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## NOTES ON TRACHYMENE HUMILIS (J. D. Hook.) Benth. (UMBELLIFERAE)

by

P. S. SHORT\*

### ABSTRACT

Short, P. S. Notes on *Trachymene humilis* (J. D. Hook.) Benth. (Umbelliferae). *Muelleria* 6(3): 159-167. (1986). — Evidence is presented to show that *Trachymene humilis* (J. D. Hook.) Benth. consists of two taxa treated here as two subspecies, *T. humilis* ssp. *humilis* and *T. humilis* ssp. *breviscapa* (Domin) P. Short. The type specimens of the names *Didiscus humilis* J. D. Hook., *D. humilis* f. *breviscapus* Domin and *D. humilis* f. *longiscapus* Domin are discussed, lectotypes designated and general comments on Ronald Gunn's collections of *T. humilis* made.

### INTRODUCTION

*Trachymene humilis* (J. D. Hook.) Benth., a perennial herb with the leaves in a basal rosette, is endemic in south-eastern Australia.

This species, first described in 1840, was originally referred to as *Didiscus humilis* J. D. Hook. but was transferred by Bentham (1867) to *Trachymene* Rudge. However, Domin (1908) in his monograph of *Didiscus* again referred it to *Didiscus*. The plant under discussion has therefore been placed under different generic names dependent on whether authors have followed Bentham or Domin. This confusion stems from De Candolle's (1829) misapplication of *Trachymene* Rudge for a genus now known as *Platysace* Bunge and the establishment of the name *Didiscus* for the genus correctly named *Trachymene* Rudge. De Candolle was widely followed in the use of the two names, e.g. by Domin (1908) (Bentham, 1867, being a notable exception), until Norman (1931) clarified the correct application of the name *Trachymene* Rudge. His interpretation has since been followed by many authors (e.g. Burt 1941, Eichler 1965, Willis 1973). Thus the accepted name for the species under discussion is *Trachymene humilis* (J. D. Hook.) Benth.

Domin (1908) recognised two forms within *D. humilis*, viz. f. *breviscapus* Domin and f. *longiscapus* Domin. They were distinguished by the relative lengths of the fruiting peduncles (scapes) and the leaves. As did Hooker (1856) and Bentham (1867), Domin noted the presence or absence of an indumentum on parts of the plant but he did not include this character when describing the infraspecific taxa.

Following routine identification work at MEL, and unaware of Domin's work, I noted that specimens of two apparently distinct taxa were being incorporated under *T. humilis*. The results of further investigations are presented below.

Collections from AD, BM, CANB, CBG, HO, MEL and NSW (abbreviations after Holmgren et al. 1981) were examined. It was expected that specimens of *T. humilis* examined by Domin would be housed in PRC and/or PR but enquiry revealed that this apparently is not the case. This may reflect the fact that Domin wrote his monograph of *Didiscus* during a stay at Kew Herbarium (Dr J. Sojak, in litt., 1984).

### RESULTS AND DISCUSSIONS

Specimens of *T. humilis* can be sorted into two groups by either the presence or absence of hairs on the leaves and/or peduncles or by the relative lengths of the longest leaves and fruiting peduncles (peduncles were considered to be fruiting if only a few of the outermost flowers in the umbel had swollen mericarps). The scatter diagram in figure 1 displays these features and shows that differences in the leaf length/fruiting peduncle length ratio are strongly correlated with the

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\* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

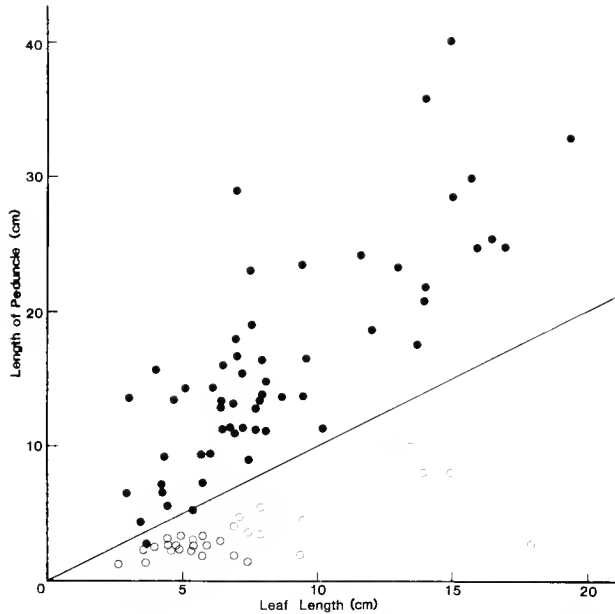


Fig. 1. Scatter diagram showing the correlation of leaf length and peduncle length in *T. humilis*. ● = plants hairy. ○ = plants glabrous.

presence or absence of hairs. This correlation allows the recognition of two distinct taxa.

Other morphological differences between the groups have not been found. Some of the variation in leaf-laminae is illustrated in figure 2. I have formally given the taxa under discussion the rank of subspecies (see below). The reasons for this are now outlined.

On the Australian mainland it is apparent from herbarium collections and field observations (D. E. Albrecht, B. J. Conn, S. J. Forbes, A. M. Opie, N. G. Walsh, pers. comms) that populations consist of only a single taxon. The ssp. *humilis* rarely occurs above 1500 m altitude whereas ssp. *breviscapa* favours sub-alpine and alpine areas at higher altitudes. Within both of these broad regions the taxa, particularly ssp. *humilis*, occupy a number of distinct habitats (see below under each subspecies). Observations suggest that the characters are not unduly influenced by environment but are genetically fixed. However transplant experiments and observations on plants of both taxa grown under controlled conditions are desirable to clarify the extent to which environmental parameters may influence morphological features.

In Tasmania differences in distribution and habitat preferences are not clear. The ssp. *humilis* is the most widespread and again appears to occur in a wider range of habitats than ssp. *breviscapa*. Both are, however, sympatric in the vicinity of the Middlesex Plains and Cradle Mountain and two collections (*Curtis s.n.*, HO 4436; *Lester-Garland s.n.*, K) from this region display features which are intermediate between the subspecies. Both collections contain plants which have a sparse indumentum and fruiting peduncles about the length of or slightly shorter than the leaves. Many of the fruit are well-developed which suggests that they were viable when collected.

The presence of collections with intermediate features, the paucity of morphological characters which distinguish them and doubt as to the extent environment may influence these characters are, I believe, good reasons for not applying the rank of species to the two taxa. Definitions of infraspecific categories, i.e. sub-

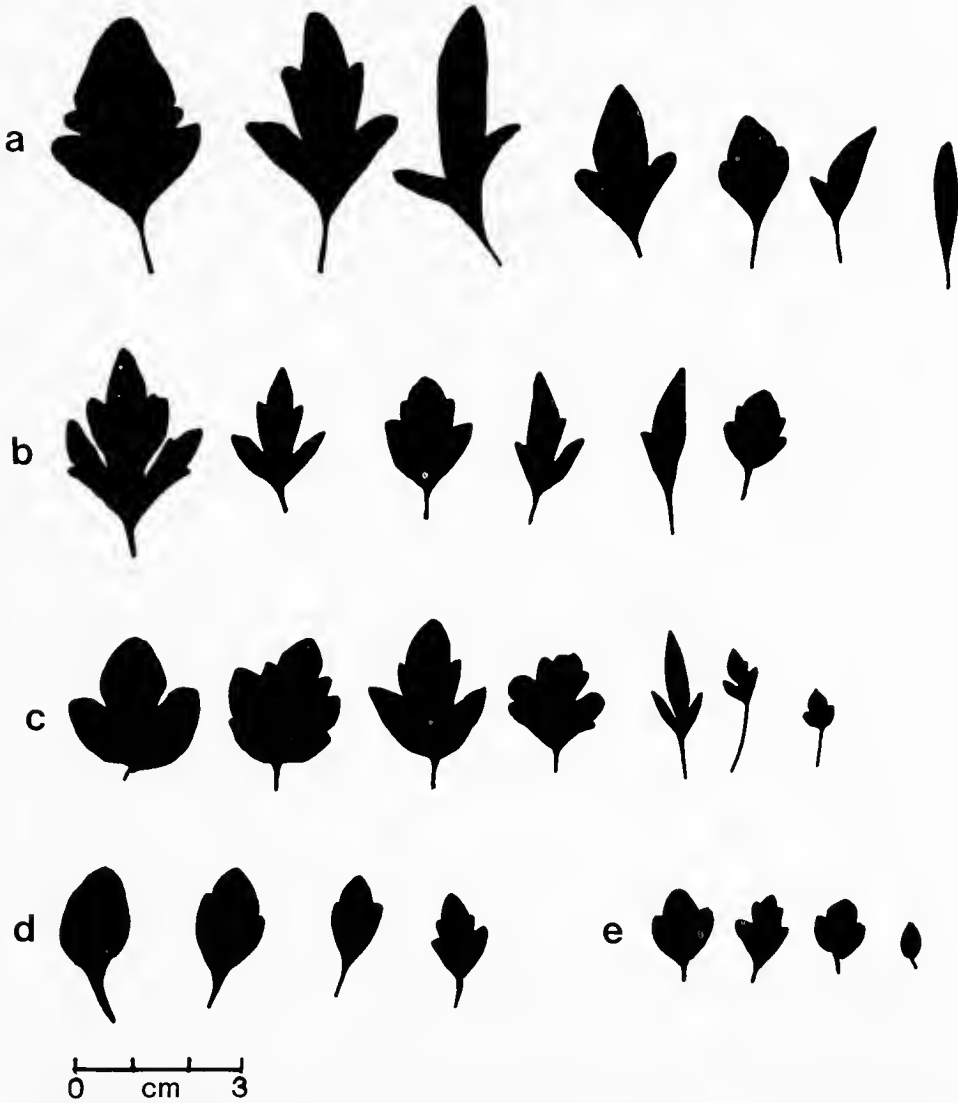


Fig. 2. Leaf-laminae variation in *T. humilis*. For each collection, the leaves figured are all from a single plant. *T. humilis* ssp. *humilis*: a — Walsh 874; b — Muir 3310. *T. humilis* ssp. *breviscapa*: c — Muir 664; d — Willis s.n. (MEL 503285); e — Eichler 18930.

species, varietas and forma, have differed widely over the years (e.g. see Davis & Heywood 1963) but I accept the definition of a subspecies "as a considerable segment of a species with a distinct area and more or less distinct morphology, often showing some intergradation" (Davis & Heywood l.c., p.99). This definition reflects well the attributes of the taxa under discussion and therefore the rank of subspecies has been applied.

#### TAXONOMY

*Trachymene humilis* (J. D. Hook.) Benth., Fl. austral. 3:351 (1863); Rodway, Tasman. fl. 63 (1903); W. M. Curtis, Students Fl. Tasman. 248 (1963); Cochrane,

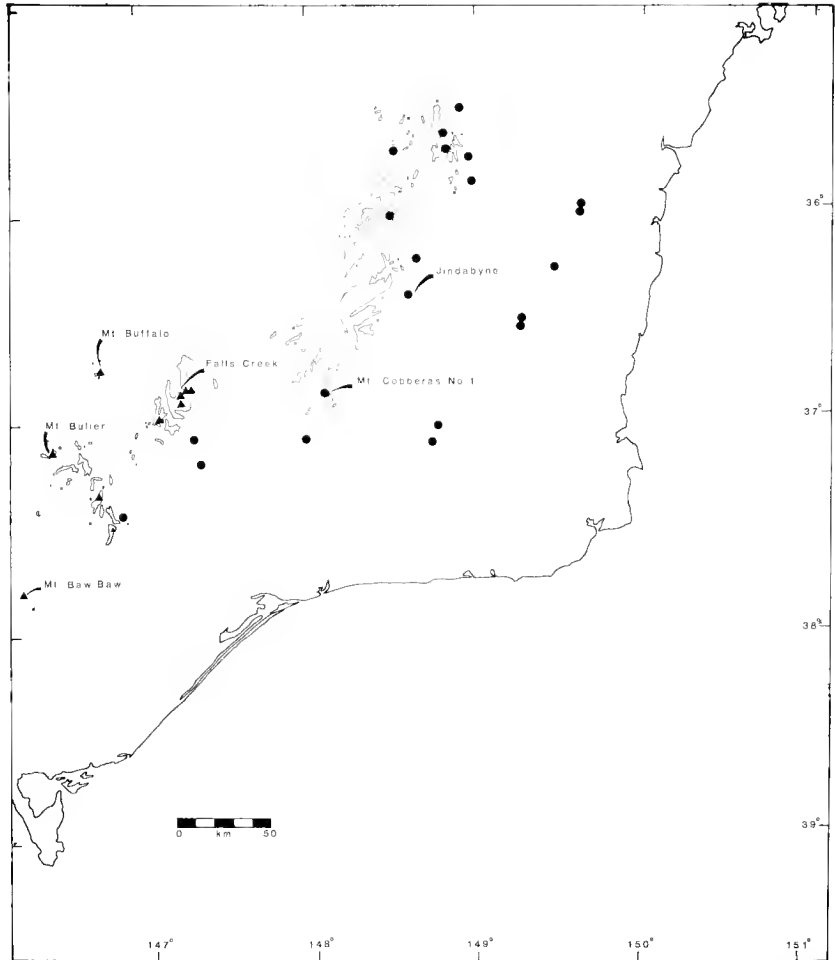


Fig. 3. Distribution of *T. humilis* ssp. *humilis* (●) and ssp. *breviscapa* (▲) in mainland Australia. 1500 metre contour shown.

Fuhrer, Rotherham and J. H. Willis, Fls. and Pl. Victoria 163, t.514 (1968); N. Burb. and M. Gray, Fl. Austral. Cap. Terr. 282, t.273 (1970); J.H. Willis, Handb. Pl. Victoria 2:484 (1973); Launceston Field Naturalists Club, Guide Fls and Pl. Tasman. 36, t.53 (1981). — *Didiscus humilis* J. D. Hook, Icon. Pl. 4, t.304 (1840); J. D. Hook., Fl. Tasman. 1:154 (1856); F. Muell., Pap. and Proc. Roy. Soc. Van Diemen's Land 3:237 (1860); Domin, Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 10:59 (1908); Ewart, Fl. Victoria 897 (1931). — [*Didiscus minor* J. D. Hook. ex Domin, o.c. 60, nom. in sched.] TYPE: "Moist open plains on the Hampshire hills, Van Dieman's Land. R. Gunn, Esq. (n.245.)". HOLOTYPE: Gunn 245/1837, Van D. Land, Hampshire Hills, — .ii.1837 (K).

*Hemicryptophyte*, with all leaves in basal rosettes, the root system often extensive and the plants forming a mat-like ground cover. *Leaves* long-petiolate, glabrous or with scattered, septate hairs; petiole c. 1-12 (13.7) cm long, with a variably sheathing base; lamina narrowly to widely elliptic, ovate or obovate in outline, 0.5-4(4.2) cm long, 0.4-3(3.2) cm wide, entire or variously lobed, symmetrical or asymmetrical (see Fig.2). *Umbels* 1-8 per rosette; *peduncles* 1.5-40 cm



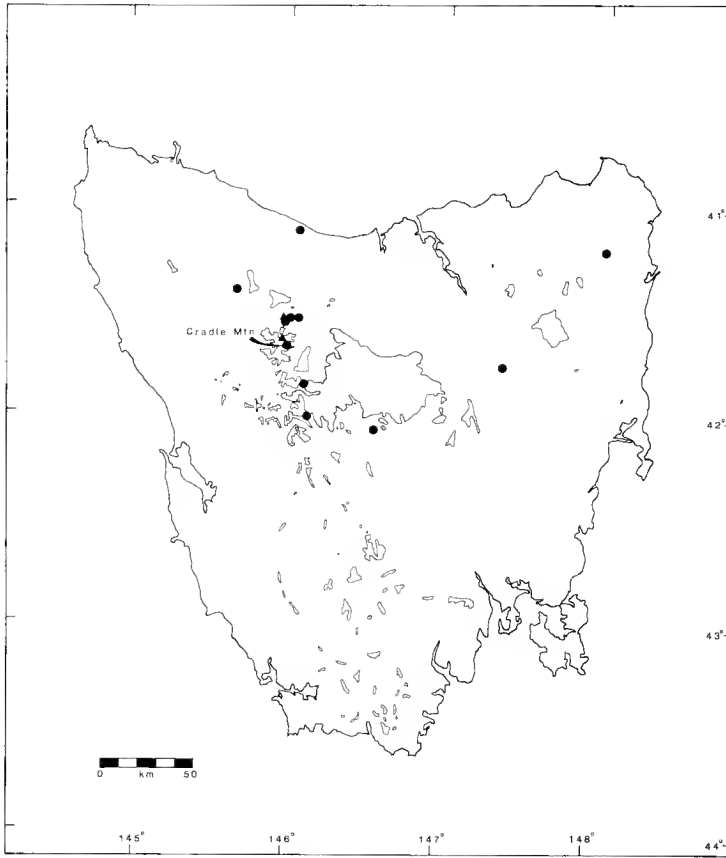


Fig. 4. Distribution of *T. humilis* ssp. *humilis* (●) and ssp. *breviscapa* (▲) in Tasmania. 1000 metre contour shown.

long, c. 0.5-3 mm diam., striate, glabrous or with scattered hairs; *involucral bracts* c. 14-20,  $\pm$  linear or very narrowly lanceolate, 5.6-14 mm long, 0.5-1 mm wide, (about the length of or longer than the outermost pedicels), glabrous or with scattered hairs; *pedicels* c. 25-50 per umbel, c. 0.5-8 mm long, the inner ones shorter than the outer ones. *Calyx* absent; *petals* 5, ovate,  $\pm$  elliptic or obovate, 0.9-1.6 mm long, 0.7-1.3 mm wide, white to pinkish-white; *stamens* 1.5-2.3 mm long, anthers 0.45-0.7 mm long; styles 1.3-1.6 mm long. *Mericarps* flattened laterally, (2.8)3-4 mm long, 2.2-3.2 mm wide,  $\pm$  smooth to conspicuously wrinkled, glabrous, those of the same fruit equally developed or sometimes only one developing.

#### DISTRIBUTION (Figs 3 & 4):

In mainland Australia the subspecies of *T. humilis* have fairly discrete distributions. Subspecies *humilis* rarely occurs above 1500 m altitude whereas ssp. *breviscapa* is apparently restricted to sub-alpine and alpine areas at altitudes greater than 1500 m.

In Tasmania ssp. *humilis* is the most widespread taxon whereas ssp. *breviscapa* occurs only in the vicinity of the Middlesex Plains and Cradle Mountain. Thus the latter taxon again favours sub-alpine to alpine conditions, conditions which occur in Tasmania at a lower altitude than on the mainland. However ssp. *humilis* also

grows in the same region and evidently in the same or similar habitats as ssp. *breviscapa*.

TYPIFICATION:

The numbers which accompany Gunn collections are intended as species numbers, not collection numbers (Burns & Skemp 1961; Haegi 1982). Thus at K there are several separate sheets containing a number of different collections by Gunn but with the same number, "245".

One of the K sheets contains five individual rosettes, each with one or more inflorescences, and apparently representing a single collection. This sheet of specimens is regarded as the holotype of the name *D. humilis* J. D. Hook. As well as the plant specimens it contains three separate labels. One records the collection information cited above for the holotype, another has drawings of the fruit and flowers of the species. These drawings are the same as those published by J. D. Hooker in Hooker's *Icones Plantarum* and are labelled "*Didiscus minor* n. sp.". The third label bears a note by Gunn. It says "1837/245. *Didiscus?* *humilis*. Most abundant at the Hampshire Hills where I collected the specimens now sent in February. It does not bear its fruit erect — but after flowering — the flower stalk appears to lengthen and grows out horizontally from the root with the fruit turned slightly upwards thus [a small illustration is then supplied]. I send the specimen from Middlesex Plains which bears the fruit [word illegible] upon a shorter stalk but I supposed the differences of climate might have caused it, & therefore did not collect more".

Another sheet housed at K undoubtedly contains the specimen referred to by Gunn in the label cited above. It is labelled "245?/1837. Middlesex Pl.", is a completely glabrous specimen and the fruiting peduncles are shorter than the longest leaves. I have referred it to *T. humilis* ssp. *breviscapa* and also regard it as the holotype of its basionym *Didiscus humilis* f. *breviscapus* Domin (see below). The collection is accompanied by others made by Gunn, by Backhouse and probably by Milligan. All are referable to ssp. *humilis*. One of the specimens, the largest one, resembles those of the type of *D. humilis* but I suspect it is the specimen to which the Backhouse label refers and it is therefore apparently not part of the type collection.

The apparent use of Gunn's species numbers on Milligan collections is of interest. One specimen on the second K sheet mentioned above is labelled as "V.D. Land, Gunn 245, Hampshire Hills, 15/12/41. In NSW there is a further sheet (NSW 152944) labelled as "245, Hampshire, H. Hills, 15.12.41, J.M. 54". It is part of "Gunn's Herbarium of Tasmanian Plants". Furthermore both BM and MEL each contain a single Milligan specimen with the label "54/106, Hamp. Hills, Tasmania". The MEL sheet (MEL 643966) also contains a label with the number "1016". Other sheets labelled as "Milligan 54" occur in K, BM and HO (HO 4433). Thus this appears to be a further case in which specimens gathered by another collector have appeared in Gunn's herbarium, with Gunn's species number. Haegi (1982) has reported similar observations. Such knowledge may well be important in determining the identity of type material collected by Gunn and fellow collectors such as Milligan, Archer, Lawrence and Stuart. However in the case of *T. humilis* it is clear from both the dates of collection and the accompanying notes that the type collection of this species was made by Gunn.

One of the Gunn collections of *T. humilis* is labelled as "245/1842, Marlborough, 4/1/41". Single sheets containing this collection exist in both BM and K. The discrepancy between the actual collection date and the date accompanying the species number is apparently quite common in Gunn collections. Thus, in a letter dated 21 April 1838 and sent from Circular Head to Kew, Gunn stated "You will perceive that my Collection for 1837, (as I have dated it for the sake of reference, although many were collected in 1836 and some in 1838) far exceeds in any extent any of its predecessors" (Burns & Skemp 1961, p.75). This statement, plus the wording in the accompanying note (cited above), shows that the type collection of

*D. humilis* may have been collected in 1836, 1837 or 1838. However from a letter published by Burns & Skemp (l.c., p.63) it is clear that Gunn collected from the Hampshire Hills in 1837.

A further sheet at K contains two separate collections of *T. humilis* ssp. *humilis* labelled as "*Didiscus minor*, Hook. fil./Van Dieman's Land. Gunn/Lindley 1834" and "No. 245/*Didiscus minor*, Hook. fil./Van Dieman's Land./R. Gunn/Sir W. J. Hooker, 1838", respectively. The manuscript name, *Didiscus minor*, on these labels and on the holotype sheet, was subsequently referred to by Domin (1908).

#### KEY TO SUBSPECIES OF *T. HUMILIS*

Plants sparsely pilose, with hairs on at least the involucre bracts, peduncles, or leaves; fruiting peduncles longer than the leaves ..... ssp. *humilis*  
Plants glabrous; fruiting peduncles shorter than the leaves ..... ssp. *breviscapa*

#### *T. humilis* ssp. *humilis*

*Didiscus humilis* f. *longiscapus* Domin, Sitzungsber. Konigl. Bohm. Ges. Wiss. Prag. Math.-Naturwiss. Cl. 10:59 (1908). TYPE: "Victoria: Alpine and subalpine pastures in the Australian Alps, leg. F. MUELLER, c. 1600 m (f. *longiscapus*)."  
LECTOTYPE (here chosen): *Mueller s.n.*, Limestone river, 5000' ., s.dat. (K). ISOLECTOTYPE: BM. POSSIBLE ISOLECTOTYPE: *Mueller s.n.*, In pratis alpinus prope . . Limestone river & Native Dog creek . . . . prope montis Cobra, -i.1854 (MEL 643972).

#### HABITAT:

The following collector's notes indicate that this subspecies occupies a wide range of habitats. Notes include "in grassland beside small creek, in moist area disturbed by grazing", "in dry sclerophyll woodland, on damp sandy soil", "in *Eucalyptus dalrympleana* — *E. viminalis* woodland with *Coprosma quadrifida*, *C. hirtella*, *Bursaria spinosa*, *Acacia melanoxylon* . . alt. c.240 m", "Poa grassland", "in clearing in *E. pauciflora* forest", "in subalpine herbfield" and "in open scrub (?regeneration from clearing) with *Nothofagus cunninghamii*, *Tasmannia lanceolata*, *Lycopodium varium*".

#### TYPIFICATION OF *DIDISCUS HUMILIS* F. *LONGISCAPUS* DOMIN:

The only Mueller collection of *T. humilis* at K is that cited above. The information provided with it does not match that cited by Domin in his publication but I have not seen any Mueller collections of *T. humilis* labelled according to Domin's citation. The locality data cited by Domin are in fact exactly those given by Bentham (1867). It seems likely that the statement used by Bentham is a general one used to encompass the distribution of all of Mueller's Victorian collections of *T. humilis* and that the same statement was subsequently used by Domin. The belief that Domin examined the "Limestone river" collection at K is also supported by his reference to the altitude ("c. 1600 m") as it is surely a conversion to the metric system. Thus I believe that the K specimen should be regarded as a type, possibly even the holotype. However I have chosen it as the lectotype specimen as a duplicate exists at BM and I have no reason to believe that it was not seen by Domin. Unfortunately I have not seen a specimen of *T. humilis* in any herbarium annotated in Domin's hand.

The MEL collection regarded as a possible isoelectotype has more detailed locality data than the lectotype sheet but Limestone Creek is again mentioned. Discrepancies between labels on specimens which are otherwise considered to be duplicates are not uncommon with Mueller collections. In this case I suggest that Mueller merely abbreviated the locality data on the material sent to K.

## SELECTED SPECIMENS EXAMINED (Total c. 65):

*New South Wales* — Coveny 6233, Hind, Hancock & Parris, Breakfast Peak on the Pike's Saddle — Dampier trig road, 31.iii.1975 (MEL, NSW); Muir 3310, near the Delegate River on Bombala — Bonang road, 16.xi.1964 (MEL); Thompson 4008, Thredbo Diggings, 4.ii.1980 (NSW).

*Australian Capital Territory* — Burbidge 6348, Blackfellow's Gap, 24.ii.1959 (AD, CANB, MEL); Darbyshire 129, 2 miles N. of A.C.T. border, on Boboyan road by Naas Creek, 25.i.1961 (CANB, MEL, NSW).

