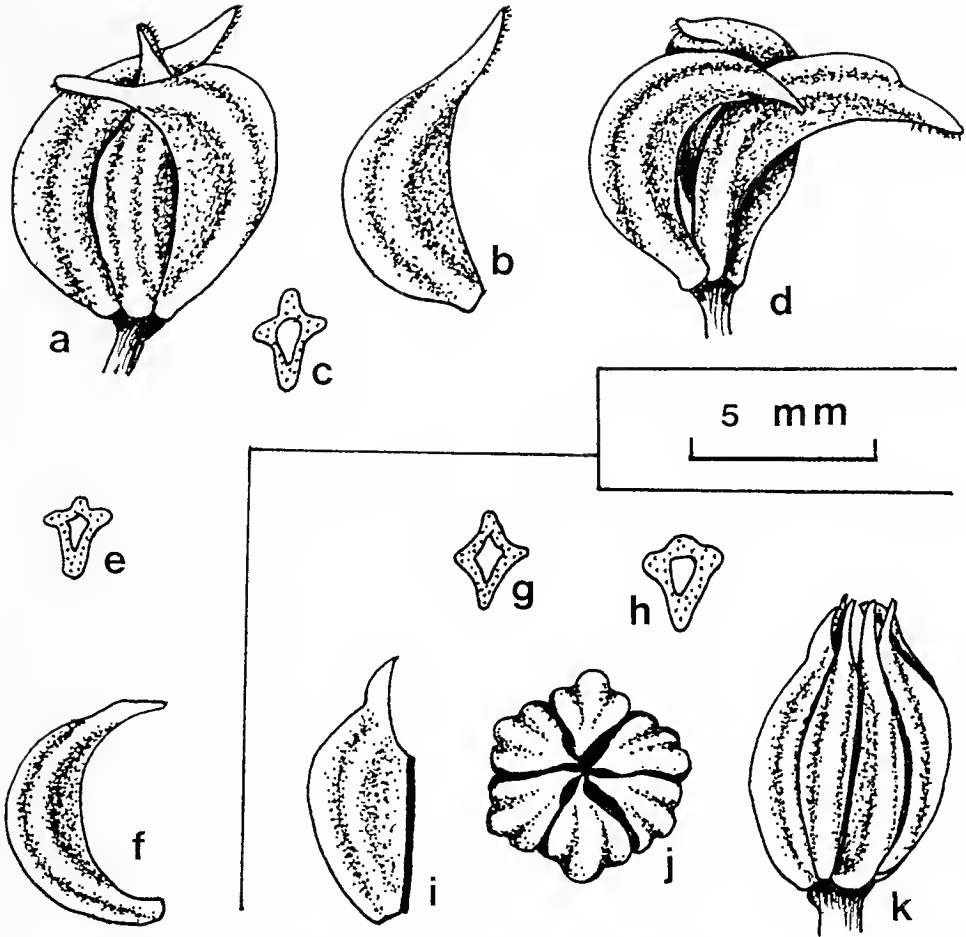


Fig. 7. Fruits and mature carpels. Attachment length shown by a thickened line on carpels in lateral view. a-f — *Triglochin huegelii*. a — 3-carpelled fruit, lateral view. b-c — carpel, lateral view and T.S. d — 3-carpelled fruit, lateral view. e-f — carpel, T.S. and lateral view. g-k — *Triglochin lineare*. g — carpel, T.S. h-i — carpel, T.S. and lateral view. j-k — fruit, apical and lateral views. (a-c — from Cranfield 4937. d — from *Strid* 21528. e-f — from *Aplin* 1365. g — from *Hnatiuk* 771429. h-k — from *Bates* 4285)

DISTRIBUTION (Fig. 8)

Confined to south-west Western Australia; recorded south and west of a line approximately through Gregory, Lake Wagin and Cape Arid.

HABITAT

Fresh, still to flowing water to 1 metre deep, mostly edging permanent lakes streams and rivers but also reported from [ephemeral?] swamps, pools and a roadside ditch; once collected from brackish flowing water (Regan's Ford; *Mann* 188). In mud, sand, or peaty-sand. Sites recorded as *Melaleuca raphiophylla* swamp (*Strid* 21528), pool surrounded by low heath (*Wilson* 12411); associated species *Juncus* (*Halliday* 176), and "aquatic herbfield".

Only one altitude of 60 m recorded.

Flowers July to January, chiefly August to November. Fruits July to January, chiefly August to December, with one collection in March.

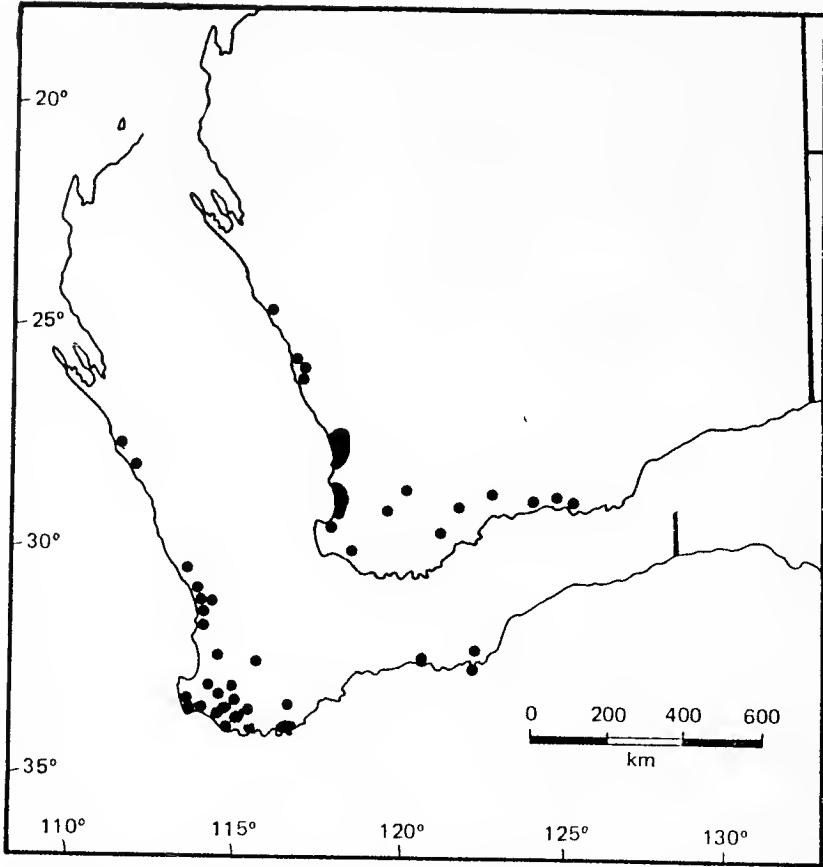


Fig. 8. Distribution of *Triglochis huegelii* and (inset) of *T. lineare*.

NOTES

Typification — In *Ann. Wiener Mus. Naturgesch.* 2: 210–211 (1839) Endlicher gave consecutive descriptions for the new genus and species *Cycnogeton* and *C. huegelii*. Under the generic name he referred to “*Cycnogeton* Endlicher *Gen. plant. Suppl. n. 1664/1. Iconograph. t. 73.*”. The second of these references, the *Iconograph*, was published (Feb.- April 1839) in the same year as the *Annalen* but the first was not published until about two years later (Feb.- March 1841).

Under the specific name in the *Annalen* Endlicher cited “In fluvia Cygnorum (Upper Swan-River) legit Carolus L.B. Hugel.” thus typifying both the species and the genus. His major type material would be expected at the Vienna Herbarium (W) but all Juncaginaceae there was destroyed during the second world war (Riedl 1981). No other possible type specimens have been located elsewhere. Plate 73 of *Iconogr. gen. pl.* consists of detailed botanical drawings captioned “*Cycnogeton Hugelii. E.*” and drawn from “Habitat in Novae Hollandiae colonia Swan-River. (Hugel).”. As part of the original material used and cited by Endlicher, the plate is therefore a suitable lectotype for both the genus and species involved.

I have now (above) formally designated *Iconogr. gen. pl. t. 73* as **lectotype** of the name *C. huegelii* Endl., and hence also as **lectotype** of the name *Cycnogeton* Endl. Although Chapman (1991a, p. 862) accepted the same plate as lectotype he incorrectly attributed the lectotypification to Endlicher himself, in the *Iconograph*. In 1839 the concept of lectotypes did not exist and, even if it had, it could not then have been applied by Endlicher to *C. huegelii* as type (plant) material was presumably still extant.

Endlicher, *Nov. stirp. dec.* Nr 9: 78–79 (20 July 1839), repeated exactly the generic and specific descriptions given in the *Annalen* cited above. Although the month of publication of the *Annalen* is undefined it is generally taken that this work has precedence over the *Nov. stirp. dec.* Endlicher himself seems to have accepted the *Annalen* as the major place of publication of the descriptions of *Cycnogeton* and *C. huegelii* as he cited it but not the *Nov. stirp. dec.* in his later *Gen. pl. Suppl 1*, p. 1369 (1841).

Morphology — See Notes under *T. lineare* concerning stamen size.

DIAGNOSIS

Mature carpels of *T. huegelii* are distinctively free, strongly incurved, and with prominent narrow-rounded dorsal and lateral ridges. Commonly 1–6 carpels mature in each fruit, the remainder aborting their development. Fruits with 5–6 mature carpels are more or less globular in outline but distorted by the varied spreading or overlap of the free carpels. Infructescences, particularly the larger ones, characteristically have one to a few of the basal fruits isolated centimetres apart along the rachis.

Triglochin lineare Endl. in Lehmann, *Pl. Preiss.* 2: 54 (1846). *Cycnogeton lineare* (Endl.) Sonder, *Linnaea* 28: 225 (1856). TYPE: “In depressis bieme inundatis ad fluvium Cygnorum, Middle Sevon [Swan], 1. Jul. [1839]. Herb. *Preiss.* No. 2406.” LECTOTYPE (here designated): “2406. / In depressis bieme inundatis / ad fluvium Cygnorum (Middle / Swan) / Fl. virides. / Jul. 1.39 / L. Preiss legit.” (LD)! ISOLECTOTYPES: [*Preiss*] “2406” (LD, MEL 720281 & 720282)!. No types present at BM, K, M, S or W.

Triglochin procerum var. *gracile* Micheli in A.D.C. & C.D.C., *Monogr. phan.* 3: 108 (1881) *pro parte, excl. typus, nom. illeg.* See Notes under *T. dubium*.

Triglochin procerum var. *procerum*, sensu B.L. Rye in N.G. Marchant *et al.*, *Fl. Perth Region* 2: 722 (1987) and in J.R. Wheeler, ed., *et al.*, *Fl. Kimberley Region* p. 973 (1992), *non sensu stricto*.

Triglochin procerum “WA”, Aston *in litt.*

Rhizomes to 3 cm long × 6–13 mm diam., bearing short fine soft fibres to 2 cm long. *Tubers* ± ellipsoid or globular to obovoid, sometimes broadly so, 9–28 mm long × 6–11 mm diam. (length 1.2–3.7 times the diam.), terminating roots 11–45 mm long; each root 0.7–3 times as long as its tuber. *Leaves* 23–73.5 cm long × 1.5–5(–10) mm wide, (from dried material apparently not dorsiventral, submerged or floating, shortly tapered and acute, thin-textured, possibly somewhat thickened and spongy toward the base), sheathed over the lower section. *T.S. leaf* about 3 cm below the sheath summit: not apparent from dried material. *Stems* in fruit 18.5–60 cm long (including the infructescence) × 1–4.5 mm diam. *Rachis* 0.75–2.5 mm diam. at base, gradually tapered upwards. *Infructescence* 3.5–14.5 cm long (= 14%–39% of the total stem length) × 7–17 mm diam. *Pedicels* usually upcurved, 1–2.5(–3.5) mm long, rarely absent and the fruits then sessile. *Fruits* loosely touching to shortly-spaced, erect to semi-erect or rarely spreading, 10–47 per infructescence, 2.6–4.2 per 1 cm of rachis length, ellipsoid to ellipsoid-obloid in outline, 6.5–9.6 mm long × 4.1–6.1 mm diam. (5.5–9.0 × 2.5–4.75 mm when dry). *Carpels* 6, straight and erect in fruit (occasionally the distal portions somewhat twisted around each other when the carpels are only shortly connate), normally all maturing, occasionally 1–3 only semi-developing, 6.3–9.6 mm long × 1.5–1.9 mm wide × 2.1–2.7 mm deep (6.2–7.7 mm long when dry); ventral edges characteristically attached along their whole length (excluding the beak sinus) but sometimes the attachment considerably less; attachment length = (27%–)46%–72% of carpel length; lateral faces ± flat, adpressed; dorsal ridge inconspicuous to prominent, rounded, (2%–)9%–18% of carpel depth; shoulder ridges rounded, 5%–17% of carpel width. (Fig. 7g–k)

SELECTED SPECIMENS EXAMINED (total examined = 42)

Western Australia — Langford, Perth, 27 Sep. 1984, Bates 4285 (AD); 8 km S of Eneabba, 27 Sept. 1977, Hnatiuk 771429 (PERTH); Lowden, Oct. 1909, Koch 2012 (NSW); Lort River, c. 65 km W of Esperance, 9 Oct. 1968, Orchard 1417 (AD, PERTH); 10 miles N of Busselton at turnoff to Ruabon, 22 Sept. 1966, Scrymgeour 1294 (PERTH).

DISTRIBUTION (Fig. 8)

Confined to south-west Western Australia; recorded south and west of a line approximately through Geraldton, Dumbleyung and Esperance.

HABITAT

Fresh, usually still and ephemeral water to 40 cm deep, in swamps, roadside ditches and low-lying floodland, also occasionally in small streams and creek pools; once reported from brackish river water (Hill River, *Parker* 367). In mud or sand but most frequently in clay soils; once reported from creek pool among granite rocks (*George* 9465). Sites recorded in *Banksia/Melaleuca* shrubland, low heathland, and with *Melaleuca hamulosa* surrounded by *Eucalyptus tetragona/Macrozamia riedlei*.

Only one altitude of 95 m recorded.

Flowers May to November. Fruits June to December. Most records for both flowers and fruits are from July to October.

NOTES

See Notes on typification under *T. dubium* concerning the exclusion of *T. lineare* from the circumscription of *T. procerum* var. *gracile* Micheli.

Marchant *et al.* (1987) state "stamens ca 1 mm long" for *T. lineare* compared with "stamens 1.5–2 mm long" for the sympatric species *T. huegelii*. I have not fully investigated this feature.

DIAGNOSIS

T. lineare is a comparatively small and slender species. The characteristic ellipsoid to ellipsoid-obloid, loosely touching to shortly spaced fruits, with usually 6 straight, erect, mostly well-connate, mature carpels are distinctive.

Triglochin microtuberosum Aston, *Muelleria* 8: 88 (1993).

TYPE: "Victoria, East Gippsland, 'Redbanks' farm, c. 2 km south-east of Genoa, 37°28'S, 149°36'E. 23 Feb. 1988, *H.I. Aston* 2683". HOLOTYPE: MEL 705958. ISOTYPES: AD, BRI, CANB, MEL 705961 & spirit material, NSW.

Rhizomes horizontal, to 7 cm long × 6–12 mm diam., bearing short coarse bristly fibres to 12 mm long. *Tubers* near-globular to obloid or rarely obovoid, 4.5–13(–17) mm long × 3–6 mm diam. (length 1.1–1.9(–5) times the diam.), terminating roots 1–7(–14) mm long; each root 0.2–2 times as long as its tuber [tuber rarely elongate, spindle-shaped, to 30 mm long × 3 mm diam., on roots to 28 mm long]. *Leaves* 30–137 cm long × 3–12 mm wide, dorsiventral, deep green above, paler green beneath, emergent, erect or with the extremities outcurved, sometimes the emerged portion fully floating or recurved with only the extremity floating, tapered and flattened distally, acute, very thickened and spongy toward the base, sheathed over the lower 27%–49% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: broadly plano- to concavo-convex and ± semi-cylindrical, width 1.6–2.4 times the thickness; each side of sheath 3.4–9.0 mm wide, equal c. 50%–84% of the leaf width, the two sheaths usually touching to overlapping; blade and sheaths together ± rounded in outline. *Stems in fruit* 54–124 cm long (including the infructescence) × 2.5–12.6 mm diam. *Rachis* 1.5–4.0 mm diam. at base, gradually tapered upwards; rachis and pedicels green. *Infructescence* 7–21 cm long (= 10%–20% of the total stem length) × 15–24 mm diam. *Pedicels* 0.5–3.0 mm long. *Fruits* touching, 44–137 per infructescence, 7–9 per 1 cm of rachis length, very widely obovoid in outline but with the base contracted into a distinctive stalk, 7.0–9.6 mm long × 5.5–8.2 mm diam.. *Carpels* (5 or) 6, in fruit straight and erect, never twisted, normally all maturing, 7.0–9.6 mm long × 2.25–3.35 mm wide × 2.6–3.75 mm deep; ventral edges attached along their whole length (excluding the beak sinus); attachment length = 58%–70% of carpel length; lateral faces ± flat, adpressed; dorsal ridge absent, the dorsal face usually shallowly concave longitudinally or sometimes shallowly convex; shoulders rounded not ridged; carpel ± triangular in cross section. (Figs 2k-l, 3m-o, 9a-f)

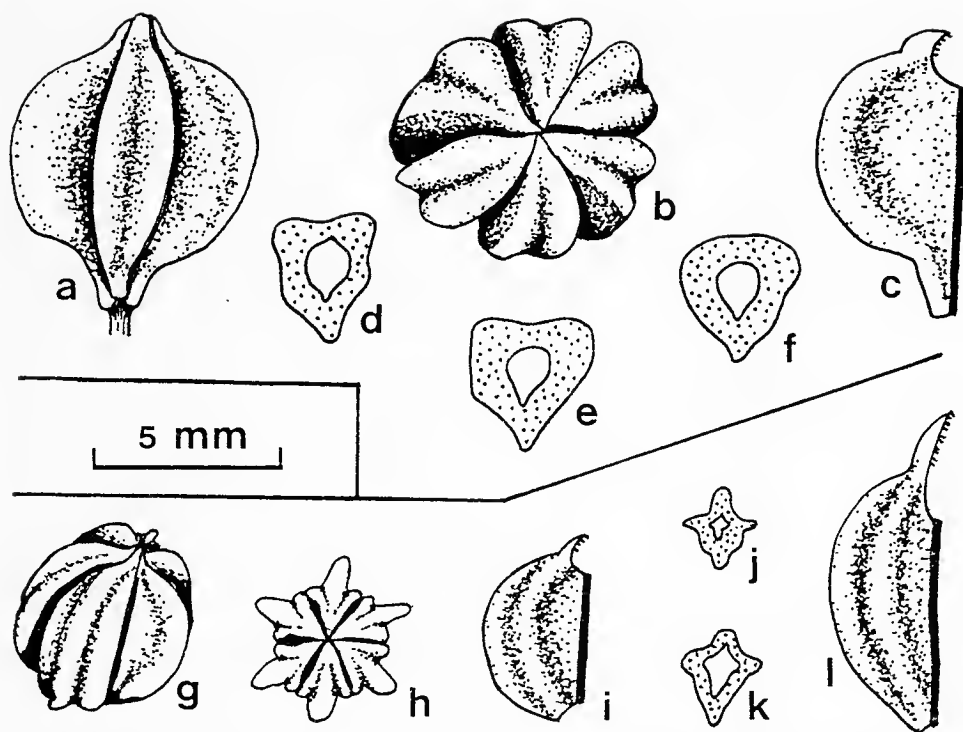


Fig. 9. Fruits and mature carpels. Ventral attachment shown by a thickened line on carpels in lateral view. a-f — *Triglochin microtuberosum*. a-b — fruit, lateral and apical views. c-d — carpel, lateral view and T.S. e-f — carpels in T.S. g-l — *Triglochin multifructum* from Victoria (g-j) and Byfield, Queensland (k-l). g,h — fruit, semi-lateral and apical views. i-j — carpel, lateral view and T.S. k-l — carpel, T.S. and lateral view. (a-d — from Aston 2683. e-f — from Aston 2685. g-h — from Aston 2779. i-j — from Aston 2797. k-l — from Anderson 4022)

DISTRIBUTION (Fig. 10)

Near-coastal regions from the vicinity of Brisbane, South-east Queensland, to Sale in eastern Victoria.

NOTES

See Aston (1993) for fuller information on this species.

When dry, the distinctive stalk of approximately the basal quarter or third of the fruit is narrowed through shrinking and may superficially be mistaken for an extension of the pedicel. The remainder of the fruit then appears depressed-globular.

T. microtuberosum often occurs in highly eutrophic water. One apparently healthy vegetative collection Jacobs 4574 (NSW) from central-coastal New South Wales was taken from a farm dam that had been "repeatedly sprayed with herbicide".

DIAGNOSIS

T. microtuberosum has numerous small distinctive tubers terminating very short roots so that the tubers are clustered closely against the rhizome. The more or less pear-shaped fruit with squat summit, stalk-like base and absence of dorsal ridges is also distinctive, the (5 or)6 carpels being ventrally attached over most of their length and more or less triangular in cross-section.

A helpful characteristic, although partly shared with the eastern variant of *T. procerum*, is the more or less cylindrical shape of the lower leaf as seen in cross-section below the sheath summit. Here the leaf blade is thickly spongy, i.e. the blade is deep in comparison with its width, and the sheaths are curved and usually touching to overlapping.

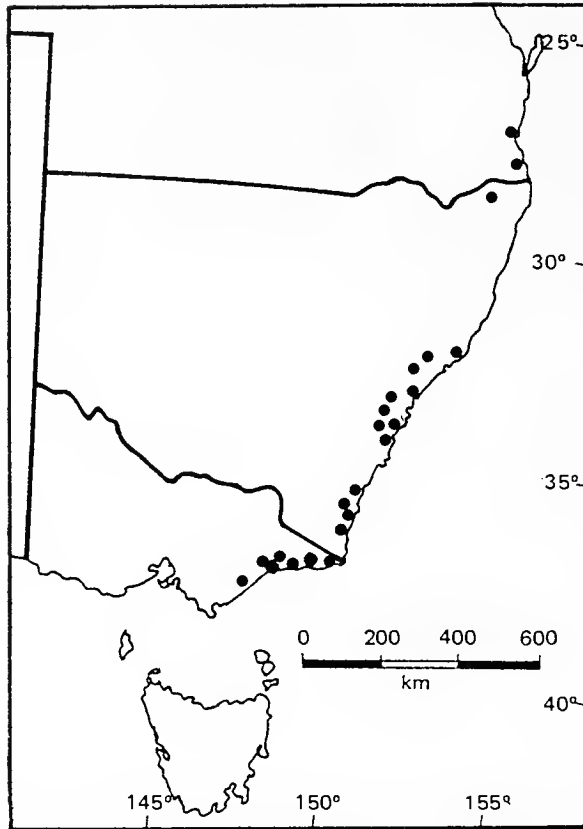


Fig. 10. Distribution of *Triglochin microtuberosum*.