*Victoria* — Mueller s.n., Moroka Valley, 4000', -iii.1861 (MEL 643971, NSW 152960); Walsh 874, The Playgrounds, 2.5 km SW. of Mt Cobberas No. 1., 23.ii.1982 (MEL, NSW).

*Tasmania* — Backhouse s.n., V.D. Land, s.dat. (K); Canning 2751, Iris River crossing on Wilmot — Cradle Mtn road, 15.ii.1969 (AD, CBG, NSW); Curtis s.n., Middlesex Plains, 7.iii.1949 (HO 4436, p.p.); Gunn 245/1842, Marlborough, 4.i.1841 (BM, K); Milligan 54 or 54/106, Hampshire Hills, 15.xii.1841 (BM, K, HO 4433, MEL 643966, NSW 152944, assumed to be from the one gathering).

**T. humilis** ssp. **breviscapa** (Domin) P.S. Short, comb. et stat. nov.

*Didiscus humilis* f. *breviscapus* Domin, Sitzungsber. Konigl. Bohm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 10:59 (1908), basionym. TYPE: "Tasmania: Copiose in stationibus subalpinus, e.g. ad Marlborough, prope Lake St. Clair, Hampshire Hills, Middlesex Plains (f. *breviscapus*) etc., leg. GUNN, LAWRENCE, BACKHOUSE etc. Van Dieman's Land: leg. R. Gunn sub no. 245". HOLOTYPE: Gunn 245?, Middlesex Plains, 1837 (K).

## HABITAT:

The ssp. *breviscapa* is apparently restricted to subalpine and alpine habitats. Collector's notes include "alpine low woodland (3.5 m) association, dominant species: *Eucalyptus pauciflora*, *Bossiaea foliosa*", "Open heathland, associated spp. *Acetosella vulgaris*, *Poa hothamensis*, *Grevillea australis*, *Hovea longifolia*", "*Poa hiemata* — *Hovea tussock* grassland", "In open sedgeland/ shrubland . . . with *Carex appressa*, *Carex jackiana*, *Poa costiniana*", "Open grassland. Ass. spp. include *Leptorhynchus squamatus*, *Poa hiemata*, *Senecio lautus*, *Cotula filicula*, *Celmisia asteliifolia*, *Oreomyrrhis eriopoda*" and "growing with *Caltha*, *Richea* etc. in a small, open sphagnum bog".

## TYPIFICATION:

The manner in which Domin referred to type specimens is perhaps ambiguous in his published work on *T. humilis*. Thus in the 'type citation' above for f. *breviscapus* it could possibly be argued that all Tasmanian collections should be regarded as syntypes. However I believe that Gunn's Middlesex Plains collection was meant to be regarded as the type specimen (see under the species description above). The name f. *breviscapus* is clearly bracketed after the Middlesex Plains location, the same method used for indicating the type collection(s) of f. *longiscapus*. Furthermore all other Tasmanian collections clearly cited by Domin are of ssp. *humilis*, with only one collection, a Gunn collection from the Hampshire Hills and housed at K, possibly being considered by Domin as belonging to f. *breviscapus*. This specimen is sparsely pilose but the peduncles, which do not bear mature fruit, are about the length of the leaves.

## SELECTED SPECIMENS EXAMINED (Total c. 45):

*Victoria* — Albrecht 225 & Conn, 2.7 km SE. of General Store at Hotham Heights, 23.ii.1984 (MEL); Eichler 18930, near Baw Baw Ski village on way to summit, 22.i.1967 (AD); Forbes 802, Adair & Gray, 4.2 km N. of Mt Cope, 13.i.1982 (MEL); Howitt ?1125, near Mt Wellington, -xii.1887 (MEL 643985); Mueller s.n., snowy plains at the head of the Yarra, the [?Tyers], the Baw Baw & Albert Ranges, -xii.1860 (MEL 643989).

*Tasmania* — Curtis s.n., Middlesex Plains, 7.iii.1949 (HO 25148, HO 51598); Eichler 16456, bog at Iris River near road from Wilmot to Waldheim, 6.i.1960 (AD).

## ACKNOWLEDGEMENTS

I sincerely thank Dr Hj. Eichler and Miss H. I. Aston for their comments on the original manuscript.

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Manuscript received 28 August 1984.



# STUDIES IN MACQUARIE ISLAND LICHENS 3: THE GENUS SPHAEROPHORUS

by

REX B. FILSON\*

## ABSTRACT

Filson, Rex B. Studies on Macquarie Island lichens 3: the genus *Sphaerophorus*. *Muelleria* 6(3): 169-172 (1986). — Two species in the genus *Sphaerophorus* are described and illustrated and a key is provided, with notes on their chemical constituents and distribution maps.

## INTRODUCTION

This paper is a continuation of a series of papers on the lichens of Macquarie Island (Filson 1981, 1981a). The genus *Sphaerophorus* is included in the family Sphaerophoraceae. It is mainly found in the Southern Hemisphere and of the twenty species discussed by Ohlsson (1973) in his world revision only six occur north of the equator. Galloway (1985) records eleven species as occurring in New Zealand. The two species discussed here are also widespread in New Zealand, Australia, Falkland Islands and South America (Ohlsson 1973). Galloway (Lowry et al. 1978) recorded *Sphaerophorus globosus* (Huds.) Vainio and *S. melanocarpus* (Sw.) DC. on Macquarie Island but the specimens he used cannot be located.

## TAXONOMY

### KEY TO SPECIES

Thallus sparingly branched; major branches terete to subterete, mostly > 1 mm diam., surface annulately cracked; coralloid phyllocladial branchlets present ..... *S. ramulifer*  
Thallus frequently branched; major branches terete, mostly < 1 mm diam., surface not annulately cracked; coralloid phyllocladial branchlets absent ..... *S. tener*

***Sphaerophorus ramulifer*** I. M. Lamb, *Farlowia* 4: 426 (1955). TYPE: Argentina, Patagonia, Rio Negro, near Lago Frias, *I. M. Lamb* 5977. HOLOTYPE: CAN n.v. ISOTYPES: FH, H, both n.v.

*Thallus* saxicolous, growing amongst bryophytes and other lichens and over the tops of cushion plants, forming compact colonies amongst the substrate; upper surface smooth, convex, annulately cracked, yellowish-green, sometimes with a pale purple stain at the base of the branches; sterile branches terete to subterete to slightly flattened, up to 40 mm long, 0.8-2.0 mm wide, irregularly sympodially branched, with numerous branched, coralloid, phyllocladial branches along the margins and in tufts around the base; fertile branches similar, distorted, sometimes heavily annulately cracked. *Apothecia* subterminal, 1.0-3.0 mm across, opening at an early stage of development by the rupturing of the receptacle; receptacle corticate, thick, with occasional phyllocladial branching along the margin; mazaedium dense; asci cylindrical, 45-60 x 4-7  $\mu\text{m}$ , 8-spored; ascospores pale grey to hyaline, (7.5-) 8.0-9.5(-10.0)  $\mu\text{m}$ , diam., often surrounded by a dark carbonaceous material. *Pycnidia* globose, mostly terminal, often laminal and sometimes axillary, immersed in the apical branchlets; microconidia straight or curved, slightly swollen at each end, 3.5-4.0 x 1.0  $\mu\text{m}$ .

REACTIONS; P+ orange or P-, K+ pale yellow or K-, KC-, C-, I-.

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\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

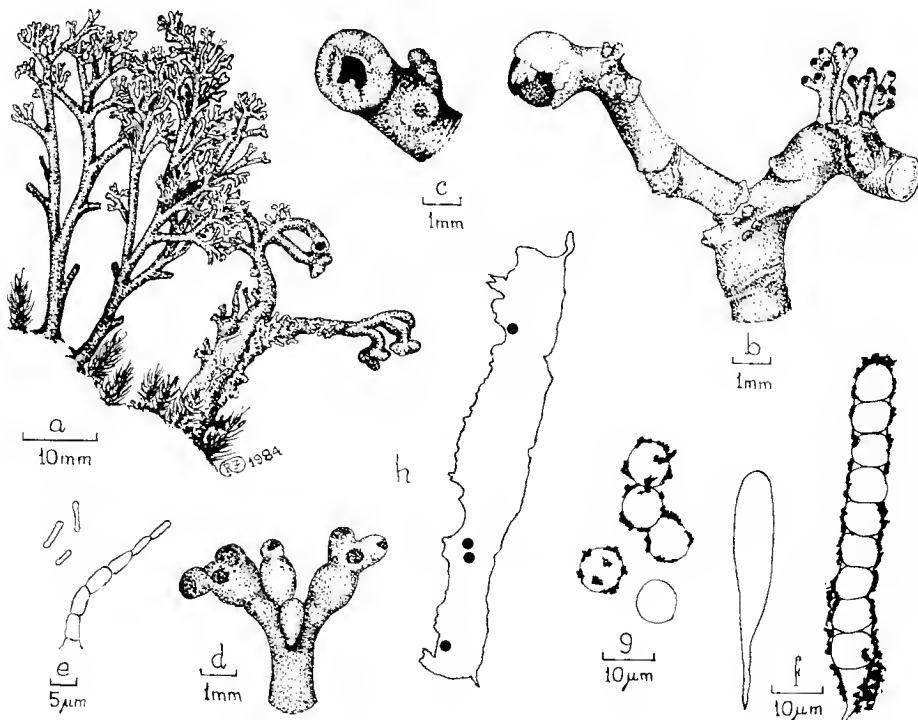


Fig. 1. *Sphaerophorus ramulifer*. a — habit, showing sterile branches and one fertile branch. b — enlargement of upper part of fertile branch showing apothecium. c — enlargement of lower side of tip of fertile branch showing the developing apothecium. d — tips of sterile branches showing the location of the pycnidia. e — microconidia-bearing hyphae from the pycnidium, and microconidia. f — ascus from the mazaedium coated with black carbonaceous substance. g — ascospores, one not coated with the black carbonaceous substance. h — known distribution on Macquarie Island. a, d & e from MEL 1047232; b, c, f & g from MEL 1047231.

**CHEMISTRY:** This species includes several chemotypes all with isousnic acid and sphaerophorin. Some also contain norstictic acid, stictic acid, conorstictic acid and an unknown substance, in varying amounts.

**SELECTED SPECIMENS EXAMINED:**

Macquarie Island, xii. 1965, *S. Thrower* (MEL 1026732); top of hill above Bauer Bay, S. of small lake, alt. 600 ft, 1.iii.1974, *R. Filson 6278 & P. Atkinson* (MEL 1047234); SE. side of Major Lake, 19.ii.1964, *R. Filson 6173 & R. Peterson* (MEL 1047233); peak of hill above and N. of Caroline Cove, 20.i.1966, *K. Simpson E82* (MEL 1000433).

**DISCUSSION:**

The flattened branches and the large cracked, fruiting branches make *Sphaerophorus ramulifer* a very distinctive lichen which cannot be confused with any other on Macquarie Island. However it is uncommon and when found is usually eroded and distorted by the harsh conditions. The sterile branches are more protected as they grow well down into the moss cushions but the fertile branches become more exposed and therefore more misshapen.

***Sphaerophorus tener*** (Laurer) Zahlbr., Cat. Lich. Univ. 1: 696 (1922). *Sphaerophoron tenerum* Laurer, Linnaea 2: 45 (1827). "Hab. in Nov. Hollandiae.", *Sieber*. LECTOPYPE: BM! Ohlsson here published, first selected Ohlsson (1973). ISOLECTOTYPE: M!



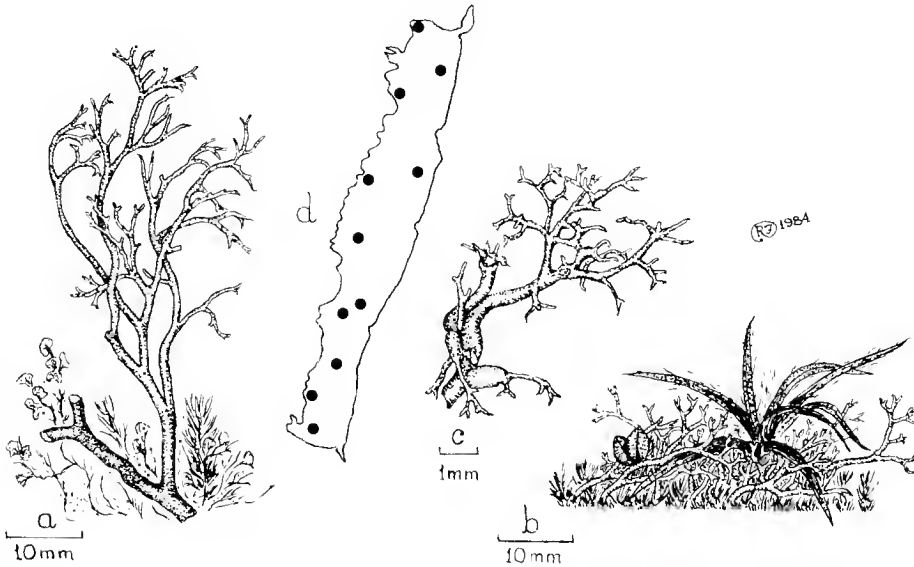


Fig. 2. *Sphaerophorus tener*. a — branch from a compact tuft growing in a sheltered habitat. b — prostrate branches growing over a cushion plant amongst bryophytes and other plants. c — distorted branch from specimen growing in a very exposed situation. d — known distribution on Macquarie Island. a from MEL 20291; b from MEL 1011254; c from MEL 8658.

*Thallus* growing amongst bryophytes, ferns and other lichens, over the tops of cushion plants, variable, forming compact tufts in sheltered habitats or extensive low patches in exposed positions, sometimes growing deep down in the moss cushions so that only the tips of the branchlets are exposed; branches terete or subterete, smooth, elongate, fragile, sparsely to frequently branched, sometimes entangled and anastomosing, 0.6-1.0 mm diam., pale greyish-white to pale brownish-white; fertile branches and apothecia not seen. *Pycnidia* terminal on apical branchlets of better developed specimens; microconidia not seen.

REACTIONS: P —, K —, KC —, C —, I —.

CHEMISTRY: Sphaerophorin and UV + unknowns.

SELECTED SPECIMENS EXAMINED:

Handspike Point, on rock outcrops c. halfway between base of point and bottom of the escarpment, 11.iii.1964, R. Filson 6319 & P. Atkinson (MEL 1047201); lower south slope of Boot Hill, 10.i.1972, R. Hnatiuk (MEL 1032817); top of hill above Bauer Bay, S. of small lake, 1.ii.1964, R. Filson 6277 & P. Atkinson (MEL 20414); half mile N. of Aurora Point, 20.ii.1964, R. Filson 6199 & R. Peterson (MEL 20258); Lake Flynn, 3.ii.1964, R. Filson 5890 & J. Phillips (MEL 20291); Major Lake, 19.ii.1964, R. Filson 6141 & R. Peterson (MEL 20254).

DISCUSSION:

*Sphaerophorus tener* is a very common lichen on Macquarie Island, growing in drier habitats along the featherbed flats and amongst the cushion plants on the plateau. It may be confused with *Cladia aggregata* (Sw.) Nyl., but can easily be distinguished from that species by the solid medulla and the lack of perforations through the cortex. It may be thought similar to some *Cladonia* species, but differs in being more intricately branched. It can easily be separated from both of these groups by the UV + reaction on the medulla and by the chemical constituents.

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Manuscript received 18 June 1985.

# NEW OR NOTEWORTHY TAXA OF *SENECIO* (ASTERACEAE) IN AUSTRALIA 1

by

ROBERT O. BELCHER\*

## ABSTRACT

Belcher, R.O. New or noteworthy taxa of *Senecio* (Asteraceae) in Australia, 1. *Muelleria* 6(3): 173-179 (1986). — *Senecio garlandii*, a new species endemic to isolated rocky hillocks in the Central Western and South Western Slopes divisions of New South Wales, is described. *S. cahillii* Belcher and *S. tuberculatus* Ali are reduced to synonymy under *S. diaschides* Drury and *S. murrayanus* Wawra, respectively. *S. glaucophyllus* Cheeseman ssp. *discoideus* (Cheeseman) Ornd. is excluded from the flora of Tasmania.

## INTRODUCTION

I report here a number of observations made during 1984 while locating and examining type and other material of all but two of the species published in *Senecio* and based on collections from Australia. This work involved visits to seven European herbaria (B, BM, G, K, LINN, P, W) and to the National Herbarium of Victoria (MEL) and the State Herbarium of South Australia (AD). At the latter institution I also had access to material loaned from ADW, CANB, CHR, HO, NSW, and PERTH to facilitate the revision of *Senecio* for the 'Flora of South Australia' by Dr Margaret Lawrence and myself.

## TAXONOMY

***Senecio garlandii*** F. Muell. ex Belcher, sp. nov.

*Senecio dryadeus* Sieber ex Sprengel, Syst. Veg. 3: 562 (1826), nom. invalid, ut syn., var. *garlandii* F. Muell. ex Maiden & Betche, Census New South Wales Pl. 205 (1916), nom. invalid.

*Senecio* sp. J (aff. *hypoleucus*), S.W.L. Jacobs & J. Pickard, Pl. New South Wales 86 (1981). [The suggestion of affinity to *S. hypoleucus* is incorrect.]

*Suffrutex* perennis, 1 (-2) m altus, ramosissimus e basi, rami ascendens. *Caules* dense lanati, plus minusve flexuosi. *Folia* sessilia, alterna, chartacea, ovata vel elliptica, obtusa vel apiculata, remote denticulata, plus minusve cordata et amplexicaulia, 8-15 x 3-9 cm, sursum diminuta; paginae inferne dense lanatae, superne sparse arachnoideae. *Inflorescentia* terminalis corymbosa; bracteae multo reductae, amplexes subulatae; pedunculi arachnoidei, bracteolis subulatis. *Capitula* radiata congesta numerosa calyculata, bracteolis 5-7. *Involucrum* campanulatum; phyllaria 13, 4 mm longa, acuta, apicibus recurvatis. *Flosculi* marginali 7-10, ligulati; ligulae oblongae, ad 4 x 2 mm; flosculi disci 20-25. *Achenia* pallide brunnea, 2 mm longa, pilis brevibus glabrescentibus in sulcis angustis. *Setae pappi* graciles uniformes non persistentes.

Perennial *subshrub* to 1 (-2) m tall, much branched from the base, branches ascending. *Stems* densely lanate, more or less flexuous. *Leaves* sessile, alternate, chartaceous, ovate or elliptical, obtuse or apiculate, remotely denticulate, more or less cordate and amplexicaul, 8-15 x 3-9 cm, reduced upwards; lower surfaces densely lanate, upper surfaces sparsely arachnoid. *Inflorescence* terminal, corymbose; bracts much reduced, clasping, subulate; peduncles arachnoid with subulate bracteoles. *Capitula* radiate, congested, numerous, calyculate with 5-7 bracteoles. *Involucre* campanulate; phyllaries 13, 4 mm long, acute, with recurved apices. *Marginal florets* 7-10, ligulate; ligules oblong, to 4 x 2 mm; disc florets 20-25.

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\* Emeritus Professor of Biology, Eastern Michigan University, P.O. Box 242, Ypsilanti, MI 48197, United States of America.



HOLO-  
TYPE

NATIONAL HERBARIUM OF  
VICTORIA (MEL), AUSTRALIA

PHYTOLOGIC MUSEUM OF MELBOURNE.

*Senecio Dryadoides*  
Nutt.  
var. *garlandii*  
Wagga Wagga  
N. S. W. Australia  
1890

BARON FRED. VON MUELLER, PH. & M.D.

Fig. 1. *Senecio garlandii*. Holotype (*Garland s.n.*, MEL 666712).

Achenes light brown, 2 mm long, with short hairs glabrescent in narrow grooves. Pappus bristles slender, uniform, not persistent.

Common name: Woolly Ragwort (see discussion).

**TYPE COLLECTION:**

*New South Wales* — "Wagga Wagga 1890", *Garland s.n.* (HOLOTYPE: MEL

666712. ISOTYPE: MEL 666711). The actual type locality is The Rock (formerly Hanging Rock) mountain, south-west of Wagga Wagga (see discussion).

SPECIMENS EXAMINED:

*New South Wales* — Hanging Rock Mountain, c. 26 km SSW. of Wagga Wagga, 35° 27' S., 147° 05' E., 19.xi.1965, *Phillips* (AD 97010435). Ibidem, 26.viii.1967, *Willis* (MEL 666706 & 666707; NSW). Ibidem, 16.i.1971, *Belcher 2084* (EMC). Summit of Tabletop Range (Mt. Lockyer), near Gerogery, 10.v.1969, *Willis* (MEL 666703 & 666704). At foot of range of hills called "Bob-in-the-box", c. 15 miles ESE of The Rock, 12.viii.1971, *Wilson* (MEL 666705). "Big Bush", Gidginbung, [34° 20' S., 147° 28' E.,] xi.1975, *Schlunke* (NSW 153245). Near Albury, 36° 06' S., 146° 54' E., 26.i.1975, *Sykes* (NSW 117786).

DISTRIBUTION:

*New South Wales* — Very local along the 147° E. meridian on the western slopes of the Dividing Range between West Wyalong and Albury. Apparently endemic to the sheltered lower slopes of isolated rocky outcrops.

DISCUSSION:

The actual type locality has been ascertained from a letter to Mueller which is preserved at the National Herbarium of Victoria. The letter, on the printed letterhead of "J. R. Garland, Solicitor, Wagga Wagga", is dated 30 December 1890 and is signed by Garland. He wrote: ". . . . I have not, until a few days ago had an opportunity of going out to the Hanging Rock for a further supply of the 'senecio'. I now send you some specimens from various parts of the plant, including some ripe seeds in heads. . . . All the plants which I have seen are growing amongst the rocks at the foot of the perpendicular face of the Hanging Rock Mountain and are thus sheltered from the westerly winds. . . ."

The "further supply" mentioned in Garland's letter is presumably subsequent to the 1890 material selected as type, and is represented by two sheets (MEL 666709! & 666710!) dated by Mueller as 1891, the year in which he would have received Garland's second consignment. An apparent duplicate of this second collection is NSW 117793 (!).

This taxon is the "species A ('garlandii' of F. Muell.)" of Lawrence (1980:153, table 1). She reported (p. 159) chromosome numbers of  $n=30$  and  $n=60$  from "morphologically indistinguishable plants", including *Lawrence 1480* (AD!), grown from cuttings taken from plants on The Rock. In cultivation in the glasshouse I found seedlings from *Belcher 2084* to be self-incompatible as are most radiate species of *Senecio* in Australia. I did not succeed in obtaining achenes from any of a number of attempted crosses both from and to other *Senecio* species.

This distinctive endemic has been frequently collected from The Rock since 1890, the specimens cited above being only a small fraction of those I have seen. It is therefore surprising that a description has not been published previously, especially since Mueller left at MEL the manuscript description (in English) which was alluded to by Maiden and Betche (*l.c.*). A major reason for this lack of a published description, no doubt, has been the confusion over what I have come to think of as the *Senecio linearifolius* complex, to which *S. garlandii* had been thought to belong. This complex includes the four forms of *S. linearifolius* A. Rich., briefly characterized by Lawrence (1980: 153), with chromosome numbers of  $n=30$ . The complex also includes an undescribed taxon from Mt Dangar, New South Wales which I believe to be a distinct species and for which I am preparing a description. Mueller himself had several successive different ideas on the affinities of *S. garlandii*, as shown by changes on his manuscript and by his annotations on Garland's material, before finally assigning it as a variety of the invalid *S. dryadeus* Sieber.

In my judgment *S. garlandii* is a good species, specifically distinct from the *S. linearifolius* complex because of its campanulate rather than cylindrical involucre, its much larger and clasping cauline leaves, and its densely woolly pubescence. In addition, it shares with *S. magnificus* F. Muell. and *S. pterophorus* DC. the presence in its capitula of an as yet unidentified substance which reacts with hot 85% lactic

acid. This reaction produces an intense brownish-black discoloration which interferes severely with effective clearing of peduncle, receptacle, phyllaries, and floret bases. Such a reaction was not exhibited by any of the several specimens referable to the *S. linearifolius* complex which I have cleared in hot lactic acid in a search for useful microcharacters in these parts. *S. garlandii* also appears to differ from all these other specimens in details of venation of the cleared phyllaries, but I have yet to quantify these differences or to show their consistency.

The name of this new taxon honors J. R. Garland, its first known collector. "Woolly Ragwort" is the name given to this plant in the trail guide to The Rock Nature Reserve issued by the local naturalists' society, and is most appropriate.

**Senecio diaschides** Drury, New Zealand J. Bot. 12: 522, fig 5 (1974).

*Senecio cahillii* Belcher, Muelleria 5(2): 120 (1983).

Drury described this species from a collection from the North Island of New Zealand, where it has become adventive in recent years along with the much more aggressive *S. bipinnatisectus* Belcher (*Erechtites atkinsoniae* F. Muell.). Both are native to the uplands of eastern New South Wales. In describing *S. cahillii* from Australia I overlooked Drury's prior publication. I have now examined material determined by Drury as *S. diaschides*, including an Australian specimen at Kew and the isotype (CHR 44758), and find the two taxa to be conspecific.

This species has apparently failed to maintain itself in the areas in southwestern Western Australia where it had previously appeared, probably as an introduction (see Belcher, *l.c.*, p. 122).

**Senecio murrayanus** Wawra, Itin. Princ. S.-Coburgi 2: 48 (1888) (as *S. murrayana*). HOLOTYPE: "Austral. Victoria/Murray Fl.", *s.d.*, *Wawra 427* (W, 7 separate pieces on one sheet). ISOTYPE: "Murray River/1873/Dr Wawra" (MEL 671631).

*Senecio tuberculatus* Ali, Kew Bull. 19: 423 (1965). HOLOTYPE: BRI, *n.v.* ISOTYPES: South of Tara, Bullock Head Creek Road, on grey clay, Queensland, 28.viii.1958, *Johnson 538* (K, NSW, CANB 63619).

This species, as Ali noted, is uniquely distinguished by its achene, which is large, long-necked, and densely papillose (Fig. 2.) The achenes of *Wawra 427* are identical to those of the duplicates of *Johnson 538* which I have seen. There is also a close resemblance between these type collections in other capitular details, as well as vegetatively. I have no doubt that these two taxa are conspecific.

Tap water added to a few papillae from the neck of an achene from *Wawra 427* led to almost instantaneous enlargement and the extrusion of two elongated strands from each papilla. Examination by light microscopy at 50, 100 and 400x indicated clearly that each strand originated in a separate cell. Medial walls were evident. Thus these papillae are not different in principle from the much more slender bicellular hairs of other species of Australasian *Senecio*. The characteristic short basal cell is also present (cf. Drury & Watson 1965, figs 11, 12; *S. murrayanus* approaches fig. 12).

The papillae after imbibition measured 0.14-0.15 x 0.08 mm (ocular micrometer at 100x), an increase in size of roughly 25% from the dehydrated state. The extruded fibrous strands measured 0.45-0.55 mm long x 0.03-0.04 mm wide, were irregularly zigzag in outline, and were sticky. The latter feature would account for Wawra's description of the achene as mucilaginous, as attested by the fact that several capitula on his type specimen have masses of adherent achenes with tightly attached wads of fibres apparently torn from the paper used in pressing them.

The isotype of *S. murrayanus* at MEL consists only of a fragment of inflorescence with a single capitulum containing numerous ripe achenes. It was found in one of the supplementary bundles of Mueller's unidentified *Senecio*. It seems probable that Wawra visited South Yarra in 1873 and at that time broke off a piece from his collection for Mueller. This piece might therefore be better designated

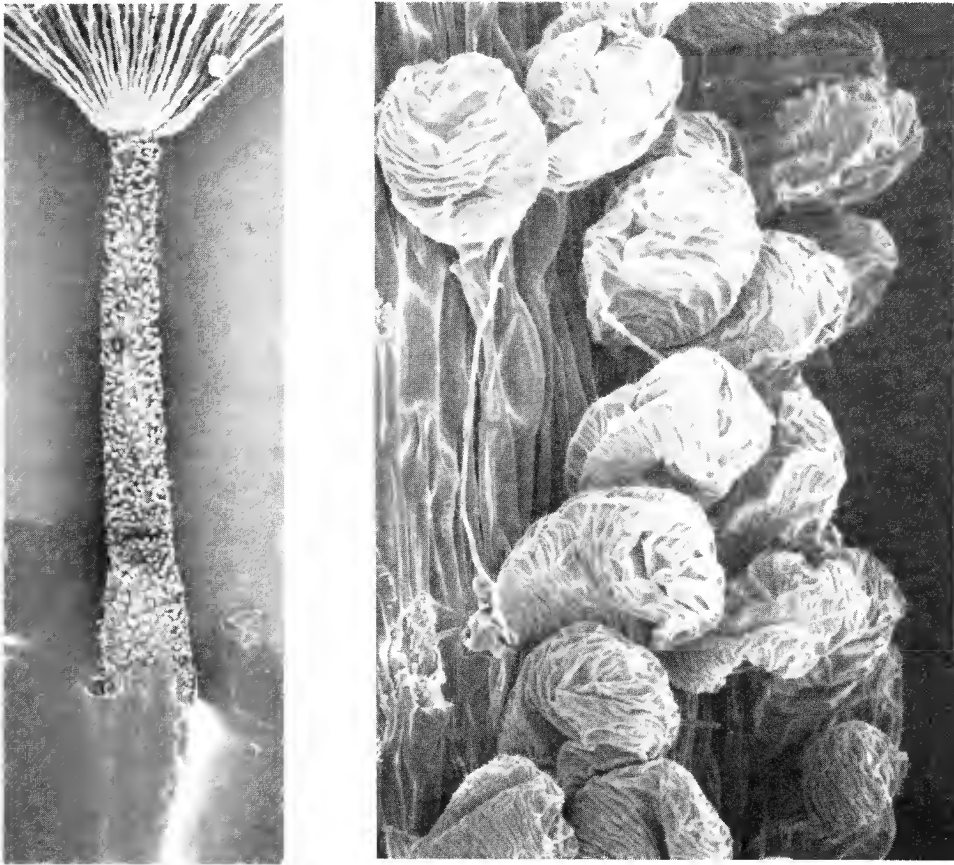


Fig. 2. *Senecio murrayanus*. SEM microphotographs. a.—whole achene (lower portion partially obscured by mountant) showing shape, papillae, and the bases of the persistent pappus bristles, x 15. b.—achene papillae, with some showing the edges of medial cell walls; the strong corrugations are apparently due to dehydration under vacuum, x 400. Both from the holotype, *Wawra 427* (W). SEM by courtesy of Mr Chris Edwards, Dental Research Institute, University of Michigan.

as a fragment of the holotype, but I could not confirm this as I had no opportunity to try to match ends. There apparently was no other distribution of duplicates.

Most of the numerous specimens of *S. murrayanus* which I located had been identified as *S. platylepsis* DC. (holotype G-DC!). There is some resemblance, especially with specimens having pinnatisect leaves (absent in *Wawra 427* holotype, present in *Johnson 538*), but the two taxa can be distinguished by the characters given in Table 1.

Wawra described the ligule as “alba”; Ali, as “pallide flava”. There are no field notes with Wawra’s specimen and nothing to indicate initial ray color. The ligules are now tawny, as are those of many old collections of species known to have yellow florets. Field notes that mention color on modern collections are few, and give the rays simply as yellow. The larger piece of *Everist 6219* from CANB, however, has rays that are quite pale and perhaps could have been reported as “alba”. There seems no likelihood that Wawra’s material had truly white rays such as are found (in Australian *Senecio*) only in *S. leucoglossus* F. Muell.

I have seen four collections from Victoria in addition to the type material; viz., Kerang, x.1887, *Minchin*; Pine Plains, W. Wimmera, 1889, *Davis*; Wimmera, 1890, *Eckert 184*; Northwestern District near Mallee, xi.1879, *Sullivan 27*; all these are

at MEL. Thus the provenance of "Victoria" given on the holotype label is apparently correct.

In addition to the listed isotypes of *S. tuberculatus* I have seen all of the material at NSW cited by Ali and duplicates of most of those he cited from BRI, plus numerous other collections from the several herbaria visited. These additional collections show that *S. murrayanus* has a broader distribution than that mapped by Ali (op. cit. 425, map 1). It has occurred widely scattered within the Murray-Darling watershed in southern Queensland, New South Wales, and Victoria, with outliers in northwestern Victoria, but apparently did not extend into South Australia. An outlying location, Thylungra, cited by Ali, is in southwestern Queensland in an area drained by a tributary of Cooper's Creek. A lack of twentieth-century collections from Victoria and west-central New South Wales, however, suggests a significant contraction in the range of this species.

Table 1. Diagnostic differences between *S. murrayanus* & *S. platylepsis*.

Characteristic	<i>S. murrayanus</i>	<i>S. platylepsis</i>
phyllary length	4-5.5 mm	7.5-9 mm
phyllary number	c. 20	11-13, rarely 20
ray-floret achenes	fully developed, plump	usually infertile, slender
achene shape	flask-shaped with long neck, even when immature	cylindrical in all stages
achene indumentum	obovoid papillae	long slender hairs
leaf margin	subentire to pinnatisect	lobate or lobulate, irregular

The distribution of *S. murrayanus* (except for the inclusion of Thylungra and the exclusion of South Australia) closely mimics that of *S. runcinifolius* J. H. Willis, although *S. murrayanus* does not appear to be as closely confined to riverine settings. The limited field notes suggest a tendency to weediness on cultivated grey clays and on overstocked brigalow country.

I have yet to see this taxon in the field, and I have not seen any reported chromosome count.

***Senecio glaucophyllus* Cheeseman ssp. *discoideus* (Cheeseman) Ornduff, Trans. & Proc. Roy. Soc. New Zealand 88: 73 (1960).**

*Senecio lautus* G. Forst. ex Willd. var. *discoideus* Cheeseman, Man. New Zealand Fl. 374 (1906).

Ali (1964, p. 289) reported an extension of range for this subspecies to Tasmania, based on "'Wilderness', Dysert, Jan. 1961, Winifred M. Curtis (HO 3890)". His identification of this collection is correct, but unfortunately the provenance was given incorrectly on the sheet. Dr Curtis has now indicated (*in litt.*) that the correct location and date of this collection are: Wilderness, Otago, New Zealand, January 1957.

"Cat. No. 3890", the number cited by Ali and applicable in the Herbarium, University of Tasmania, prior to the transfer of that herbarium to the Tasmanian Museum, is at the top of the sheet that now carries the number HO 14949. This sheet was annotated by Ali as *Senecio glaucophyllus* ssp. *discoides* [sic!] on 7 May 1963. A second sheet, HO 69514, contains one specimen of this taxon apparently demounted and transferred to it from the sheet annotated by Ali.

*Senecio glaucophyllus* ssp. *discoideus* is to be excluded from the flora of Tasmania, at least on the evidence of the above two sheets. Ali cited "T. Kirk", rather than Cheeseman, as the original authority for this infraspecific epithet. I do not find in the literature any support for this ascription.



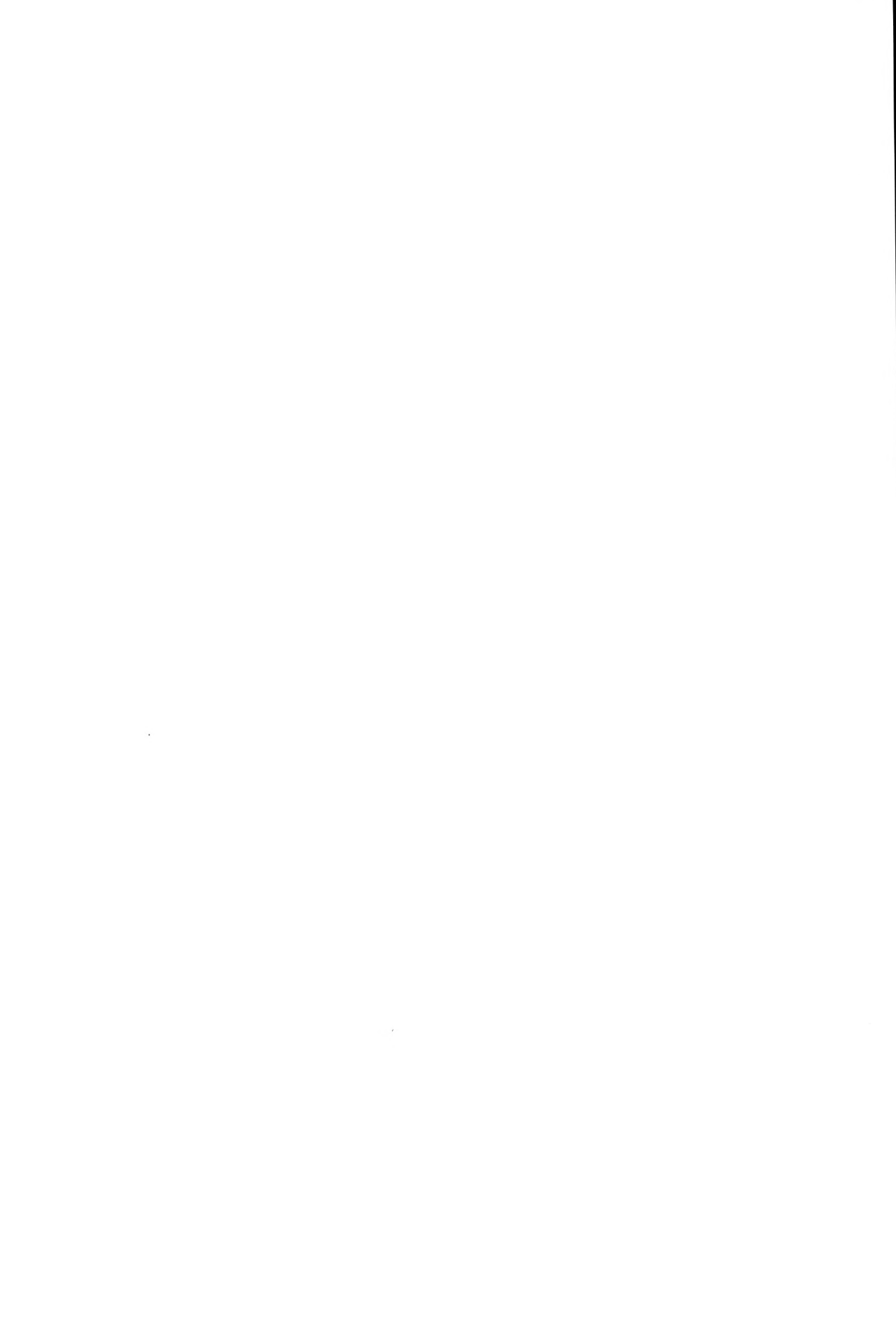
## ACKNOWLEDGEMENTS

Thanks are expressed to the directors and staff of all herbaria mentioned in the introduction, for invaluable assistance, and to H. I. Aston and L. Haegi for numerous helpful suggestions on this manuscript.

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Manuscript received 13 May 1985.



## TWO NEW SPECIES OF OLEARIA Moench (COMPOSITAE: ASTEREAEE) FROM CENTRAL AUSTRALIA

by

D. A. COOKE\*

### ABSTRACT

Cooke, D. A. New species of *Olearia* Moench (Compositae: Astereae) from central Australia. *Muelleria* 6(3):181-184 (1986). — Two new species of *Olearia*, *O. macdonnellensis* and *O. tridens*, are described and discussed; both are currently known from the Macdonnell Ranges of the Northern Territory.

### TAXONOMY

#### *Olearia macdonnellensis* D. A. Cooke, sp. nov.

Frutex viscidus aromaticus ad 1.2 m altus., *Caulis* erectus lignosus divaricate ramificans; ramuli subteretes striati brunnei initio vernicosi puberulenti pilis glandulosis ad 0.15 mm longis. *Folia* coriacea viridia concolora vernicosa ut videtur glabra, pilis glandulosis ad 0.12 mm longis in strato vernicis inclusis; laminae oblongae lato-obovatae obtusae 1.2-2.5 cm longae 6-14 mm latae, plerumque 4-10-crenatae rariore serratae vel repandae, venatione camptodroma craspedodromave distincta, in petiolis 2-6 mm longis sensim transientes. *Capitula* 2-5 in corymbos terminales. *Pedunculi* 2-8 cm longi squamis 1-6 angusto-lanceolatis 1-2 mm longis instructi, bracteis oblanceolatis 5-13 mm longis subtenti. *Involucrum* cyathiforme 6-9 mm longum viride vel purpurascens, extrinsecus glandulosum vernicosum; bractee c. 3-seriatae inaequales, extimae lanceolatae 1.5-2.5 mm longae herbaceae, interiores anguste linearo-ellipticae herbaceae marginibus scarioso-hyalinis, apicibus acutis integris vel eroso-ciliatis. *Receptaculum* subconvexum c. 1.5 mm diametro nudum. *Flosculi* radii 8-14 manifeste uniseriati foemini, ligulis 8-15 mm longis albis; flosculi disci numerosiores bisexuales 5-meri, corollis 6-8 mm longis luteis. *Antherae* c. 2.8 mm longae cum apicibus lanceolatis sterilibus c. 0.6 mm longis. *Achenium* teretum 2.5-3 mm longum c. 0.5 mm latum sericeo-villosum. *Pappus* uniseriatus 7-8 mm longus, setis 40-55.

Viscid aromatic shrub to 1.2 m high. *Stem* erect, woody, divaricate-branched; branchlets subterete, striate, brown, at first varnished, puberulent with glandular hairs to 0.15 mm long. *Leaves* coriaceous, green concolourous, varnished and appearing glabrous, with glandular hairs to 0.12 mm long imbedded in the varnish layer; laminae oblong to broad-ovate, obtuse, 1.2-2.5 cm long, 6-14 mm wide, usually 4-10-crenate, more rarely serrate or repand, with distinct camptodromous to craspedodromous venation, passing gradually into petioles 2-6 mm long. *Capitula* in terminal corymbs of 2-5. *Peduncles* (corymb branches) 2-8 cm long, each subtended by an oblanceolate bract 5-13 mm long and bearing 1-6 narrow-lanceolate scales 1-2 mm long. *Involucre* cyathiform, 6-9 mm long, green to purplish, glandular and varnished on the outside; bracts c. 3-seriate, unequal, the outermost ones lanceolate, 1.5-2.5 mm long, herbaceous, the inner ones narrowly linear-elliptic, herbaceous with scarioso-hyaline margins and acute entire to erose-ciliate apices. *Receptacle* somewhat convex, c. 1.5 mm diam., naked. *Ray florets* 8-14, manifestly uniseriate, female, with white ligules 8-15 mm long; disc florets more numerous, bisexual, 5-merous; corollas 6-8 mm long, yellow. *Anthers* c. 2.8 mm long, including the sterile lanceolate apices c. 0.6 mm long. *Achene* terete, 2.5-3 mm long, c. 0.5 mm wide, silky-villous. *Pappus* uniseriate, 7-8 mm long, consisting of 40-55 bristles. (Fig. 1a,b).

#### TYPE COLLECTION:

1 km W. of Ellery Creek Big Hole, N.T., 23°47'S, 133°03'E, 17.vii.1983, P. K. Latz 9639. (HOLOTYPE: NT 73777. ISOTYPE: AD. Also, according to NT label data, DNA, MEL, PERTH).

\*State Herbarium, Botanic Gardens, North Terrace, Adelaide, South Australia, Australia 5000.

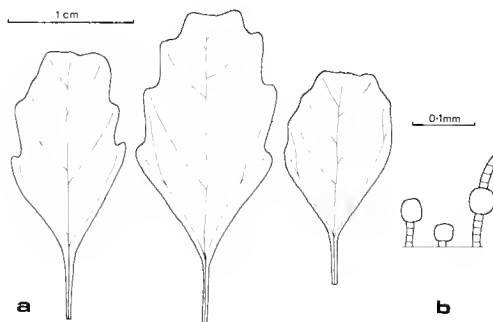


Fig. 1. *Olearia macdonnellensis*. a — leaves.  
b — glandular hairs. From the type collection.

#### ALSO EXAMINED:

Northern Territory — Ellery Creek Waterhole, 6.viii.1961, *G. Chippendale s.n.* (NT 8298; AD 96445098; also MEL 674095 n.v. and, according to NT label data, BRI, CANB, DNA, SYDN [? = NSW], PERTH); Serpentine Gorge, 1.ix.1978, *A. C. Kalotas s.n.* (NT 57615).

#### DISTRIBUTION AND HABITAT:

Recorded from the Serpentine and Ellery Gorges in the central Macdonnell Ranges west of Alice Springs, and possibly more widely distributed in this area. All collections are from the bases of steep rocky slopes which provide a sheltered microclimate. Flowering is recorded in August and early September.

#### DISCUSSION:

*Olearia macdonnellensis* is related to *O. calcarea* F. Muell. ex Benth. and *O. muelleri* (Sonder) Benth. but readily distinguished by the pedunculate capitula forming corymbs and by the larger leaves with more distinct venation and petioles. The two latter species are widespread on calcareous loams and sandy soils in the semi-arid winter rainfall zone of southern Australia with a few records from the Great Victoria and Gibson deserts. The restricted habitat of *O. macdonnellensis* is apparently isolated from this distribution by the mountain ranges of central Australia.

The microscopic glandular hairs were observed on leaves from which the varnish had been dissolved by immersion in absolute alcohol for a few minutes. They occur sparsely scattered on both surfaces of the lamina, and more densely near the margins and midvein. Similar hairs, more or less imbedded in varnish, were observed on the leaves and branchlets of *O. calcarea* and *O. muelleri*.

#### *Olearia tridens* D. A. Cooke, sp. nov.

Frutex nanus virgatus 25-35 cm altus. *Caules* erecti lignosi repetitive ramificantes; ramuli subteretes costulis ab foliis decurrentibus virides. *Indumentum* ramulorum foliorumque initio minute araneosum pilis laxis crispatis ad 0.4 mm longis, postea scaberulum papillis conicis ad 0.06 mm altis. *Folia* anguste cuneata vel spathulata 5-18 mm longa, ad apices in dentibus tribus aequalibus acutis mucronulatis subrecurvatis 1-3 mm longis symmetrice divisa, rariore asymmetrica dentibus 1-2 adjectis brevioribus, rigide coriacea marginibus incurvis in sicco. *Capitula* terminalia solitaria. *Pedunculi* 1-4 cm longi, squamis 1-4 angusto-lanceolatis 1-3 mm longis instructi, microscopice araneosi, in ramulis foliosis sensim transientes. *Involverum* cyathiforme 3-6 mm longum viride vel purpurascens, extrinsecus microscopice glandulosum, bracteae c. 4-seriatae inaequales, herbaceae marginibus angustis hyalinis, extimae lanceolatae 1.5-2.5 mm longae, interiores anguste elliptico-lanceolatae apicibus acutis vel acuminatis ciliolatis. *Receptaculum* convexum c. 1.5 mm diametro nudum. *Flosculi* radii 30-40 conferti ut videtur biseriati, foemini, ligulis 5-8 mm longis coeruleis; flosculi disci pauciores bisexuales 5-meri, corollis c. 3.5 mm longis luteis. *Antherae* c. 1.9 mm longae cum apicibus lanceolatis sterilibus c. 0.4 mm longis. *Achenium* teretum c. 1.5 mm longum c. 0.3 mm latum pubescens. *Pappus* uniseriatus c. 3 mm longus, setis 25-40.

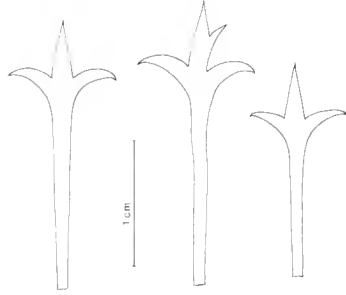


Fig. 2. *Olearia tridens*, leaves. From the type collection.

Dwarf virgate shrub 25-35 cm high. *Stems* erect, woody, repeatedly branched; branchlets subterete with ridges decurrent from the leaf bases, green. *Indumentum* of the branchlets and leaves at first minutely arachnose with lax crisped hairs to 0.4 mm long, later scabridulous with conical papillae to 0.06 mm high. *Leaves* narrowly cuneate to spatulate, 5-18 mm long, symmetrically divided at the apex into 3 equal acute mucronulate slightly recurved teeth 1-3 mm long, more rarely asymmetrical with 1-2 additional shorter teeth, rigidly coriaceous with margins incurved in dried material. *Capitula* terminal, solitary. *Peduncles* 1-4 cm long, microscopically arachnose, with 1-4 narrow-lanceolate scales 1-3 mm long, passing gradually into the leafy branchlets. *Involucre* cyathiform, 3-6 mm long, green or purplish, microscopically glandular on the outside; bracts c. 4-seriate, unequal, herbaceous with narrow hyaline margins, the outermost lanceolate, 1.5-2.5 mm long, the inner ones narrowly elliptic-lanceolate with acute to acuminate ciliolate apices. *Receptacle* convex, c. 1.5 mm diam., naked. *Ray florets* 30-40, crowded and appearing biseriate, female, with pale blue ligules 5-8 mm long; disc florets fewer, bisexual, 5-merous; corollas c. 3.5 mm long, yellow. *Anthers* c. 1.9 mm long, including the sterile lanceolate apices c. 0.4 mm long. *Achene* terete, c. 1.5 mm long, c. 0.3 mm wide, pubescent. *Pappus* uniseriate, c. 3 mm long, consisting of 25-40 bristles. (Fig. 2).

#### TYPE COLLECTION:

4 km W. of Trepina Gorge, N.T., 23°32'S, 134°22'E, 17.vii.1983, *P. K. Latz* 9589. (HOLOTYPE: NT 73590. ISOTYPE: AD 98421171. Also, according to NT label data, DNA, PERTH).

#### ALSO EXAMINED:

*Northern Territory* — Amphitheatre, Palm Valley, 24.ix.1972, *G. Griffin* 6 (NT 43482); Palm Valley, 20.vii. 1972, *P. K. Latz* 2659 (NT 36698); AD 97244206); Reedy Creek, George Gill's Range, 1894, *R. Tate* s.n. (AD 95838012).

#### DISTRIBUTION AND HABITAT:

The species has a wide but possibly discontinuous distribution in the Macdonnell Ranges. It occurs on steep rocky slopes and cliffs in skeletal soils. Flowering is recorded in July.

#### DISCUSSION:

*Olearia tridens* is related to *O. stuartii* (F. Muell.) F. Muell. ex Benth. and may be confused with depauperate specimens of this generally larger shrub. It is recognizable by the characteristic leaf shape and the indumentum which contrasts with the pubescence of mixed persistent glandular and non-glandular hairs in *O. stuartii*.

The specific epithet is from the Latin *tridens*, a trident, referring to the shape of the leaves.

ACKNOWLEDGEMENT

I would like to thank the Officer in Charge of the Herbarium of the Northern Territory for the loan of specimens.

Manuscript received 13 August 1985.

# CALADENIA CALCICOLA (ORCHIDACEAE), A NEW SPECIES FROM VICTORIA, AUSTRALIA

by

G. W. CARR\*

## ABSTRACT

Carr, G. W. *Caladenia calcicola* (Orchidaceae) a new species from Victoria, Australia. *Muelleria* 6(3):185-191 (1986). — A new spider-orchid, *Caladenia calcicola* G. W. Carr (sect. *Calonema* Benth.), an endemic in far south-west Victoria, Australia, is described and figured. It has affinities with *C. reticulata* Fitzg., to which it is compared. The distribution, ecology and conservation status of the new species is discussed.

## TAXONOMY

### *Caladenia calcicola* G. W. Carr, sp. nov.

Ex affinitate *C. reticulatae* R. D. Fitzg., sed in proprietatibus sequentibus differt: floribus parvioribus; segmento quoque perianthii nitenti, superficie lineam mediam atro-rubram ferenti; labello parvo rubro nitenti, a dentibus paucis brevibus marginalibus atque callis brevibus congestis truncatulis 4 (interdum 6)-seriatis praedito; columna rubra.