Triglochin multifractum Aston, *Muelleria* 8: 90 (1993). TYPE: "New South Wales, c. 11 km \pm north-east of Barham, 35°34'01"S, 144°12'06"E. 19 Apr. 1987, H.I. Aston 2656" HOLOTYPE: MEL 705960. ISOTYPES: AD, BRI, CANB, MEL 705959 & spirit material, NSW.

Rhizomes horizontal to upcurved, to 11.5 cm long \times 14–18 mm diam., bearing long fine soft fibres 1–6 cm long. *Tubers* narrow-ellipsoid or narrow-obovoid to ellipsoid or obovoid, rarely broad-obovoid, 13–40 mm long \times 4–14 mm diam. (length 1.3–5.2 times the diam.), terminating roots (8–)20–100 mm long; each root 1–4(–5.7) times as long as its tuber. *Leaves* 43–133 cm long \times (2–)3.5–17(–34) mm wide, dorsiventral, deep green and glossy above, paler yellowish-green below, floating or sometimes with an emerged curve or with the extremities of younger shorter leaves emergent and erect, shortly tapered, obtuse-acute, thickened and spongy toward the base, sheathed over the lower 14%–20% of the leaf length. *T.S. leaf* about 3 cm below the sheath summit: narrowly plano- to concavo-convex, width 4.3–6.5 times the thickness; each side of sheath 2–6 mm wide, equal c. 20%–40% of the leaf width. *Stems* in fruit (28–)41–112(–175) cm long (including the infructescence) \times 3.5–15 mm diam. *Rachis* (1.3–)2.3–5.5(–9) mm diam. at base, gradually tapered upwards; rachis and pedicels usually pale to deep maroon-cyclamen, or sometimes the rachis pale cream-green. *Infructescence* (5.7–)12–36.5(–110) cm long (= 17%–46%(–63%) of the total stem length) \times 10–19 mm diam.. *Pedicels* 1.1–4 mm long. *Fruits* tightly touching, 229–c. 1000 per infructescence, 14–27 per 1 cm of rachis length, globular in outline, 3–5 mm long \times 3–5 mm diam. (but fruits usually more ellipsoid and 4.5–8.5 mm long outside Victoria and New South Wales). *Carpels* 6(–8), straight and erect in fruit, normally all maturing, rarely 1 aborted, 3–5 mm long \times 0.9–1.5 mm wide \times 1.1–2.25 mm deep; ventral edges attached along their

whole length (excluding the beak sinus); attachment length = 57%–75% of carpel length; lateral faces \pm flat, adpressed; dorsal ridge prominent, narrow-rounded (32%–42% of carpel depth); shoulder ridges inconspicuous before carpels separate but then seen in T.S. to be 15%–28% of carpel width. (Figs 2i-j, 3f-g, 9g-l)

SELECTED ADDITIONAL SPECIMEN EXAMINED

Victoria — “Gum Swamp”, 13.5 km W of Werribee, 15 May 1994, *Aston 2859* (MEL).

DISTRIBUTION (Fig. 11)

Through eastern Queensland, eastern New South Wales, and northern Victoria, rarely in southern Victoria. Recorded once in the Northern Territory (Gulf of Carpen-

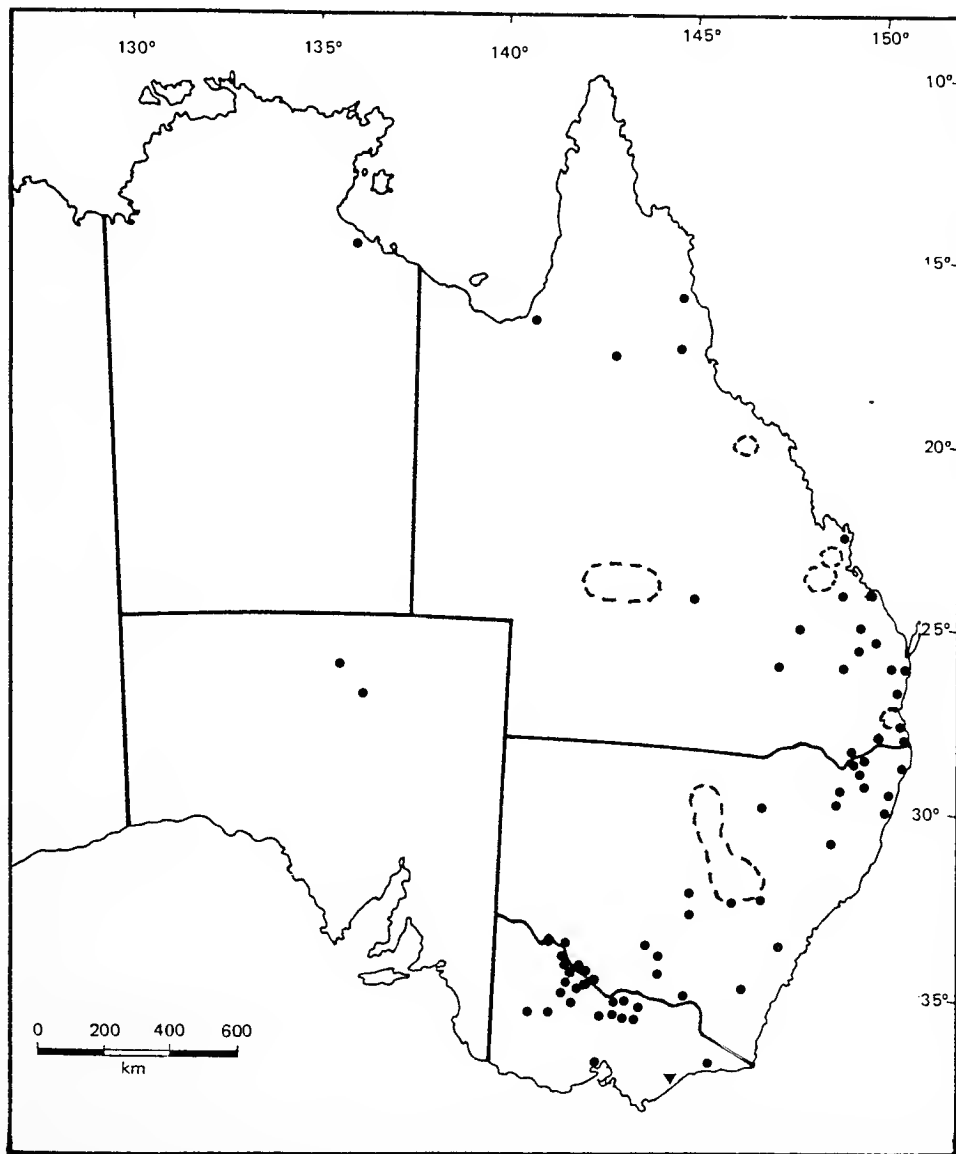


Fig. 11. Distribution of *Triglochis multifractum*. Triangle = a doubtful record. Dashed line = approximate position of an imprecise locality.

taria) and twice in South Australia (northern Lake Eyre Basin). Only recently located on the basalt plains west of Melbourne, southern Victoria. There found in similar habitat to places where *T. multifructum* occurs in northern parts of the State, and believed to be native to the area.

NOTES

See Aston (1993) for fuller information on this species.

DIAGNOSIS

Mature fruiting plants are readily distinguished in the field by the comparatively long infructescence with typical maroon-cyclamen rachis and numerous, small, tightly-touching fruits (c. 14–27 per 1 cm of rachis length). Within Victoria and New South Wales, mature fruits are typically only 3–5 mm long \times 3–5 mm diam., globular in outline but strongly ridged. Elsewhere, fruits tend to be more ellipsoid in outline and generally somewhat larger, from 4.5–8.5 mm long. The 6(–8) carpels are ventrally attached along their full length except for the beak sinus and each has a prominent, narrow, dorsal ridge and two noticeable lateral ridges.

Triglochin procerum R.Br., *Prodr. Fl. Nov. Holl.* 343 (1910).

Cynogeton procerum (R.Br.) Buchenau, *Abh. Naturwiss. Vereine Bremen* 1: 224 (1868). TYPE: “(J.T.) v.v.”. LECTOTYPE (here designated): “Triglochin maximum / Hawkesbury 1804”, left hand specimen on sheet containing 3 collections, each with a label in R. Brown’s hand, (BM)!. PROBABLE ISOLECTOTYPES: “[day indecipherable] Sept 1804” [Probably coll. R. Brown] (E)! [Probably coll. R. Brown] (E)! POSSIBLE SYNTYPES (= the two remaining collections on the lectotype sheet, here excluded from the circumscription of *T. procerum* R.Br.): “Triglochin / No 11 descⁿ / Carpentaria. Main. [= mainland] opposite Groote Island. / Jan^y 4 desc 5, 1803”; “Carpentaria / Island h [= North Island, Sir Edward Pellew Group] / in paludo. Dec^r 20 / 1802” (BM)! Excluded as possible Syntype (separate sheet): “Nova Hollandia, Pt Jackson — Mr Brown” (BM)! No types located at G or G-DC, M, P, UPS, or W. See Notes below on typification.

Triglochin procerum agg., form C, Robb & Ladiges (1981).

Triglochin procerum “C” and “Cc”, Aston *in litt.*

Description Excluding Eastern Variant — *Rhizomes* semi-horizontal, 4.5–18 cm long \times 7–18(30) mm diam., bearing long fine to semi-coarse to coarsely stiff fibres. *Tubers* usually elongated, narrow-ellipsoid to cylindrical, less frequently ellipsoid to obovoid or obloid, 20–145 mm long \times 4.5–13 mm diam. (length 2.5–20 times the diam.), terminating roots 37–139 mm long; each root 0.5–3.3 times as long as its tuber. *Leaves* 27–227 cm long \times 7–41(–150 *n.v.*, western variant) mm wide, dorsiventral, dark green and glossy above, paler yellowish-green to mid-green beneath, floating or with an emerged curve or emergent and erect to semi-erect, shortly tapered, obtuse-acute, thickened and spongy toward the base, sheathed over the lower 14–34% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: \pm transversely elliptic in outline including the sheaths, the central spongy portion narrowly plano- to concavo-convex with width 2.2–5.4 times the thickness; each side of sheath 5–18 mm wide, equal c. 33–59% of the leaf width. *Stems* in fruit 33–197 cm long (including the infructescence) \times 4–23 mm diam. *Rachis* 2.5–9(–14, western variant) mm diam. at base gradually tapered upwards; rachis and pedicels usually pale cream-green to green, or sometimes the pedicels and rarely the rachis tinged maroon. *Infructescence* 6–51(–144, western variant) cm long (= 12–40%[–82%, western variant] of the total stem length) \times 17–29(–42, western variant) mm diameter. *Pedicels* 1.7–5.2 mm long. *Fruits* touching, 67–320 per infructescence, 5–11(–18, western variant) per 1 cm of rachis length, globular to ellipsoid or rarely depressed-globular in outline, 6.8–14.4 mm long \times 6.8–10.9 mm diam., the length 1.1–1.9 times the diam., rarely slightly $<$ diam. *Carpels* 6(or 7), in fruit straight and erect to partly spiralled around each other and then giving a twisted appearance to the fruit, all maturing or with 1–2(rarely –5) only partially developing so that fruits may be asymmetrical, (6.4–)8.5–13.6 mm long \times 2.35–3.4 mm wide \times 3.2–4.9 mm deep; ventral edges attached along their whole length (excluding the beak sinus)

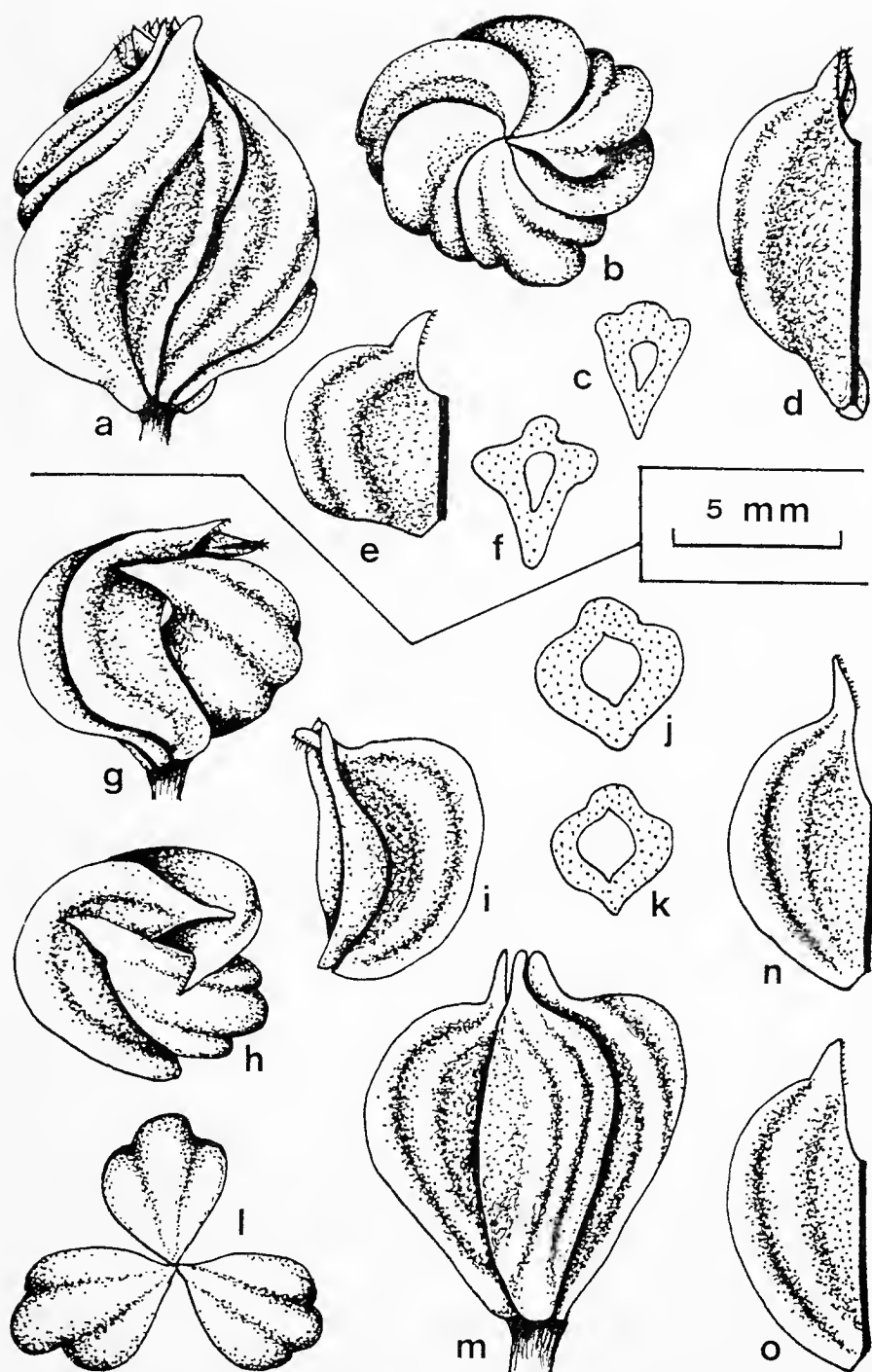


Fig. 12. Fruits and mature carpels. Attachment length shown by a thickened line on carpels in lateral view. a-f — *Triglochin procerum*, excluding variants. a-b — twisted-globular fruit of 6-carpels, lateral and apical views. c — carpel, lateral view, indicating spiralling. e-f — carpel, from broader, more squat, straight fruit, lateral view and T.S. g-o — *Triglochin procerum*, eastern variant. g-h — twisted-tapered, 3-carpelled fruit, lateral and apical views. i — 3-carpelled fruit with 2 aborted and 1 mature carpel, lateral view. j-k — carpels in T.S. l-m — straight-3-carpelled fruit, apical and lateral views. n-o — carpels, straight, lateral views. (a-d — from *Aston 2695*. e-f — from *Aston 2780*. g-o — from *Aston 2825*)

or becoming mechanically unattached distally in twisted fruits; attachment length = 55%–80% of carpel length or mechanically reduced to as little as 30% on strongly twisted fruits; lateral faces \pm flat, adpressed; dorsal ridge prominent (7%–22% of carpel depth); shoulder ridges variable, in T.S. either not differentiated and continuous with the lateral faces or projecting and then 11%–28% of carpel width. (Figs 2a-c, 3a-b, 12a-f)

Partial Description of Eastern Variant — *Leaves* 53–163 cm long \times 5–13 mm wide, emergent, stiffly erect to outcurved, usually standing well above the water surface, rarely floating, \pm linear but gradually narrowed above the sheath then gradually widening and finally tapered distally, acute, greatly thickened and spongy toward the base, sheathed over the lower 21%–37% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: \pm circular in outline including the sheaths, the central spongy portion broadly concavo-convex with width 1.6–2.4 times the thickness; each side of sheath 6.5–14 mm wide, equal c. 51%–99% of the leaf width and often overlapping each other in situ. *Stems* in fruit 56–158 cm long (including the infructescence) \times 4.5–12 mm diameter. *Rachis* 2–4.5 mm diam. at base. *Infructescence* 9–32 cm long (= 11%–27% of the total stem length) \times 18–30 mm diameter. *Fruits* 52–228 per infructescence, 5–10 per cm of rachis length. *Carpels* 3–6, in fruit straight and erect to sometimes slightly spiralled around each other, often strongly incurved and falcate, (1 or)(2 or)3–5(or 6) maturing, the remainder aborting or only partially developing, 7.7–13.7 mm long \times 2.8–4.6 mm wide \times 3.5–5.4 mm deep; ventral edges attached along the whole length excluding the beak sinus when carpels are straight and erect, but unattached distally when carpels are falcate and spiralled; attachment length 37%–66% of carpel length; lateral faces shallowly convex, only partially adpressed; dorsal ridges usually prominent (6%–22% of carpel depth), broadly obtuse. Plants otherwise essentially as given in the Description Excluding Eastern Variant above. (Figs 3c-d, 12g-o)

SELECTED SPECIMENS EXAMINED, EXCLUDING THE EASTERN VARIANT (total examined = 238)

South Australia — Boat Harbour Creek, between Cape Jervis and Victor Harbour, Fleurieu Peninsula, 16 Nov. 1957, *Eichler 14418* (AD!, H n.v., L n.v., MTJB n.v.); South West River, near bridge of South Coast Road, Kangaroo Island, 7 Nov. 1958, *Eichler 15291* (AD); NE of Penola, 17 Dec. 1961, *Hunt 573* (AD); 17 km NNE of Penola toward Penola Swamp, 5 Nov. 1981, *Munir 5495* (AD!, CHR n.v., COLD n.v.); Southern Bakers Range, 12 Nov. 1986, *Pillman 6874* per *Kinnear* (AD); Greenway Landing, River Murray, 16 Feb. 1984, *Thompson 52* (AD); Finnis River, just E of Mt Effie, southern Mt Lofty Range, 1 Nov. 1959, *Whibley 549* (AD! Z n.v.); N of Kingston, 11 Jan. 1982, *Williams s.n.* (AD); Ewens Ponds, c. 8 km E of Port MacDonnell, 19 Nov. 1959, *P. Wilson 1363* (AD!, NSW n.v., PH n.v., PNH n.v., PRE n.v., RSA n.v.); Mosquito Creek, off Penola to Naracoorte road, c. 18 km S of Naracoorte, 20 Nov. 1959, *P. Wilson 1372* (AD!, KW n.v.).

New South Wales — Little Plains River, c. 14 km by straight line \pm ENE of Delegate, 19 Feb. 1990, *Aston 2829* (MEL, NSW); Wilbriggie State Forest, South Western Plains, 17 Dec. 1984, *McIntyre & Newnham MNSM275* (NSW); Nepean River, c. 4 miles [c. 6.5 km] S of Wallacia, 1 Dec. 1963, *Salasoo 2658* (NSW).

Victoria — Middle Creek, c. 12 km \pm SE of Carisbrook, 23 Nov. 1987, *Aston 2672* (AD, CANB, HO, K, MEL) and *Aston 2673* (AD, CANB, HO, MEL); Joyces Creek (White Creek), c. 8 km by straight line \pm W of Newstead, 23 Nov. 1987, *Aston 2674* (MEL, NSW); c. 2 km NE of Seymour, 27 Feb. 1988, *Aston 2695* (CANB, HO, MEL); Bungallally Creek, c. 7 km S of Horsham, 9 Nov. 1988, *Aston 2703* (BRI, CANB, MEL, PERTH); 2.4 km E of Dergholm, 12 Nov. 1988, *Aston 2725* (MEL, NSW); c. 3.5 km NNW of Piangil North, 17 Dec. 1988, *Aston 2735* (MEL); c. 11 km by straight line E of Streatham, 23 Feb. 1989, *Aston 2773* (MEL); c. 3 km SSE of Wood Wood, 5 Nov. 1989, *Aston 2780* (MEL); c. 3 km S of the Koondrook-Barham bridge over the Murray River, 6 Nov. 1989, *Aston 2782* (MEL); Lower Tostaree, East Gippsland, 19 Jan. 1992, *Aston 2834* (MEL).

Tasmania — Maria Island, 11 Dec. 1983, *Buchanan 2072* (HO); Tamar River at Dilston, 13 Oct. 1985, *Buchanan 7297* (HO); Lake Crescent, 18 Feb. 1971, *Curtis s.n.* (HO); Jordan River at Hunting Ground, 13 Jan. 1982, *Curtis & Allan s.n.* (HO); Gordon River, within a few miles of Macquarie Harbour, 21 Jan. 1949, *Garden NSW7321* (NSW); Gunn's Lake, N of Arthur's Lake, 16 Feb. 1981, *Moscal 646* (HO, MEL); Roaring Beach, Tasman Peninsula, 9 Feb. 1960, *Thorne 26954 & Carolin* (NSW!; RSA n.v.).