*Herb* perennating from a globular to ellipsoid, annually-renewed tuberoid to 12 mm diam. *Stem* subterranean, to c. 10 cm long; tuberoids and stem invested in dense, finely-fibrous, long-persistent, brown tunic from previous tuberoid and stem tissue. *Leaf* subtended by an opposite, membranous, closed-cylindrical, minutely mucronate, truncate bract. *Leaf* hirsute, solitary, basal, erect or ascending, lanceolate to linear-lanceolate, to 13 cm long x 1.5 cm wide, acute, often partly withered at anthesis; abaxial surface basally green and irregularly blotched or spotted red-purple, the whole surface densely hirsute with  $\pm$  patent straight to slightly retrorse, uniseriate, eglandular trichomes to 10 mm long; basal cell of trichome barrel-shaped to terete, minutely rugose, white-opaque, then with 1-5 extremely fine transparent cells; adaxial leaf surface less densely hirsute with smaller trichomes. *Scape* (7-)-13-22(-28) cm long, 1.0-2.5 mm diam., arising at centre of leaf, rigidly erect, straight to slightly flexuose, green or reddish, hirsute throughout with  $\pm$  patent, eglandular trichomes similar to leaf trichomes and also with shorter glandular trichomes scattered above the middle, increasing in density upwards. *Glandular trichomes* similar to eglandular ones, but each terminated by a minute dark red spherical cell. *Sterile bract* near middle of scape slightly spreading, narrow-lanceolate, subulate, acute, (12-)-15-20(-25) mm x (2.5-)-4-5(-8.5) mm, externally hirsute, internally glabrous, with involute margins. *Floral bract* similar, (2.5-)-5-6(-8.5) mm x (4.0-)-4.5-6.0(-8.5) mm; margins less inrolled, embracing the pedicel. *Flower* 1(-2), rather small, scented with a relatively weak, sweet floral fragrance with a pungent animal-like overtone; scent only perceptible above c. 20°C. *Pedicel* (4-)-10-15(-24) mm long. *Ovary* fusiforme, (4-)-6-8(-11) mm long, 2-3 mm diam., densely hirsute with short eglandular and (mostly) glandular patent or retrorse trichomes. *Perianth* stiffly spreading; base of sepals sparsely glandular-hirsute externally. *Dorsal sepal* erect, (21-)-23-28(-36) mm long, (1.5-)-2.0-2.5(-3) mm wide near base, strongly curved forward, linear-acuminate, narrowed to a channelled cauda 0.5-0.8 mm wide; dorsal sepal pale-yellow (RHS Yellow Group 2C in brightest specimens) with distinct deep red (close to RHS Greyed-Purple Group 187C) median stripe within and a narrower median stripe and irregular streaks on outside of sepal; sepal usually glossy within, terminated by a linear osmophore† ('club') (3-)-4-6(-9) mm

\* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

† The term "osmophore", a scent-producing gland (Dressler 1981), is preferred to "club" (widely used in *Caladenia* literature) because it emphasises the functional significance of this organ. Stoutamire (1983) showed that the osmophores in pseudocopulatory *Caladenia* species emit sexual pheromones to attract male wasp pollinators.

long x 0.6-1.2 mm wide; osmophore often downturned, consisting of minute, densely-packed, yellowish- to reddish-purple, sessile, glandular cells (RHS Greyed-Orange Group 166 A — Greyed-Purple Group 187 A). *Lateral sepals* (17-)25-33 (-40) mm long, deflexed at angle of c. 45°, slightly falcate with  $\pm$  flat ovate-lanceolate lamina (1.5-)3.5-4.5(-5) mm wide,  $\pm$  abruptly tapering into a very narrow channelled cauda (5-)8-10(-13.5) mm long x 0.4-1.0 mm minimum width; osmophore similar to that of the dorsal sepal, often upturned, (2.2-)4.5-5(-6) mm x (0.3-)0.6-0.8(-1) mm. Lateral sepals similar in colour to dorsal sepal, median stripe above broad, greater than half the width of sepal, narrowly striped below along median line and often irregularly streaked, usually glossy. *Petals* narrow linear-lanceolate, flat, evenly tapering to very fine points, (16-)18-23(-25) mm x (1.5-)2-2.5(-5.3) mm wide, slightly arcuate, from  $\pm$  horizontal to deflexed to c. 45°; colour similar to that of the lateral sepals but red median stripe above and below extending to margins above the middle; petals often the most intensely coloured part of the perianth, glossy. *Labellum* articulated on a short claw ( $\pm$  1 x 1 mm), cordate at base, ovate-rhomboid when flattened, (8-)10-12(-15) mm x (7-)8-10(-11) mm, car-nose, very firm and waxy in texture, unevenly curved throughout, projected forward and somewhat flattened above the middle, finally strongly recurved; margin of labellum with (6-)7-9(-10) thick, angular-truncate, rounded or sub-acute antrorse teeth about the middle; teeth up to 1 mm long; apex of labellum entire, gibbous. *Calli of labellum*  $\pm$  congested, often touching, in 4(-6) longitudinal rows in a basal median zone (5-)8-11 mm long x (2.2-)2.5-3.5(-4.5) mm wide; inner 2 rows each with (4-)5-8(-9) calli, adjacent 2 rows each with 5-8(-9), outer rows (where 6 rows are present) with 1-3 calli each; calli mostly short-stalked, becoming sessile towards apex, (1-)1.5-2.2(-2.5) mm high near base of labellum, the ultimate ones 0.2-0.3 mm high; head of calli broad, flat-topped, either  $\pm$  circular, ovate, elliptical or teardrop-shaped when viewed from above. *Lamina of labellum* red like petals, at least in distal half, marginal teeth and apex very dark red (RHS Greyed-Purple 166 A); proximal half of labellum usually paler red or yellowish-cream, with prominent dark red striations along veins above and below; calli pale to dark red, yellowish-red, or dark with paler colour at centre of head, often prominently contrasting with lamina in basal half; labellum very glossy and waxy in texture. *Column* erect but strongly curved forward, (6.5-)8.5-10 mm high, 4-5 mm wide viewed from front, with 2 prominent rounded swollen yellow glands about 1 mm long on the inner base; axis  $\pm$  1.5 mm wide, narrowly winged below, expanding upward into thick rounded incurved and cucullate wings 2-3 mm wide; *anther* terminal, blunt, 2-2.5 x 2 mm, with a minute terminal apiculus to 0.5 mm long; anther flaps green and pale yellow usually heavily suffused with dark red; *pollinia* 4, flat,  $\pm$  irregularly triangular. *Column wings* transparent,  $\pm$  deep red throughout or colourless with numerous red striations; axis red dorsally, red or green with numerous reddish striations within; column glossy and waxy in texture. *Stigma* large, c. 2 mm diam., green and glistening, immediately behind anther, circular, centrally depressed; viscidium very narrow, c. 1.5 mm long, touching anther flaps. *Capsule* (absent from type collection) turgid, broadly fusiform, to 16 mm long x 6.5 mm diam.,  $\pm$  chartaceous at dehiscence. *Seeds* grey-brown.

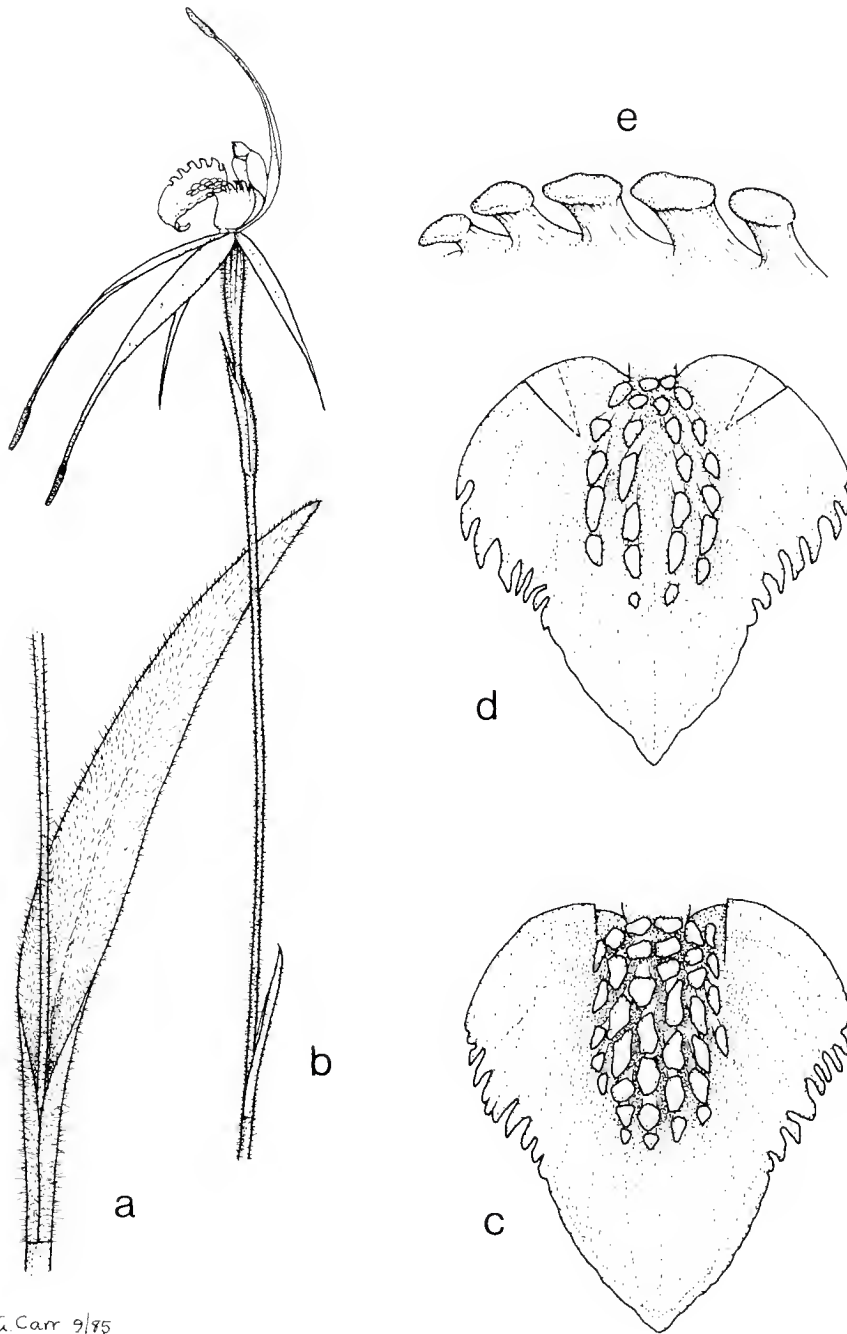
TYPE COLLECTION:

Bat's Ridges, c. 10 km west of Portland, Victoria, 38°20'30" S.; 141°29'03" E., Victorian plant grid E21, 13.x.1984, G. W. Carr 10049 (HOLOTYPE: MEL 1537340. ISOTYPES: AD, CANB, CBG, PERTH, also spirit specimens AD, CANB, MEL.

SELECTED SPECIMENS EXAMINED (total number examined, 7):

Victoria — Portland, 17.x.1934, F. Melblom s.n. (MEL 579794, ex herb W. H. Nicholls). Portland, x.1935, G. Lyell s.n. (MEL 574287). Gorae West [in error, actually Bats Ridge], 21.x.1943, A. C. Beaglehole s.n. (MEL 579768, ex herb. W. H. Nicholls). F. Davies Hill, Cashmore, 38°19' S., 141°29' E., 28.x.1983, C. & D. Woolcock 1285 (MEL 654791).





G. Carr 9/75

Fig. 1. *Caladenia calcicola*. a — leaf and lower scape, x 1. b — scape and flower, x 1.2. c and d — labellum (flattened, and thus artificially folded along the proximal margin), x 5. e — oblique view of inner row of calli from the labellum (excluding the basal two calli), x 10. a from living plant collected at the type locality and maintained in cultivation. b from colour transparency of plant at type locality. c and e from isotype (AD). d from isotype (CANB).

## DISTRIBUTION:

Known only from the Bats Ridge area approximately ten kilometres west of Portland in far south-west Victoria. Local botanists C. & D. Woolcock and A. C. Beauglehole (pers. comm.) have never observed the species elsewhere in the region. *Woolcock 1285* is from an area adjoining the eastern boundary of the Bats Ridge Wildlife Reserve (Woolcock, pers. comm.). The "Portland" locality of some collections almost certainly refers to Bats Ridge.

## ECOLOGY:

Occurs on very well-drained, shallow, sandy, terra rossa loams (pH 7.7, A1 soil horizon), on low ridges overlying limestone. Tuberooids are often situated amongst rocks. The limestone is the Miocene Port Campbell formation which outcrops in south-west Victoria and south-eastern South Australia (Abele *et al.* 1976).

The natural vegetation at the Bats Ridge type locality has been partly cleared, grazed by stock and weed-invaded but is remarkably species-rich. A total of 63 native and 26 naturalized vascular species were recorded from a 10 x 10 m quadrat. Principal structural dominants of the vegetation were *Acacia sophorae*, *Eucalyptus viminalis*, *Lepidosperma canescens* and *Leucopogon parviflorus*. Other important native species included *Acacia pycnantha*, *Acrotriche affinis*, *Bursaria spinosa*, *Caladenia latifolia*, *Clematis microphylla*, *Helichrysum apiculatum*, *Hibbertia sericea*, *Lomandra filiformis*, *L. glauca*, *Pimelea glauca*, *Pododthea angustifolia*, *Pterostylis foliata*, *Scaevola pallida*, *Senecio lautus*, *Themeda australis* and *Viola hederacea* ssp. *seppeltiana* (nomenclature follows Forbes *et al.* (1984)).

## AFFINITIES AND BIOLOGY:

*Caladenia calcicola* is most closely related to *C. reticulata* Fitzg., from which it is distinguished by the floral characters given in Table 1. The two species apparently also differ in their habitat preferences, thus phytosociological attributes, in the sense of Izco (1980), are likely to provide useful distinctions.

Distributions of *C. calcicola* and *C. reticulata* do not overlap. *C. calcicola* occurs on limestone ridges on shallow terra rossa soils and is the only species of *Caladenia* (section *Calonema*) on this limestone. Downslope these soils grade into deep siliceous Tertiary sands carrying woodland dominated by *Eucalyptus baxteri* with a heathy understorey. *Caladenia reticulata* occurs on the sandy soils in at least two localities at the foot of the southern slope of Bats Ridge (Carr pers. observation; Woolcock pers. comm.).

It is perhaps surprising that this distinctive species has been overlooked for so long, as several orchid specialists including W. H. Nicholls saw collections of *C. calcicola*. The species was illustrated in Woolcock & Woolcock (1984) under the name *C. reticulata* where the habitat note "sandy limestone ridges" refers to the Bats Ridge locality of *C. calcicola*.

Differences between *C. calcicola* and *C. reticulata* are not readily apparent in dried material, where salient features such as colour, texture, glossiness and calli size and shape are lost or obscured. This indicates the importance of viewing living material, or wet collections combined with colour photographs, for effective taxonomic appraisal of *Caladenia*.

Between 5% and 10% of the plants in the populations of *C. calcicola*, observed between 1979 and 1985, were pollinated annually. Pollination is doubtless affected by a thynnid wasp as described for other *Caladenia* (sect. *Calonema*) species (see Stoutamire, 1983). It is predicted that *C. calcicola* and *C. reticulata* will be found to be pollinated by different wasp species as there are considerable differences in flower colour, floral fragrance, labellum size and ornamentation. The flowering season overlaps in these species and for *C. calcicola* extends from mid September to early November, with an early- to mid-October peak.

Table 1. Comparison between *Caladenia calcicola* and *C. reticulata*.

Based on examination of 30 specimens of *C. calcicola* and 35 specimens of *C. reticulata* (MEL and private cultivation). Specimens of the latter derived from throughout its range in Victoria.

	<i>C. calcicola</i>	<i>C. reticulata</i>
scape	to 28 cm	to at least 40 cm
dorsal sepal	(21-)23-28(-36) mm long; osmophore (3-)4-6(-9) mm long, pale yellow to dark red	(25-)30-35(-45) mm long; osmophore (3-)7-11(-20) mm long, dark red
lateral sepals	(17-)25-33(-40) mm long; osmophores (2.2-)4.5-5(-6) mm long	(23-)32-37(-50) mm long; osmophores (3-)6-12(-17) mm long
perianth segments	pale yellow with deep red median stripe(s) on both outer and inner surface; petals nearly wholly red; perianth segments glossy, at least internally	inner surface concolorous, from red to cream; narrow median stripe (if present) on outer surface only, perianth not glossy
labellum	fleshy, rigid, waxy in texture, small, (8-)10-12(-15) x (7-)8-10(-11) mm, unevenly curved, projected forward and somewhat flattened above the middle, finally strongly recurved; wholly deep red to lighter red or deep red grading to pale yellow at base; striated deep red along veins; very glossy above	less fleshy, not waxy, usually larger, evenly curved throughout; usually bicolorous, deep red at apex, the remainder $\pm$ creamish and striated red along veins, or wholly red; not glossy.
marginal teeth of labellum	(6-)7-9(-10), to 1 mm long, $\pm$ angular-truncate, concolorous	(7-)15-25(-27), the largest to 3 mm or more long, sub-acute, bicolorous.
calli	congested, distant from apex, in 4 (occasionally 6) rows; inner row with about same number of calli as marginal teeth	widely spaced, approaching apex, in 6 (rarely 4) rows; inner row with about same number of calli as marginal teeth.
calli	very shortly stalked, to 2.5 mm high, with broad $\pm$ planate heads, concolorous, dark to light yellowish-red, or dark with paler flat surface.	long-stalked, to 3.5 mm high, narrow, bicolorous.
column	small, wings $\pm$ deep red and translucent throughout	larger, wings almost colourless
floral fragrance	weak, sweet, with pungent animal-like overtone	strong 'burnt plastic' smell

#### CONSERVATION STATUS:

A very restricted endemic known with certainty from only about ten square kilometres around the type locality and from private land at Cashmore, several kilometres east of the type area. Around the type locality it exists on public land in the Bats Ridge Wildlife Reserve (several populations) and on adjoining private land. Extant populations are of unknown size. The conservation status according to the code of Leigh *et al.* (1981) is assessed at 2VC.

*Caladenia calcicola* is one of the rarest and most restricted species of *Caladenia* in Victoria. Its former distribution may have been wider on limestone outcrops (see ecology) in far south-west Victoria and perhaps south-east South Australia. Most of these outcrops have been cleared for agriculture but the species may occur in similar habitat in the Lower Glenelg National Park to the west of Bats Ridge.

The largest population known by me, adjacent to the type locality, was destroyed in 1980-1984 by limestone quarrying operations.

#### SPECIES CONCEPTS IN CALADENIA (SECTION CALONEMA)

The recognition of *C. calcicola* as a distinct species is based on an evolutionary species concept (Wiley, 1981) to which reproductive isolation is central. This contrasts with the traditional conservative species concepts, often based on inadequate

material and lack of field knowledge of taxa, which prevailed before the reproductive biology and pollination system in *Caladenia* (section *Calonema*) were known.

Stoutamire (1974, 1975, 1983) showed that pseudocopulation is a basic pollination syndrome in *Caladenia* (section *Calonema*). Male thynnid wasps are attracted to flowers for sexual rewards. Unpublished data collected by the author and M. A. Clements (pers. comm.) support these findings.

On the available evidence it is very likely that mechanisms involved in *Caladenia* pollination parallel those involved in the pollination of the Mediterranean orchid genus *Ophrys*. The model developed for *Ophrys* pollination by Kullenberg (1961), Kullenberg and Bergström (1976) and Bergström (1978) indicates that olfactory, tactile and visual stimuli lead to behaviour in male aculeate hymenoptera which affects pollination. The olfactory stimulus is the primary and independent stimulus and tactile and visual stimuli are secondary and dependent (Bergström, 1978).

Concerning the taxonomic appraisal of *Caladenia* (section *Calonema*) in the context of an evolutionary species concept, weight is placed on morphological and other criteria hitherto overlooked or ignored in a traditional species concept. This accounts for the detailed description of *C. calcicola* presented here. Taxonomic criteria include habitat (ecology), trichome characters, floral fragrance, colour of floral organs and detailed comparative morphology of floral parts. The functional significance, however, of some of the morphological features (e.g. marginal ornamentation of labellum, presence of two basal glandular processes on the inside of the column) is not yet known.

In traditional concepts variation in a number of characters was often considered to be continuous in polymorphic assemblages, e.g. colour and relative sizes of floral parts. This is rarely the case and where it does exist introgression may often explain this variation (Carr, unpublished data).

It is considered that the primary mechanism for speciation in pseudocopulatory *Caladenia* is likely to be segregation of a biochemical isolate differing in floral fragrance (i.e. sexual pheromones). This would be capable of attracting a different species of pollinating insect. Pollinator-mediated selection pressures would then lead to morphological differentiation as a consequence of the crucial role of visual and tactile stimuli in the pollination process.

#### ACKNOWLEDGEMENTS

I am most grateful to Dr J. H. Willis for the Latin diagnosis and to David Albrecht (National Herbarium of Victoria), Colin and Dorothy Woolcock and Randall Robinson for valuable assistance. The Directors of HO and AD are thanked for the loan of *Caladenia* material.

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# A NEW SPECIES OF HELICIA, NEW COMBINATIONS AND LECTOTYPIFICATION IN TRIUNIA (PROTEACEAE) FROM AUSTRALIA

by

D. B. FOREMAN\*

## ABSTRACT

Foreman, D. B. A new species of *Helicia*, new combinations and lectotypification in *Triunia* (Proteaceae) from Australia. *Muelleria* 6(3): 193-196 (1986). — *Helicia recurva* sp. nov. is described, together with notes on distribution, habitat and diagnostic features. *Helicia youngiana* C. Moore & F. Muell. var. *montana* C. White and *H. youngiana* var. *robusta* C. White are raised to species level in the genus *Triunia* L. Johnson & B. Briggs; lectotypes are designated for these two taxa.

## HELICIA LOUR.

In a recent review of the genus *Helicia* Lour. in Australia (Foreman 1983) particular comment was made on two collections from north Queensland, viz. *C. T. White 10643* (BRI) from Mt Spurgeon and *H. Flecker 2330* (QRS) from Upper Mossman River. These collections were tentatively placed under *Helicia australasica* F. Muell., although at the time it was pointed out that the leaves were more coriaceous than usual for that species and the margins of the leaves were recurved, a feature which had not been seen in other specimens of *H. australasica*. Further matching collections from much the same localities, in flower and young fruit, have now been seen and it has become apparent that these collections belong to a distinct taxon which I now describe.

### *Helicia recurva* D. Foreman, sp. nov.

*Arbor* ad 10 m alta. *Foliorum* lamina plerumque elliptica vel parum obovata, acuta ad acuminata, versus basin cuneata ad attenuata, 5-13.5 cm longa, 2.5-5 cm lata, coriacea, juventute sparsim ferrugineo-pilosa; margines recurvi, integri vel dentibus paucis parvis instructi; nervi 5-9-jugi, in pagina abaxiali elevati, prominentes; petiolus 5-8 mm longus. *Inflorescentia* axillaris, 7-11.5 cm longa, ferrugineo-pilosa. *Pedicelli* 2 mm longi, ferrugineo-pilosa. *Perianthium* 10-13 mm longum, ± glabrum. *Ovarium* sparsim pilosum, pilis ferrugineis vel rufis. *Fructus* immaturus, eo *H. australasicae* similis; pericarpium coriaceum.

*Tree* to 10 m tall. *Branchlets* terete, ferruginous-pilose to ferruginous-tomentose towards the tips, becoming glabrous lower down. *Leaf blade* mostly elliptic or slightly obovate, acute to acuminate, cuneate to attenuate at the base, 5-13.5 cm long, 2.5-5 cm wide, coriaceous, sparsely ferruginous-pilose when young particularly on the midrib and main nerves, becoming glabrous, drying olivaceous to yellowish-green above, mid- to light-brown beneath; margin recurved, entire or with a few small irregularly spaced teeth mostly towards the apex; midrib flattened to slightly sunken above, raised and very prominent beneath; nerves 5-9 pairs, slightly sunken above, raised and very prominent beneath, straight in the lower half to two-thirds, curved upwardly and anastomosing towards the margin; reticulations obscure, dense, slightly raised on both surfaces; petiole 5-8 mm long, with a well defined pulvinus. *Inflorescence* axillary, 7-11.5 cm long, ferruginous-pilose; rachis 1 mm diam. *Bract* subtending flower pairs 1 mm long, ferruginous-pilose. *Floral bracts* 0.5 mm long, ferruginous-pilose. *Pedicels* 2 mm long, ferruginous-pilose. *Perianth* 10-13 mm long, glabrous or sparsely ferruginous-pilose; limb 3 mm x 1.5 mm, fusiform. *Anthers* 1.5 mm long. *Hypogynous glands* free, rounded. *Ovary* sparsely ferruginous- to rufous-pilose; style glabrous; pollen presenter 2 mm x 0.5 mm, fusiform. *Fruit* (immature, about half ripe) final size and shape not discernible but apparently ± similar to *H. australasica*; pericarp coriaceous. (Fig. 1).

\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

*Helicia recurva*  
Foreman

of SPAIN

... FOREMAN  
... fibrous leaves and  
...  
... FOREMAN, n. s.,  
... No. 10643, September 1930.  
... tall tree in rain forest.

NATIONAL HERBARIUM OF VICTORIA



Fig. 1. *Helicia recurva* D. Foreman. Holotype.



## TYPE COLLECTION:

Mt Spurgeon, North Queensland, ix.1936, *C. T. White 10643* (flowering collection). (HOLOTYPE: BRI 164227. ISOTYPES: BRI 164226; MEL 1540426).

## FURTHER SPECIMENS EXAMINED:

*Queensland* — Upper Mossman River, 21.x.1938, *Flecker 2330* (QRS); Platypus Creek at head of Mossman River, ix.1972, *Tracy 14883* (BRI); near Schillers Hut, Mt Spurgeon, ix.1972, *Webb & Tracey 13370* (BRI).

## DISTRIBUTION AND HABITAT:

Known only from Mt Spurgeon and the upper reaches of the Mossman River. In simple notophyll vine forest on soils derived from granite, at altitudes to 1250 metres.

## DISCUSSION:

The specific epithet refers to the recurved leaf margin, a feature not seen in other Australian species of *Helicia*.

*H. recurva* appears to be most closely allied to *H. australasica*. Both species have distinct petioles, glabrous or near-glabrous leaves and hairy ovaries. The only other *Helicia* species to have this combination of characters is *H. grayi* Foreman which can be distinguished immediately by its much longer pedicels and perianth segments.

*H. recurva* can be distinguished from *H. australasica* (syn. *H. glabrescens* C. White) (Foreman 1983) and also from *H. grayi* by its more coriaceous leaves with midrib and main nerves impressed above and very prominent beneath, giving many of the leaves a sub-bullate appearance, by its recurved leaf margin (this feature appears to be fairly consistent in all the dried material examined) and by the predominantly elliptic leaf shape. The flowers of *H. recurva* and *H. australasica* are quite similar although those of *H. recurva* tend to have fewer hairs.

## TRIUNA L. JOHNSON &amp; B. BRIGGS

Johnson & Briggs (1975) established the genus *Triunia* by raising to generic rank *Helicia* section *Macadamopsis* Sleum., typifying it by *Helicia youngiana* C. Moore & F. Muell. They considered at this time that the genus included "one or two further species" although formal combinations were not made. Since *Helicia youngiana* var. *montana* C. White and *Helicia youngiana* var. *robusta* C. White both appear to be distinct from each other and from *Triunia youngiana* (C. Moore & F. Muell.) Johnson & Briggs they are here raised to species rank, giving a total of three species of *Triunia* present in Australia.