SELECTED SPECIMENS EXAMINED, EASTERN VARIANT (total examined = 57)

Queensland — [North] Stradbroke Island, Eighteen Mile Swamp, 6 Jun. 1977, *Anderson s.n.* (BRI); Samuel Hill, c. 10 km WNW of Mt Atherton, 10 Jul. 1977, *Clarkson 956 & Stanley* (BRI); North Stradbroke Island, Eighteen Mile Swamp, 23 Nov. 1971, *Durrington 660* (BRI); Moreton Island, Eagers Swamp 13.5 km

SSE of Cape Moreton, 11 Oct. 1973, *Durrington 1251 & Levine* (BR1); 2 km N of Coolum Beach, c. 130 km N of Brisbane, 30 Nov. 1975, *Sharpe 1865* (BR1).

New South Wales — Wonboyn Creek, c. 22 km SSW of Eden, 12 Feb. 1990, *Aston 2811* (MEL); Swamp beside western tributary of Cullendulla Creek, c. 3.5 km NE of Batemans Bay, 17 Feb. 1990, *Aston 2825* (BR1, CANB, MEL, NSW); Dragon Swamp Creek, 0.2 km W of Cathcart, 19 Feb. 1990, *Aston 2828* (MEL, NSW); Port Macquarie, Oct. 1893, *Bauerlen NSW228273* (NSW); Tabbigai, Kurnell Peninsula, 28 Aug. 1965, *Briggs NSW80707* (NSW); Kingsford-Smith Aerodrome, Mascot, 8 Jun. 1965, *Constable 5969* (NSW); Grassy Gully, Shoalhaven River, 3 Jan. 1932, *Rodway 9161* (K n.v., NSW!);

Victoria — Between Marlo and Cape Conran, 2 km W of the turnoff to Burbang Caravan Park, 20 Jan. 1992, *Aston 2835* (CANB, MEL, NSW); Emu Creek, where crossed by the Marlo to Cabbage Tree Creek road, 21 Jan. 1992, *Aston 2837* (MEL, NSW); Barracoota Lake, \pm 6 miles [10 km] direct ENE of Mallacoota, 6 Nov. 1969, *Beaglehole 31561* (MEL); \pm 2 miles [3 km] SW of Bemm River township, 21 Feb. 1975, *Robinson s.n.* (MEL).

DISTRIBUTION (Fig. 13)

An eastern variant occurs in coastal or near-coastal areas from near Rockhampton south through south-eastern Queensland and eastern New South Wales to near Orbost,

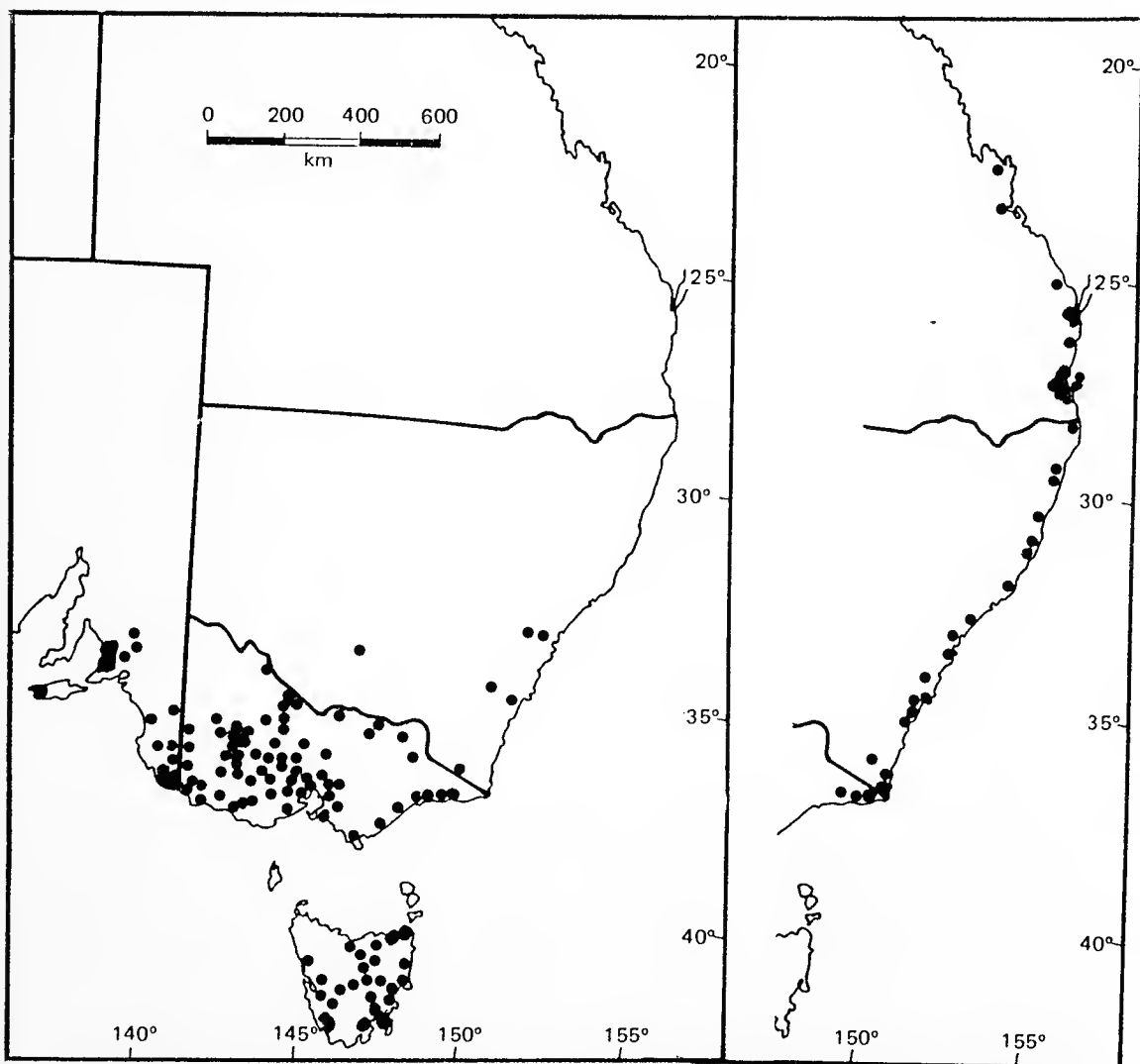


Fig. 13. Distribution of *Triglochin procerum*. Left = excluding the eastern variant. Right = eastern variant only.

East Gippsland, Victoria. A western variant occurs in south-eastern South Australia and Tasmania. Apart from these variants, distribution of the species is from Kangaroo Island, the southern Lofty, lower Murray and south-eastern areas of South Australia through most of Victoria (excluding the north-west and alpine regions) to the south-eastern quarter of New South Wales and in Tasmania.

HABITAT

Excluding the Eastern Variant — Fresh, still to slow-flowing, usually clear water to 1(–2) metres deep in mostly permanent swamps, lagoons, drains, stagnant waterholes, creeks and rivers, surviving on saturated to damp soils above receding waters. Water sometimes stained black from litter decomposition or semi-turbid. Rhizomes and roots embedded mostly in sandy to heavy grey clays overlain with several centimetres of soft silt sand or humus, also in heavy loams or deep fine silt or sand. Sites typically fringed by *Eucalyptus camaldulensis* (River Red Gum) or grazed farmland. One East Gippsland record (Aston 2840) from black silty peat with *Eleocharis sphacelata* and *Villarsia exaltata* in sedge swamp fringed with *Melaleuca squarrosa*, i.e., the usual habitat of the eastern variant. One Kangaroo Island collection (*Haegi* 2327) from a stream in *Eucalyptus obliqua*, *E. baxteri*, *E. leucoxyton* forest with *Leptospermum lanigerum*, *Gahnia sieberana*, *Pteridium* and *Blechnum* understorey. Associated species recorded are *Eleocharis sphacelata*, *Villarsia reniformis*, *Myriophyllum 'propinquum'*, *Triglochin multifractum*, *Potamogeton tricarinatus*, *Typha*, *Juncus*, sedges and herbaceous aquatics.

Common in lowlands from virtually sea level to c. 450 m altitude; also sparsely recorded to 760 m on the mainland and to 990 m in Tasmania.

Flowers all months, but chiefly September to February, on the mainland; recorded September to March, but chiefly October to December in Tasmania. Fruits September to June, chiefly September to March, on the mainland; recorded October to May, chiefly October to March, in Tasmania.

Eastern Variant — Fresh, still to slow-flowing, usually clear water to 1 metre deep in mostly permanent swamps, sedgelands and creeks; also in brackish coastal swamps. Water sometimes stained black from decomposition of leaf litter and one population (Aston 2825) located in highly polluted, reddish-black, humic and oily? water receiving industrial spillage. Rhizomes and roots embedded in loamy or humic sand or in sandy peat, less frequently in heavier loam. Sites typically in or fringed by *Melaleuca squarrosa*, *M. ericifolia*, *Leptospermum juniperinum*, *Gahnia* sp., *Casuarina glauca*, or *Banksia* scrub. Associated species recorded are *Eleocharis sphacelata*, *E. equisetina*, *Baunaea rubiginosa*, *Leptocarpus tenax*, *Lepironia articulata*, *Empodisma minus*, *Restio tetraphyllum*, *Nymphaea stellata*, *Villarsia exaltata*, *V. reniformis*, and *Gleichenia* sp.

Commonly occurs from virtually sea level to c. 200 metres altitude, with one record (Aston 2828) from c. 800 metres.

Flowers and fruits recorded May to February.

NOTES

Typification of *T. procerum* — Robert Brown described *T. procerum* from material he collected in areas "(J.T.)". Area (T.) embraces two regions [see Typification under *T. dubium*]. One of these is the Carpentarian region, northern Australia. The common tuberous-rooted species of this region is *T. dubium*, which Brown recognised and described as distinct from *T. procerum*. There is only one other allied species, the newly-described *T. multifractum* Aston (1993), known from the Carpentarian region where it is apparently uncommon, having been collected there post-1970 from only two localities. It is therefore unlikely that Brown would have collected any tuberous-rooted *Triglochin* from the Carpentarian region other than *T. dubium*, or that he would have placed any such material within his species *T. procerum*.

The other region which Brown included in area (T.) is central eastern Queensland. *T. procerum*, as circumscribed here, now appears rare in this region. However, the entity commonly occurs in Brown's area (J.) which extends approximately between

Sydney and Newcastle, New South Wales, including the Hunter River and its branches (Stearn 1962). It therefore seems most probable that Brown's major collection(s) of his *T. procerum* would have been made in the vicinity of Sydney to Newcastle.

In his published diagnoses, Brown gives *T. procerum* as 6-carpelled [per flower or fruit] and *T. dubium* as 3-carpelled. I have seen two sheets sent on loan by the British Museum and regarded in their collections as type material of *T. procerum*. The sheet "Nova Hollandiae, Pt Jackson — Mr Brown" contains foliage and one inflorescence with 3-carpelled flowers. It therefore does not fit Brown's diagnosis of *T. procerum* and I exclude it from consideration as type material of this species. The second sheet has three collections made by Brown. The left hand specimen is a portion of scape and infructescence from which all mature fruits which may have been present have now vanished. A few partial or complete fruits in the earliest stages of development are adequate to show that they are 6-carpelled and I have designated this specimen, from Hawkesbury (= near Sydney), as **lectotype**. The two remaining collections on the lectotype sheet are of solitary scapes, lack all fertile parts, and cannot be identified with certainty by standard morphological means. Although cited above as possible syntypes of *T. procerum*, their smallness and localities make me suspect that they are portions of *T. dubium* and I have excluded them from the circumscription of *T. procerum*. It is even possible that they are part of the missing type collection(s) of *T. dubium* R.Br.

T. procerum as circumscribed here is very variable throughout its range and even within the complex which I have loosely grouped as an eastern variant. I cannot be certain which variation is represented by the meagre and immature lectotype specimen. Because the complex embraced within the eastern variant is apparently the most common within Brown's area (J.), it might be expected that the lectotype would represent some entity within this complex. However, the shape and the long attachment length of the immature carpels of the lectotype specimen could indicate that the latter represents *T. procerum* plants from outside the eastern variant complex. Future work and other techniques may show that further formal taxonomic segregation within the current circumscription is justified. If so, I predict that the designation of an "interpretive type" for *T. procerum* R.Br. will be necessary at that stage (Hawksworth 1994). Such a type should most appropriately originate from the area covered by Brown's area (J.) and should be representative of a taxon bearing 6-carpelled mature fruits.

Typification of *Cycnogeton procerum* — I have examined the unbound issues, still in their original paper covers, of *Abhandlungen herausgegeben vom naturwissenschaftlichen Vereine zu Bremen* in which Buchenau published his article "Index criticus Juncaginacearum hucusque descriptarum" and a brief supplement to it. The article appeared in Band 1, Heft 2, [Vol. 1, No. 2] pp. 213–222 (upper half of page only), published at the end of March 1867 ("Ende März 1867"). The supplement appeared a year later in Band 1, Heft 3 [Vol. 1, No. 3], pp. 222 (lower half of page only)–224, published at the end of March 1868 ("Ende März 1868"). As the new combination *Cycnogeton procerum* (R.Br.) Buchenau was made on page 224, i.e. in the supplement in Heft 3, its date of publication is March 1868, not March 1867 as given by Chapman (1991a).

The dates of publication given above for *Abh. Naturwiss. Vereine Bremen* are taken from a table of contents for each of the three hefts of Volume 1 published inside Heft 3. However, Stafleu & Cowan (1976, p. 390, entry no. 865) give the date of publication of all pages 213–224 as after September 1868. Although this is incorrect for pages 213–222 (upper half), it might be taken as correct for the critical page 224. A publication date of after September 1868 could compete with the 6 October 1868 publication date of Buchenau's *Index criticus Butomacearum, Alismacearum, Juncaginacearumque* in which (p. 50) the combination of *Cycnogeton procerum* (R.Br.) Buchenau also appears. Without additional evidence, and in agreement with Chapman (1991a), I accept that the *Abhandlungen...* has priority.

Morphological Variation — *Triglochin procerum*, as circumscribed here, is a highly polymorphic species which requires further study including experimental work. Without this, I believe that formal taxonomic segregation within this entity is currently unjustified and could lead to nomenclatural instability in the future. A brief discussion

of the variability of two characters, the mature fruit and the leaf in transverse section, is given here.

Four extremes in fruit shape (Fig. 12), namely large straight-ellipsoid, twisted-globular, straight-3-carpelled, and twisted-tapered are partly related to geographical distribution. The straight-3-carpelled and the twisted-tapered fruits both occur in an eastern variant distributed coastally from Queensland to eastern Victoria, the large straight-ellipsoid fruits occur in a western variant distributed in south-eastern South Australia and Tasmania, and the twisted-globular fruits are widespread from South Australia to New South Wales and in Tasmania. These four extreme kinds of fruit could well be attributed to distinct species except for the occurrence of numerous gradations between the extremes, even within the same population or on the one infructescence. See also Distribution and Field Observations.

Two extremes in leaf cross-section below the top of the sheath are also partly related to geographical distribution. Those of the eastern variant are approximately cylindrical in such section, with overlapping or touching sheaths, whereas those from plants elsewhere are narrowly to broadly elliptic with the sheaths not meeting across the ventral face of the blade (Fig. 3a-d). Although intergrades between these leaf extremes are evident, gradation between them does not seem as pronounced or as frequent as is the case with fruits. In addition, leaves of the eastern variant are almost always quite stiffly emergent and erect to outcurved, whereas elliptic-sectioned leaves are usually looped or trailing. Elliptic-sectioned leaves can, however, be erect or outcurved, particularly when they are of the widest diameters and are then most thickly spongy and have the greatest turgidity.

Fruits of the widespread, strongly-twisted, globular kind are often in populations bearing similar-sized, globular to ellipsoid, non-twisted to only slightly twisted fruits.

DIAGNOSIS

See notes on morphological variation above.

The eastern variant is detectable in the field by its comparatively slender habit, usually erect leaves cylindrical at the base, carpel number often three, and carpel shape. The western variant has large, straight, elliptic, usually 6-carpelled fruits with the carpels attached along most of their length. The leaves, stems and infructescences are often exceptionally large and robust but in many cases they fall well within the smaller dimensions shown by the wide-ranging plants with more globular twisted fruits.

FIELD OBSERVATIONS

Excluding both Variants — As discussed in a previous paper (Aston 1993), *Triglochin procerum* frequently co-exists with *T. multifructum* and has also been observed growing intermingled with *T. alcockiae*.

Near Carisbrook, in central Victoria, two different growth-forms (Aston 2672 & 2673) grew intermingled in 10–30 cm of clear, slowly flowing, fresh water in a small creek. Plants of Aston 2672 had broader, shorter leaves held erect above the water surface, the longer of them then looping down and their extremities floating. Flowering was over, all plants being in fruit. Fruits were large (10–13 mm long), green, with straight carpels or with the carpels slightly twisted on some infructescences. In contrast, plants of Aston 2673 had narrower, longer leaves with all of their emerged portions trailing on the water surface and none rising above it. Flowering was still in progress, only about 50% of the stems bearing mature fruits. Fruits were small (6–7 mm long), dark brown-maroon, with the carpels strongly twisted. There was no noticeable ecological reason for the differences in growth-forms or for the consistent linkage of fruit size and shape with growth-form. Apparently at least some of the differences were genetically based.

Eastern Variant — The fruit variability shown by the eastern variant has been observed in the field within several populations in both Victoria and south-eastern New South Wales. Herbarium specimens indicate that this variability continues northwards into Queensland. For example, *Durrington 660* has different fruits (more squat,

straighter, shorter stylar beaks) to those of *Anderson s.n.* (more elongated, strongly twisted, longer projecting stylar beaks) but both collections are from the same swamp on Stradbroke Island.

Fruit variability is well illustrated by plants observed within a diameter of six metres in a swamp near the Burbang Caravan Park (*Aston 2835*) and along an eight metre line within Emu Creek (*Aston 2837*), both these sites being near Marlo, Victoria.

At the Burbang site, each fruit usually had either 3, 4 or 5 mature carpels but frequently there were only 2; sometimes only 1 or else all 6 carpels matured. Fruits with only 3 mature carpels were usually very regular in shape, with straight erect carpels, whereas fruits with 4 or 5 mature carpels were less regular and had the carpels usually twisted. Each infructescence held fruits which were predominantly of either the 3-carpelled or the 4 and 5-carpelled kind. However, some 1 to 6-carpelled fruits, either straight or with various degrees of twisting, could occur on any infructescence and almost all of the infructescences had fruits with examples of gradation in both the number and the twisting of the carpels.

At the Emu Creek site, most fruits also had either 3, 4 or 5 mature carpels but frequently some had 2, and less often 1 or 6. At one extreme of the morphological range within the population, some infructescences had most of their fruits of the same regular 3-carpelled kind described for the Burbang site. The remaining fruits of these infructescences were 4-carpelled or less frequently 1-, 2- or 5-carpelled, with all carpels having the same straight and erect shape. At the other extreme, one infructescence had some of its fruits with 4 mature carpels but most with either 5 or 6, the carpels of each fruit being strongly twisted with their upper portions incurved and overlapping. Other infructescences had fruits showing a range of variation between these two extremes, i.e. variation in carpel number, shape and degree of twisting. The plant bearing the twisted, 5- or 6-carpelled fruits had leaves which were a little broader and with somewhat less depth to the spongy base than those of other plants. However, both extremes had the same wide, overlapping sheaths and a cylindrical appearance in cross-section below the sheath apex.

At most sites, non-twisted fruits were generally more or less squat with short (often <2 mm long) erect stylar beaks, each beak clearly demarcated by the abrupt inward curvature of the dorsal carpel surface. In contrast, twisted fruits generally possessed more attenuated carpels with longer (3–4 mm long), commonly undemarcated, stylar beaks more or less continuous with the dorsal carpel surface. In twisted fruits the whole carpels or just the stylar beaks were often strongly and regularly incurved and overlapping so that the beaks projected quite strongly from the fruits. From herbarium collections examined, carpels appear to become longer and more attenuate as locations become more northerly into Queensland.

The rhizomes and tubers of *T. procerum* are usually quite deeply subterranean. A plant (*Aston 2828*) of the eastern variant dug from damp loam beside a swamp at Cathcart, New South Wales, had rhizomes 20–25 cm below the soil surface; tubers were obtained from 40 to 60 cm below the surface and others would obviously have occurred at greater depth, as roots were still extending deeper.

***Triglochin rheophilum* Aston, *Muelleria* 8: 94 (1993).**

TYPE: "Victoria — East Gippsland; Pyramid Creek, c. 0.05 km north on the Combenbar road from Club Terrace, 37°32.4'S, 148°56.2'E. 14 Dec. 1991, *W.M. Molyneux s.n.*". HOLOTYPE: MEL 705965. ISOTYPES: BRI, CANB, MEL 705964 & spirit material, NSW.

Rhizomes horizontal to vertical, 3.5–18.5 cm long × 4–14 mm diam., bearing long fine soft fibres 2–11 cm long. Tubers globular (young one), narrow-ellipsoid or narrow-oblongate to elliptic or obovate, or elongated and ± long-cylindrical to narrow-rhomboid and tapered at each end (often twisted or pitted by the gravelly substrate), 11–80(–102) mm long × 2–11 mm diam. (length 1.8–12.5(–20.4) times as long as diam.), terminating roots 25–126(–178) mm long; each root 1.2–7.9 times as long as its

tuber. *Leaves* 41–450 cm long \times (1–)2–16 mm wide, usually isolateral, non-glossy, semi-translucent and mid-green to reddish-green, completely submerged at or several centimetres below the water surface and often loosely spiralled or with undulate margins (leaves somewhat dorsiventral when stranded, with upper surfaces darker green and \pm glossy), linear throughout whole length (including sheathed portion) except tapered distally, acute to narrow-obtuse, thin-textured, not thickened and spongy toward the base, sheathed over the lower (13–)18–42% of the leaf length. *T.S. leaf about 3 cm below the sheath summit*: linear to thinly plano-convex, width 4.4–20.7 times the thickness; each side of sheath 1.4–5.2 mm wide, equal c. 18%–40% of the leaf width but mostly inrolled so that sheath width when rolled is 1–3.2 mm, equal only c. 11%–26% of the leaf width. *Stems* in fruit (19–)29–115 cm long (including the infructescence) \times 2–18 mm diam. *Rachis* 1–10 mm diam. at base, gradually tapered upwards; rachis and pedicels pale green-cream, rarely tinged maroon-cyclamen. *Infructescence* 5–36 cm long (= (8%–)20%–42% of the total stem length) \times 15–30(–35) mm diam.. *Pedicels* often slender, upcurved, 2.5–9 mm long. *Fruits* touching, those on longer pedicels loosely so, those on shorter pedicels more firmly so, (20–)35–232 per rachis, 4–9 per 1 cm of rachis length, ellipsoid to mildly obovate in outline, 9–16 mm long \times 5–9.5 mm diam. *Carpels* 6(or 7), in fruit usually straight and erect but sometimes partly spiralled around each

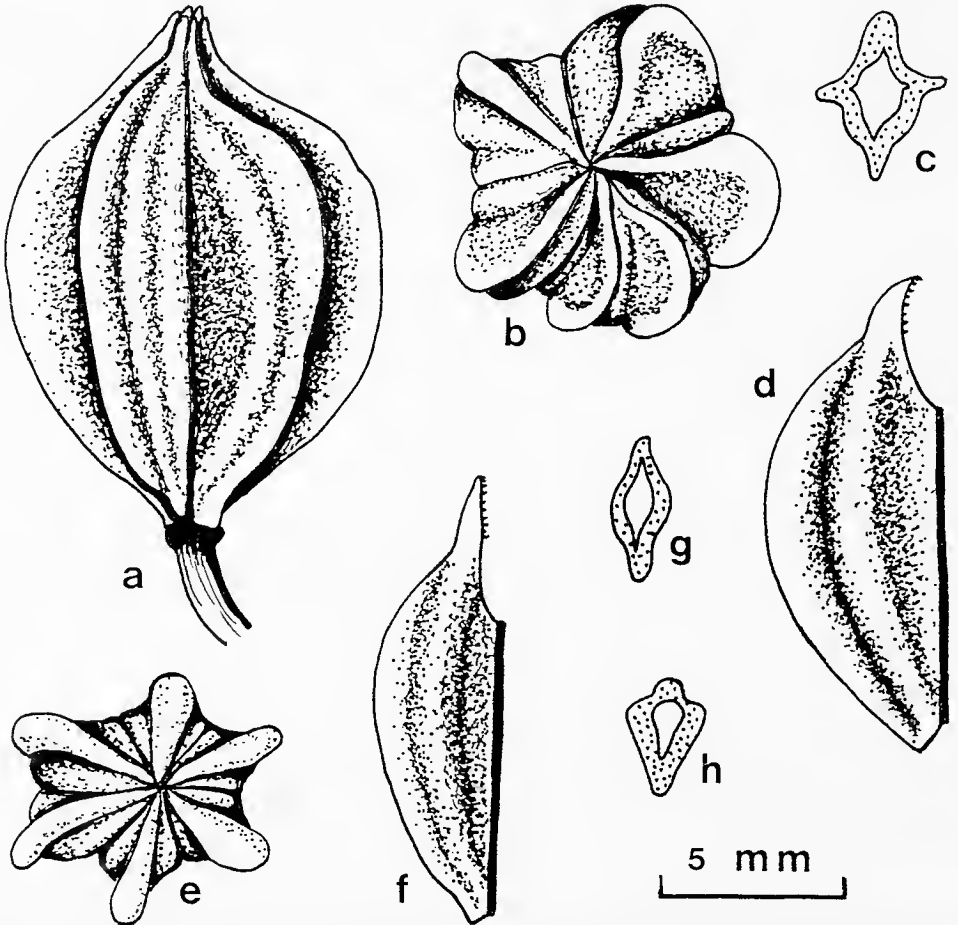


Fig. 14. Fruits and mature carpels of *Triglochin rheophilum*. Ventral attachment shown by a thickened line on carpels in lateral view. a-b — fruit, lateral and apical views. c-d — carpel, T.S. and lateral view. e — fruit, apical view. f-g — carpel, lateral view and T.S. h — carpel, T.S. (a-d — from Clarke 1934. e-g — from Aston 2842. h — from Aston 2676)

other and then giving a twisted appearance to the fruit, normally all maturing, 8.5–15.5 mm long \times 1.6–2.8 mm wide \times 2.1–4.6 mm deep; ventral edges attached along their whole length (excluding the beak sinus); attachment length = 63%–70% of carpel length; lateral faces \pm flat, adpressed; dorsal ridge typically prominent and narrow-rounded, sometimes broad-rounded and less pronounced, (17%–33% of carpel depth); shoulder ridges inconspicuous before carpels separate and then seen in T.S. to be 0%–16% of carpel width (i.e., non-demarcated to projecting from the lateral faces). (Figs 2e-f, 3h-i, 14)

DISTRIBUTION (Fig. 15)

From south-eastern Queensland through eastern New South Wales and eastern Victoria to Tasmania. Mostly east and south of the Great Dividing Range.

NOTES

See Aston (1993) for fuller information on this species.

T. rheophilum is restricted to clear, often swiftly flowing, non-polluted, flood-prone streams and rivers.

DIAGNOSIS

The long (to 4.5 m), narrow, linear, thin-textured, non-spongy, leaves with narrow, usually inrolled, leaf sheaths and the fruits of *T. rheophilum* are distinctive. Mature fruits are 9–16 mm long, ellipsoid to mildly obovate in outline, and 4–9 per 1 cm of rachis length. The 6(or 7) mature carpels are attached over most of their length, each with a narrow and prominent dorsal ridge. Pedicels (to 9 mm long) are often longer and narrower than in other species.

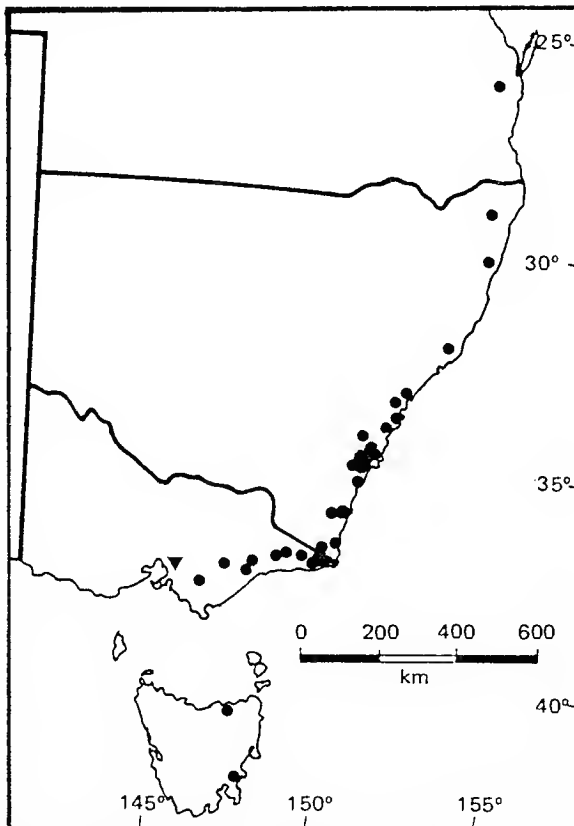


Fig. 15. Distribution of *T. rheophilum*. Triangle = a doubtful record.

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STUDIES IN PHORMIACEAE (LILIACEAE) I: NEW SPECIES AND
COMBINATIONS IN *DIANELLA* Lam. ex Juss.

G.W.CARR* AND P.F.HORSFALL**

ABSTRACT

Carr, G.W. and Horsfall, P.H. Studies in Phormiaceae (Liliaceae) I: New species and combinations in *Dianella* Lam. ex Juss. *Muelleria* 8:(3): 365–378 (1995). — Three new species of *Dianella* (Phormiaceae/Liliaceae) are described: *D. callicarpa* G.W.Carr and P.F.Horsfall from Victoria, *D. amoena* G.W.Carr and P.F.Horsfall from Victoria and Tasmania, and *D. tarda* P.F.Horsfall and G.W.Carr from Victoria and New South Wales. The new names and combinations, *Dianella brevicaulis* (Ostenf.) G.W.Carr and P.F.Horsfall and *Dianella porracea* (R.Henderson) P.F.Horsfall and G.W.Carr, are effected.

INTRODUCTION

Recent regional accounts of *Dianella* Lam. ex Juss. for South Australia (Jessop and Henderson 1986), New South Wales (Wilson 1993) and Victoria (Conran 1994) are largely based on the *Flora of Australia* treatment by Henderson (1987). The genus however is poorly studied, as acknowledged by Henderson (1987), Wilson (1993) and Conran (1994), and this is particularly evident when attempting to apply names to both fresh and dry material using this literature.

The taxa recognised by Henderson (1987) in *Flora of Australia*, including many new species and varieties described therein, are poorly circumscribed because of the imposed brevity of the *Flora of Australia* accounts. Furthermore, dried material of this genus is extremely difficult to work with, as many taxonomically valuable characters are lost or damaged on drying; for example the way the leaves are held, leaf colour and shape in cross section, time flowers open, perianth colour, anther and strumae colour and shape, and floral fragrance. Most dried material is also incomplete, particularly in representation of roots and rhizomes, partly because of the large size of many *Dianella* plants; furthermore almost all collections we have examined in Australian herbaria lack flowers or possess flowers that are damaged or poorly pressed.

Study of living *Dianella* material is essential (Green 1994), and our studies of living material in recent years have shown the taxonomic utility of character states hitherto overlooked or unavailable to previous workers on *Dianella*. These may be useful alone or (more usually) in combination and there is much less morphological variation within *Dianella* taxa than generally credited. Continuous variation in vegetative characters is common in relatively few taxa, and where morphological discontinuities occur in combination, the existence of additional taxa can often be demonstrated. These morphological discontinuities are often also correlated with environmental (i.e. ecological) parameters.

We have observed by cultivation of multiple collections of numerous taxa, that most morphological and chemical (colour and floral fragrance) characters are constant. Our field and laboratory studies of Australian *Dianella* in recent years show the existence of undescribed species, and that some infraspecific entities warrant recognition at higher rank, as recognised by Curtis (1952) and acknowledged by Henderson (1987). We describe here 3 new species from south-eastern Australia and elevate 2 entities to specific rank.

Nomenclature for plant parts generally follows Henderson (1987), and the colour of the organs, are of crucial relevance in *Dianella* taxonomy, is given where possible according to the Royal Horticultural Society Colour Chart, Royal Horticultural Society, London and Flower Council of Holland, Leiden (no date).

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TAXONOMY

Dianella callicarpa G.W.Carr *et* P.F.Horsfall, *sp. nov.*

Herba perennans, caespitosa dense ad longi-rhizomatosam. Folia ad 160 cm longa, 2 cm lata, tenuia, lorata, atrovirentia, subnitida; vaginae oclusae partim vel perfecte, in sectione transversali plus minusve biconvexae. Inflorescentia ad 190 cm elatum, elegans; flores fragrantés leniter, perianthium caeruleo-violaceum, tepala tenuia; strumae staminales atro-aurantiacae, antherae luteolae. Fructus purpuratus vividus.

TYPUS: Victoria-cultivated in Melbourne garden of G.W.Carr, ex Victorian Volcanic Plain, south of Branhholme, Victorian plant grid D50, 2 Nov. 1991, *G.W.Carr* 11643 (**HOLOTYPE:** MEL; **ISOTYPI:** MEL, HO, AD, NSW, K).

Loosely rhizomic to densely caespitose evergreen perennial herb to 190 cm high and 1.5 m diameter at the base, shoots touching to c. 15 cm apart; roots fibrous, not fleshy, yellow, (nearest Greyed-Orange Group 163B); rhizomes up to 20 cm long by 6–10 mm diam, yellow, (nearest Yellow Group 6C); stems of shoots 10–80 mm long by 7–8 mm diam. *Leaves* lorate, gradually tapering to the apex, 33–160 cm long by 8–20 mm wide, \pm flat or weakly revolute, mid to dark green, (nearest Yellow-Green Group 147A), slightly discolourous, lamina smooth and glossy, minutely and irregularly scabrous along margins and abaxial midrib, most pronounced on midrib below leaf apex. *Leaf sheaths* equitant, fan-shaped, tightly clasping, biconvex in cross section, $\frac{1}{4}$ – $\frac{4}{5}$ occluded near summit of sheath, weakly to strongly marked with dull crimson at the base (nearest Greyed-Red Group 182A), especially on the veins. *Inflorescence* tall, \pm erect, 60–190 cm long, scape slender, arching; panicle 25–50 cm long, \pm narrow-conical in outline, branches widely spreading, relatively short, regularly spaced; cymes 2–12 flowered, pedicels strongly recurved, 3–11 mm long. *Flowers* nodding, medium sized, weakly but sweetly fragrant, opening early to mid morning, collapsing late afternoon; perianth segments blue-violet suffused with dull crimson (nearest Blue-Violet Group 93D); outer tepals somewhat discolourous, strongly marked with dull crimson abaxially (nearest Red-Purple Group 72A or Greyed-Red Group 182B), adaxially paler, (Violet Group 185B); segments strongly and equally recurved; broadly lanceolate to narrow ovate-lanceolate, subacute, 7–9 mm long by 3–4 mm wide, 5-veined; inner tepals (Blue-Violet Group 97A), broadly ovate, shallowly emarginate, 6.5–8 mm long by 3.5–4.5 mm wide, 5-veined. Stamens 6 mm long; filaments 2.5 mm long (straightened) by 0.75 mm wide, strongly sigmoid, dark blue-violet at the base, becoming white distally, \pm translucent; strumae compressed globose-cuneate, \pm hexagonal in section, minutely papillose, deep orange-yellow (nearest Yellow-Orange Group 23A or Orange Group 24A); anthers dirty pale yellow, (nearest Yellow Group 10A), much darker in the lateral grooves and around the base, dorsally the darker colour extends to the apical pores; 3.5–4 mm long by 1 mm wide, very narrowly cuneate-lanceolate. Style very pale blue-violet, just exceeding the anthers, 6 mm long; ovary green, 3-locular, \pm globular, 1.25 mm long by 1.5 mm wide; ovules 8 per loculus. *Fruit* globose to obovoid, \pm lumpy, deep blue-purple, glossy, 6–15 mm long. *Seeds* globose-lenticular, slightly angular, completely smooth, black, very shiny, 3 mm long by 2 mm wide.

ETYMOLOGY

From the Greek, *calli* - beautiful and *carpus* - fruit in reference to the abundant, brilliant, deep purple fruits on a graceful infructescence.

OTHER SPECIMENS EXAMINED

Victoria - Type locality, 2 Nov. 1991, *P.F.Horsfall and G.W.Carr* 11644 (MEL). Near Lake Condah, 19 Jan. 1992, *G.W.Carr* 11695 (MEL). 6.5 miles NE of Dergholm, along McPherson Creek, 8 Dec. 1971, *A.C.Beauglehole* 38033 (MEL 534272). W side of Victoria Range, between Glenisla and Billywing, swamp near road, 4 Mar. 1957, *A.C.Beauglehole* 4633 (MEL 534260). Wannon River, Diprose Bridge, 9 km SW of Cavendish P.O., SW Study Area (D33), 5 Feb. 1978, *A.C.Beauglehole* 57715 (MEL 1602519). 3 km NW of Bessiebelle, SW Study Area (E6), 12 Dec. 1979, *A.C.Beauglehole* 67235 (MEL 1597878).

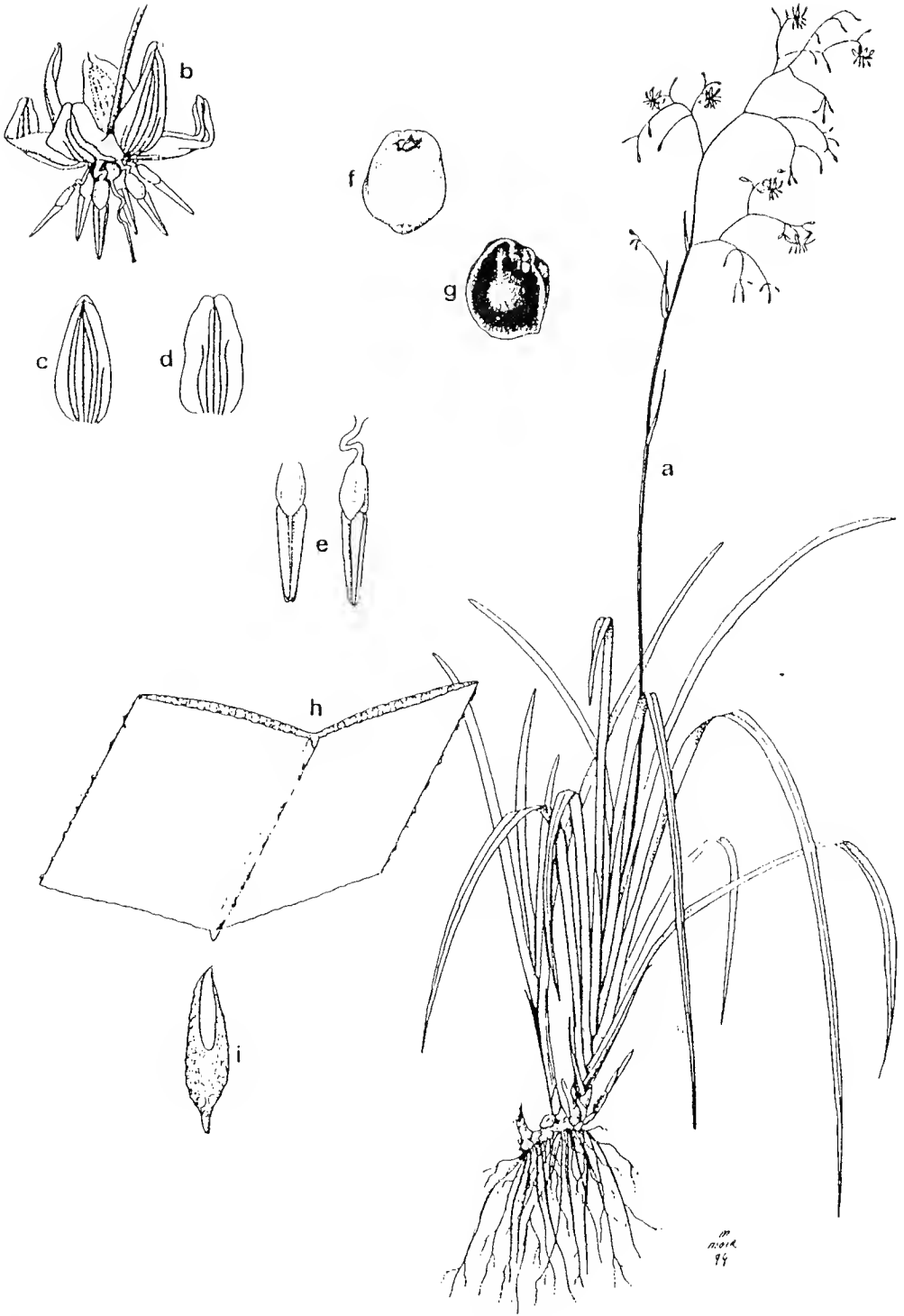


Fig. 1. *Dianella callicarpa*. a — habit $\times 0.13$, b — flower $\times 2$, c — outer tepal $\times 2$, d — inner tepal $\times 2$, e — anther adaxial — abaxial $\times 4$, f — fruit $\times 1$, g — seed $\times 4$, h — section through mid leaf lamina $\times 4$, i — cross section mid leaf sheath $\times 4$.

DISTRIBUTION AND CONSERVATION STATUS

Dianella callicarpa was first collected (as *D. tasmanica* J.D.Hook.) by A.C. Beauglehole (MEL) in south-west Victoria. It was recognised as an undescribed species by the authors at the type locality (2 populations) near Branxholme, and a very small population was found subsequently near Lake Condah during a vegetation survey (Carr *et al.* 1993). Further populations were found south-west of the Condah Mission in 1993 (Carr unpublished), and at Halls Gap in the Grampians (Horsfall unpublished). Scattered roadside populations were found in 1993, 2–3 km south of Myamyn, on the east side of the Henty Highway between Hamilton and Portland, also in the Branxholme — Condah area (Horsfall unpublished). The southernmost collection was made by M. Trengrove (pers. comm.) at Hopkins Falls near Warnambool. Although less than 10 populations are known to us, the range of habitat it occupies suggest that *D. callicarpa* may be much more widespread in southern and western Victoria and probably occurs, or occurred, in south-east South Australia. The species also occurs on the Mornington Peninsula at Crib Point (Horsfall unpublished) and in the Dandenong Ranges east of Melbourne (R. Robinson pers. comm.). All populations known to us are small, with the largest (near Condah Mission) containing about 30 plants. Further searches will undoubtedly reveal more populations in south-west Victoria, but habitat has been much depleted for agriculture and exotic forestry. The risk rating according to the code of Briggs and Leigh (1989) is 3e, that is with a current geographic range greater than 100 km, vulnerable in the long term, and inadequately reserved.

The major threats to *D. callicarpa* are environmental weed invasions as discussed by Carr *et al.* (1993) in connection with Lake Condah reserve vegetation. At the type locality *Rubus bicolor* (see Ross 1993 for taxonomic authorities) and bird dispersed populations of *Pittosporum undulatum*, *Euonymus* sp. and *Rosa* sp. threaten the species. Near Condah, populations on farm land and in forest are heavily grazed by cattle.

HABITAT AND ECOLOGY

At the type locality *D. callicarpa* occurs in remnant *Leptospermum lanigerum* scrub on seasonally inundated, permanently moist or waterlogged, dark peaty Quaternary sediments derived from basalt. The site is very shaded. Associated species include *Leucopogon lanceolata* and *Gahnia clarkei*. A similar, substantially cleared, weed-invaded habitat is occupied near Lake Condah. The species also occurs on a very dry stony rise (Carr *et al.* 1993) dominated by *Eucalyptus viminalis*. To the south-east near Condah Mission, *D. callicarpa* occurs on moist loams of drainage lines in *Eucalyptus ovata* and *E. obliqua* forest with *Lepidosperma laterale* var. *majus* as an understorey dominant. At Hopkins Falls, *D. callicarpa* occurs on shaded slopes among basalt rocks on sites dominated by *Notelaea ligustrina* and *Hymenantha dentata*.