***Triunia montana*** (C. White) D. Foreman, comb. et stat. nov.

*Helicia youngiana* C. Moore & F. Muell. var. *montana* C. White, Contr. Arnold Abor. 4: 24 (1933). LECTOTYPE (here designated): Bellenden Ker, Palm Camp, Meston's Bellenden Ker Expedition, 1889, *F. M. Bailey s.n.* (BRI 164626). SYNTYPES: Bellenden Kerr near the summit, i. 1923, *C. T. White s.n.* (BRI 164310 & 164311).

At one time it was thought that *T. montana* was restricted in its distribution to the Bellenden Ker Range in north Queensland (White 1933). However, now it has been found on Mt Lewis and the Great Dividing Range, north-west of Mossman in the vicinity of Black Mountain and Mt Spurgeon.

*T. montana* can be distinguished from both *T. youngiana* and *T. robusta* by its entire, acuminate, coriaceous, smooth glossy leaves which dry ± the same colour above and beneath. The flowers of all three species are more or less similar, but the perianth segments of *T. montana* are less hairy than those of either *T. youngiana*

or *T. robusta* and they have a characteristic tuft of hairs about 1-1.5 mm long at the end of the limb.

REPRESENTATIVE SPECIMENS SEEN:

Queensland — State Forest Reserve 310, Bellenden Ker Logging Area, 26.ix.1975, *Dockrill 1084* (QRS); Timber Reserve 140, Zarda Logging Area, 17.iv.1968, *Hyland 4935* (QRS); Summit of Mt Bellenden Ker, 2.viii.1971, *Hyland 5320* (QRS); Bellenden Ker, 30.xi.1972, *Hyland 6571* (QRS); Mt Bartle-Frere, i.1891, *Johnson s.n.* (MEL).

***Triunia robusta*** (C. White) D. Foreman, comb. et stat. nov.

*Helicia youngiana* C. Moore & F. Muell. var. *robusta* C. White, Contr. Arnold Arbor. 4: 23 (1933). LECTOTYPE (here designated): Eumundi, xi. 1892, *J. H. Simmonds s.n.* (BRI 164315). ISOLECTOTYPE: Eumundi, xi. 1892, *J. H. Simmonds s.n.* (BRI 164314). SYNTYPES: Maroochie [Yandina], vii. 1888, *F. M. Bailey s.n.* (BRI 022471); Eumundi, xi. 1894, *F. M. Bailey & J. H. Simmonds s.n.* (BRI 164313); Eumundi, 1900, *J. F. Bailey s.n.* (BRI 164317); Maroochie [Yandina], *J. Low s.n.* (BRI 164316); Eumundi, xi. 1892, *J. B. Staer s.n.* (BRI 164312).

*Triunia robusta* is most closely allied to *T. youngiana* but it can be distinguished by its larger oblong-elliptic leaves which are smooth and glossy above, mostly entire or with a few (sometimes deep) teeth towards the apex.

White (1933) included amongst the specimens he cited under *Helicia youngiana* var. *robusta* a collection from East Malanda, Atherton Tableland, 22.ix.1929, *S. F. Kajewski 1219* (BRI). This and other collections from north Queensland which have been referred to *H. youngiana* var. *robusta* appear to represent a distinct but as yet undescribed species.

There do not appear to be any recent collections of *Triunia robusta* from the Eumundi/Maroochie (Yandina) area and due to extensive clearing in the region this taxon may now be extinct.

ADDITIONAL SPECIMENS EXAMINED:

Queensland — Maroochie [Yandina], xi. 1879, *Bailey* (MEL 93791); Eumundi, *Shirley* (BRI 164284); Eumundi, v. 1892, *Simmonds* (BRI 105362).

ACKNOWLEDGEMENTS

I wish to thank the Directors of BRI and QRS for the loan of herbarium material. Mr Alex George kindly prepared the Latin description.

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# NYMPHOIDES DISPERMA (MENYANTHACEAE): A NEW AUSTRALIAN SPECIES

by

HELEN I. ASTON\*

## ABSTRACT

Aston, H. I. *Nymphoides disperma* (Menyanthaceae): a new Australian species. *Muelleria* 6(3): 197-200 (1986). — *Nymphoides disperma* is described and its diagnostic features illustrated. The species occurs in the Kimberley region of Western Australia.

## TAXONOMY

This paper is the third precursor to a revision of *Nymphoides* Séguier in Australia. Two previous papers describing seven new species appeared in *Muelleria* 5:35-51 (1982) and 5:265-270 (1984). Except for a modification concerning style type, the common characters given on page 35 of the first paper also apply to *N. disperma*. This species belongs in the "geminata group" defined on the same page.

### *Nymphoides disperma* H. I. Aston, sp. nov.

*Annua. Lamina folii* natans, 15-40 x 14-45 mm, plus minusve rotunda (nonnunquam late-ovata) profunde cordata. *Inflorescentia* breviter elongata pedicellis geminatis unoquoque nodo vel condensatis; internodia brevia, ad 1-8 mm longa. *Flores* 5-partiti, non nisi homostylosi (= mediotylosi) iam cogniti. *Corolla* c. 16-25 mm diam. aurantio-lutea; lobae alis latis valde laciniatis atque basi fimbria transversali imperfecta praeditae papillarum gracilium in uno centrali fasciculo et duobus fasciculis lateralibus dispositarum; unusquisque fasciculus plerumque in basi prominente; tubus quinque fasciculis pilorum c. 10-12 brevium tenuium simplicium liberorum intra faucem praeditus. *Capsula* oblonga, c. 3.5-4.3 x 2.0-2.25 mm. *Semina* 1-4, plerumque 2 (duobus superpositis) per capsulam plus minusve globosa et modice utrinque compressa, 1.9-2.4 x 1.75-2.3 x 1.55-1.85 mm, sculpta per caespites dispersos tuberculorum longorum obtusorum eminentes super planum parietum cellularum convexorum (nonnunquam caespites eminentes desunt); caruncula basalis, semi-circularis, pallida, parva, inconspicua.

Ab aliis luteofloralibus speciebus, "geminatae gregis", et per ordinationem fimbriae in corolla, et per magnitudinem formamque seminorum, et per sculpturam seminorum, et per capsulam plerumque 2-seminalem distincta est.

Annual, perhaps perennial where water persists. *Rootstock* slender, few-60 mm long x 2-3 mm diam., bearing lateral roots. *Branches* several from the plant base, slender, flexuose, floating, simple or once forked, to 50 cm long x <1-1.5 mm diam., their terminal portions developing the inflorescences. *Basal leaves* several; petiole slender, terete, 6.5-31 cm long x 1-1.5 mm diam.; blade near-rounded (occasionally broad-ovate) in outline, deeply cordate (the lobes mostly 27-40% of the total blade length and separated by a sinus of 30°-50° (-80°) angle), obtuse to rounded, entire, 15-40 x 14-45 mm with length from a little less than to a little greater than the width, thin-textured, green above, green to deep purplish-maroon beneath, floating. *Cauline leaves* similar; petiole 2-7 cm long. *Inflorescences* as for the "geminata group", terminal on the branches, the rachis short and from more or less absent (the pedicels then appearing clustered) to 3 cm long; internodes short, from <1-8 mm long; pedicels 7-15 per inflorescence, very slender, 45-92 mm long x c. 0.5 mm diam. *Flowers* 5-partite. *Calyx lobes* lanceolate to ovate, acute, 4-4.5 mm long, with narrow translucent margins. *Corolla* c. 16-25 mm span, yellow to orange-yellow. *Corolla lobes* broad-oblong to obovate. Mid-section of corolla lobe glabrous except for a conspicuous, incomplete, transverse fringe of papillae across its base and for an inconspicuous cluster of short fine simple hairs on each edge at the base; fringe consisting of one central and two lateral clusters of slender

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\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

papillae, sometimes with scattered single papillae arising between the clusters; papillae of each cluster to 1.5 mm long, united on a base of raised tissue or those of the central cluster distinct, without a common base. Side-wings of corolla lobe broad, undulate, strongly lacinate, extending from the lobe apex almost to its base. *Corolla tube* papillae free within each cluster, sessile, consisting of c. 10-12 short, fine, simple hairs. *Stamens* with filaments c. 0.8-1.1 mm long in mid-styled flowers; anthers more or less linear, c. 2.2-2.5 times as long as broad, 1.5-1.7 mm long. *Gynoecium (mid-styled flower)* c. 3.7 mm long; ovary 2-2.2 mm long, free except at the base, more or less linear-conical, tapered into the short broad style; placentas 2, positioned centrally along the length of the ovary wall, the 1 or 2 funicles on each being short and thick; ovules 2 (-4); style 0.1 mm long, almost indistinguishable from the ovary summit; stigmas 2, each a papillate, erect, deeply lobed and undulate wing c. 1.2-1.4 mm long x c. 1.6 mm broad. *Capsule* oblong (drying, in typical 2-seeded capsules, with a slight transverse constriction around the middle between the seeds), from a little less than to a little greater than the calyx, c. 3.5-4.3 x 2-2.5 mm. *Seeds* (1-2)(-4) per capsule; body of seed more or less globose but moderately laterally compressed, 1.9-2.4 mm long x 1.75-2.3 mm wide x 1.55-1.85 mm broad, more or less straw-coloured (or ? finally black) when mature, sculptured with a uniform layer of low convex cell walls and usually also with spaced clusters of long obtuse tubercles projecting vertically above that layer like steep-sided plateaus rising abruptly from a plain; basal caruncle present, pale, semi-circular around a short projection of the seed body, small and inconspicuous.

TYPE COLLECTION:

Unnamed creek running into Pauline Bay, Vansittart Bay, Northern Kimberley, Western Australia, 14° 12' 30" S., 126° 22' E., 22.v.1984, S. J. Forbes 2098 (HOLOTYPE: MEL 672226. ISOTYPES: MEL 672227, PERTH).

OTHER SPECIMENS EXAMINED:

Western Australia (Kimberley region) — Kalumburu [14° 18' S., 126° 38' E.], 3.vii.1960, Douglas & Mees s.n. (PERTH). Blyxa Creek, Prince Regent River Reserve, 15° 48' S., 125° 20' E., 21.viii.1974, A. S. George 12508 in part (PERTH — sheet 3 of dried coll. & spirit coll. 2167/B; not sheets 1 & 2 which are *N. aurantiaca* (Dalz.) Kuntze).

DISTRIBUTION:

Western Australia — Known only from the three collections cited above, all from the northern or north-western Kimberley region. Almost certainly occurs in other places of suitable habitat in this remote area.

HABITAT:

Clear, still to flowing, fresh water to 70 cm deep on sandy substrate in creeks and creek-pools. Altitude 10 m (Forbes 2098).

NOTES:

Readily recognised as a member of the "geminata group" by the orange-yellow flowers and the more or less open inflorescence with twinned pedicels. It differs from all other members of that group in the pattern of the corolla fringe and in the distinctive sculpturing of typical seeds.

The epithet *disperma* refers to the usually two seeds which are superposed in each capsule.

As the material examined is limited and I have not seen this species in the field, dimensions given in the description will probably need some expansion as more collections are made. No obviously long-styled or short-styled flowers have yet been collected but it is very probable that they exist. Spirit-preserved flowers from the Forbes 2098 type collection all appear mid-styled, with the anthers held more or less level with the stigmas. Buds examined from spirit-preserved inflorescences of George 12508 agree with flowers from Forbes 2098.

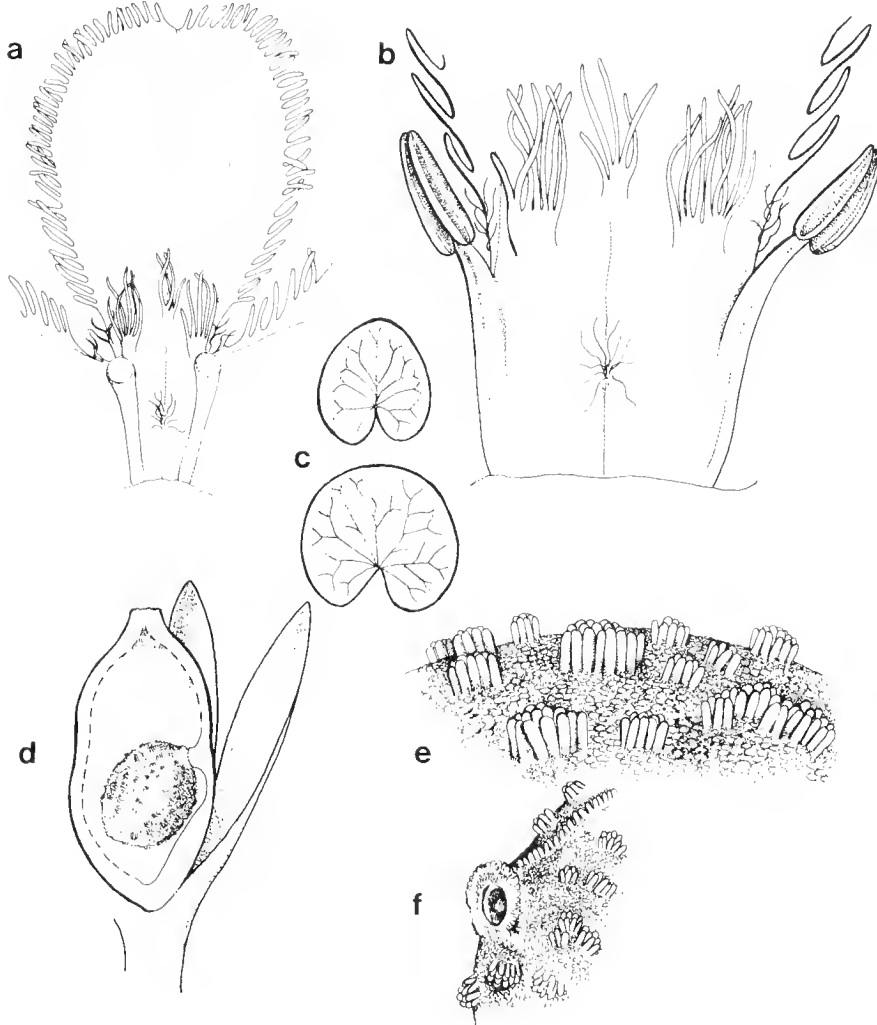


Fig. 1. *Nymphoides disperma*. a — corolla, portion showing one lobe with its incomplete basal fringe and one of the “papillae” clusters of the throat; stamens removed, x 6.5. b — corolla, basal portion of (a) enlarged; stamens shown, x 13. c — leaf laminas, x 1. d — capsule, 2-seeded, L.S. showing one of the placentas (= a short thick funicle) with its seed; second placenta and seed from L.H. side of capsule not shown, x 8. e — seed, portion of surface showing sculpture, x 50. f — seed, basal portion showing caruncle and surface sculpture, x 30. All from *Forbes 2098* (MEL).

The projecting clusters of tubercles which form part of the sculpture of typical seeds are conspicuously present in the type material and in the *Douglas & Mees s.n.* collection but are absent from the *N. disperma* portions of *George 12508*. Seeds of the latter retain the layer of convex cell walls and are comparable in other ways with fully sculptured seeds.

#### ACKNOWLEDGEMENTS

My thanks are extended to Mr K. F. Kenneally, Western Australian Herbarium, for his assiduous collection of *Nymphoides* during his various Kimberley expeditions,

to Mr S. J. Forbes, National Herbarium of Victoria, for his vigilance on my behalf during his 1984 Kimberley expedition, to Dr G. A. M. Scott, Botany Department, Monash University, Melbourne, for preparation of the Latin description from an English draft and to Miss A. Podwyszynski, National Herbarium of Victoria, for providing the illustration.

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# A NEW SPECIES OF CAREX (CYPERACEAE: CARICOIDEAE) FROM SOUTH-EASTERN AUSTRALIA

by

K. R. THIELE\*

## ABSTRACT

Thiele, K. R. A new species of *Carex* (Cyperaceae: Caricoideae) from south-eastern Australia. *Muelleria* 6(3): 201-204 (1986). — A new species of *Carex*, *C. incomitata*, from montane south-eastern Australia is described and illustrated, with notes on its distribution and habitat.

## INTRODUCTION

Examination of material determined as *Carex appressa* R.Br. in MEL and CBG has revealed that a number of specimens from Victoria and south-eastern New South Wales previously referred to that name constitute an undescribed species which is here named *C. incomitata*.

## TAXONOMY

***Carex incomitata*** K. R. Thiele, sp. nov.

*C. appressa* R.Br. forma *minor* sens. plur. auct. Aust., non Kükenthal.

*Caricis appressae* affinis sed rhizomate repenti, habitu diffuse caespitoso; inflorescentia brevi congesta, spiculis ad basim multorum flosculorum femineorum, ad maturitatem utriculorum late reflexorum, masculae sectionis terminalis inconspicuae, utriculis omnino tenuiter papyraceis, ambo extremitates versus aequaliter contractis, laete viridibus, ad maturitatem denigricantibus differt.

### TYPE COLLECTION:

Victoria, Goongerah, 69 km N. of Orbost on the Bonang Highway, 37°21'S., 148°41'E., 8.xi.1982, K. R. Thiele 392 (HOLOTYPE: MEL 105860. ISOTYPES: CANB, K, NSW).

*Perennial. Rhizome* stout, short-creeping, 2-4 mm diameter, covered with persistent dull brown papery scales. *Leaves* to 85 cm x 8 mm, pale verdant green, rather thin and lax, strongly but finely retrorsely scabridulous at least distally on the margins and adaxial surface of the major nerves; internerve surfaces and minor nerves smooth to minutely tuberculate; leaf-sheath pale, transversely septate, smooth and glossy adaxially, smooth to minutely tuberculate abaxially, with a hyaline membranous margin. *Culms* erect to inclined, (26-)50-70(-90) cm tall, rather slender, acutely triquetrous with retrorsely scabridulous angles at least towards the apex. *Inflorescence axis* unbranched or with few closely appressed basal branches to 20 mm long, the axis and branches densely covered with numerous, congested, sessile, short, ovoid spikes, the whole forming a cylindrical or narrow-oblong spike-like panicle (2.4-)5-8(-10) cm long x (5-)6-8(-10) cm wide, sometimes somewhat lobed or interrupted at the base. *Bracts* subtending the panicle branches and spikes glumaceous or the lowermost filiform-scabrid, to 10 mm long. *Spikes* androgynous; axis 1.0-1.5 mm long, bearing 5-12 female florets below and 6-10 male florets above. *Male glumes* 2 mm long, ovate, obtuse or truncate-erose at the apex, with a pallid greenish one-nerved costa and hyaline margins suffused apically with reddish-chestnut. *Female glumes* 2.5 mm long, two thirds the length of the mature utricle, similar in shape and colouration to the male. *Utricle* (2.4-)2.5-2.6(-2.7) mm long, (1.4-)1.5-1.6(-1.8) mm wide, plano-convex to lenticular in section, elliptic,

\* C/o Australian National Herbarium, CSIRO Division of Plant Industry, Black Mountain, Canberra, A.C.T., Australia 2601.

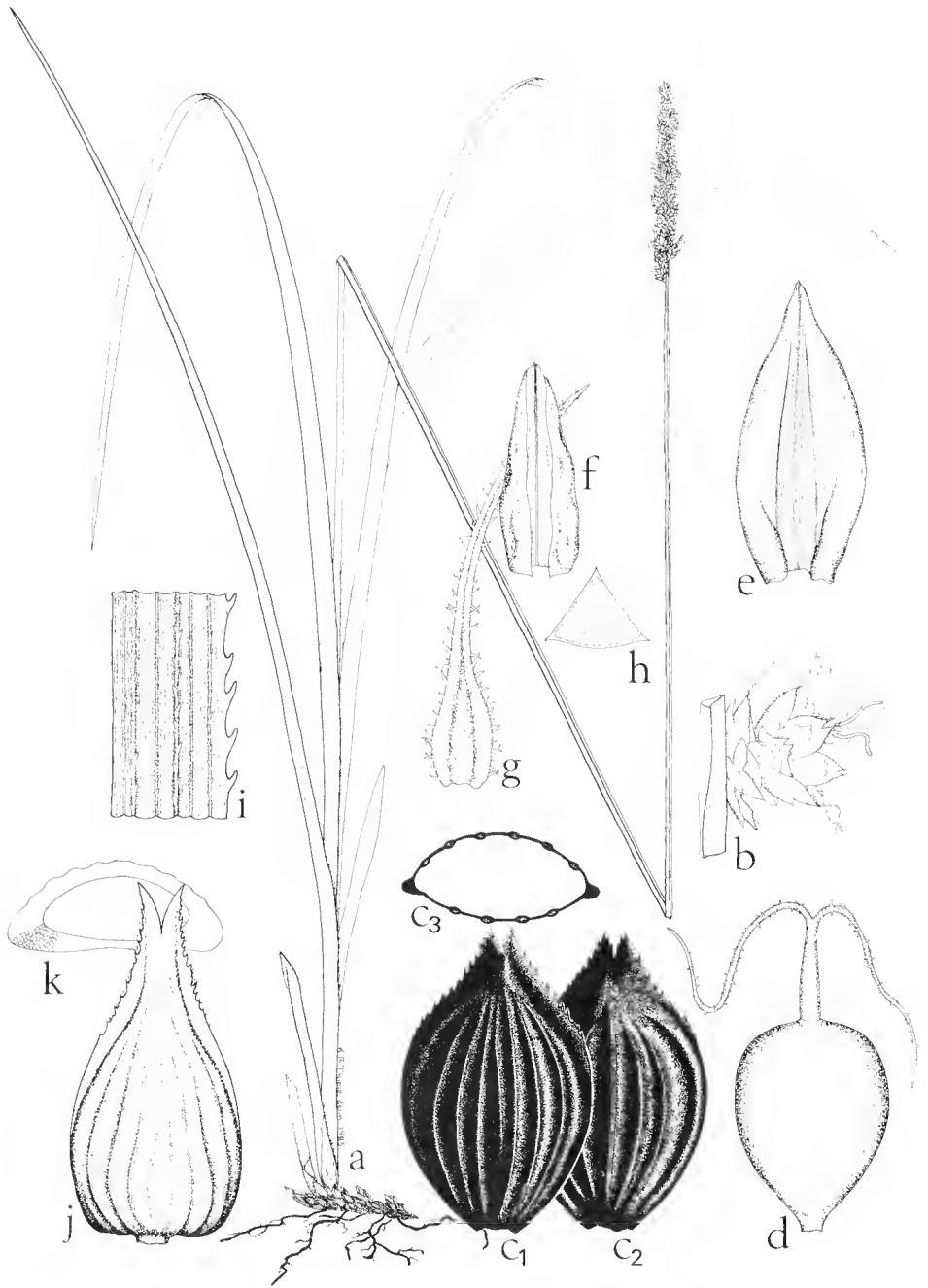


Fig. 1. *Carex incomitatus*. a — habit, x 0.5. b — spikelet, x 3. c — utricle (1, abaxial; 2, adaxial; 3, T.S.), x 15. d — nut, x 15. e — female glume, x 18. f — male glume, x 18. g — lower bract, x 14. h — T.S. culm, x 7. i — leaf, portion of abaxial surface, x 14. *Carex appressa*. j — utricle, abaxial, x 15. k — T.S. utricle, x 15. a—i, from the holotype.



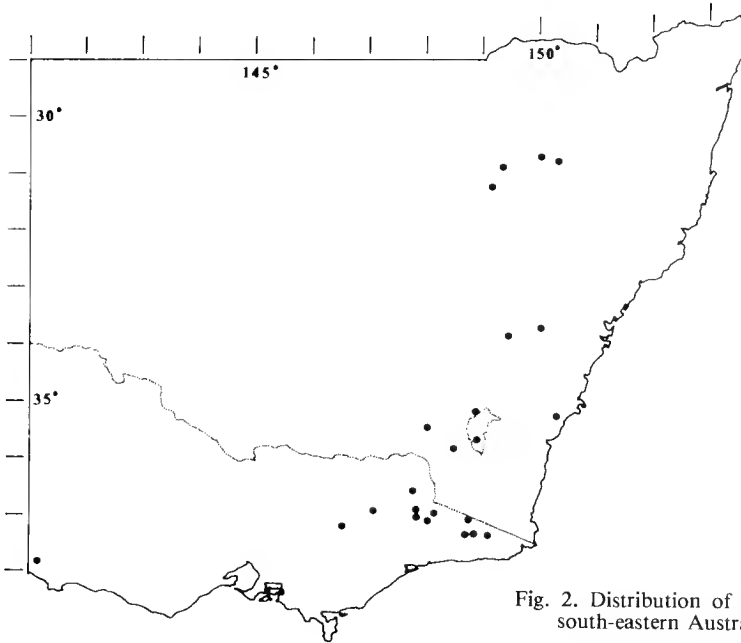


Fig. 2. Distribution of *Carex incomitata* in south-eastern Australia.

narrowing evenly and symmetrically to both ends, short-beaked, spiny-scabrous in the upper third, papery throughout but slightly ribbed on the margins, vivid green becoming shining black at maturity; abaxial surface 6-7 nerved; adaxial surface 4-5 nerved but the nerves sometimes incomplete. *Style-branches* 2. *Achene* obovate, short-beaked, lenticular in transverse section.

#### DISTRIBUTION:

Apparently widespread and frequent in montane eastern Victoria and south-eastern New South Wales, with isolated occurrences as far north as the Warrumbungle Range. A single record for the Western District of Victoria (MEL 536393) is anomalous and further collecting is needed to evaluate the significance of this record.

#### HABITAT:

Characteristically in open grassy woodland and forests, usually on well-drained slopes and ridge-tops. In this respect it differs from other species of *Carex* in the region.

#### SELECTED SPECIMENS EXAMINED:

*Victoria* — East Gippsland, B.A.Road, between Bonang Highway and Mount Ellery, Grid Z20, 25.xi.1970, A.C. Beauglehole 3493 (MEL 536389). Weeragua, Grid Z23, 20.xi.1947, N.A. Wakefield 3081 (MEL 1508969). Near head of Bundarra River at fossil cliff, Bogong High Plains, c. 5600 feet, 15.i.1946, J.H. Willis (MEL 1527685). Wilkin, SW. of Casterton, Grid D38, 30.x.1960, A.C. Beauglehole 8225 (MEL 536393).

*New South Wales* — Cave Creek, 18 miles NNE. of Kiandra, 11.xii.1969, R. Coveny 2606 & A. Rodd (MEL 1527686). Batlow Hill, 0.5 km W., 3.5 km N. of Batlow P.O., 14.xii.1980, K.R. Thiele 188 (CBG 8100631). Little Forest Plateau, 16 km NW. of Milton, South Coast, 35°12'S., 150°19'E., alt. 500 m, 11.xii.1975, I.R. Telford 4221 (CBG 8202264).