All sites mentioned above occur on volcanic geology. At the Halls Gap locality *D. callicarpa* occurs on colluvial sandy loam in highly degraded *E. ovata* riparian forest in heavy shade beside a stream. At the Crib Point site the plant occurs on moist sandy loam, in dense heathy woodland with *Eucalyptus radiata*, *E. ovata* and *E. viminalis* overstorey. Permanent moisture, medium to heavy shade and moderately to highly fertile soils characterise all sites except the stony rise.

The pollinator of *D. callicarpa* has not been observed *in situ*, but an unidentified bee was baited 30 m from the type population in grassy *E. viminalis* woodland outside the *Leptospermum* stand on a cut inflorescence of *D. callicarpa*, and also on a potted flowering plant of *D. amoena* G.W.Carr & P.F.Horsfall. The bee effected buzz pollination (Buchmann 1985) while hanging upside down at the tips of the anthers with its feet clasping the strumae.

NOTES

Dianella callicarpa has previously been identified with the unrelated *D. tasmanica* from which it differs in many floral and vegetative characters. The new species appears to be a member of the poorly resolved *D. caerulea* Sims complex. It is unlike any known taxon of that group (see Henderson 1987) in combined vegetative and floral features and it appears taxonomically isolated.

Plants are only rarely, and then very shortly caulescent, i.e. with aerial stems, (cf. for example *D. caerulea* var. *caerulea*) and hypogeous rhizomes are very short (plants tussock-forming), to quite long. In the latter growth habit it resembles *D. tasmanica*. The very long, lorate, strongly occluded leaves are thin and frequently arching or bent down, especially in situations of heavy shade. Flowers of *D. callicarpa* are very like *D. caerulea* Sims var. *caerulea* in perianth and stamen morphology. The general blue-violet coloration of the perianth and often maroon suffusions on the abaxial side of the outer tepals, combined with the deep orange strumae and the pale yellow anther colours, are distinctive. Flowers are weakly fragrant. Fruits are borne in relative abundance. In their brilliant, glossy, deep purple-blue colour the fruits resemble those of many taxa in the *D. caerulea* complex.

Dianella callicarpa is easily cultivated and propagated by seed and division. Plants are self fertile and fruit production can be greatly enhanced by artificial endogamous or exogamous pollination. This is accomplished by mimicking buzz pollination (Buchmann 1985) using a tuning fork applied to the anthers to extract pollen, which is then applied to the stigma.

The common name of **Swamp Flax-lily** is suggested in reference to its moist habitat.

Dianella amoena G.W.Carr et P.F.Horsfall, *sp. nov.*

A D. longifolia R.Br. statura humile, rhizomate angusta ad 30 cm inter caespes, facienti coloniis ad 6 mm diametrum, foliis glaucis angustis tenuibus, plus minusvc deciduo-aestivalibus, asperatis valde marginibus et costis, et floribus magnis fragrantissimis malvinis, strumis staminalibus aurantiacis vividis et antheris luteolis differt.

TYPUS: Victoria, Midlands, Nutfield, Victorian plant grid N35, 6 Jan. 1993 *G.W.Carr* 12370 (HOLOTYPE: MEL; ISOTYPE: MEL, HO, NSW, AD, CBG, K.)

Extensively rhizomic, partially to fully summer-deciduous perennial herb to 90 cm high, forming extensive loose mats to 5 m wide; roots fleshy-fibrous, fusiforme, to 4 mm diam; rhizomes slender, yellow (Yellow-Grey Group 11A), to 4 mm diam; shoots to c. 30 cm apart on rhizomes, usually much less. *Leaves* relatively small, lamina narrow linear-lanceolate, long-tapering, to 43 cm long by 4–12 mm wide, thin, broadly V-shaped to nearly flat, prominently keeled abaxially along the midrib; grey-green (nearest Yellow-Green Group 147B), concolourous, and often marked with dull crimson at the base (Red-Purple Group 59D). *Leaf sheaths* loosely clasping, 1/5–2/3 occluded, occlusion zone prominently thickened in cross section; blades, sheaths and midribs with prominent, closely spaced to distant pale brown, antrorse, patent or retrorse outgrowths, ‘teeth’, to 0.5 mm long. *Inflorescences* ± erect, 20–90 cm long, scape relatively slender, usually arching; panicle branching at steep angles, irregularly ovoid-pyramidal, loose and interrupted; cymules 2–5 flowered; pedicels recurved, 3–20 mm long. *Flowers* large, nodding, strongly and sweetly fragrant, opening early to mid-morning, collapsing late afternoon; perianth segments pale to deep blue-violet (abaxial side Blue-Violet Group 96B, 97A), strongly and equally recurved; outer tepals narrow elliptic, sub-acute, 9–9.5 mm long by 2–2.5 mm wide, 5-veined; inner tepals elliptical, shallowly emarginate, 9–9.5 mm long by 3.5 mm wide, 3-veined. *Stamens* 6.5–7 mm long; filaments very pale yellow, 2.5 mm long (straightened), slightly sigmoid in distal 1/3; strumae compressed-obovoid, microscopically papillose, deep orange (Yellow-Orange Group 21A, Orange Group 24A), 2 mm long by 1 mm wide; anthers very narrow-cuneate, pale lime-yellow (Green-Yellow Group 1C, Yellow Group 10A), 3 mm long by 1 mm wide. *Style* whitish-translucent, 6 mm long; ovary green, depressed-globular, 1.5 mm high by 2 mm wide; ovules 6–8 per loculus. *Fruit* globular or obovoid, ultimately shiny off white to dark blue-purple (nearest Violet-Blue Group 90A–90B, Yellow-White Group 158B) 4–7 mm long. Seeds black shiny, smooth, angular-globose, 3 mm long by 2.5 mm wide.

ETYMOLOGY

From the Latin *amoenus* — beautiful, pleasing, in reference to the neat habit and the showy, fragrant flowers.



Fig. 2. *Dianella amoena*. a — habit $\times 0.2$. b — flower $\times 2$. c — outer tepal $\times 2$. d — inner tepal $\times 2$. e — anther adaxial — abaxial $\times 4$. f — fruit $\times 1$. g — seed $\times 4$. h — section through mid leaf lamina $\times 4$. i — cross section mid leaf sheath $\times 4$.

OTHER SPECIMENS EXAMINED

Victoria - Yuroke Creek, Broadmeadows, 15 Dec. 1993, *G.W. Carr* 12815 (MEL). Towards Yea, 12 Dec. 1993, *R.W. Robinson s.n.* (MEL). Mernda, 12 Dec. 1993, *N. van Roosendaal s.n.* (MEL). Merri Creek Reserve, 6 Dec. 1992, *G.W. Carr* 12315 (MEL). Headwaters of Darebin Creek, Mernda, 6 Dec. 1992, *N. van Roosendaal s.n.* (MEL). Doreen, south of Yan Yean Reservoir, 8 Apr. 1994, *A.M. Muir s.n.* (MEL).

Tasmania — Near Cascade Brewery, Hobart, 23 Jul. 1892, *L. Rodway s.n.* (HO 84352); Barracks, Anglesea (Hobart), Dec. 1891, *L. Rodway s.n.* (HO 84349); South Esk, no date, *W.H. Archer s.n.* (NSW 149262); Penuite, 22 Jan. 1842, *R. Gunn 1837* (NSW 149263).

DISTRIBUTION AND CONSERVATION STATUS

Dianella amoena is found in Victoria (Midlands, Volcanic Plains and Gippsland Plain of Conn (1993)) and Tasmania, but in both states it is very poorly collected and undoubtedly rare given the status of grassland and grassy woodland vegetation (Scarlet and Parsons 1993, Frood and Calder 1987). Recent surveys of grassy woodland and grassland, mostly in the Melbourne region, Victoria, have revealed 13 populations. In these studies *D. amoena* has been called *D. sp. nov.* (Nutfield). The following localities have been recorded by recent workers: Merri Creek (McMahon and Schulz 1993), La Trobe Valley (Carr *et al.* 1992), Broadmeadows (Carr *et al.* 1993, McMahon and Peake 1994), Doreen (Muir *et al.* 1994), Eltham (Bedgood *et al.* 1994). Four old collections are known from Tasmania, but the species may occur on roadsides in the Midlands (D. Morris, pers. comm.). All known populations are very small (5 populations of 1 plant only) and the largest contains about 5 plants.

Recruitment is believed to be non-existent. Populations are clearly fragments of much larger populations that have persisted in highly degraded vegetation. Most sites are extremely weedy (see quadrat data in above references) and stock grazing and mowing occurs in some. The conservation code according to criteria of Briggs and Leigh (1989) is 3E, with a range exceeding 100 km, endangered, and unrepresented in conservation reserves.

HABITAT AND ECOLOGY

Dianella amoena is a plant of lowland grassland and grassy woodland on very well drained to seasonally waterlogged fertile sandy loams to heavy cracking clays. In Victoria soils are derived from Silurian and Tertiary sediments, or (most sites) volcanic geology.

While vegetation at all sites seen by us (except the type locality) is grossly degraded, it is possible to reconstruct eucalypt dominants, viz. *Eucalyptus pauciflora* ssp. *pauciflora* (LaTrobe Valley), *E. ovata* and *E. camaldulensis* (Epping), *E. camaldulensis* (Mernda, Bundoora), *E. melliodora* and *E. gonicalyx* (type locality) and *E. gonicalyx*, *E. polyanthemus* ssp. *vestita* and *E. macrorhyncha* ssp. *macrorhyncha* (Eltham). On basalt escarpments (Coburg, Merri Creek) eucalypts may have been absent.

At all sites grasses dominate the field layer. Excluding the abundant or dominant exotics (such as *Holcus*, *Paspalum*, *Agrostis*) these are *Themeda triandra* (common to all sites), *Microleana stipoides*, and *Danthonia* spp. Quadrat data (held at the Flora and Fauna Branch, Department of Conservation and Natural Resources) for the sites containing *Dianella amoena* are given in the references cited above.

NOTES

Dianella amoena is unusual in its combined morphological features. It has long, very slender, wiry and much-branched rhizomes and narrow, tapering and thin lax or stiff leaves that are summer deciduous when water stressed. Leaves are also partially to fully occluded and thickened in the occlusion zone and have closely spaced to distant, \pm patent asperities (peg like projections or teeth) on the leaf midrib and margins. The relatively few-flowered panicles are often small. Flowers are large (upper size range in *Dianella*), colourful and highly fragrant. Plants are often very floriferous and the species is rather late flowering. The stamens are large and showy with bright orange strumae. Fruits are small, few-seeded and rather dull.

Dianella amoena has no close relatives among species from Victoria, South Australia and Tasmania, and it does not belong with the *D. caerulea* Sims, *D. revoluta* R.Br., *D. longifolia* R.Br. or *D. tasmanica* J.D.Hook. groups (see Henderson 1987) which otherwise constitute the bulk of the *Dianella* flora of Australia. The only Herbarium material (from Hobart) at HO and NSW collected before our study was determined as *D. tasmanica* or *D. caerulea* var. *caerulea*, from both of which it is taxonomically distant.

At several sites *D. amoena* is sympatric with *D. revoluta* R.Br. var. *revoluta* and *D. longifolia* R.Br. var. *longifolia* or *D. longifolia* R.Br. var. *grandis* R.Henderson (*sensu* Conran 1994), and flowering times overlap for these taxa.

Buzz pollination (see note under *D. callicarpa*) at the type locality has been observed to be effected by 2 unidentified bee species, at least one of which also pollinates *D. longifolia* var. *longifolia* (*sensu* Ross 1993 and Conran 1994). This same bee species has been baited to flowers of a container-grown *D. amoena* at Hurstbridge near the type locality. At Branxholme another bee species visited *D. amoena* flowers and those of *D. callicarpa* (see note under later species). Bees approached inflorescences or clumps of inflorescences from downwind, scribing a zigzag path and actively worked flowers for pollen in the behaviour described under *D. callicarpa* (above).

The common name of **Matted Flax-lily** is proposed in reference to the extensively rhizomatous habit of *D. amoena*.

***Dianella tarda* P.F.Horsfall et G.W.Carr, sp. nov.**

D. longifoliae R.Br. complexae pertinenti, habitu robusto et caespitose arcte, foliis angustis crassiusculis glaucis canaliculatis valde, ad 160 cm longis, 17 mm latis, inflorescentia elata multiflora obovoidica anguste vel ellipsoidica et floribus parviss fragrantissimis apericentibus serotinissimis et collabentibus serotini pariter distinguitur.

TYPUS: Victoria, Riverina, Strathmerton, Victorian plant grid M9, 8 Jan. 1993 P.F.Horsfall 396 (HOLOTYPE: MEL; ISOTYPE: MEL, AD, NSW, BRI, K).

Robust, densely caespitose perennial herb to 2 m high, forming clumps to 20 cm wide at the base; roots fleshy, long-fusiforme, to 90 cm long and 7–9 mm diam; rhizomes between shoots to 70 mm long; stems of shoots to 20 mm long and 7–9 mm diam. *Leaves* 35–160 cm long by 8–17 mm wide, linear-attenuate, coriaceous-fleshy, lamina moderately to strongly V-shaped in section, dark grey-green and sub-glaucous (nearest yellow-green Group 147A), margins smooth, midrib minutely scabrid near leaf tip; leaf sheaths loosely embracing, U-shaped, not or only slightly occluded, slightly keeled or rounded abaxially. *Inflorescence* robust, to 2 m high, scape rigidly erect; panicle narrowly obovoid in outline, somewhat interrupted below, dense above, branching at steep angles; cymes 2–18 flowered, closely spaced; pedicels 4–22 mm long, very slender, strongly recurved. *Flowers* nodding, relatively small with strong Dianthus-like fragrance, opening between 1–4 pm, collapsing between 8–10 pm; perianth very pale blue (Violet-Blue Group 97A); outer tepals narrow-elliptic, 7 mm long by 3 mm wide, 5-veined; inner tepals ovate-elliptic, 6.5 mm long by 2.5 mm wide, 3-veined. *Stamens* 7–9 mm long; filaments 2–3 mm long, strongly sigmoid in upper half; strumae rich yellow (nearest Yellow Group 9A), obovoid-globose, microscopically papillose, 1.5 mm long by 1 mm wide; anthers pale lemon-yellow (Yellow Group 4A), narrowly linear-cuneate, 4 mm long by 1 mm wide; style pale blue-violet (Violet-Blue Group 94D), 5–6.5 mm long; ovary ± globose but distinctly 3-lobed, 1.5 mm high by 1.5 mm wide, green (Yellow-Green Group 144D); ovules 5 per loculus; *Fruit* china blue or uncommonly white (Violet Blue Group 89A), irregularly globose, 3–10 mm long by 3–9 mm wide. *Seeds* lenticular-globose or angular-globose, smooth 2.5–3.5 mm long by 1.75–2 mm wide, black, very shiny.

ETYMOLOGY

From the Latin *tardus*-late, in reference to the very late time of flower opening (early-mid afternoon) and correspondingly late flower collapsing (evening).

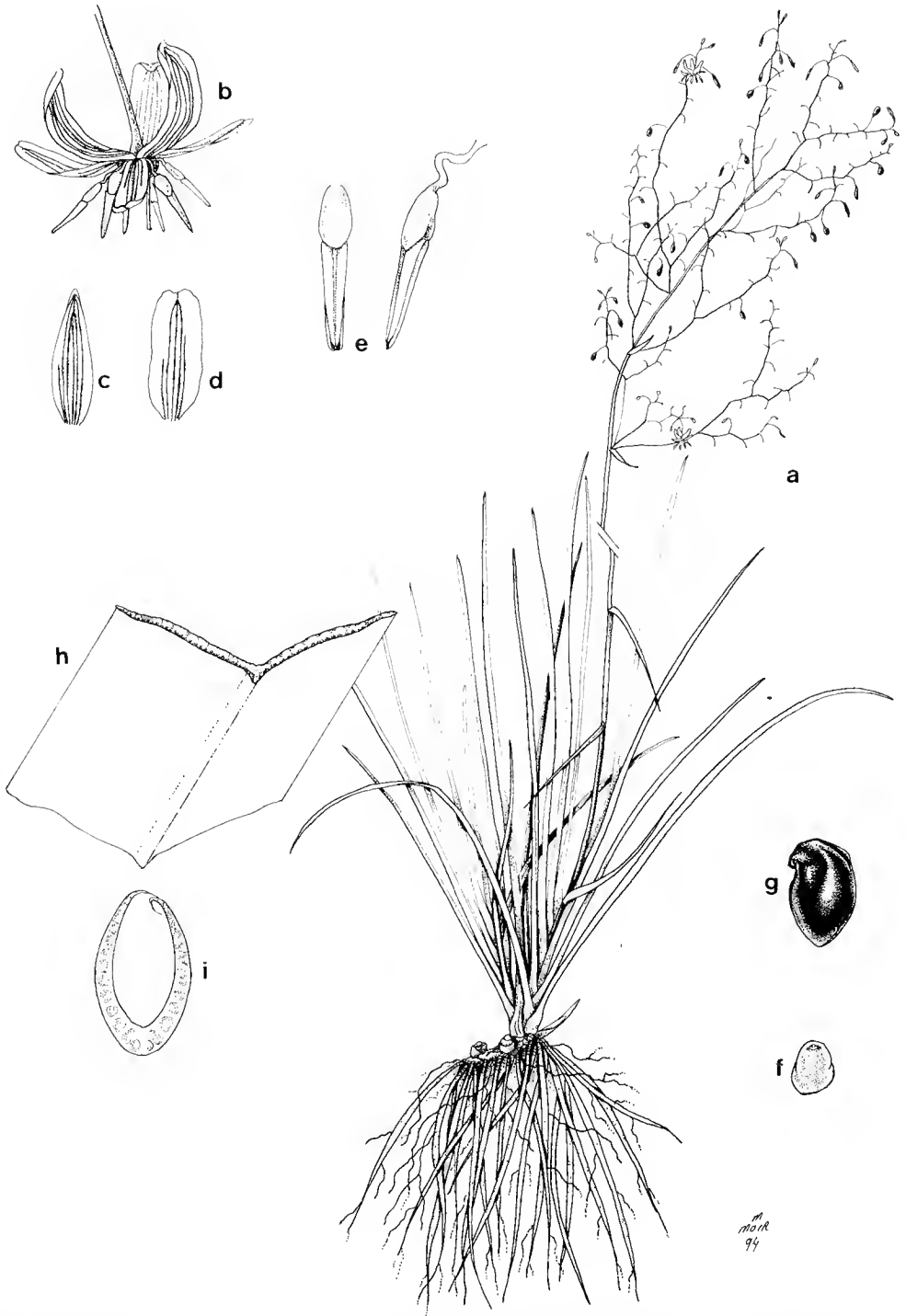


Fig. 3. *Dianella tarda*. a — habit $\times 0.13$. b — flower $\times 2$. c — outer tepal $\times 2$. d — inner tepal $\times 2$. e — anther adaxial — abaxial $\times 4$. f — fruit $\times 1$. g — seed $\times 4$. h — section through mid leaf lamina $\times 4$. i — cross section lower leaf sheath $\times 4$.

OTHER SPECIMENS EXAMINED

Victoria - 5km NW of Strathmerton 29 Dec. 1993, *P.F.Horsfall* (MEL). Broken Creek 5–8 km NW of Nathalia 29 Dec. 1993 *P.F.Horsfall* (MEL). Hume Highway near Creighton Creek, 23 Jan. 1988, *A.C.Beauglehole* 92784 (MEL 1606234). Tocumwal Regional Park, 17 Nov. 1985, *A.C.Beauglehole* 82142 (MEL 684583), Runnymede Flora Reserve, 3 Nov. 1981, *A.C.Beauglehole* 69769 (MEL 1595718). Mt Meg Flora and Fauna Reserve, 7 Nov. 1985, *A.C.Beauglehole* 81458 (MEL 684836). Lake Powell \pm 16 km SE of Robinvale P.O., Mallee Study Area (F39), 3 May 1977, *A.C.Beauglehole* 56113 (MEL 1515724). Far NW Hattah Lakes National Park, 10 Sep. 1960, *A.C.Beauglehole* 39298 (MEL 534244).

New South Wales — Near Karoola-Grenfell, Jan. 1974, *G.M.Cunningham and P.S.Millthorpe* 1972 (NSW).

DISTRIBUTION AND CONSERVATION STATUS

Dianella tarda has a much depleted and fragmented distribution on the northern plains of Victoria, in the Riverina and the Midlands. Natural Regions of Conn (1993), but few collections have been made. It is likely to occur in the South Western Plains, South West Slopes and Central Western Slopes of New South Wales (Harden 1991), but has only been definitely recorded for the latter as (*D. longifolia* R.Br. *sens. lat.*). However most material in NSW is too difficult to identify with confidence, but some specimens from the above-mentioned regions are probably *D. tarda*.

The conservation status is assumed to be depleted in the sense of Gullan *et al.* (1990), as the rare populations in Victoria are small and threatened by weed invasions (especially exotic grasses). Recruitment is assumed to be rare or non-existent, judged by the age structure of the populations that we have observed in Victoria.

HABITAT AND ECOLOGY

In Victoria *Dianella tarda* is a plant of heavy clays, clay loams and sandy loams, mostly on Quaternary fluvial plains on high alluvium or alluvial terraces. Rainfall is within the 400–500mm isohyets. Vegetation at the populations observed and from herbarium labels indicates that the species has a preference for grassy *Eucalyptus camaldulensis* riparian flood plain forest. Other vegetation in which this species has been recorded, as *D. sp. nov.* (Riverina), include grassy woodland or forest dominated by *E. camaldulensis*, *E. melliodora* and *E. goniocalyx* (Bedgood and Peake 1993, Peake *et al.* 1993).

Pollinators are assumed to be attracted by the strong *Dianthus*-like fragrance but have not been observed. These are most probably bees effecting buzz pollination, see notes on *D. amoena* and *D. callicarpa* above. The lateness of the flowering time suggests temporal avoidance of competition with other plant species for pollinators e.g., the sympatric *D. revoluta* R.Br. var. *revoluta*.

NOTES

Dianella tarda is a member of the *D. longifolia* R.Br. complex (Henderson 1987) and is most closely related in Victoria to *D. longifolia* var. *longifolia* (*sensu* Conran 1994) and *D. porracea* (R.Henderson) P.F.Horsfall and G.W.Carr.