*Australian Capital Territory* — Gudgenby Nature Reserve, Orroral River crossing on Orroral Road, at picnic reserve, 35°40'S., 148°59'E., alt. 880 m, 23.x.1980, E.M. Canning 5020 & D. Verdon (CBG 8007982).

## NOTES:

The epithet is derived from the Latin for "unaccompanied". *C. incomitata* is characteristically found in a habitat from which other species of *Carex* are absent.

*C. incomitata* belongs in *Carex* subgenus *Vigneae*, along with *C. appressa* with which it has been confused. It differs from that species principally in the characters given in Table 1.

Table 1. Principal characters distinguishing *Carex appressa* and *C. incomitata*

	<i>C. appressa</i>	<i>C. incomitata</i>
Utricle	inflated and corky in the lower half, abruptly contracting to the insertion, dull brown at maturity.	membranous and papery throughout, evenly and symmetrically tapering to both ends, bright green turning black at maturity.
Spikelets	basal female florets usually few, inconspicuous, the terete distal male section clearly projecting at maturity.	basal female florets many, widely reflexed at maturity and hiding the distal male section from view.
Inflorescence	often more than 12 cm long, sometimes rather loose.	never more than 12 cm long, always congested.
Habit	often large, dense, well-formed tussocks.	rather diffuse, shortly-rhizomatous tussocks.
Habitat	moist places in swamps, soaks and stream-banks.	hill slopes and ridge-tops in grassy forest and woodland.

Specimens of *Carex incomitata* have usually been referred to *C. appressa* R.Br. forma *minor* Kükenthal. Examination of apparent type material (MEL 625287) of this latter taxon held at MEL reveals it to be clearly similar to typical *C. appressa* in the possession of inflated, corky utricles. *C. incomitata*, with papery utricles, differs markedly.

Although *Carex incomitata* generally resembles *C. appressa* it may not be taxonomically close to that species. Until a comprehensive systematic treatment of at least the Australian species of *Carex* is prepared the affinities of this new species remain in doubt.

## ACKNOWLEDGEMENTS

I wish to thank Dr J. H. Ross, National Herbarium of Victoria, Melbourne, and Dr B. A. Barlow, Australian National Herbarium, CSIRO, Canberra, for their comments on the manuscript. Dr A. Kanis, Australian National Herbarium, prepared the Latin diagnosis.

# REDISCOVERY OF HEMICHROA MESEMBRYANTHEMA F. Muell. (AMARANTHACEAE)

by

R. J. CHINNOCK\* and F. J. BADMAN†

## ABSTRACT

Chinnock, R. J. and Badman, F. J. Rediscovery of *Hemichroa mesembryanthea* F. Muell. (Amaranthaceae). *Muelleria* 6(3): 205-209 (1986). — *Hemichroa mesembryanthea* was recently rediscovered, 112 years after Ernest Giles first collected it. A detailed description and illustrations of the species are provided and relationships with the two other species of *Hemichroa* are considered. The known distribution and ecology of the species are discussed.

## INTRODUCTION

In August 1872 Ernest Giles embarked on the first of his exploring expeditions to arid regions of Australia, including what is now northern South Australia. The trip was partially sponsored by Ferdinand Mueller, the government botanist at the Melbourne Botanic Gardens, hoping that Giles would in return collect plant specimens for him. One of the collections made by Giles near Lake Eyre was described by Mueller in April of the following year as *Hemichroa mesembryanthea*. No further specimens of this species are known to have been collected since that time.

In August 1984 F. J. Badman found two plants growing at Strangways Springs on the west side of Lake Eyre and a pressed specimen of them was identified as *Hemichroa mesembryanthea*. During a concerted search for it in March 1985 three populations of this species were located between Strangways Railway Siding and Mound Springs ruins (Fig. 1). Two of the populations (sites B & C) consisted of between 200 and 300 plants each while the third (site C) was much larger, having an estimated 600 plants.

It is very likely that Giles collected his specimen in this general area as he passed through Strangways Springs Telegraph Station on his way to Peake. He also made reference to the mound springs and their value as a water source in the preface to the account of his journeys to central Australia published in 1889.

## DESCRIPTION

***Hemichroa mesembryanthea*** F. Muell., *Fragm.* 8:38 (1873); J. Black, *Fl. S. Aust.* edn 1:209 (1924); edn 2:323 (1948). — *Polycnemon mesembryanthemum* (F. Muell.) F. Muell., *J. Bot.* 15:276 (1877); F. Muell., *Syst. Census Austral. Pl.* 1:29 (1882); F. Muell., *Second Syst. Census Austral. Pl.* 49 (1889); Tate, *Fl. Extratrop. S. Austral.* 219 (1890). HOLOTYPE: *E. Giles s.n.*, towards Lake Eyre, no date (MEL 98604).

Erect glabrous divaricate shrub 0.6-1(-1.1) m tall, 0.6-1.5(-2.35) m diam. *Branches* fleshy, light reddish-purple, glaucous, becoming light brown when woody, very finely striate and minutely irregularly papillate; branch tips more or less spinescent. *Leaves* opposite, adnate to the branch, succulent, glaucous, grey-green but often tinged purplish; free part triquetrous or clavate, (5-)15-22 x 2.5-4 mm, mucronate, constricted just above the base, base purplish, slightly gibbose. *Flower spikes* terminal; floral bracts opposite or subopposite, at flowering stage 9-12 x 2.5-3.5 mm, erect and similar in shape and colour to the leaves although the adaxial surface is concave in the basal half; during fruit development the bracts enlarge to

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\* State Herbarium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia, Australia 5000.

† P.O. Box 38, Marree, South Australia, Australia 5733.

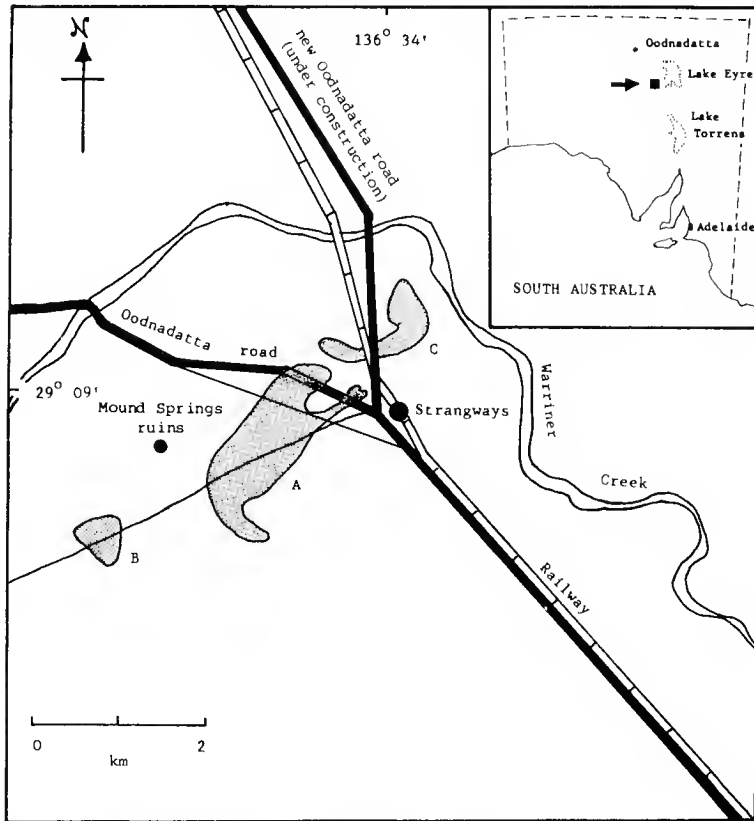


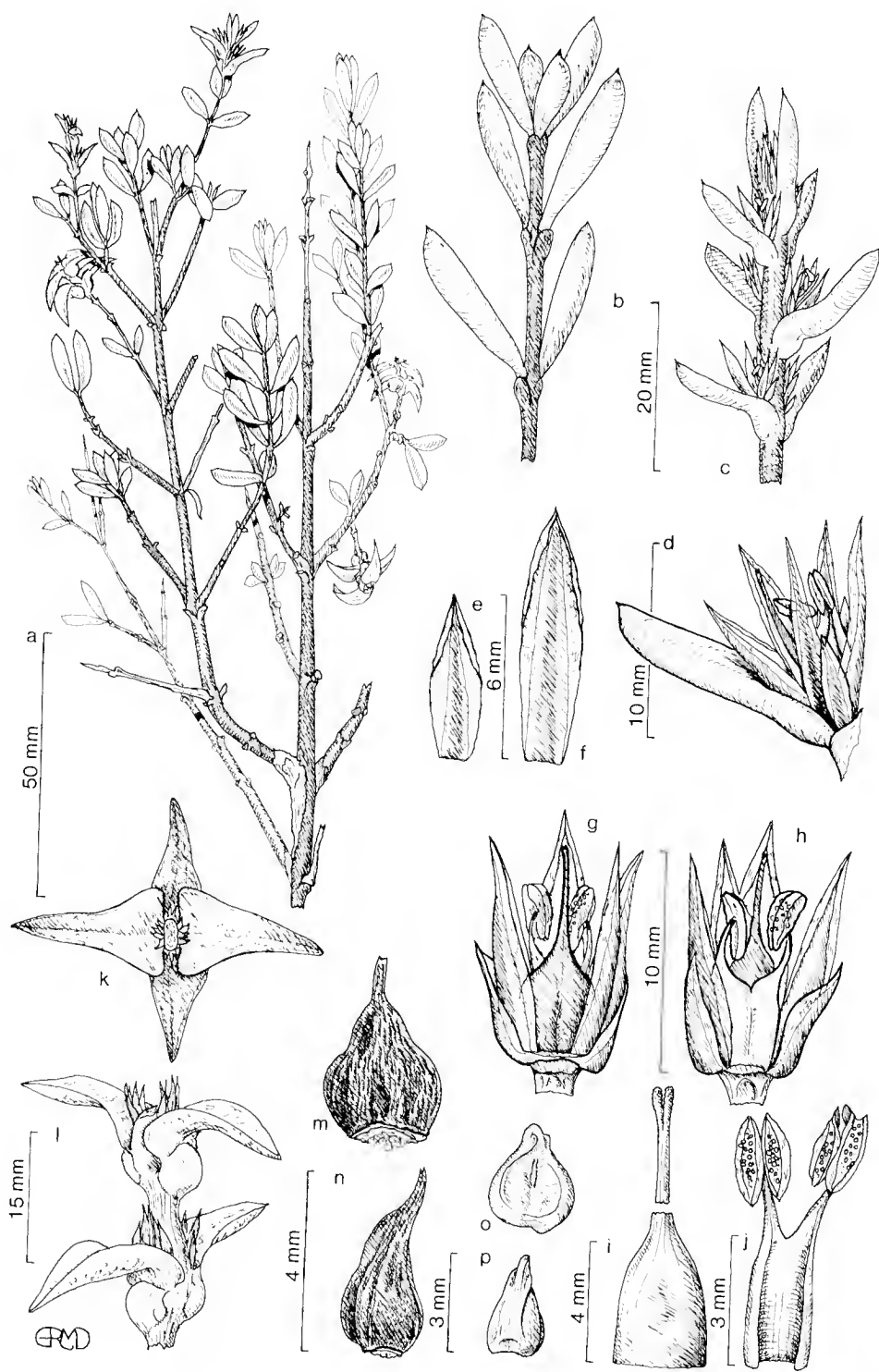
Fig. 1. Known populations of *Hemichroa mesembryanthea*.

15-30 x 7-10 mm, becoming patent or reflexed, rigid and pale brown on drying with the apex weakly spinescent and the base prominently gibbose. *Flowers* solitary in the bract axil; bracteoles lanceolate, 4.5-7 x 1.3-2.3 mm, acuminate, prominently keeled, the midportion fleshy, green drying brown, the margins membranous, translucent. *Tepals* 5, imbricate, subequal, lanceolate, 7.5-10 x 2-3 mm, acuminate, medial portion thick, green, drying pale brown, marginal portions white, translucent along edges. *Stamens* 2; filaments bright red drying black, connate in lower two-thirds, dilated and flattened, more or less plate-like, appressed to ovary; anthers yellow, bilocular, dehiscing longitudinally. *Ovary* superior, bright red, ovoid, compressed on posterior and anterior surfaces, unilocular with one ovule, smooth; style with a bifid stigma. *Fruit* indehiscent, crustaceous, black, ovoid, 3-4 x 2.3-3.7 mm, compressed, more or less rugose. *Seed* light brown, pyriform to almost globose, 2.7-3.5 x 2-2.5 mm, smooth.

**SPECIMENS EXAMINED:**

*South Australia (Lake Eyre region)* — *Badman 1407*, Strangways Springs, 2.viii.1984 (AD, CANB). *Badman 1633*, 1 km N. of Strangways Rail Siding, 10.iii.1985 (AD, MEL). *Badman 1637*, 2 km W. of Strangways Rail Siding, 12.iii.1985 (AD, MEL). *Badman 1640*, 3 km W. of Strangways Rail Siding, 16.iii.1985 (AD).

Fig. 2. *Hemichroa mesembryanthea*. a—habit. b—vegetative shoot. c—floral shoot. d—open flower in bract axil. e—bracteole. f—tepal. g & h—adaxial and abaxial views of flower. i—ovary and uppermost part of style with bifid stigma. j—stamens showing the dilated connate base and longitudinally dehiscent anthers. k & l—top and side view of mature fruiting bracts (cf. flowering bract (c), same scale). m & n—abaxial and side view of fruit. o & p—distal and lateral view of seed. All from *Badman 1637*.



## DISTRIBUTION AND ECOLOGY:

*Hemichroa mesembryanthema* is, according to present records, endemic to the Strangways-Mound Springs area between latitudes 29°08' and 29° 09'S. and between longitudes 136°32' and 136°34'E. It occurs in low shrubland dominated by chenopodiaceous shrubs on fine powdery yellowish-red saline clay loam on low-lying flats.

At site A, *Halosarcia* species predominate although *Atriplex vesicaria* and *Maireana astrotricha* are very common. In the northern part *Acacia ligulata* and *A. victoriae* are common although they do occur sporadically throughout the area together with *A. tetragonophylla* and *Pittosporum phylliraeoides*. Perennial grasses *Enneapogon cylindricus* and *Panicum decompositum* and numerous ephemerals including *Helipterum floribundum*, *H. strictum*, *Calocephalus platycephalum*, *Streptoglossa adscendens*, *Salsola kali* and *Osteocarpum dipterocarpum* are also common. *Convolvulus erubescens* is frequently found climbing over *Hemichroa* plants.

The vegetation at sites A & B are comparable but at site C *Maireana astrotricha*, *Acacia ligulata* and *A. victoriae* are absent and replaced by *Acacia stenophylla*, *Atriplex nummularia*, *Nitraria billardieri*, *Lawrenzia glomerata*, *Frankenia* sp. and *Eragrostis* sp.

*Hemichroa mesembryanthema* occurs on low-lying flats or along drainage systems in a band running north-east to south-west between the Mound Springs ruins and Strangways. The species is, however, absent from the limestone mound springs, the lowest lying areas dominated almost exclusively by *Halosarcia* spp., the gibber plains to the south dominated by *Maireana pyramidata* and the low sandy rises and dunes.

During March 1985 rabbits were found to be common at all sites and about 100 cattle were watering at Strangways Bore, but no browsing of *Hemichroa* was observed. It is interesting to note that Leigh, Boden & Briggs (1984) considered that the presumed extinction of *H. mesembryanthema* appeared to be the result of grazing by domestic stock and rabbits.

## NOTES:

*Hemichroa mesembryanthema* is closely related to *H. diandra* R.Br. Both species have floral bracts which, during fruit formation, enlarge and develop a gibbose base; they have two stamens which have their filaments connate and dilated in the basal half or two-thirds and ovoid to pyriform, pale brown, smooth seed with a dull surface. The former species is readily distinguished by its divaricate branch pattern, the glabrous branches with more or less spinescent branch tips, opposite leaves and bracts, red staminal filaments and ovary, the greatly enlarging floral bracts which become patent or reflexed and a seed which is twice as large. In *H. diandra* only slight enlargement of the bracts occurs and the base quite often is not gibbose.

The third species in the genus, *H. pentandra*, is not considered to be closely related to the above two species. The branches are densely hairy towards the apices; the leaves and bracts are not adnate to the branches below the free base; the floral bracts neither enlarge nor become gibbose; five free stamens occur in a ring around the ovary and the seed is sublenticular, black and glossy. In addition this species appears to be confined to coastal saline swamps whereas both *H. diandra* and *H. mesembryanthema* favour soils adjacent to coastal swamps or shores or areas only subject to occasional floodings in inland areas.

It should be noted that Black's (1924, 1948) reference to twin flowers in *Hemichroa mesembryanthema* is misleading. Only one flower occurs in each bract axil and presumably he meant that the flowers were paired along the branch because of the opposite, connate, bract pairs.

## CONSERVATION STATUS:

Leigh et. al. (1981) gave *Hemichroa mesembryanthema* a conservation status

rating of 1X (known only from the type collection and not collected in the last 50 years). The ammended rating is now 2V. However, the populations should be monitored as they are adjacent to the Marree — Oodnadatta road and already a number of cleared lines for a new road (now abandoned) have been cut through site A, the largest population of the species. A new Oodnadatta road is being constructed through site C and a station track passes through sites A and B (Map 1). Between 50 and 100 plants have already been destroyed by earthworks associated with the new road.

#### ACKNOWLEDGEMENTS

We thank Dr P. Short, National Herbarium of Victoria, for initially examining the type specimen of *Hemichroa mesembryanthera* for us, and Mr G. R. M. Dashorst for preparing the illustration.

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Manuscript received 4 July 1985.





NOTES ON AFZELIA Sm. AND PETALOSTYLIS R.Br.  
(CAESALPINIACEAE)

by

J. H. ROSS\*

ABSTRACT

Ross, J. H. Notes on *Afzelia* Sm. and *Petalostylis* R.Br. (Caesalpinaceae). *Muelleria* 6(3): 211-215 (1986). — *Afzelia australis* F. M. Bailey is lectotypified. The genus *Petalostylis* is reviewed, a neotype of *P. spinescens* E. Pritzl is chosen, and notes, distribution maps and a key to the two species recognized are provided.

INTRODUCTION

The following notes arise out of the preparation of accounts of the respective genera for the Flora of Australia.

TYPIFICATION OF AFZELIA AUSTRALIS F. M. BAILEY

F. M. Bailey (1888) based his description of *Afzelia australis* on material collected by Dr T. L. Bancroft at Johnstone River in the Cook district, Queensland. In response to a request for the loan of the type of *A. australis* I received from the Queensland Herbarium a specimen (BRI 8142) which has been accepted in BRI as type material although with some doubt. This doubt is indicated by a typed note initialled by C. T. White accompanying the specimen which reads: "The label of this specimen has been lost but it is probably the remains of Bailey's type of the species". The specimen is sterile and a trifle fragmentary.

In contrast, there is a fertile specimen in MEL (MEL 1530057) accompanied by a letter from Bailey to Mueller dated 26 Nov. 1886. Bailey wrote: "At your request I have sent with this all of the flowers, I had, a pod, and shoot of foliage with a single trijugate leaf, a small piece of the wood, and a piece of the bark of *Afzelia australis*". Bailey's letter contains the same description of *A. australis* as that subsequently published in the protologue so it is clear that he had drawn up the description of what he called "my tree of the Johnstone River" before he sent the material to Mueller. All of the elements described by Bailey in his letter as having been sent to Mueller are represented on MEL 1530057.

As indicated by Bailey in the protologue of *A. australis*, he and Mueller differed over the identity of the Johnstone River plant. Mueller (1882) had recorded the existence of *A. bijuga* (Colebr.) A. Gray in Queensland and his request to Bailey for material of the Johnstone River plant was to enable him to decide whether the material matched other material he had seen referred to *A. bijuga* or whether it did in fact represent a second species. Bailey went to some length in his letter to convince Mueller that *A. australis* was not conspecific with *A. bijuga* and offered to publish *A. australis* "under our joint authority" if Mueller agreed that the Johnstone River plant was specifically distinct. It is clear, however, that Mueller considered *A. australis* to be conspecific with *A. bijuga*, a view accepted by subsequent workers, the only difference being that the Queensland plant is now placed in the genus *Intsia* and is known as *I. bijuga* (Colebr.) O. Kuntze.

In view of the uncertainty surrounding the specimen in BRI and the fact that it is sterile, I now select the sheet in MEL (MEL 1530057) collected by T. L. Bancroft at Johnstone River in 1886 and referred to above as the **lectotype** of *A. australis*. The BRI specimen (BRI 8142) is regarded as a doubtful isolectotype.

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\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

## NOTES ON PETALOSTYLIS R. BR.

*Petalostylis* R.Br., a small endemic genus largely confined to the arid regions of Australia, is distinguished from *Labichea* Gaudich. ex DC., the other member of the subtribe Labicheinae Irwin & Barneby, by the distinctive style which is dilated into a boat-shaped petaloid limb, and by differences in the androecium.

R. Brown (1849) based his description of *Petalostylis* and the type *P. labicheoides* on material collected by Sturt in Central Australia. Mueller (1856), mistakenly believing *Petalostylis* R.Br. to be a later homonym of *Petalostylis* Grisebach, transferred *P. labicheoides* to his new genus *Petalogyne* and described a second species, *Petalogyne cassioides* from material he collected in northern Australia. *Petalogyne cassioides* was reduced to varietal rank under *Petalostylis labicheoides* by Bentham (1864), a situation which prevailed until Symon (1981) accorded var. *cassioides* specific rank. At the same time Symon relegated *Petalostylis millefolium* Pritzel, *Petalostylis labicheoides* var. *microphylla* Ewart & Morrison and *Petalostylis spinescens* Pritzel to synonymy under *Petalostylis cassioides* so that in recent years only two species have been recognized within the genus.

Symon (1981) employed a combination of the length of the leaf-rhachis, leaflet number and leaflet shape to differentiate *P. cassioides* from *P. labicheoides*. Although these characters enable the two species to be distinguished in much of central Australia, when material of the genus is examined throughout its range there is no discontinuity between the two species on the basis of leaf-rhachis length or in leaflet number. *P. labicheoides* tends to have short leaves with few large leaflets whereas *P. cassioides* tends to have longer leaves with more numerous smaller leaflets. Leaflet shape offers a more reliable means of separating the two species and the majority of specimens can be sorted quite readily on this basis (see key). A feature of some of the material referable to *P. cassioides* is the tendency for the leaf-rhachis to become fairly rigid and persist after the leaflets have been shed. No diagnostic differences have been found in the flowers or fruits.

The following key should enable most specimens to be determined:

Leaflets 3-19, lanceolate, elliptic or narrow-obovate-oblong, acuminate apically, 0.8-3 cm long; leaf-rhachis 0.5-6, rarely to 8, cm long (W.A., S.A., Qld., NSW) ..... *P. labicheoides*  
 Leaflets mostly 11-80, usually obovate, obovate-oblong, obcordate or suborbicular, rounded or obtuse apically and emarginate, retuse or shortly mucronate, 0.2-1.8 cm long; leaf-rhachis 1.5-14 cm long (W.A., N.T., S.A., Qld) .... *P. cassioides*

*P. cassioides* and *P. labicheoides* have different distributional ranges which show little overlap except perhaps in Western Australia between Onslow and Carnarvon and in the Burke, Gregory and Mitchell districts of Queensland (see Figs. 1 and 2).

Occasional specimens are very difficult to place with certainty, for example, Shields 2 (BRI 89374) collected from the Mitchell District, 20-40 miles SSW. of Winton on the Opalton road, Queensland. The specimen has some of the attributes of each species: it differs from typical *P. labicheoides* in having more numerous leaflets on some leaves and from typical *P. cassioides* in leaflet shape. The specimen shows an approach to *P. cassioides*, falls within the distributional range of this species, and has been referred to it hesitantly. The notes accompanying the specimen indicate that it was growing along a stock route which raises the possibility that the plant was raised from seed brought in by stock.

There are two specimens from Doomadgee Reserve in north-west Queensland. *J. R. Clarkson* 2682 (BRI, QRS), collected on a levee of the Nicholson River, is unquestionably *P. cassioides*. An undated specimen collected by *F. W. Whitehouse s.n.* (BRI 345975) is difficult to place but is apparently referable to *P. labicheoides*. It occurs within the distributional range of *P. cassioides* and far from the nearest population of *P. labicheoides*. Despite these occasional difficulties, *P. cassioides* and *P. labicheoides* appear to be sufficiently distinctive to warrant specific rank.



Fig. 1.

The distribution of *Petalostylis labicheoides*.

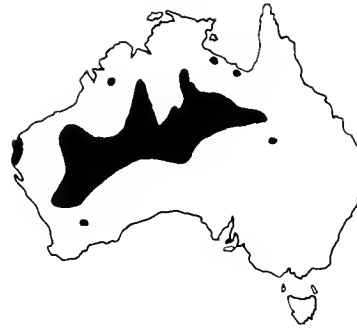


Fig. 2.

The distribution of *Petalostylis cassioides*.

Unlike *P. labicheoides* which is relatively uniform throughout its range, *P. cassioides* is polymorphic on account of the current inclusion within it of material formerly ascribed to *P. millefolium*, *P. labicheoides* var. *microphylla* and *P. spinescens*. During the preparation of a flora account of *Petalostylis* it was necessary to review this earlier decision to accommodate these taxa within *P. cassioides*.

Pritzel (1904) based his description of *P. millefolium* on a specimen collected by Diels near Menzies in Western Australia. In naming *P. millefolium*, Pritzel was recognizing the variant with decumbent stems which are pubescent when young, leaves 4-10 cm long with numerous (40-80), small (3-4 mm long, 2-3 mm wide) obovate or suborbicular sparingly pubescent leaflets, broadly ovate or subcordate stipules, and relatively small flowers. I have not succeeded in tracing *Diels 5168*, the type. There is no specimen in B (presumably destroyed during the second world war), BM, E, HBG, K, L, M or P or in any of the Australian herbaria but Pritzel's comprehensive description leaves no doubt about either the plant that he had before him when describing *P. millefolium* or the application of the name. Neither have I found a specimen that exactly matches Pritzel's description and a search in the type locality during the spring of 1984 by my colleague Mrs M. G. Corrick failed to locate any plants of *Petalostylis*. As I have not seen a specimen that is a reasonable match of Pritzel's description, I have refrained from selecting a neotype of *P. millefolium*. The specimen, *B. H. Smith 450* (MEL) collected along the road from Payne's Find to Wubin, Western Australia, shows an approach to typical *P. millefolium* in having decumbent stems, leaves with numerous pairs of small leaflets and the distinctive stipules but differs in that the stem is branched and is not subglabrous when mature, the flowers are larger and the specimen lacks fruits.

*P. labicheoides* var. *microphylla* was described by Ewart & Morrison (1913) from a specimen collected by G. F. Hill (No. 364) 40 miles W. of Lander's Creek in the Northern Territory and housed in MEL. Var. *microphylla* was characterised by having stout rigid densely pubescent leaf-rhachides which persist after the leaflets have fallen and are occasionally almost spinescent, and up to 41 broadly obovate and retuse or obcordate leaflets 2-4 mm long and less than 3 mm wide which are glabrous above and thinly pubescent below. Ewart and Morrison acknowledged the existence of numerous intermediates between var. *microphylla* and typical *P. cassioides*.

In describing *P. spinescens*, Pritzel (1918) was recognizing essentially the same taxon as that described by Ewart and Morrison under the name *P. labicheoides* var. *microphylla* and presumably was unaware of Ewart and Morrison's work. Pritzel based his description of *P. spinescens* on *Basedow 440* from Central Australia (district C as defined by Tate). *P. spinescens* was described as a glaucous tomentose shrub having spreading leaves 4-6 cm long with somewhat incurved spinescent rhachides and 18-24 ovate or suborbicular leaflets up to 5 mm long and 4 mm

wide which were sparsely tomentose above and densely so below. There is no type specimen in B, BM, E, HBG, K, L, M or P or in any of the Australian herbaria and I have not found a specimen that exactly matches the description. Although the application of the name is not in doubt, in the absence of any type material I now select the specimen *P. K. Latz 883* in MEL collected 5 miles W. of Docker River Settlement in the Northern Territory as the **neotype** of *P. spinescens*. *Latz 883* agrees reasonably well with the description but differs in that some leaves are slightly longer and have more numerous slightly narrower leaflets, none of which is suborbicular, and bears young fruits as well as flowers.

Specimens of typical *P. cassioides*, typical *P. millefolium* and typical *P. spinescens* look very different at first sight. However, when the entire range of morphological variation is inspected the extremes are seen to be linked by numerous and varied intermediates which show various combinations of characters. The characters typifying each extreme appear to vary independently of each other although some combinations of characters are commoner than others. For example, typical *P. millefolium* has decumbent stems and leaves with 40-80 leaflets but decumbent stems are by no means always associated with numerous leaflets. Neither are the spinescent rhachides typical of *P. spinescens* always associated with densely pubescent rhachides and leaflets.

Specimens referable to typical *P. cassioides* are distributed throughout much of the drier areas of Western Australia, the central Northern Territory, north-western South Australia and in parts of western Queensland. Specimens typical of *P. millefolium* and *P. spinescens* occur sporadically in Western Australia and the Northern Territory within the range of distribution of *P. cassioides*.

Unfortunately I have had limited opportunity to study *Petalostylis* in the field or to conduct an in-depth study of the genus. For the Flora of Australia account I have followed Symon in recognizing only two species and in treating *P. millefolium*, *P. labicheoides* var. *microphylla* and *P. spinescens* as synonyms of *P. cassioides* although I am not convinced that this decision is entirely correct. The status of *P. millefolium* in particular needs to be established. There is a suggestion that differences in habit, stipule size and shape and perhaps flower colour may be meaningful. Regrettably the notes accompanying the majority of collections make no mention of the habit of the plant. The genus is in need of critical evaluation and detailed field studies coupled with a study of breeding systems are required to clarify whether any of the taxa placed in synonymy under *P. cassioides* should be accorded formal recognition at some rank. The genus commends itself to further study.

#### ACKNOWLEDGEMENTS

I am most grateful to Dr S. W. L. Jacobs, National Herbarium of New South Wales, for searching for types of *Petalostylis* species while serving as Australian Botanical Liaison Officer at the Herbarium, Royal Botanic Gardens, Kew, England, and to my colleague Mrs M. G. Corrick and to Mr and Mrs B. H. Smith, Wongan Hills, for searching for and collecting material of *Petalostylis* in Western Australia.

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# STUDIES IN MACQUARIE ISLAND LICHENS 4: THE GENERA CLADIA AND CLADONIA

by

REX B. FILSON\* AND ALAN W. ARCHER†

## ABSTRACT

Filson, R. B. & Archer, A. W. Studies in Macquarie Island lichens 4: The genera *Cladia* and *Cladonia*. *Muelleria* 6(3): 217-235 (1986). — The species of *Cladia* and *Cladonia* which occur on Macquarie Island are examined critically and a full description of each is provided. Previous records are discussed and synonymy is given. The chemistry of each species was examined and the results are presented together with a taxonomic key and distribution maps. *Cladonia subantarctica* Filson & Archer is described as new.

## INTRODUCTION

This paper is a continuation of a series of papers on the lichens of Macquarie Island (Filson 1981, 1981a, 1986). *Cladonia* is a very common and easily collected fruticose genus and almost every biologist who collected lichens on Macquarie Island has brought back representatives of it (see Filson 1981). The first definitive treatment of the Macquarie Island Cladoniae was by Dodge (1948), who enumerated four species, including two species and one variety new to science. Six species were enumerated for the Horning collection (Lowry et. al. 1978), two of which, *C. aueri* Räsänen and *C. foliaceae* (Huds.) Willd. are not included in this paper as unfortunately relevant specimens have not been located. Although not available for examination, the specimen of *C. aueri* probably is referable to *C. subsubulata* Nyl., and the record of *C. foliaceae* is apparently due to misidentification as this taxon is endemic to the coastal regions of Europe. This paper is based on the collections cited in Filson (1981) as more recent collections have not been made available for study.

The lichen compounds present in the specimens cited were identified by thin-layer chromatography; acetone extracts of specimens were examined using the solvent systems of Culberson (Culberson 1972) and the separated compounds were detected with sulphuric acid (Culberson 1972) and MBTH (Archer 1978).

## TAXONOMY

### KEY TO SPECIES OF CLADIA AND CLADONIA

1. Thallus lacking a primary thallus; supportive tissue on the outside as a cartilaginous cortex; cortex perforate with sub-round fenestrations ..... *Cladia aggregata*
1. Thallus mostly with a basal primary thallus; supportive tissue a cartilaginous layer on the inside of the podetia; cortex not perforate, without sub-round fenestrations ..... *Cladonia*
2. Thallus consisting of primary squamules only, stictic acid present ..... *Cladonia wilsonii*
2. Thallus consisting of well-developed podetia as well as basal squamules
3. Apothecia and pycnidia red
4. Cups abruptly flaring towards the top, K+ yellow (thamnolic acid) ..... *Cladonia subdigitata*
4. Cups gradually tapering from the base, K- (Usnic and isousnic acid) .... *Cladonia pleurota*
3. Apothecia and pycnidia brown
5. Podetia wholly corticate
6. Podetia forming cups
7. Cups proliferating from the centre, with or without squamules ..... *Cladonia cervicornis* ssp. *verticillata*
7. Cups proliferating from the margins or not proliferating

\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

†Division of Analytical Laboratories, P.O. Box 162, Lidcombe, New South Wales, Australia 2141.

- 8. Interior of the cups perforated
  - 9. Cortex strongly rugulose, nitid, epruinose, P+ red (fumarprotocetraric acid) ..... *Cladonia furcata*
  - 9. Cortex smooth or only weakly rugulose, dull, pruinose, P- (barbatic acid) ..... *Cladonia subantarctica*
- 8. Interior of the cups imperforate
  - 10. Podetia nitid, epruinose, K-, atranorin absent ..... *Cladonia gracilis*
  - 10. Podetia dull, squamulose, pruinose in the upper parts, K+ yellow, atranorin present ..... *Cladonia ecmocyna*
- 6. Podetia subulate or distorted, not forming cups
  - 11. Podetia simple, once or twice divided or sparsely branched
  - 12. Podetia with few scattered squamules
  - 13. Axils open
    - 14. Cortex strongly rugulose, nitid, epruinose, P+ red (fumarprotocetraric acid) ..... *Cladonia furcata*
    - 14. Cortex smooth, only weakly rugulose, dull, pruinose, P- (barbatic acid) ..... *Cladonia subantarctica*
  - 13. Axils closed ..... *Cladonia gracilis*
  - 12. Podetia thickly squamulose ..... *Cladonia ecmocyna*
  - 11. Podetia split, branched at the apices many times ..... *Cladonia wilsonii*
- 5. Podetia ecorticate or only partly corticate in the lower parts
  - 15. Podetia sorediate
    - 16. Podetia forming well-developed cups
      - 17. Podetia granular-sorediate ..... *Cladonia chlorophaea*
      - 17. Podetia covered in small, flat, peltate squamules ..... *Cladonia pyxidata*
    - 16. Podetia subulate, not forming well-developed cups
      - 18. Lower part of the podetium corticate, upper part covered in farinose soredia
        - 19. Podetia short, thick; podetial squamules in the lower part; soredia abundant ..... *Cladonia cornuta*
        - 19. Podetia tall, slender; podetial squamules may reach the tip; soredia sparse ..... *Cladonia scabriuscula*
      - 18. Lower part of the podetium not corticate
        - 20. Soredia farinose, disintegrating in the upper parts, exposing the thin medulla and inner cartilaginous layer ..... *Cladonia corniculata*
        - 20. Soredia granular, persistent to the apex, rarely distintegrating in small patches ..... *Cladonia coniocraea*
  - 15. Podetia esorediate
    - 21. Podetia squamulose, inner cartilagenous layer not exposed
    - 22. Podetia forming cups ..... *Cladonia pyxidata*
    - 22. Podetia subulate, apically branched ..... *Cladonia scabriuscula*
    - 21. Podetia esquamulose; medulla thin, exposing the inner cartilagenous layer ..... *Cladonia corniculata*

### CLADIA

**Cladia aggregata** (Sw.) Nyl., *Recogn. Ram.* 69 (1870). — *Lichen aggregatus* Sw., *Nov. Gen. Pl.* 147 (1788). TYPE: "Jamaica, O.P. Swartz." (S! LECTOTYPE).

*Thallus* fruticose, composed of pseudopodetia, variable in size, from as low as a few mm in exposed positions and to 80 mm tall in sheltered habitats, hollow, horny, rigid and fragile when dry, dichotomously or irregularly branched, flexuose, prostrate or ascending; colour varied, cream, straw, brown to almost black; walls perforate; perforations round to elliptic; cortex smooth, dull to nitid. *Fertile pseudopodetia* only slightly taller than the sterile pseudopodetia, more intricately branched and perforate towards the tips. *Apothecia* terminal on short branchlets, sessile, to 0.8 mm diam.; disk slightly concave to flat, matt, brownish-black to black; hymenium to 50  $\mu$ m tall, brown; paraphyses simple, 1.5  $\mu$ m diam., apical cell expanded to 4  $\mu$ m; asci 48 x 11  $\mu$ m; ascospores 12-15 x 4-5  $\mu$ m, simple, hyaline. *Pycnidia* on tips of sterile pseudopodetia, ellipsoidal, black; microconidia 5 x 1  $\mu$ m, curved.

REACTIONS: K-, C-, KC-, P-.

CHEMISTRY: Barbatic acid, fumarprotocetraric acid, ursolic acid, protocetraric acid, and a trace of 4-O-demethylbarbatic acid.



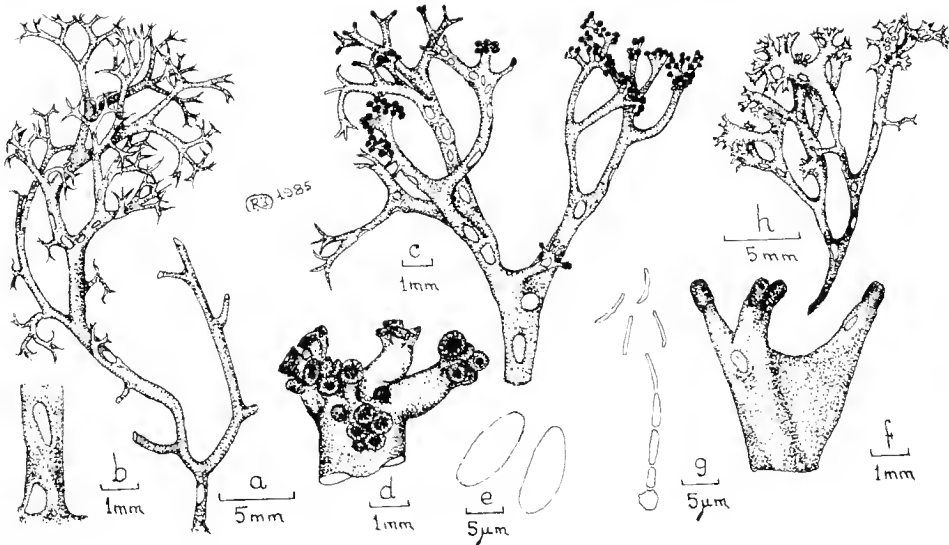


Fig. 1. *Cladia aggregata*. a — single pseudopodium separated from a clump; b — enlargement of portion of pseudopodium showing fenestrations; c — upper part of fertile pseudopodium showing apothecia and pycnidia; d — enlargement of apothecia; e — ascospores; f — enlargement of pycnidia; g — microconidia-bearing hyphae and microconidia; h — inflated and distorted pseudopodium separated from a moss cushion. a-g, from MEL 20274; h, from MEL 1032792.

#### SELECTED SPECIMENS EXAMINED:

Handspike Point on rocky outcrop c. halfway between base of Point and bottom of escarpment, 11.iii.1964, R. Filson 6321 & P. Atkinson (MEL 20298); lower slope of Boot Hill, 10.i.1972, R. Hnatiuk (MEL 1032813); W. slope of Mt Elder 200 ft below summit in slight col above and SW. of Upper Nuggets penguin colonies, 2.viii.1965, K. Simpson B11 (MEL 30317); on *Azorella* cushions c. half way along W. shore of Gratitude Lake, 4.ii.1964, R. Filson 5948 & J. Phillips (MEL 20293); top of scree slope above Hurd Point, 13.ii.1964; R. Filson 6125 & P. Atkinson (MEL 40203).

#### DISCUSSION:

*Cladia aggregata* grows amongst mosses and grasses, sometimes deep in the cushions of *Azorella selago* with only the tips of the ultimate branchlets protruding above the surface. It may be confused with *Sphaerophorus tener* (Laurer) Zahlbr., which occupies the same habitat. *C. aggregata* can be distinguished by the darker colour and hollow thallus with round to elliptical perforations through the cortex into the central canal.

Only one fertile specimen from the study area has been seen. It was growing in a sheltered position between rocks on the hillside on the south-eastern side of Lake Prion (MEL 20274).

#### CLADONIA

*Cladonia cervicornis* ssp. *verticillata* (Hoffm.) Ahti, Lichenologist 12: 126 (1980). — *Cladonia pyxidata* \* *C. verticillata* Hoffm., Deutschl. Fl. 2: 122 (1796). — *Cladonia verticillata* (Hoffm.) Schaerer, Lich. Helvet. Spic. 31 (1823). TYPE: not known (Ahti 1980: 126).

*Cladonia mawsoni* Dodge, B.A.N.Z. Antarctic Res. Exped. 1929-31, Rep. Ser., B. Zool.-Bot. 7: 128 (1948). TYPE: "Macquarie Island, north end, Sta. 81. B.A.N.Z.A.R.E. B543-4." (Herb. Dodge, n.v.).

*Thallus* fruticose, growing amongst mosses or in sheltered positions on hillsides; primary squamules mostly persistent but sometimes disappearing, varying in size

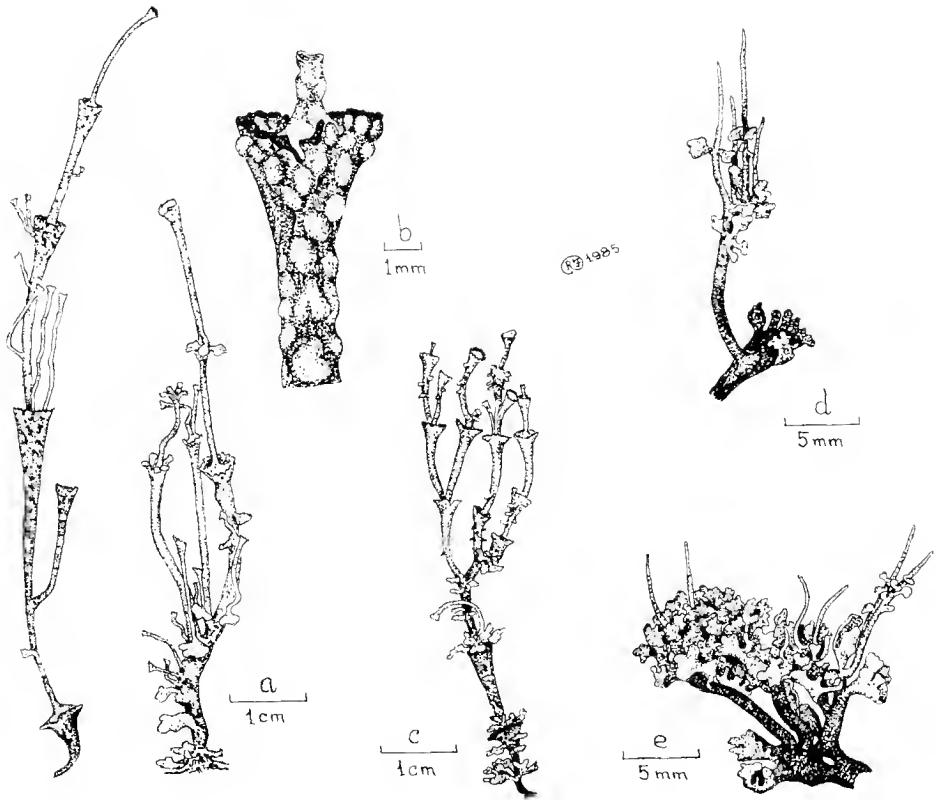


Fig. 2. *Cladonia cervicornis* ssp. *verticillata*. a — two old weathered podetia showing habit; b — enlargement of scyphus showing the central proliferation; c — podetia showing habit of a much-branched and proliferating thallus; d-e — small subulate thalli. All portions below the squamules were buried in a moss cushion. a-b, from MEL 7712; c, from MEL 20279; d-e, from MEL 30358.

and number, to 5.0(–8.0) mm long and 4.0 mm wide, crenulate to irregularly-lobed, sometimes deeply incised, flat or convolute; upper side corticate, olive-green to brownish-green; lower side ecorticate, white, sometimes blackening towards the base. *Podetia* to 80 mm tall with regular, broad, closed cups which proliferate from the centre, sometimes with several tiers of cups; margin of cups entire or with apothecia or pycnidia; cortex continuous or areolate, dull, dark olive-green to brown, sometimes blackening between the areolae, esorediate, with or without squamules. *Apothecia* brown, sessile on the margins of the cups. *Pycnidia* not seen.

REACTIONS: K–, C–, KC–, P+ red.

CHEMISTRY: Fumarprotocetraric acid.

SELECTED SPECIMENS EXAMINED:

Camp Hill, 19.iii.1966, *K. Simpson* E96, (MEL 30358); vicinity of the Nuggets Valley, 7.ix.1948, *N. Laird* (MEL 7712); 1 mile N. of Bauer Bay, 28.i.1964, *R. Filson* 5834 (MEL 20279); N. side of Aurora Point, 11.ii.1964, *R. Filson* 6296 & *K. Simpson* (MEL 20283).

DISCUSSION:

This subspecies is very distinctive, as it is the only taxon in the study area which proliferates from the centre of the cups. *Cladonia cervicornis* ssp. *verticillata*

is readily determined by the continuous cortex and the even margin of the closed cups. There are two distinct forms on the island, one with few podetial squamules, the other with densely squamulose podetia. The densely squamulose form may be referable to *Cladonia cervicornis* f. *phyllocephala* (Flotow) Oliver.

***Cladonia chlorophaea*** (Flörke ex Somm.) Sprengel, in Linn., Syst. Veg. ed. 16, 4: 273 (1827). — *Cenomyce chlorophaea* Flörke ex Somm., Suppl. Fl. Lapon. 130 (1826). TYPE: not known (Ahti 1966: 382).

*Cladonia floriformis* Dodge, B.A.N.Z. Antarctic Res. Exped. 1929-31, Rep. Ser., B. Zool.-Bot. 7: 134 (1948). TYPE: "Macquarie Island, north end, Sta. 81. B.A.N.Z.A.R.E. 540-9." (Herb. Dodge, n.v.)

*Thallus* fruticose, growing over moss cushions, peat or litter; primary squamules persistent, to 5 mm long, deeply incised to lacerate, with crenate margins; upper side smooth, convex, brownish-green to pale greenish-olive, esorediate; lower side white, sometimes darkening towards the base. *Podetia* arising from the primary squamules, cup-forming, but occasionally subulate, the cups flaring gradually, regular to irregular, proliferating from the margins, the base of the podetium corticate; cortex areolate; upper parts of the podetium becoming decorticate and granular-sorediate. *Apothecia* brown, sessile on small denticulate proliferations on the margins of the cups, or sessile on the margins of the cups, to 0.25(-0.3) mm diam.; margin slightly raised. *Pycnidia* brown, on denticulate proliferations on the margins of the cups or terminal on subulate podetia, sessile to stipitate.

REACTIONS: K -, C -, KC -, P + red.

CHEMISTRY: Fumarprotocetraric acid.

SPECIMENS EXAMINED:

Vicinity of Nuggets Creek, 20.viii.1948, *N. Laird* (MEL 7738); Langdon Point on N. side of ridge between Hill 330 and the plateau, 14.ii.1964, *R. Filson* 6301 & *K. Simpson* (MEL 20298); Brothers South Ridge, W. of Brothers Summit, 14.viii.1965, *K. Simpson* A85 (MEL 30338); c. 1.5 miles S. of Green Gorge, 21.i.1964, *R. Filson* 5753 & *N. Barrett* (MEL 20252); Caroline Cove, N. of Caroline Creek, 20.i.1966, *K. Simpson* E69 (MEL 30351).

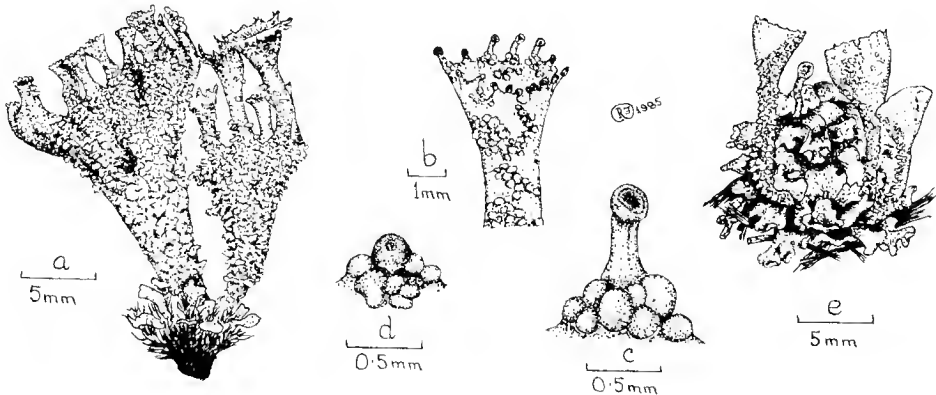


Fig. 3. *Cladonia chlorophaea*. a — two squamulose podetia showing marginal proliferations; b — enlargement of scyphus showing pycnidia and marginal teeth with apothecia; c — enlargement of marginal tooth with apothecia; d — enlargement of pycnidia on the margin of scyphus; e — habit showing three podetia arising from primary squamules growing over litter. a-d, from MEL 20252; e, from MEL 7738.

## DISCUSSION:

*Cladonia chlorophaea* is a widely distributed lichen species with a very variable chemistry. This has resulted in several taxa being segregated by virtue of chemistry alone. The populations on Macquarie Island, however, are all placed in *C. chlorophaea* sens. strict., as they contain only fumarprotocetraric acid. This species may be confused with *C. pyxidata*, but it is distinguished by the sorediate upper part of the podetium in contrast to the squamulose upper part in *C. pyxidata*. It is also similar to *C. pleurota*, but it differs in having a grey-green colour rather than the yellow-green (usnic and isousnic acids) colour of *C. pleurota*. The type material of *C. floriformis* has not been examined. However, the material held at MEL, determined as *C. floriformis* by Dodge and cited in Dodge & Rudolph (1955) is referable to *C. chlorophaea*.

***Cladonia coniocraea*** auct. sensu Ahti 1980, p. 130, non Flörke, Deutsche Lich. 7: 14 (1821).

[*Cladonia sarmentosa* (Taylor) Dodge, sensu Dodge 1948, p.129, non *Cenomyce sarmentosa* Taylor.]

*Thallus* fruticose, growing over mosses, decaying grasses, litter and peat; primary squamules persistent, large, almost as broad as long, to 7.0 mm diam.; margins flexuose, smooth when young, becoming lobed and incised with age; upper side smooth, pale grey-green to creamy-brown; lower side white, granular-sorediate. *Podetia* arising from the upper side of the primary squamules, very variable, subulate or with small cups, to 25 mm tall and to 2.0(-4.0) mm thick, sometimes branched and often divided near the apex, corticate only at the very base of the podetium, subcontinuous and areolate, sometimes squamulose; upper parts decorticate and sorediate; soredia farinose. *Apothecia* brown, on the tips of the podetia. *Pycnidia* brown, on the tips of the podetia.

REACTIONS: K- or K+ faint brown, C-, KC-, P+ red.

CHEMISTRY: Fumarprotocetraric acid.

## SELECTED SPECIMENS EXAMINED:

Vicinity of Nuggets Creek, 20.viii.1948, *N. R. Laird* 1c (MEL 7732); c. 1 mile N. Bauer Bay near Boiler Rocks, 28.i.1964, *R. Filson* 5815 (MEL 1024215); N. side of Aurora Point, 11.ii.1964, *R. Filson* 6299 & *K. Simpson* (MEL 20255); N. Lusitania Bay, 200 ft., 29.xii.1971, *R. Hnatiuk* (MEL 1032800); Bank of creek flowing into E. side of Caroline Cove, 11.x.1965, *K. Simpson* A60 (MEL 30336).