It is distinct from these taxa in a combination of vegetative and floral features and in distribution. Plants are robust, evergreen and densely tussock-forming, with narrow, \pm smooth, erect, moderately glaucous, deeply channelled, \pm fleshy leaves; inflorescences are usually tall, \pm obovoid to elliptical in outline with sprawling, elongated panicles. The size of flowers are at the small end of the range for the southern species in the *D. longifolia* complex. Flowers have a strong fragrance very similar to *Dianthus caryophyllus* (garden carnation), reminiscent of cloves, in common with *D. porracea*.

In its diurnal anthesis-pattern, flowers open later than any of the other *Dianella* for which we have data. In summer flowers commence opening between 1–4 pm and collapse correspondingly late, between 8–10 pm. Flowers of most *Dianella* taxa open in the morning and collapse in mid to late afternoon.

The perianth segments of *D. tarda* are rather narrow, consistently pale blue and strongly reflexed. The colour, size, shape and proportions of the strumae and anthers are distinctive.

The common name, **Late-flowered Flax-lily** is proposed, in reference to the flowering time.

Dianella brevicaulis (Ostenf.) G.W.Carr et P.F.Horsfall. *comb. et stat. nov.*

BASEONYM: *Dianella revoluta* R.Br. var. *brevicaulis* Ostenf., *Det Kgl. Danske Vidensk. Selsk. Biol. Meddel.* 3 (2): 24, t. 1, fig. 1 (1921). **LECTOTYPUS:** C (right-hand piece) *vide* Henderson, *Fl. Aust.* 45: 483 (1987). (**LECTOTYPUS n.v.**). *Dianella revoluta* R.Br. f. *pygmaea* Schlittler, *Mitt. Bot. Mus. Univ. Zurich* 163: 272 (1940). **LECTOTYPUS:** Mt Direction, Tasmania, 5 Dec. 1921, R.A.Black, *vide* Henderson *Fl. Aust.* 45: 485 (1987)(n.v.).

ILLUSTRATIONS: Ostenfeld *op. cit.*, Curtis (1952).

REPRESENTATIVE SPECIMENS EXAMINED

Victoria — Point Addis, near Anglesea, exposed coastal heath (P20), 1986/87, *M.D.White* 2 (MEL 690475). Melbourne, Royal Melbourne Golf Course, Cheltenham Rd, Black Rock, (N52), 27 Oct. 1987, *I.C.Clarke* 2052 (MEL 588772). Cape Nelson, c. 700m E of the lighthouse (E22), 3 Dec. 1992, *D.E.Albrecht* 5179 (MEL 2017297). Little Desert National Park, 0.2km W of S end of old Nhill track, on Boundary Track, 18 Dec. 1983, *G.W.Carr* 7701 (MEL 1554308).

Tasmania - 5 km E of South Arm, 4 Nov. 1967, *J.H.Hemsley* 6331 (NSW).

South Australia - Coffin Bay National Park, Eyre Peninsula, 24 Oct. 1988, *P.H.Venow* 927 (NSW). Kingscote, Jan. 1907, *J.H.Maiden* (NSW 149149)

Western Australia - 67 km S of Nanambina Station, S of Belladonia, 24 Oct. 1963, *T.E.H.Aplin* 2580 (NSW). Irwins Inlet, 24 Dec. 1912, *Colby and S.W.Jackson* (NSW 149164).

NOTES

Dianella brevicaulis is abundantly distinct from *D. revoluta* R.Br. var. *revoluta* (*sensu* Henderson 1987) as recognised by Curtis (1952) and it is surprising that the species has so long retained varietal rank. Henderson (1987) noted that the taxon may warrant higher rank upon further study. In rhizome architecture, leaf, floral characters and broad distribution it is easily distinguished, as seen in the comparison with *D. revoluta* var. *revoluta* (Table 1). Plants of *D. brevicaulis* commonly occur with *D. revoluta* var. *revoluta* as understood by Henderson (1987) and Conran (1994), and with a previously unrecognised coastal taxon belonging to the *D. revoluta* complex (Carr & Horsfall unpublished data), but intermediates have not been recorded.

Dianella porracea (R.Henderson) P.F.Horsfall et G.W.Carr. *comb. et stat. nov.*

BASEONYM: *Dianella longifolia* R.Br. var. *porracea* R.Henderson, *Fl. Aust.* 45: 481 (1987). **TYPUS:** c. 28km W of Cunnamulla on road to Eulo, Queensland, 9 Oct. 1977, R.Henderson 2576 (**HOLOTYPUS:** BRI *n.v.*).

ILLUSTRATIONS: G.M.Cunningham *et al.*, *Pl. W. New South Wales*, 184 (1982); R.J.Henderson *op. cit.* fig. 68E, 221 (1987).

REPRESENTATIVE SPECIMENS EXAMINED

Victoria - Lake Powell, ± 16 km SE of Robinvale P.O., Mallee Study Area (F39), 3 May 1977, *A.C.Beauglehole* 56113 (MEL 1515724). Hattah Lakes National Park, 10 Sep. 1960, *A.C.Beauglehole* 39298 (MEL 534244)

New South Wales — c. 2 km E of Minetta, 6 Nov. 1971, *A.Rodd* 1918 (NSW). Lighting Ridge, 5 Nov. 1987, *D.I.Wilson & P.G.Wilson s.n.* (NSW). Between Euston and Gol Gol, 15 Oct. 1949, *J.Vickery s.n.* (NSW 149256). Homestead Gorge, Mootwingee National Park, 22 Oct. 1988, *I.Crawford* 1094 (NSW, BRI).

Queensland. 28km W of Cunnamulla on road to Eulo, 9 Oct. 1977, *R.J.Henderson II* 25769 (NSW)

NOTES

Henderson (1987) suggested that his taxon may warrant elevation to subspecific or specific status on further study. *Dianella porracea* is abundantly distinct from other

Table 1. Comparison of *Dianella brevicaulis* and *D. revoluta* var. *revoluta* (mostly based on Victorian material).

Character	<i>Dianella brevicaulis</i>	<i>Dianella revoluta</i> var. <i>revoluta</i>
Distribution	Coastal Victoria, Tasmania, South Australia and Western Australia (restricted distribution inland)	Very widespread, inland Vic., Tas., S.A., W.A., N.S.W. and Qld. Unusually coastal in Vic.
Habit	Very densely tussock forming, plants to 25 cm at base, occasionally (S.A.) shortly rhizomic to c. 1 m wide	Extensively rhizomic, plants to 10 m wide.
Rhizomes	Very short, usually <10 mm, occasionally to 15 cm long and 3 mm diameter	Up to 50 cm long, 6 mm diameter
Leaves	To 100 cm long \times 5–7 mm wide, margins revolute; leaves non-glaucous	To 110 cm long \times 8–12 mm wide, margins revolute, leaves glaucous
Inflorescence	Very short and dense, 11–35 cm long, seldom exceeding half the length of the leaves and always within the tussocks	To 80 cm long, open to very open and usually exceeding the leaves; outside the tussocks
Cymules	3–13 flowered	2–9 flowered
Pedicels	3–8 mm long	3–29 mm long
Flowers	Very small to small	Medium sized
Perianth	Pale to deep blue, rarely white	Deep blue
Outer tepals	5–6.5 mm long \times 2–2.25 mm wide	6.5–11 mm long \times 2.5–3.5 mm wide
Inner tepals	4.5–6 mm \times 3–4 mm wide	6–9 mm long \times 3.5–4.5 mm wide
Filaments	0.7–2 mm long	1–1.5 mm long
Strumae	0.5 mm long \times 0.4 mm wide	0.75–1 mm long \times 0.5–0.8 mm wide
Anther	2–2.5 mm long \times 0.8 mm wide	2–4 mm long \times 0.75–1.25 mm wide
Style	3–4 mm long	4–6 mm long
Ovary	1 mm high \times 1.5–2 mm diam.	1.5 mm high \times 1.75 mm diam.
Ovules	4 per loculus	8 per loculus
Fruit	Globular to obovoid or irregularly shaped, dull purple-blue, rarely greenish white or white, 3–6 mm long \times 4–6 mm wide	Depressed globular or globular, 5–11 mm long \times 5–10 mm wide, very dark purplish-blue
Seed	Black, very glossy, \pm ovoid-lenticular or angular, 3 mm long \times 1.75 mm wide	Black, very glossy, \pm ovoid-lenticular or angular, 3.5 mm long \times 2.75 mm wide
Flower time	August to December	August to January
Pollination	Effected by native bees c. 4.5 mm long	Effected by native bees 6–7 mm long
Chromosome number	$2n = 16$ (<i>vide</i> Curtis 1952)	$2n = 16, 32, 48$ (<i>vide</i> Henderson 1987)

members of the *D. longifolia* complex in a combination of vegetative and floral features, distribution and ecology. It is most distinct vegetatively in leaf characters: leaves are smooth, broad, \pm flat, rather soft and fleshy, distinctively ribbed and strongly recurved or arcuate, and summer deciduous unlike all members of the *D. longifolia* complex we know. It is not possible to present a table comparing *D. porracea* with *D. longifolia* var *longifolia* or other varieties in the group, as they are currently poorly circumscribed and require further study. As in all functionally deciduous drought-avoiding *Dianella* (see

D. amoena above), the leaves persist where summer conditions allow. The species is capable of surviving for several months with its roots inundated, and in its natural habitat of riparian forest, where plants are subject to flooding, the leaves die back to the fleshy tuberous roots until more favourable conditions allow regrowth. Populations of *Dianella porracea* that have been observed along Gunbower Parade at Koondrook in northern Victoria, grow with *Dianella revoluta* var. *revoluta*. Plants have also been observed in the Gutteram Swamp NW of Koondrook, and SW of Boort; currently the most southern population known to us. In N.S.W., plants have been observed growing along Barber Creek just NE of Barham and on an anabranch of Eagle Creek just N of Barham. At all sites, plants have been growing in *E. camaldulensis* grassy woodland on grey cracking gilgai clays subject to inundation, and except for the Boort plants, generally tend to grow alongside riverbanks.

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CALLISTEMON KENMORRISONII (MYRTACEAE), A NEW SPECIES FROM EAST GIPPSLAND

W. MOLYNEUX*

ABSTRACT

Molyneux, W. *Callistemon kenmorrisonii* (Myrtaceae), a new species from East Gippsland. *Muelleria* 8 (3): 379–383 (1994). — *Callistemon kenmorrisonii* is described. Its relationship with *Callistemon subulatus* and *C. citrinus* is discussed. An illustration and map are provided.

INTRODUCTION

In *Muelleria* 8(1):61–64(1993), I described *Callistemon forresterae*, and stated in its introduction that it was the first named of a number of apparently new species of *Callistemon* from eastern Gippsland, which have remained virtually uncollected, often due to remoteness of locality and limited population sizes.

Callistemon kenmorrisonii is described from one such population, but rather than being remotely sited, it has been overlooked in a relatively accessible area.

Even though it grows in close proximity to *C. citrinus* with which it may be superficially confused, it is a rheophytic, chasmophytic shrub (i.e. a plant which is anchored into crevices in rock) rather than one of moist ground or heathlands. No records exist of its collection under *C. citrinus* from the Betka River.

Callistemon kenmorrisonii exhibits some characteristics of both *C. subulatus* and *C. citrinus*, but growing trials by seed indicate that its characters do not segregate toward either of these species, and illustrate only the variability one would expect to plot in any taxon.

TAXONOMY

Callistemon kenmorrisonii Molyneux *sp. nov.*

a *C. subulato* E.Cheel statura majore, conflorescentiis majoribus multo, antheriis purpureis, foliis majoribus difformibus, fructibus majoribus multo differt; a *C. citrino* (Curt.) Stapf pilis sporadicis saepe caespitosis in rhachidi, perigynio glabro praeter pilos caespitosos irregulares basi latere unico, foliis minoribus ad finem, fructibus maturis deciduis prompte, et habitatione differt.

TYPUS: Victoria, Upper Betka River, east Gippsland, below bridge on Stony Peak Rd, c. 2.65 km south of the Princes Highway 37°32'S, 149°31'E, 12 Dec. 1993, *W.M. Molyneux* and *S.G. Forrester s.n.* (**HOLOTYPE:** MEL; **ISOTYPE:** BRI, CANB, CBG, NSW)

Shrub, upright or occasionally angular spreading, 1–3 m tall and 1–4 m wide, mostly multi-stemmed from a swollen rootstock; branching irregular; new growth sericeous, pink, soon becoming blue-green, eventually green with a sheen, but not glossy. *Bark* papery, spongy (particularly at the base), grey outside peeling to white. *Leaves* dense, spreading at c. 25°–45° to stems and branches, petioles variously twisted, aligning leaves in an irregular pattern; lamina stiff, coriaceous, narrowly to broadly lanceolate, mucronate, sometimes falcate, flat or shallowly concave, 15(25–28 & 33–46) 52 mm long, 3(4–5.5)6 mm wide, midvein apparent only on lower surface, level with or slightly indented into the leaf, margins rounded, secondary venation not visible, oil glands large, green, darker than leaves, openly distributed on both surfaces. *Conflorescence* usually distally frondose or less often on short stems arising low down on old wood, upright to declined or sometimes pendulous, 30–66 flowers per head, 60(80,90 & 100)105 mm long, 55(58)60 mm wide, rachis with either a sparse scattering of long white hairs along its length, or with random patches of these hairs, which are often

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around one side of the perigynium; leaves growing out above maturing flower head mostly interrupt the very end of the spike, giving the appearance of large floral bracts; true bracts often deciduous at an early stage of bud development, or if persistent, chaffy with white spreading hairs on the outside at the base, convex, roughly elliptical to subulate, c. 5 mm long, 1.5–2 mm wide. *Perigynium* 5–6 mm long, 3–4 mm wide, glabrous, but for a few long white hairs in common with the rachis at their point of attachment; sepals brown, c. 1.5 mm long, 2 mm wide, with irregular patches of short

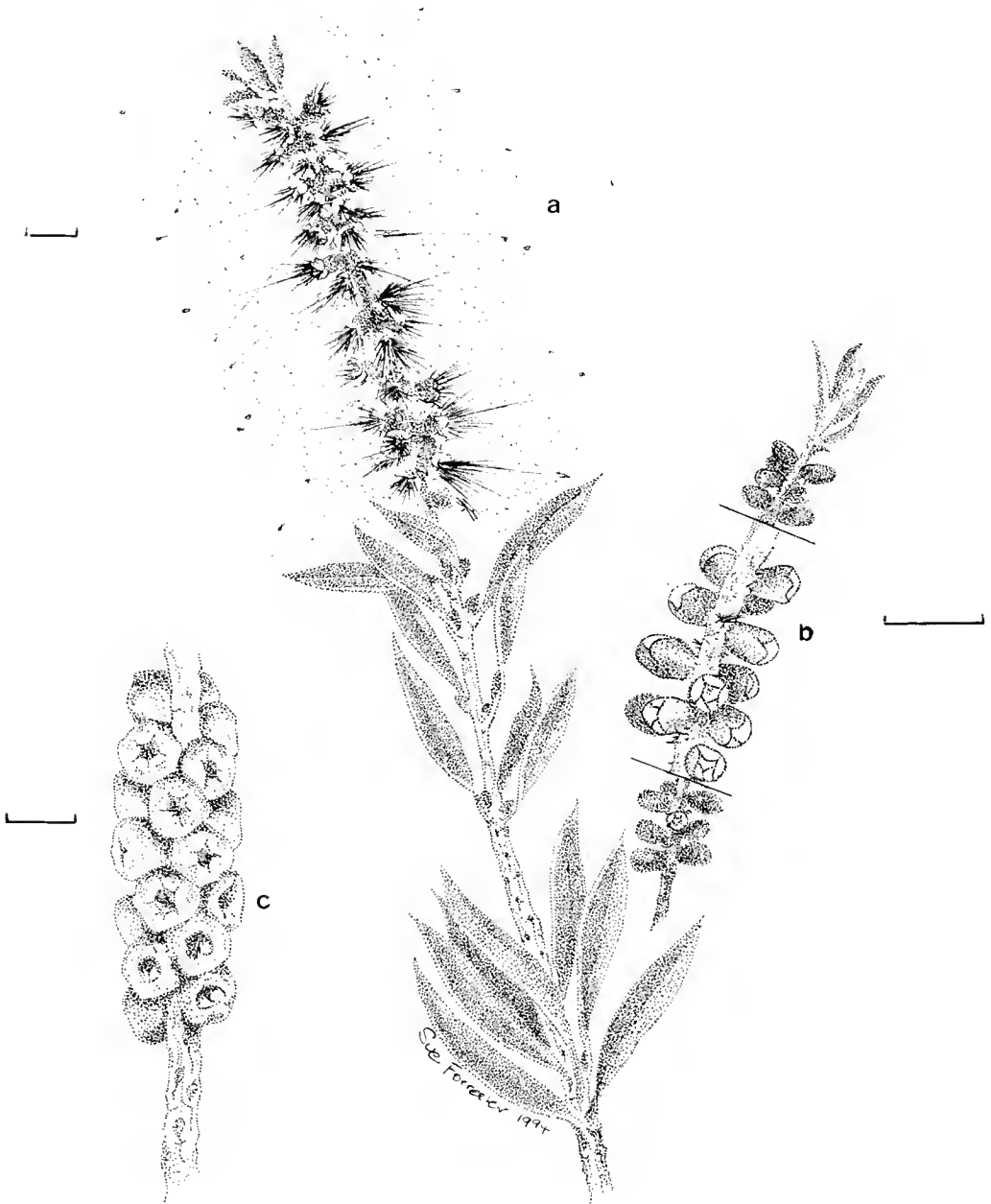


Fig. 1. *Callistemon kenmorrisonii*. a — conflorescence. b — section of rachis illustrating random tufts of hairs. c — fruits. Scale bars = 1 cm

white hairs at the base of their outer edges; petals green, 3.5–4.5 mm long, c. 2 mm wide, with irregularly ciliate edges; soon becoming chaffy, deciduous. *Stamens* 20–32 per flower, 16(22)25 mm long; filaments free, crimson; anthers c. 1.2 mm long, purple, gland not prominent. *Ovary* with a covering of shaggy white hairs c. 1.7 mm across, c. 1–1.5 mm below rim; style nearly straight or variously curved, mostly \pm level with stamens, or sometimes exceeding them by up to c. 5 mm, crimson, 20(22)26 mm long, gradually expanding behind the domed pollen presenter, mostly persistent after stamens fall. *Fruit* squat, eventually partially embedded in the stem, truncate, c. 6–9.5 mm wide, 5–6 mm deep, densely packed on stems, orifice irregular c. 2–4 mm wide, 1–2 mm deep, readily shed but not necessarily dehiscent by about the third year. (Fig. 1)

All measurements made from living material collected at the type locality.

FLOWERING TIME

November–February

DISTRIBUTION, HABITAT AND CONSERVATION STATUS

At this time, *C. kenmorrisonii* is only known by a population of c. 50 plants and is limited to an area of the upper Betka River, growing as a rheophytic chasmophyte, on undifferentiated Devonian-Silurian granites. *C. subulatus* is recorded from a single specimen nearby, but as the dominant species on granite at the Miners Track crossing, c. 16 km downstream. Here it is a shrub to c. 1.8 m tall and 1.8 m wide. (Fig. 2.)

Present also at Miners Track crossing is a single plant of a *Callistemon* which cannot be attributed to any of the three presently known species on and around the Betka River. While of similar size to *C. subulatus*, it has a much longer but still narrow foliage, and the conflorescences are mauve not crimson. In this character, it bears a superficial resemblance to *C. forresterae* of the Genoa River.

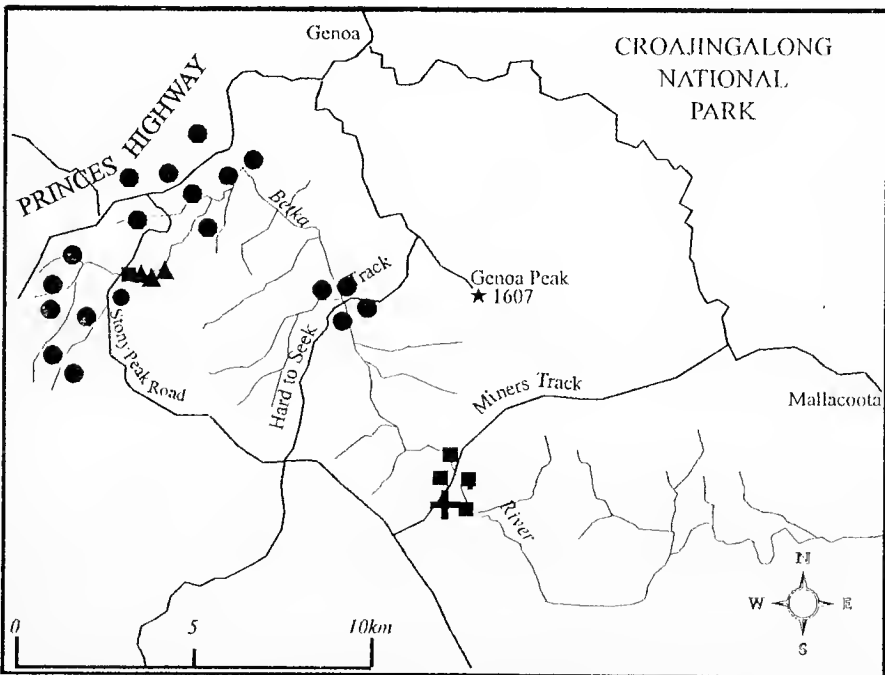


Fig. 2. Distribution of *Callistemon kenmorrisonii* (▲), *C. citrinus* (●), *C. subulatus* (■) and *C. sp* (single specimen)(+)

There is much of the Betka River, a short but productive stream, which is not easy to access, and a more thorough search of its length needs to be undertaken to ascertain whether this specimen is an isolate of a much larger upstream population.

In addition to the two rheophytic species, *C. citrinus* grows as a widespread shrub of moist to wet heathlands, occupying positions in the headwaters of tributaries of the Betka River, that *C. subulatus* and *C. kenmorrisonii* do not. It is also present on low swampy ground at the Hard-to-Seek Track crossing of the Betka River c. 9 km upstream from the Miners Track crossing.

Some of the plants found on and above the Betka River include:

Acacia longifolia, *Allocasuarina littoralis*, *Dampiera stricta*, *Eucalyptus obliqua*, *Eucalyptus radiata*, *Eucalyptus sieberi*, *Gahnia sieberiana*, *Goodenia ovata*, *Hakea sericea*, *Hakea teretifolia*, *Patersonia sericea*, *Pimelea humilis*, *Platylobium formosum*, *Platysace lanceolata*, *Pultenaea cuneata*, *Scaevola ramosissima*, *Sphaerolobium minus*, *Spyridium parvifolium*, *Triglochin rheophilum* and *Tristaniopsis laurina*.

The risk code (sensu Briggs & Leigh, 1989) for *C. kenmorrisonii* is assessed as 2V, that is the species has a maximum geographic range of less than 100 km and is vulnerable.

ETYMOLOGY

The epithet *kenmorrisonii* honours Kenneth Eugene Morrison (1926–) former Ranger of the Croajingalong National Park, stationed at Mallacoota; natural historian and teacher of others through his extensive knowledge of the plants, birds, mammals and reptiles, and their habitats, in a region to which he has devoted much of his adult life.

It was decided to name this plant *Callistemon kenmorrisonii* rather than *C. morrisonii*, to avoid confusion with the late Victorian naturalist Philip Crosbie Morrison.

DISCUSSION

Callistemon kenmorrisonii differs from *C. subulatus* in its larger size; 1–3 m tall, 1–4 m wide, compared with c. 1.2(1.8) m tall, c. 1(1.8) m wide in *C. subulatus*; longer, wider, more irregularly arranged leaves, c. 15–52 mm long, 3–6 mm wide, compared with c. 15–41 mm long and 1–3 mm wide in *C. subulatus*; crimson confluences with purple anthers, c. 6–10.5 cm long, 5.5–6 cm wide, compared with crimson confluences and crimson anthers, 5–8 cm long and 4–5 cm wide in *C. subulatus*; and fruits c. 6–9.5 mm wide, 5–6 mm deep compared with c. 2.5–4 mm wide, 2–4 mm deep in *C. subulatus*.

It differs from *C. citrinus* in the less regularly hairy rachis (densely villous in *C. citrinus* in local comparative populations); perigynium glabrous but for irregular patches of hairs at the base (regularly villous all over in *C. citrinus*); smaller leaves c. 15–52 mm long, 3–6 mm wide, compared with c. 30–80 mm long, 4–15 mm wide in *C. citrinus* and a rheophytic, chasmophyte habitat, compared with a moist or near-swamp habitat for *C. citrinus*.

NOTE

In *Muelleria* (8(1): 61–64 (1993) I described and named *Callistemon forresterae* from a single collection on the upper Genoa River in East Gippsland.

During December 1994, I investigated the middle reaches of the river and located a number of additional populations growing either on rock bars or in sand over rock.

The last of these (a single specimen) was within c. 6 km upstream of the hamlet of Genoa.

Further investigation needs to be undertaken to ascertain whether it occurs on the Genoa River upstream of the New South Wales border.

ACKNOWLEDGMENTS

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NYCTALIS MIRABILIS (FUNGI: AGARICALES), A NEW SPECIES FROM AUSTRALIA

TOM W. MAY* AND BRUCE A. FUHRER**

ABSTRACT

May, Tom W. & Fuhrer, Bruce A. *Nyctalis mirabilis* (Fungi: Agaricales), a new species from Australia. *Muelleria* 8(3): 385–390 (1995). — *Nyctalis mirabilis* sp. nov. is described and illustrated from collections made in Victoria, where it is known only from Cool Temperate Rainforest, and Tasmania. This is the first record of *Nyctalis* from Australia.

INTRODUCTION

Species of *Nyctalis* Fr. are among the few agarics which grow on the basidiomes of other fungi, and the genus is further distinguished by the production of chlamydospores. *Asterophora* Ditmar: Fr. predates *Nyctalis* and in addition is sanctioned, but Donk (1962) does not consider the former genus to have priority because it represents the anamorphic state. Donk's interpretation is accepted here following, among others, Corner (1966) and Rauschert (1992), although Moser (1983) and Singer (1986) continue to use *Asterophora*.

All modern treatments include only two well documented and readily distinguishable species of *Nyctalis*: *N. agaricoides* (Fr.: Fr.) Bon & Courtec. [synonyms *Asterophora lycoperdoides* Fr.: Fr., *N. asterophora* Fr., *N. lycoperdoides* (Bull.) Konrad & Maubl.] and *N. parasitica* (Bull.: Fr.) Fr. Although often described under one of its synonyms, *N. agaricoides* is the name which must be employed because it is the sanctioned name based on the oldest basionym. Further species which have been described in the genus are likely to be abnormal states of other fungi (Corner, 1966; Singer, 1986).

In *N. agaricoides* the chlamydospores are stellate and are formed in the upper pileal trama, the pileus has a powdery surface and is globose to pulvinate, and the lamellae are often rudimentary, whilst in *N. parasitica* the chlamydospores are smooth and are formed in the lamellar trama and in the lower pileal trama, the pileus has a silky surface and is convex to umbonate, and the lamellae are blunt but comparatively normal (Thompson, 1936; Corner, 1966; Durand & Nicot, 1968; Moser, 1983; Phillips, 1983). Basidiomes of both species frequently do not produce basidiospores. The two species occupy a similar geographic range, both occurring in North America, Europe, North Africa, East Asia and Papua New Guinea (Corner, 1966; Horak, 1980; Singer, 1986), but the genus has not been recorded previously from Australia. The most common hosts are species of Russulaceae (*Lactarius* Pers. or *Russula* Pers.) Recent collections of *Nyctalis* from Victoria and Tasmania do not agree with either of the two known species.

MATERIALS AND METHODS

Colour notations in the form '6E5' are from Kornerup and Wanscher (1981), whilst those in the form '10YR 7/3' are from Munsell (1975; 1977). L is the number of lamellae, Q is the quotient of the length and width of an individual spore. Material for microscopic examination was mounted in 3% KOH. Spore measurements do not include the hilar appendage. The length of intercalary chlamydospores was measured from the septum with one subtending hypha to the septum with the other; the length of

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terminal chlamydospores was measured from the basal septum to the apex. Chlamydospore width does not include projections.

TAXONOMY

Nyctalis mirabilis T.W.May, *sp. nov.*

A Nyctalis parasitica chlamydosporis stellatis differt; a *N. agaricoide* supra pileum non pulverulentum, chlamydosporis praesentibus in trama lamellae et in trama pilei inferna differt.

HOLOTYPE: Australia, Victoria, Eastern Highlands, Donna Buang Rd, Myrtle Creek, 37°42'S, 145°42'E, 10 Apr. 1986, *T.W. May B-281* & *B.A. Fuhrer* (MEL 228691).

Pileus 13–27 mm diam., convex, broadly convex, plano-convex or campanulate, margin decurved then flaring out or curling up, sometimes broadly wavy; not hygrophanous, not translucent striate, or only with age at margin, surface dry, covered with a layer of fine silvery grey appressed fibrils over a brown ground colour (6E5) appearing silvery grey or pale greyish brown (10YR 7/3, 10YR 8/1, 5B2–3), occasionally with lilac flecks, darkening with age or handling to dark reddish brown (8–9F8). *Lamellae* normally formed, 1.5–4 mm deep, adnate with decurrent tooth, moderately crowded ($L = 22–25$), moderately thick, rarely forked, light brown (10 YR 5/4, 5D4–5) then dark brown or dark reddish brown (5YR 3/4, 7F8, 8–9F7), edge concolourous, even or wavy, not blunt, lamellulae present in several series. *Stipe* (8–)26–35 mm long, 1.5–3 mm diam., central, cylindrical or flattened above, even or a little expanded above, surface dry, concolourous with pileus, with silvery grey appressed longitudinal fibrils, coarser than those on the pileus and appearing silky striate, apex finely squamulose, basal mycelium pale grey, finely strigose, with pale grey cobwebby or felty mycelial mat on host surface. *Context* hollow in the stipe, sometimes with cavity extending into the pileus; very dark brown or dark reddish brown (2.5 YR 3/3) in the stipe and in the pileus over the lamellae, paler grey in the pileus beneath the surface and in the stipe immediately below surface. *Odour* strongly farinaceous to unpleasant. *Hymenium* extending over entire surface of lamellae. *Basidiospores* very sparse to common, $5–6(–7.5) \times 3–4(–5) \mu\text{m}$, $Q = 1.25–1.67(–1.80)$, ellipsoid, smooth, thin-walled, not amyloid. *Basidia* $19–23 \times 5–7 \mu\text{m}$, clavate, 4-spored, sterigmata up to $4 \mu\text{m}$ long. *Chlamydospores* numerous in the lamellar trama and in the pileal trama above the lamellae, very sparse to absent in the upper part of the pileal trama and on the pileus surface, numerous in the host tissue, intercalary or terminal, fusoid-stellate, $13–35(–40) \times 6–12.5(–15) \mu\text{m}$, hyaline then pale yellow, outer wall up to $0.5 \mu\text{m}$ thick; initially with granular contents throughout, at length with an inner wall up to $0.5(–2.5) \mu\text{m}$ thick which excludes the projections and a segment adjacent to each subtending hypha (the apical portion of terminal chlamydospores is similarly excluded), enclosing contents which are granular and with small and large, refractive droplets, these contents eventually surrounded by a layer of laminated appearance, up to $3 \mu\text{m}$ thick; projections 6–11, bluntly conical, up to $6 \mu\text{m}$ long and $5 \mu\text{m}$ wide, apex sometimes truncate or expanded, when delimited by inner wall empty and sometimes with one or more septae; in terminal chlamydospores the apical portion is empty and up to $10 \mu\text{m}$ long. *Pileipellis* a cutis, consisting of parallel, cylindrical hyphae, $5–11 \mu\text{m}$ diam., radially arranged, becoming irregular over the centre. *Pileal trama* consisting of more or less parallel, cylindrical to broadly subfusoid hyphae, $5–17 \mu\text{m}$ diam., radially arranged, a little interwoven, becoming shorter and disorganised over the stipe. *Lamellar trama* regular, consisting of more or less parallel, cylindrical hyphae $4–16 \mu\text{m}$ diam. *Subhymenium* a narrow layer of short or subsodiametric elements, $2.5–5 \mu\text{m}$ diam. *Stipitipellis* composed of parallel, cylindrical hyphae, $3–9.5 \mu\text{m}$ diam, becoming interwoven at the apex. *Stipe trama* consisting of parallel, cylindrical to subfusoid hyphae, $4–18 \mu\text{m}$ diam. *Hyphae* of all tissues thin-walled to slightly thick-walled (up to $0.5 \mu\text{m}$ diam.), with clamp connections, hyaline, to pale yellow in stipe trama, and sometimes with pale brown intrahyphal pigment in pileipellis. (Figs 1 & 2a-c)



Fig. 1. *Nyctalis mirabilis*. Fruiting bodies *in situ* (T.W. May B-281 & B.A. Fuhrer). Approx. $\times 2$.

HABIT, PHENOLOGY AND HOST

The caespitose basidiomes arise from a common base on old blackened agaric basidiomes and are produced in autumn. The host in all collections is a member of the Russulaceae (*Russula* or *Lactarius*). Knowledge of the Australian representatives of these genera is insufficient to allow identification to species. In four of the five collections examined the host basidiospores are similar enough to suggest that the host is the same species. Basidiospores from these hosts are $7\text{--}8\text{--}(8.5) \times 5.5\text{--}7 \mu\text{m}$, broadly ellipsoid, $Q = 1.14\text{--}1.33\text{--}(1.38)$, with an amyloid ornamentation consisting of a more or less complete reticulum joining verrucae up to $1 \mu\text{m}$ high, and a plage is present (Fig. 2d). The host of *May B-200* has slightly larger basidiospores, $7.5\text{--}9 \times 6.5\text{--}7\text{--}(8) \mu\text{m}$, $Q = 1.11\text{--}1.29$, with a less complete reticulum.

FURTHER COLLECTIONS EXAMINED

Tasmania — Mt Wellington, Pillinger Track, off Fern Glade Track, 3 Mar. 1994, A.V. Ratkowsky, in A.K. Mills 1190 (HO, MEL).

Victoria — *Eastern Highlands Region*: Acheron Way, Acheron Gap, 5 Apr. 1986, T.W. May B-284 & K.E. Geering (MEL 228690); Lady Talbot Drive, Whitehouse Creek Scenic Reserve, 30 Mar. 1985, B.A. Fuhrer & G.A. Crichton in T.W. May B-200 (MEL 228693); 19 Mar. 1989, T.W. May B-585 & B.A. Fuhrer (MEL 228689).

HABITAT, DISTRIBUTION AND CONSERVATION STATUS

Victorian collections of *N. mirabilis* are all from Cool Temperate Rainforest dominated by *Nothofagus cunninghamii* (Hook.) Oerst. We have also observed the species in Victoria to the east of the Baw Baw National Park, where the Thompson Valley Road crosses South Cascades Creek (under *Nothofagus*), but no specimens were retained. The Tasmanian site is in *Eucalyptus* forest, but *N. cunninghamii* occurs in the vicinity and did occur at the locality prior to wildfires in 1967 (A.K. Mills, pers. comm.).

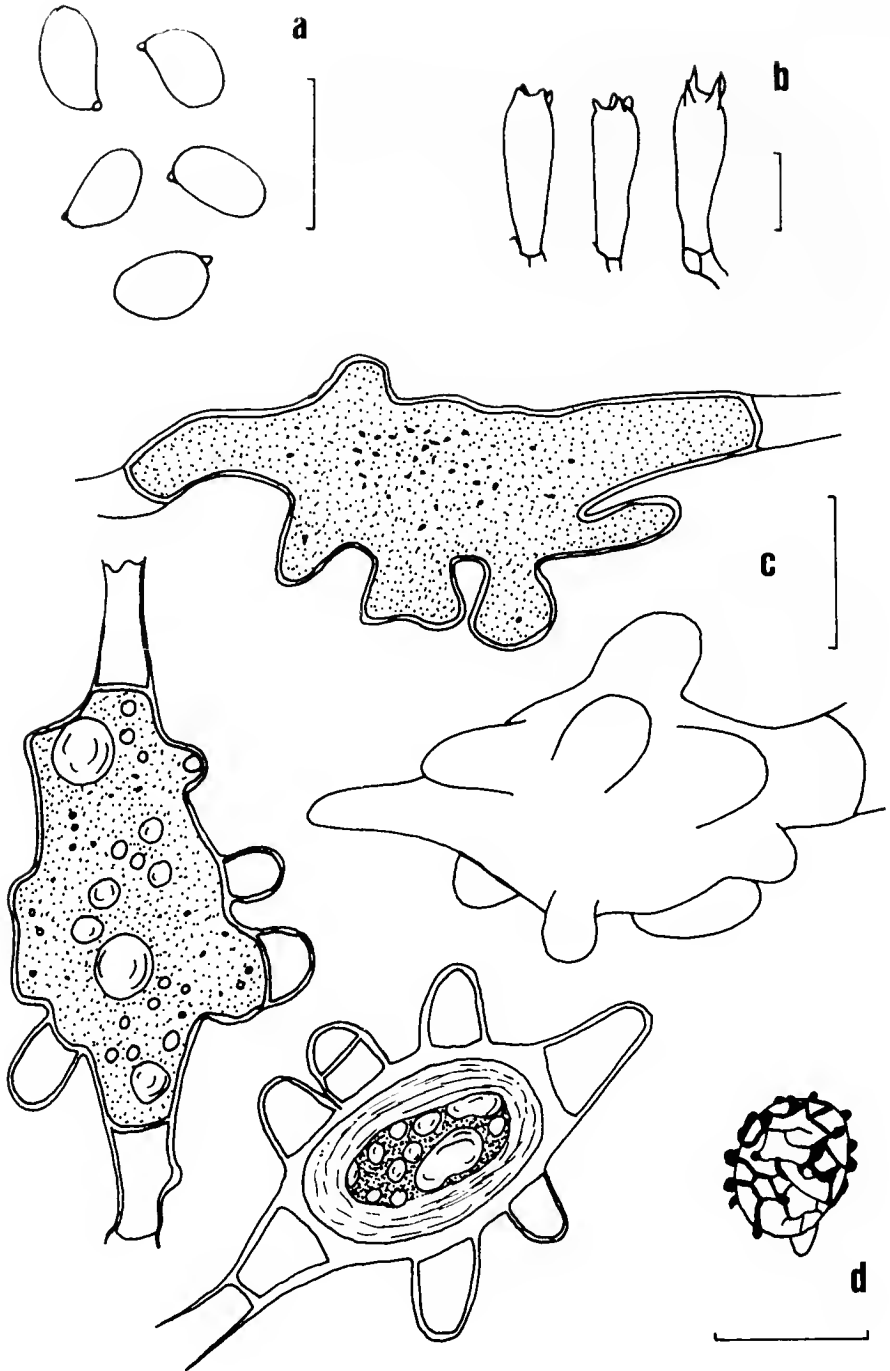


Fig. 2. *Nyctalis mirabilis*. a — basidiospores. b — basidia. c — chlamyospores, one in surface view, three in optical section. d — basidiospore from host. Scale bars = 10 μ m. a from *T.W. May B-200*, b & c from *T.W. May B-281* & *B.A. Fuhrer*, d from *T.W. May B-585*.

Known localities of *N. mirabilis* in Victoria are within a 70 km range in the Eastern Highlands. The Myrtle Creek site is in a Crown Land Reserve, Acheron Gap is State Forest, and Whitehouse Creek is a State Forest Special Purposes Reserve. In Tasmania the Mt Wellington site is within a Public Park administered by the Hobart City Council.

Despite repeated collecting activity throughout the range of Cool Temperate Rainforest in Victoria and Tasmania, we have rarely seen fruiting bodies of *Nyctalis mirabilis*. A coding system for conservation and distribution information suitable for fungi is yet to be devised, but the species must be regarded on present knowledge as rare and of restricted distribution. Although all sites from which collections have been made are reserved in some way, none are within National Parks and thus the conservation status of the sites should be monitored. In assessing the conservation status of *N. mirabilis* it will be important to establish the host range and the conservation status and distribution of the host or hosts.

ETYMOLOGY

The Latin epithet *mirabilis* (unusual, surprising) alludes both to the habit and also to the discovery of the species when the other members of the genus have been known for so long.

DISCUSSION

N. mirabilis is in appearance similar to *N. parasitica* and yet has the distinctive stellate chlamydospores of *N. agaricoides*.

The close association of *N. mirabilis* with *Nothofagus* in a restricted area of south-eastern Australia contrasts with the wide distribution of the other two species of *Nyctalis* and presents an interesting biogeographic problem. An explanation for these distribution patterns will need to involve a phylogenetic analysis of *Nyctalis* but the situation does invite comparison with that in the mycorrhizal agaric genera *Descolea* Singer and *Rozites* P.Karst. In these genera there are a number of species present in Australia, New Zealand and other Gondwanan regions, frequently restricted to Cool Temperate Rainforest, with further species occurring in the Northern Hemisphere which are considered to be of more recent origin (Horak, 1983).

Interpretation of the distribution of *Nyctalis* will also need to involve a consideration of the evolution and biogeography of the russulaceous hosts, which are themselves almost exclusively mycorrhizal (Singer, 1986).

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NOTES ON *PULTENAEA* Sm. (FABACEAE) IN VICTORIA

M.G. CORRICK*

ABSTRACT

M.G. Corrick. Notes on *Pultenaea* Sm. (Fabaceae) in Victoria. *Muelleria* 8(3): 391–394 (1994). — One species of *Pultenaea*, *P. viscosa* R.Br. ex Benth. is placed in synonymy under *P. mollis* Lindl. and three varieties of *Pultenaea*, *P. paleacea* Willd. var. *sericea* Benth., *P. paleacea* Willd. var. *williamsonii* (Maiden) H.B. Williamson and *P. juniperina* Labill. var. *mucronata* (Benth.) Corrick are raised to specific rank as *P. sericea* (Benth.) Corrick, *P. williamsonii* Maiden and *P. forsythiana* Blakely respectively.

INTRODUCTION

In order to facilitate an account of the genus *Pultenaea* Sm. for the forthcoming *Flora of Victoria* some nomenclatural changes are necessary. Several varieties of *P. paleacea* Willd. have been described but both White (1939) and Briggs & Crisp (1994) suggest that some or perhaps all of these should be raised to specific rank. Recent studies of the two of these taxa occurring in Victoria uphold this view and the necessary changes are now made.

Specific rank is also considered more appropriate for the taxon currently known as *P. juniperina* Labill. var. *mucronata* (Benth.) Corrick, a view held by Blakely when describing it as *P. forsythiana* Blakely, and upheld by M.D. Crisp (pers. comm.). This change is also now formally made.

P. viscosa R.Br. ex Benth. is relegated to synonymy under *P. mollis* Lindl.

TAXONOMY

Pultenaea williamsonii Maiden, *The Victorian Naturalist* 22: 99 (1905). TYPE: Victoria, Strathbogie, near creeks, Nov. 1902, *Anton W. Vroland* (No. 921 of H.B. Williamson) (HOLO: NSW; ISO: MEL).

P. paleacea var. *williamsonii* H.B. Williamson, *Proc. Roy. Soc. Victoria* ns. 32: 22 (1922).

Pultenaea williamsonii is distinguished by its broad, flat, widely and irregularly spaced leaves which are usually more than 3 mm wide and less than six times as long as wide and by the broad bracteoles 1.5–2 mm wide compared with a width of up to 1.25 mm in *P. paleacea* var. *paleacea* and 1 mm in *P. helophila*, and by the position of the bracteoles not more than 0.5 mm above the base of the calyx tube.

P. williamsonii is confined to a few localities in the Central Highlands of Victoria, in the Strathbogie area, near Eildon and near Wonangatta.

It is unfortunate that under the International Code of Botanical Nomenclature the original epithet of Maiden must be retained in spite of the similarity in name of *P. williamsoniana* J.H. Willis which is confined to the northern part of the Grampians. Examples cited under Article 64.3 of the ICBN indicate that an application to have the specific epithet *williamsoniana* rejected on the basis of confusion due to this similarity would not succeed.

SELECTED SPECIMENS EXAMINED

Victoria — Eastern Highlands: 1 km E of Mt Barranhet (c. 10 km due E of Strathbogie), 22 Jun. 1985, *D.E. Albrecht 1818* (MEL); Near Wonangatta Station, 1 Dec. 1989, *E.A. Chesterfield 2586* (MEL); Beside Tatong-Tolmie road near Archerton, 10 Dec. 1974, *M.G. Corrick 4883* (MEL); Between Eildon and Jamieson near Big River, 12 Nov. 1962, *B. Strange s.n.* (MEL 536106).

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Pultenaea sericea (Benth.) Corrick, *stat. nov.*

P. paleacea var. *sericea* Benth., *Fl. Austral.* 2: 116 (1864). LECTOTYPE (here selected): Victoria, Marshy places near Melbourne, 4 Dec. 1855, *F.M. Adamson* (K).

P. sericea is distinguished by its narrow linear leaves usually not more than 3 mm wide and more than 8 times as long as wide and by the narrow bracteoles 0.75–1 mm wide attached about 2–3 mm above the base of the calyx-tube. The floral bracts are also distinctive in their pale straw colour and in that the longest of them exceeds the length of the calyx in contrast to the broad floral bracts of *P. williamsonii* which are usually shorter than the calyx.

P. sericea occurs in heathlands of southern Victoria and NE Tasmania.

SELECTED SPECIMENS EXAMINED

Victoria — Wilson's Promontory, 9 Nov. 1908, *Audas and St John s.n.* (MEL 624751); Cicada Trail, between Mueller and Wingan Rivers, 22 Nov. 1969, *A.C. Beauglehole 31969 and E.W. Finck* (MEL); Langwarrin Railway Reserve, 12 Nov. 1978, *M.G. Corrick 6174* (MEL); Railway easement between Clarkefield and Riddell's Creek, 19 Oct. 1982, *B. Kemp s.n.* (MEL 628577).

Tasmania — Bridport, 15 Nov. 1952, *W.M. Curtis s.n.* (MEL 598217).

Comparison of some distinguishing characters of *P. paleacea* var. *paleacea*, *P. helophila* and *P. williamsonii* [adapted from Briggs & Crisp (1994)]

	<i>P. paleacea</i>	<i>P. helophila</i>	<i>P. williamsonii</i>
Leaf length	6–12 [23]	6–25	5–25
Leaf width	0.8–3 [5]	1–3 [6]	2–8
Stipule length	5–7 [10]	6–10	5–7
Bracteole length	4–6	3.5–5	4.5–5
Bracteole width	1–1.25	0.75–1	1.5–2
Bracteole attachment from base of calyx	1.5–2.5	2–3	0–0.5
Floral bract colour	Dark reddish brown	Pale straw colour	Dark reddish brown

(measurements in mm)

Pultenaea forsythiana Blakely, *Contr. New South Wales Natl. Herb.* 1: 121 (1941). TYPE: New South Wales, Lobbs Hole, Nov. 1900, *W. Forsyth* (NSW).

P. juniperina Labill. var. *leiocalyx* Blakely, *Contr. Natl. Herb. New South Wales* 1: 123 (Mar. 1941). LECTOTYPE (here selected): New South Wales, Mt Kosciusko up to 5500 ft, Jan. 1898, *J.H. Maiden s.n.* (NSW).

P. forsythiana Blakely var. *uniflora* Blakely, *Contr. New South Wales. Natl. Herb.* 1: 122 (Mar. 1941). LECTOTYPE (here selected): New South Wales, Brindabella Mtn, Federal Capital Territory, 10 Dec. 1911, *R.H. Cambage No. 3334* (NSW).

P. juniperina Labill. var. *macrophylla* Wawra, *Itinera Principum S. Coburgi* 1: 13 (1883). TYPE: Ebene um Dandenong Coll. I. 592 *n.v.*

P. juniperina Labill. var. *planifolia* H.B. Williamson, *Proc. Roy. Soc. Victoria* n.s. 33: 138 (1921) *nom. illeg.*. TYPE: New South Wales, Clarence River, *Beckler* (MEL).

P. juniperina Labill. var. *mucronata* (Benth.) Corrick

Muelleria 3: 249 (Sept. 1977). BASIONYM: *P. flexilis* var. *mucronata* Benth. TYPE: New South Wales, Clarence River, *Beckler* (MEL).

This taxon differs from *P. juniperina* chiefly in the leaves which are wider above the middle, narrow gradually towards the base and have a mucronate tip. The leaves of *P. juniperina* are broadest near the base and often cordate and narrow gradually into a slender pungent tip. Blakely's protologue describes the leaves of *P. forsythiana* as being paler on the lower surface than the upper. Examination of the type collection does not support this, the lower surface is distinctly darker than the upper, a character which is consistent throughout the range of specimens examined.

The calyx of *P. forsythiana* is glabrous externally except for the densely ciliate margins of the calyx lobes. *P. juniperina* usually has some hairs on the calyx, often dense

and crisped, but a collection (J.H. Willis, Dec 1932, MEL 1619502) from Tonimbuk in Victoria and some Tasmanian collections are almost glabrous.

The seed aril of *P. forsythiana* is narrow and rugose whilst that of *P. juniperina* is intricately divided into numerous fleshy threads. *P. forsythiana* in Victoria shows considerable variation in bracteole size and vestiture. The typical form from the Eastern Highlands and Snowfields has narrow lanceolate bracteoles, longer than the calyx-tube with a very hairy mid-rib. The majority of other collections have broad lanceolate to ovate bracteoles, shorter than the calyx-tube and with the mid-rib only slightly hairy.

SELECTED SPECIMENS EXAMINED

Victoria — 3 km S along Aberfeldy-Walhalla Road from its intersection with Binns Road, 26 Sep. 1985, D.E. Albrecht 1901; Benambra-Corryong Road at Gibbo River bridge, 1 Nov 1977, M.G. Corrick 6008; Otway Range, 8 km SW of Forrest, 26 Oct 1984, S.G. Harris 31; Playground top, between Cobberas No. 1 and Rams Horn, 12 Jan 1949, N.A. Wakefield 2602.

P. forsythiana occurs on heavier loam soils in moist forest, usually on mountain slopes, in Victoria and the Southern and Central Tablelands of New South Wales. *P. juniperina* in Victoria is restricted to sandy soils in the heathland understorey of the Grampians and near Tonimbuk but is widespread in a variety of habitats in Tasmania.

***Pultenaea mollis* Lindl.** in T. Mitch., *Three Exped. Interior East Australia* 2: 258 (1838)

P. viscosa R.Br. ex Benth., *Fl. Austral.* 2: 127 (1864)

P. mollis as currently recognized in Victoria is a highly variable taxon. It is widespread in the state, mainly south of the Dividing Range usually in moist forest as part of a shrub or heathland understorey. Williamson (1922 and 1928) commented on the problems and segregated some taxa.

In publishing *P. viscosa* Bentham (1864) includes in his type citation a specimen collected from Mt Sturgeon by Robertson as well as Brown's collection from Parramatta. Under *P. mollis* he cites a collection by Mitchell from Wannon River at the foot of the Grampians. Mitchell's expedition camped on the Wannon River near the foot of Mt Sturgeon and there seems little doubt that both the Robertson and Mitchell collections came from the same population. Bentham also commented on the similarities between *P. mollis*, *P. viscosa* and *P. hibernioides*. *P. hibernioides* Hook.f. has already been placed in synonymy under *P. mollis* (Corrick 1988). I have seen this plant in the type locality in Tasmania and believe it to be indistinguishable from many of the Victorian populations of *P. mollis*.

P. viscosa, as recognized by Willis (1972), is known in Victoria from only one or two localities in East Gippsland. The large, long bracteoles, large bracts and stipules and broad leaves which are considered to distinguish it from *P. mollis* occur singly or in combination in many populations of *P. mollis*. Variation is particularly evident in the Grampians where the plant is widespread.

I have observed and collected *P. mollis* from most of the areas of Victoria where it occurs and also in southern New South Wales where Mueller collected material cited by Bentham (1864) under *P. viscosa*.

Differences between the extremes of variation seem striking but the extremes are linked by an enormous number of intermediate forms; until a complete study of the complex can be undertaken it seems preferable to regard it as one polymorphic taxon.

SELECTED SPECIMENS EXAMINED

Victoria — Wannon River, 14 Sep. 1836, T.L. Mitchell 299 (MEL, ISOTYPE); Wilson's Promontory, 5 Nov. 1980, M.G. Corrick 7075 (MEL); 2.5 miles SE Gembrook, 5 Oct. 1960, T.B. Muir 1293 (MEL); Buffalo Range, Mar. 1853, F. Mueller s.n. (MEL 1503843); Grampians: Junction of Roses Creek and Mt Victory Road, 16 Oct. 1976, M.G. Corrick 5623 (MEL); Mt William Road, 20 Nov. 1976, M.G. Corrick 5715 (MEL).

New South Wales — Nalbaugh National Park, 22 Nov. 1987, D.E. Albrecht 3175 (MEL).

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FERDINAND MUELLER ANNIVERSARY

SARA MAROSKE*

ABSTRACT

Maroske. Sara. Ferdinand Mueller Anniversary. *Muelleria* 8(3): 395–398 (1995). — 1995 marks the 170th anniversary of Ferdinand Mueller's birth in the city of Rostock. From humble beginnings Mueller went on to become one of the greatest botanists Australia has known despite many personal and professional hardships. This journal proudly commemorates his name.

FERDINAND MUELLER (1825–1896)

Ferdinand Jakob Heinrich Müller was born in the port city of Rostock, Mecklenberg on 30 June 1825. His father, Friedrich Müller, was a customs official, and his mother was Louise née Mertens. The family enjoyed free accommodation in the Mönchentor (one of the city gates leading to the harbour) a place which was Ferdinand Müller's home for the first ten years of his life (Fig. 1). He moved to the town of Tönning in Schleswig-Holstein after his father's death in 1835, and moved again to Husum to



Fig. 1. Mueller's birthplace, Rostock, Mecklenburg, n.d. (Original at the Library, Royal Botanic Gardens, Melbourne.)

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start an apprenticeship in pharmacy in 1840. From this unpretentious beginning he became Australia's greatest nineteenth-century scientist, with an international botanical reputation.

This year marks the 170th anniversary of the year of Müller's birth. When Ferdinand Müller became a naturalised British subject in South Australia in 1849, he changed the spelling of his surname to Mueller. That name is remembered in the title of this journal, *Muelleria*, which was founded to publish the botanical, horticultural and historical research of staff members of the National Herbarium of Victoria (and Royal Botanic Gardens) which itself was founded by Mueller in 1853.

Mueller made contributions to many fields of science including geography, pharmacy, medicine, horticulture, agriculture, forestry, paleontology, and zoology, but his major contribution was to botany. This fact is evident alone in the hundreds of Australian plant names which are followed by 'F. Muell' (or as his authorship was represented in the nineteenth-century 'F.v.M.'). Mueller, however, also played a crucial role in publicising Australian botanical knowledge nationally and internationally, and in fostering an interest in botany in other Australians, so that although no one of his stature subsequently emerged in the field, many individuals followed him whom he encouraged and assisted.

Mueller was interested in botany from his youth (Fig. 2). He studied the subject during his apprenticeship in Husum (Fig. 3), and also at Kiel University where, in 1847,



Fig. 2. Mueller at age eighteen. (Original at the Library, Royal Botanic Gardens, Melbourne.)



Fig. 3. The market place in Husum around the time Mueller was an apprentice at the 'Unicorn Pharmacy'. The pharmacy is the second building on the left. (Taken from a print at the Library, Royal Botanic Gardens, Melbourne.)

he graduated a Doctor of Philosophy¹ with a thesis on the flora of south west Schleswig. The death of his parents and a sister through tuberculosis prompted him to leave Germany with his two surviving sisters, Bertha and Clara. They chose South Australia as their destination, partly because other Germans had already settled there, and also because its flora was still relatively little known to science (Mueller to Fischer-Benzon, 16 Dec. 1887). Mueller's enthusiasm for botany is apparent from the fact that his first known Australian collection was an alga plucked from over the side of the ship as he arrived in 1847, before he had even set foot on land (Womersley & Sinkora 1987). Over the following five years which he spent in South Australia he made the decision to stay permanently in the country, and set as his goal to write Australia's flora.

Mueller moved to Victoria in 1852 and was appointed the colony's first Government Botanist the following year (a position which he held until his death in 1896). He was appointed first Director of the Botanic Gardens (1857-73), which institution for a time incorporated the zoo (1858-61). In the first decade of Mueller's career in Victoria he made substantial personal explorations of the colony, as Sophie Ducker has remarked 'it is scarcely an exaggeration to say that he covered Victoria on his hands and knees' (Ducker 1981). From 1855-6 he took part in the North Australian Exploring Expedition under the leadership of A.C. Gregory. Mueller also established an extensive network of collectors who were increasingly to do the 'leg-work' for him in the future. Much of his botanical research was published in his journal *Fragmenta phytographiae Australiae*, which he distributed widely.

The 1860s and '70s were years of less personal satisfaction to Mueller than the previous decade. He made several unsuccessful attempts to establish a happy domestic life, he was denied the authorship of Australia's flora (it went to George Bentham, a man

1. Doctor of Philosophy certificate, 2 August 1847, RB MSS M200, Library, Royal Botanic Gardens, Melbourne.

who never saw Australian plants in their natural habitat) and he was dismissed as Director of the Botanic Gardens. Nevertheless, these years were ones of great botanical productivity. Mueller published his anti-Darwinian work the *Flora of the Chatham Islands* in 1864, the first edition of his encyclopaedic work on economic botany, *Select extra-tropical plants* in 1876, and an educational text book for children *Introduction to Botanical Teachings* in 1877.

In old age Mueller became something of a living icon of Australian botany, well known to all the practitioners in the field and almost a household name. He published major monographs on the acacias, eucalypts, Myoporaceae and salt bushes, the *Systematic Census of Australian Plants* in 1882, and promoted the exploration of New Guinea and Antarctica through the Royal Geographical Society of Australasia. While the last decades of his life were somewhat soured by administrative struggles with the government he did receive substantial international recognition for his work in the form of numerous titles, awards and honorary memberships of scientific societies. Notable among this was his FRS in 1861, a Barony from the King of Württemberg in 1871, and a KCMG in 1879.

The 100th anniversary of Mueller's death in 1996 will provide a further opportunity to reflect on the significance of this individual's contribution to science in Australia. An international history and taxonomy conference is planned for September 1996, a grand ball at Government House in June, a pilgrimage to his grave memorial in St Kilda with Field Naturalists Club of Victoria in October, and publications by the Mueller Project and others. Mueller did not marry and had no children. Bertha had two children and Clara fifteen. Mueller often claimed to have sunk his own money into botany and died a poor man in surprisingly squalid conditions. His botanical successors are the main beneficiaries of his devotion to science, notably through his massive collections of Australian and overseas plants and in his unique botanical library, both of which are housed at the National Herbarium of Victoria.

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BOOK REVIEW

Management of Endangered Plants. S.C. Cropper. Published by CSIRO Australia, Melbourne. 1993. 182 pp. ISBN 0 643 05533 9 (Soft cover). Price \$AU49.95

With the best intentions, Simon Cropper set out to write a book that would combine shelves of published research by biologists around the world with his own years of field experience in Victoria. The resulting amalgam would be the kind of book that could lie dog-eared and grubby on the back seat of a four-wheel drive just as naturally as it could grace a coffee table. It's hard to imagine a book that would succeed on both fronts and *Management of Endangered Plants* will not satisfy either market.

This is unfortunate since there are important lessons to be learnt from Cropper's experience in managing endangered plants in Victoria and there are some interesting tales languishing within the book. The major problem seems to be a lack of synthesis. The paragraphs tumble after one another, a series of mini reviews of published work or personal anecdotes. The cases studied are extremely eclectic and I can't see how they provide a framework for managing endangered species in general. Most of the methods and principles are culled from standard texts or declare what in most cases would be the common sense approach.

There are plenty of statements of fact, but these seldom represent the culmination of a well-argued exposition. We are often presented with dubious generalizations, such as 'newspaper articles do little to aid in species conservation'. This is true because one item in a large Melbourne daily gave the precise locality of a rare orchid population which was subsequently severely damaged. The educative value of media coverage (and the ability to withhold precise locality information) is ignored. Other advice is equally dogmatic and often seems to be based on personal experience rather than any serious analysis of the issues. It is perhaps getting too pedantic, but as a reader I don't like to be told that 'the *only* way to protect vegetation from fire is to lower the risk of fire starting' and 'this can *only* be done by reducing the fuel load on adjacent land' (my italics). In many, or even most, case these statements may well be true, but this is not the way to present a topic as complex as the interaction between fire and Australian vegetation. Other advice is too vague, such as '*ex situ* collections should...be returned to the wild before any significant deterioration has occurred' (this is clarified somewhat 5 pages further on).

In addition to 10 case studies there are chapters on rarity and extinction, conservation strategies, finding rare plant populations, monitoring known populations, management techniques and a series of appendices containing sources of information, various contacts and tools for plant management. The bibliography, glossary, gazetteer and index are comprehensive and useful. As a book of interesting anecdotes, it is nicely presented and includes plenty of localities and plants familiar to at least Victorians. However, the illustrations are of variable quality and some design features are irritating (e.g. appendix items such as the frequently used word 'population' highlighted in bold the first time they appear in each section). Having 'icons' to signify crucial passages is effective if not always all that helpful.

Overall I don't think the book is satisfactory. It certainly contains some useful information and it at least makes us aware of the important role of management in maintaining biodiversity. It fails, however, to excite the imagination or to provide a source book for threatened plant management.

TIMOTHY J. ENTWISLE

BOOK REVIEW

Australian Tropical Rain Forest Trees: An Interactive Identification System. — B.P.M. Hyland and T. Whiffin. Published by CSIRO, Melbourne. 1993. 3 volumes & computer disks. ISBN 0 643 05403 0. \$AU 195.00

Anyone who has collected or carried out any ecological surveys in rainforest will know that the chance of collecting flowering material of all species present is virtually nil. The use of a standard flora (if one exists) is therefore impossible and one must rely on either matching material with specimens that have, hopefully, been correctly identified (a method which easily produces incorrect identifications) or have someone who is familiar with the flora do the identifications instead (a luxury that is not always available).

Bernie Hyland overcame this problem of using flowering material for identifying rainforest material by producing a punched-hole computer card key to the rainforest trees of north-east Queensland in the mid 1970's. It was very innovative at the time and I think the first and only polyclave regional flora in Australia. The card key (as it is commonly called) used only leaf and bark characters to determine any tree over 2 m tall and, until recently, was regularly used to identify the native trees of the Wet Tropics. However, with age, it had developed a number of flaws. Over the years the nomenclature of the species present had changed as a result of the increased awareness of the rainforest flora, the number of species present in the rainforest had increased, and a correct or satisfactory result was not guaranteed when identifying plants out of the immediate range of the card key. The descriptions were also very scanty and not every species was illustrated.

It was a delight, then, to see the long awaited 'Australian Rain Forest Trees' computer package. With its expanded character list (it now includes flowers, fruits and seedlings), extended range to include all of the tropical rainforests of northern Australia, updated taxonomy, and expanded descriptions and illustrations, as such it alleviates most of the problems associated with the card key. It can also be regularly updated — something which was not possible for the card key, as the machinery needed to punch the slots was no longer available.

The package comes in the form of three volumes and three computer disks. The system can be installed on either MS-DOS computers (3.5" or 5.25" disks) or Apple Macintosh computers; only one disk is required for installation. The system can be used on notebooks that lack hard drives using a 2-disk system. The programme can be used on either monochrome or colour monitors. On some monochrome screens, however, the highlighted bar that should appear once a character is chosen is not always present. This requires the user to either make a note of the character used or to frequently use the characters used option, which can become annoying and frustrating.

The system is very user-friendly and one does not need a background in computers to be able to successfully identify a specimen. The main menu offers a number of character sets to choose from, which include morphological features such as leaves, flowers, fruit, seedlings and bark as well as a family list and geographic area options. A character list is chosen and by simply pressing the space bar at the character which matches one on the specimen, the number of possible taxa is whittled down to a manageable number of possibilities. A couple of words of caution though; it is better to leave out any character that is missing, rather than trying to guess whether the feature is there or not. The same can be said for characters that are not fully formed or have become distorted in some way. By including these guesses, there is a higher probability of misidentification. The other is, if you do not succeed in getting a correct identification the first time, try the same characters but in a different order i.e. start with leaves instead of flowers the second time, and start looking at the remaining taxa list once you have reduced the list to about 20 or so. Occasionally, I have managed to correctly match my unknown via this method.

Volume 1 gives simple, easy-to-follow installation instructions, an explanation of the character lists, a family and generic list, species lists (by code number, and alphabetically by genus and common name), and a glossary of terms. This volume is important when using the computer key and is constantly referred to in the early stages

of becoming familiar with the system. It is important to read what the authors define for each character state. This is the criteria they used for coding each species, and by following their clear definitions, any ambiguities that are likely to arise over character states that can be interpreted differently are eliminated. The lists that make up the bulk of Volume 1 are useful if you want to jog your memory on a particular species or you are familiar with the common name and would like the botanical name or vice versa. I felt the list of species by code number to be purely academic and I have not had a use for it yet. The only use I can think of would be to use it as a shorthand form when compiling species inventories. Of course, this would break down if species being recorded are not included in the computer key.

Volume 2 is used to help confirm the specimen identified. It is set out in alphabetical order — first by family, then genus, then species. The species code number is located along the right hand margin in bold. What follows is a description of the plant and then a list of additional diagnostic characters, and finally its distribution and ecology. The diagnostic characters are detailed and comparable to any flora treatment. These descriptions are far superior to the three or four line entries that were used in the accompanying book for the card key. What is disappointing is there is not a list of diagnostic characters after the family heading. Most families found in the rainforest have one to several vegetative characters which are diagnostic to that family. This omission is something Betsy Jackes from James Cook University first pointed out to me and I wholly agree with her in this unfortunate exclusion. It would have added no more than 10 pages to the book and is something that is sorely absent from the literature. Hopefully, this can be added to future editions.

Finally, but by no means least, Volume 3 comprises the leaf atlas compiled by David Christophel and Bernie Hyland. Leaves of all of the taxa in the computer key have been illustrated using x-ray photography. The result is a fine reproduction of the size, shape and venation pattern of every leaf. Most of the leaves are present at their actual size and for compound leaves, one or more leaflets are presented. Venation patterns are often a good diagnostic character to distinguish species and the photos replace the 'thousand words' it would take to describe some of the important features.

Each book has on its cover reprints of paintings of rainforest taxa by local North Queensland artists. These front covers only enhance the desirability of the boxed set. I strongly recommend this computer key to anyone who has an interest in the rainforest tree flora of northern Australia. Some people may be hesitant at the price of \$195.00, but I can assure them it is excellent value for money.

PETER JOBSON

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