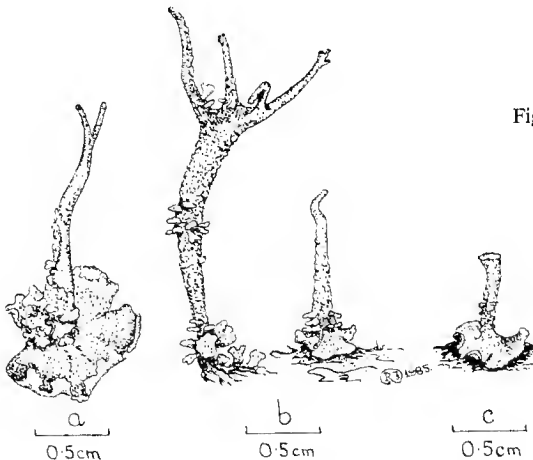


Fig. 4. *Cladonia coniocraea*. a — Podetium with divided tip arising from a large primary squamule; b — two podetia showing simple and branched forms; c — podetium with small cup. a, from MEL 20255; c, from MEL 7732.

## DISCUSSION:

Ahti (1980) discusses the nomenclature of the *C. coniocraea*-*C. ochrochlora* group. He points out that whilst he considers that there are two species involved (Ahti 1977), the types of the two names are conspecific. The problem needs further investigation and in the interim he recommends using the name *C. coniocraea* auct. for the species which has subulate podetia or very small cups and is only slightly corticate at the base.

On Macquarie Island this taxon may be confused with *C. cornuta* and *C. corniculata*. It can be separated from *C. cornuta* by being partly corticate at the base of the podetia, in having fewer podetial squamules and in that the podetia are often divided towards the apex. *C. corniculata* differs from *C. coniocraea* by being completely ecorticate, by having a very thin medulla which exposes the inner cartilagenous sheath and by the lack of large persistent basal squamules.

***Cladonia corniculata*** Ahti & Kashwadani in Inoue, Studies on Cryptogams in Southern Chile 136 (1984). TYPE: "Chile. Prov. Llanquihue: Around top of Cerro Pavilo, ca 16 km west of Tegulalda, alt. 800-870 m, in wet *Fitzroya* forest, in 1981 H. Kashwadani 17882." (TNS n.v. HOLOTYPE; H! ISOTYPE).

*Thallus* fruticose, growing out through the tops of moss cushions; primary squamules mostly disappearing though sometimes persistent, to 2.5 mm long and 2.0 mm wide, lobed, flexuose; upper side smooth, cream to pale yellow-green; lower side white to very pale grey, grading to creamy-yellow towards the base. *Podetia* to 40 mm tall, mostly branched towards the apices; tips subulate; surface entirely sorediate; soredia disintegrating to expose the thin white medulla or the internal cartilagenous layer which is lightly ridged or grooved. *Apothecia* not seen. *Pycnidia* brown, globose, in cylindrical projections terminal on the branches; microconidia not seen.

REACTIONS: K -, C -, KC -, P+ red.

CHEMISTRY: Fumarprotocetraric acid.

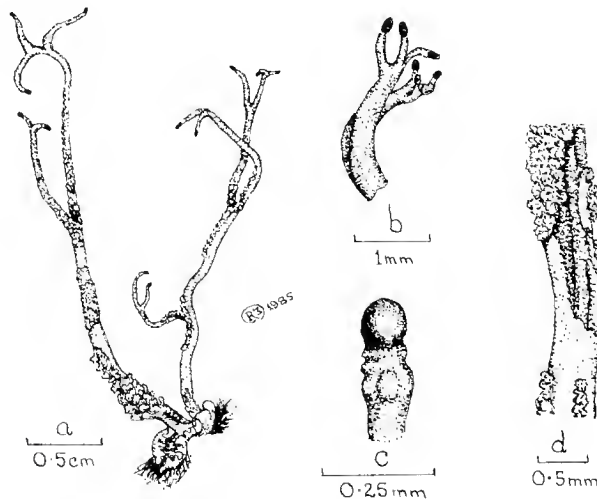


Fig. 5. *Cladonia corniculata*. a — podetia separated out from a clump showing habit; b — enlargement of ultimate branchlet showing pycnidia; c — enlargement of pycnidium; d — enlargement of portion of podetium showing soredia, medulla and exposed cartilagenous tissue. All from MEL 20267.

## SPECIMEN EXAMINED:

Lusitania Creek, 10.ii.1964, R. Filson 5993 & P. Atkinson (MEL 20276).

## DISCUSSION:

*Cladonia corniculata* was described initially from Chile. In their discussion, the authors of the name say that the species is similar to *C. subulata* (L.) Wigg, but is separated from that species in the complete absence of scyphi, and that the soredia are strongly caducous, whereas they are rather persistent in *C. subulata*.

Unbranched podetia may appear similar to those of *C. cornuta* but they can be distinguished by being completely ecorticate. *C. corniculata* may appear similar to *C. scabriuscula* but that species is squamulose and only sparsely sorediate.

**Cladonia cornuta** (L.) Hoffm., Plant. Lich. 1: plate 25 (1791). — *Lichen cornutus* L., Sp. Pl. 2: 1152 (1753). TYPE: "Habitat in Europae ericetis." (OXF n.v., not typified Ahti 1980a: 219).

*Thallus* growing amongst mosses; primary squamules persistent or disappearing, to 6.0 mm long and 2.5 mm wide, crenulate to irregularly-lobed; upper side corticate, green to pale olive-green; lower side white, ecorticate, esorediate. *Podetia* to 60 mm tall and 3.0 mm wide, cupless, cylindrical, subulate; lower parts of the podetium areolate-corticate, dull white to very pale brownish-yellow, often densely covered with squamules similar to the primary squamules; upper part of the podetium ecorticate, becoming sorediate, the ultimate tip covered with farinose soredia. *Apothecia* and *pycnidia* not seen.

REACTIONS: K —, C —, KC —, P + red.

CHEMISTRY: Fumarprotocetraric acid.

## SPECIMEN EXAMINED:

Amongst mosses, c. one and a half miles S. of Green Gorge, 22.i.1964, R. Filson 5753a & N. Barrett (MEL 20275).

## DISCUSSION:

This species is very widespread, being reported from Australia, New Zealand,

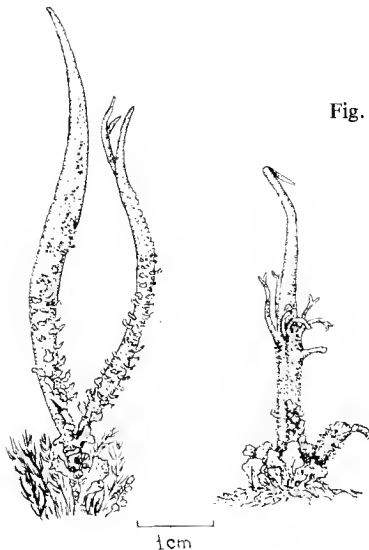


Fig. 6. *Cladonia cornuta*. Two podetia growing amongst mosses. From MEL 20275.

South America, Africa, Africa and the Kerguelen Islands as well as many localities in the Northern Hemisphere, but there is only one collection from Macquarie Island. At this site it was moderately abundant, growing on the hillside amongst mosses and grasses in an easterly aspect in the headwaters of Sawyers Creek.

*Cladonia ecmocyna* Leighton, Ann. Mag. Nat. Hist. ser. 3, 18: 406 (1866). TYPE: "USSR, Murmansk Region, Kola Peninsula, Svyatoy nos, N. I. Fellman, Lich. arct. 28, 1863." (BM! LECTOTYPE).

*Thallus* fruticose, mostly embedded in moss cushions or sometimes clumped in sheltered positions, the lower parts dying away, upper parts continuing to grow; primary squamules persistent or disappearing, to 5.0 mm long and 3.0 mm wide, crenulate to irregularly-lobed, flat to concave, grey-green to pale brown above, white, ecorticate below. *Podetia* simple or branched, to 60 mm tall and to 1.0 mm diam., with or without scyphi, most often subulate though often swollen and misshapen; scyphi narrow, with dentate margins, which sometimes grow into secondary scyphi or subulate secondary podetia; scyphi sometimes proliferating from one side to form a dorsiventral oar-shaped body; cortex areolate, dull, slightly pruinose, pale grey to greyish-brown, esorediate, often squamulose in the lower parts, infrequently with scattered squamules to the tip; areolae somewhat pulvinate. *Apothecia* not seen. *Pycnidia* common on tips of branches or margins of the scyphi, dark brown to black, constricted at the base; microconidia not seen.

REACTIONS: K+ yellow, C-, KC-, P+ red.

CHEMISTRY: Atranorin and fumarprotocetraric acid.

SELECTED SPECIMENS EXAMINED:

Gadgets Gully, 18.iii.1964, *R. Filson 6362* & *R. Peterson* (MEL 20410); on tundra N. of Mt Hamilton, alt. 800 ft. 29.xii.1971, *R. Hnatiuk 11556* (MEL 1027188); abundant on the summit of Mt Hamilton, 13.ii.1964, *R. Filson 6102* & *P. Atkinson* (MEL 20302).

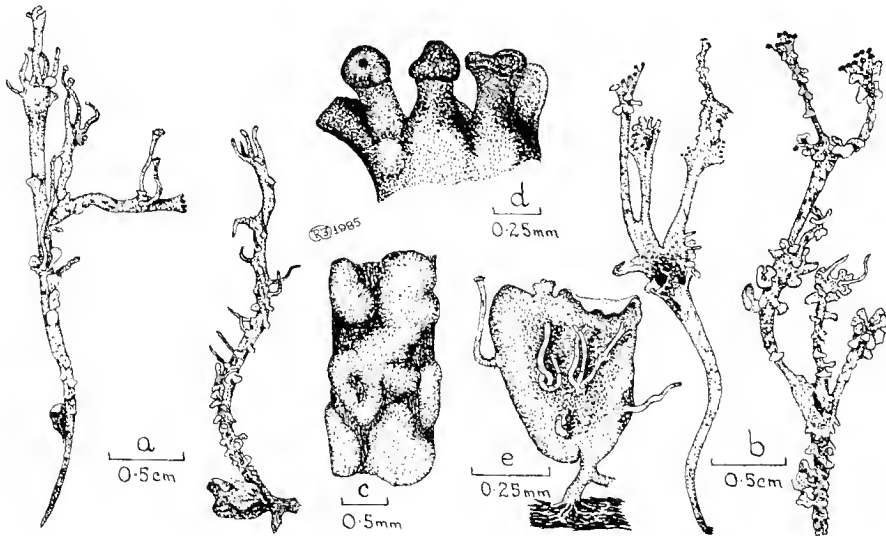


Fig. 7. *Cladonia ecmocyna*. a — two distorted podetia showing habit; b — two podetia showing distorted scyphi and squamulose thallus; c — enlargement of portion of podetium showing pulvinate cortex; d — enlargement of margin of scyphus showing pycnidia; e — primary squamule showing primordia of podetia. a-c, from MEL 20302; b, d-e, from MEL 20410.

## DISCUSSION:

*Cladonia ecmocyna* forms part of the "gracilis group" and is often included as a subspecies of *C. gracilis*. However it differs from that species by the dull, often pruinose cortex and the presence of atranorin (K+ yellow reaction). It is common on Macquarie Island where it favours moist areas.

***Cladonia furcata*** (Huds.) Schrad., Spic. fl. Germ. 107 (1794). — *Lichen furcata* Huds. Fl. angl. 458 (1762). TYPE: "n.69, in ericetis et locis montosis." (?BM n.v.).

*Thallus* fruticose, ascending or subprostrate; primary squamules disappearing. *Podetia* cupless, terete to subterete, to 75(-90) mm tall and 0.1 mm diam., widening towards the joints, simple or branched; branching dichotomous or sometimes in whorls towards the tips and then sometimes almost forming cups; axils commonly widened and mostly open; ultimate branchlets subulate, occasionally in severe habitats becoming swollen and misshapen; cortex continuous, smooth in the lower parts, grading to verruculose to smoothly areolate above, dull to shining, esorediate, with or without podetial squamules, pale creamish-olive to warm cinnamon to dark brown where exposed but always pale where protected; squamules to 1 mm long, irregularly crenate, corticate and concolourous with the thallus above, ecorticate below. *Apothecia* not seen. *Pycnidia* at the tips of the ultimate branchlets, cylindrical to almost globose, 0.25 mm diam., dark brown to black, sometimes pruinose; microconidia 6-8 x 1.0  $\mu$ m, curved.

REACTIONS: K-, C-, KC-, P+ red.

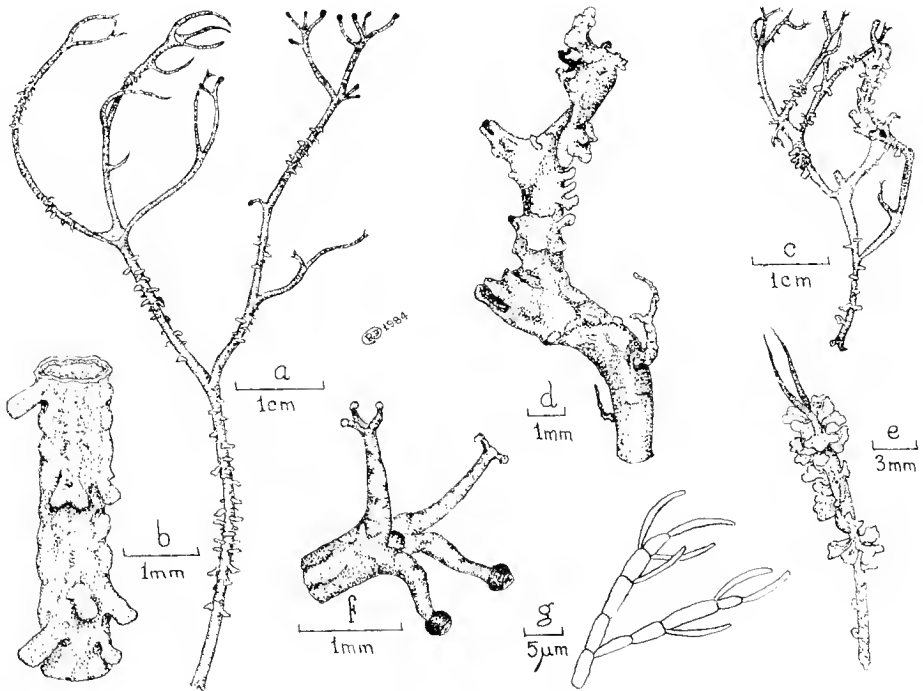


Fig. 8. *Cladonia furcata*. a — habit; b — enlargement of part of podetium; c — branched podetium with misshapen branch; d — enlargement of misshapen branch; e — small squamulose podetium; f — enlargement of tip of podetium showing pycnidia; g — microconidia-bearing hyphae. a-b, from MEL 1033025, c-d, f, g, from MEL 20280; e, from 30350.



CHEMISTRY: Fumarprotocetraric acid.

SELECTED SPECIMENS EXAMINED:

Handspike Point, 17.i.1972, *R. Hnatiuk* (MEL 1033025); growing on featherbed c. 1 mile N. of Bauer Bay, 28.i.1964, *R. Filson 5811* (MEL 20280); N. Lusitania Bay, 900ft, 29.xii.1971, *R. Hnatiuk* (MEL 1032795); Display Hill, 20.i.1966, *K. Simpson E86* (MEL 30350); Mt Haswell, 12.ii.1964, *R. Filson 6017* & *P. Atkinson* (MEL 20263).

DISCUSSION:

This species and the following taxon, *C. gracilis* ssp. *tenerrima*, are very similar. They grow in the same habitat, deep in moss cushions with only the upper parts protruding. These exposed parts become twisted and contorted by the harsh weather conditions. There are small specimens in herbaria that are impossible to separate, but if sufficient material is available they can be distinguished by the open cups and axils of *C. furcata* in contrast to the closed cups and axils of *C. gracilis* ssp. *tenerrima*.

***Cladonia gracilis* ssp. *tenerrima*** Ahti, Ann. Bot. Fennici 17: 208 (1980). TYPE: Australia. Victoria. Cathedral Range, North Jawbone, 5 km NW. of Buxton, on flat area amongst grasses just west of the summit, 1979, *Rex Filson 16627* (MEL 1023710! HOLOTYPE: BM!, H! ISOTYPES).

*Thallus* fruticose, growing amongst mosses, hepatics and other lichens; primary thallus persistent or disappearing. *Podetia* very variable, to 1.0 mm diam. and to 50 mm tall, with or without scyphi, simple or branched; inner membrane of the cups and axils closed, cups shallow and flaring rapidly, to 2.5 mm diam., prolif-

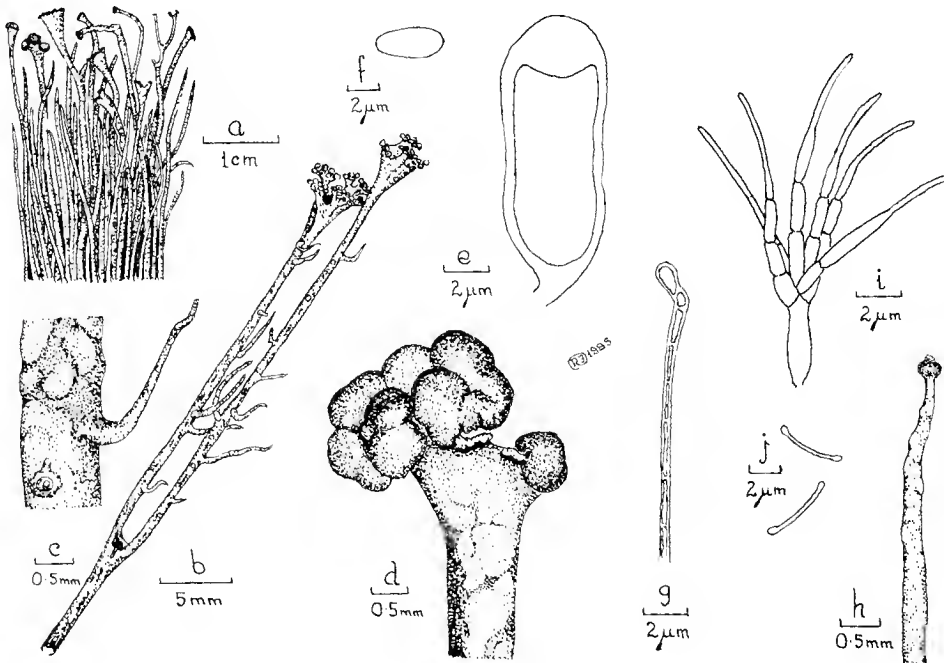


Fig. 9. *Cladonia gracilis* ssp. *tenerrima*. a — habit; b — branched podetium showing subulate side branches and toothed scyphi; c — enlargement of part of podetium; d — apothecia; e — ascus; f — ascospore; g — paraphysis; h — pycnidium at tip of subulate podetium; i — microconidia-bearing hyphae; j — microconidia. a, d-j, from MEL 20262; b-c, from MEL 1047741.

erating from the margins; proliferations bearing apothecia or subulate; cortex smooth to mildly rugulose, continuous, varying in colour from pale greenish-olive to pale cinnamon-brown to dark brown. *Apothecia* on the margins of the cups, irregular when young, almost hemispheric when mature, to 1.5 mm diam., pale brown to dark reddish-brown; margin disappearing; hypothecium hyaline, I+ blue, fading; hymenium up to 30  $\mu\text{m}$  tall including the pale brown epihymenium; paraphyses simple or branched, septate, the apical cell only slightly expanded; asci I+ blue, 17-24 x 7-12  $\mu\text{m}$ ; ascospores simple, ellipsoid, hyaline, 5 x 2  $\mu\text{m}$ . *Pycnidia* on the margins of the cups and terminal on sterile podetia or on short lateral branchlets; microconidia 7-10 x 0.5  $\mu\text{m}$ , curved, slightly thickened at each end.

REACTIONS: K- , C- , KC- , P+ red.

CHEMISTRY: Fumarprotocetraric acid.

SELECTED SPECIMENS EXAMINED:

Handspike Point, 17.i.1972, *R. Hnatiuk* (MEL 1033026); one mile N. of Bauer Bay, 28.i.1964, *R. Filson* 5833 (MEL 20262); growing amongst mosses on earth bank along the southern shore of Lake Flynn, 3.iii.1964, *R. Filson* 5899 & *J. Phillips* (MEL 1047741).

DISCUSSION:

This subspecies grows deep in moss cushions, the lower parts of the podetia rotting away, the upper parts slightly protruding above the cushion. Cupless forms may be confused with *C. furcata* as they are very similar in habit; however they can be separated from the latter by the closed axils of the branches.

***Cladonia pleurota*** (Flörke) Schaerer, Enum. Lich. Europ. 186 (1850). — *Capitularia pleurota* Flörke, Ges. Naturf. Freunde Berlin Mag. 2: 218 (1808). — *Cladonia coccifera* var. *pleurota* (Flörke) Schaerer, Lich. helv. spic. 25 (1823). TYPE: "An der Erde, auch wohl auf altem morschen Holze in den Heidegegenden und Waldungen; bey Berlin, bey Jena, im Salzburgerischen, z. B. auf dem Rathhausberge in Gastein, auf der Grasbergalpe im Zillerthale, und wahrscheinlich in allen Gegenden Deutschlands." (n.v.).

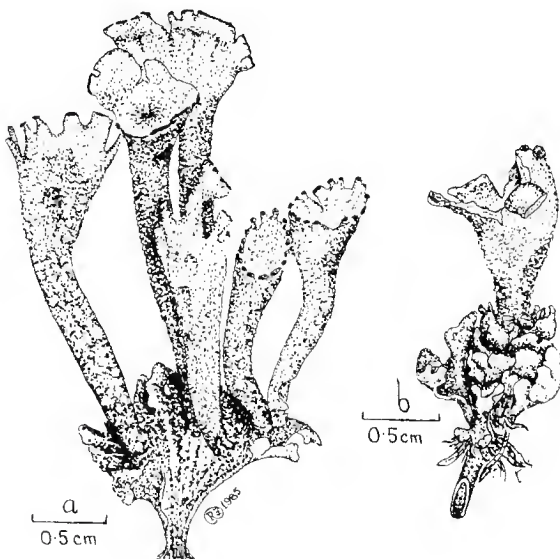


Fig. 10. *Cladonia pleurota*. a — three old and three new podetia arising from a large old primary squamule; b — very old lacerate podetium with numerous persistent primary squamules at the base. All from MEL 20278.

*Thallus* fruticose, growing amongst mosses, grasses and other lichens; primary squamules persistent or disappearing, irregularly incised; upper side smooth, convex, yellowish-green; lower side white, sometimes with scattered granular soredia. *Podetia* arising from the primary squamules, cup-forming; cups flaring broadly and irregularly, sometimes gradually from the base, sometimes goblet-shaped; margins of the cups regular, entire or incised to deeply lacerate in old specimens; inside of the cups granular-sorediate; base of the podetium corticate, becoming ecorticate and sorediate. *Apothecia* scarlet, on the margins of the cups, uncommon. *Pycnidia* not seen.

REACTIONS: K -, C -, KC + yellow, P -.

CHEMISTRY: Usnic acid, isousnic acid, zeorin.

SPECIMENS EXAMINED:

Handspike Point on rocky outcrop c. halfway between base of point and bottom of escarpment, 11.iii.1964, R. Filson 6322 & P. Atkinson (MEL 20407); c. 1 mile N. of Bauer Bay, 28.i.1964, R. Filson 5812 (MEL 20278).

DISCUSSION:

*Cladonia pleurota* is the sorediate morph of *C. coccifera* (L.) Willd. Older specimens may be confused with *C. chlorophaea* but *C. pleurota* differs from that species in being more finely sorediate and in containing usnic acid which gives it a more yellowish-green appearance. *C. chlorophaea* also differs in having brown apothecia and pycnidia.

*Cladonia pyxidata* (L.) Hoffm. Deut. Fl. 2: 121 (1796). — *Lichen pyxidatus* L. Sp. Pl. 2: 1151 (1753). TYPE: "Habitat in Europae sylvis." not known (Ahti 1966: 387).

*Thallus* fruticose, growing over litter, mosses or earth; primary squamules persistent, to 6 mm long and 4 mm wide, irregularly lobed or crenate; upper side smooth, glaucous-green to olive-green, older specimens becoming brownish-olive; lower side white, esorediate. *Podetia* arising from the primary squamules, to 22 mm tall, cup-forming; cups deep, goblet-shaped, squamulose within; margins of the cups regular, entire, becoming incised to lacerate with age; base of the podetium corticate, sometimes squamulose, the upper parts decorticate, squamulose to granular-sorediate. *Apothecia* dark brown to reddish-brown, sessile on the margins of

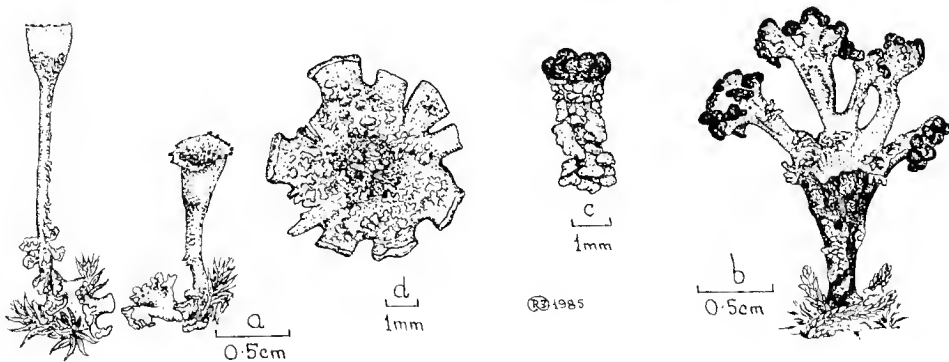


Fig. 11. *Cladonia pyxidata*. a — habit of tall, smooth-cupped podetia; b — an old fertile podetium; c — enlargement of an apothecium on a marginal proliferation; d — looking into a squamulose cup with the marginal apothecia removed. a, from MEL 20282; b-d, from MEL 20408.

the cups, on small proliferations or on secondary cups. *Pycnidia* sessile on the margins of the cups, on the surface of the podetia or on the squamules in the cups.

REACTIONS: K-, C-, KC-, P+ red.

CHEMISTRY: Fumarprotocetraric acid.

SELECTED SPECIMENS EXAMINED:

Gadgets Gully, 18.iii.1964, *R. Filson* & *R. Peterson* (MEL 20408); Nuggets Creek, 20.viii.1948, *N. Laird* (MEL 7717); outcrops in featherbed half mile N. of Aurora Point, 20.ii.1964, *R. Filson* 6195 & *R. Peterson* (MEL 20282); Stoney Creek, 9.i.1972, *R. Hnatiuk* (MEL 1032804); N. Lusitania Bay catchment, 29.xii.1971, *R. Hnatiuk* (MEL 1027245).

DISCUSSION:

*C. pyxidata* is a cosmopolitan species. It occurs in most Herbfield and Bog alliances on Macquarie Island. It is similar to *C. chlorophaea* from which it can be distinguished by the deeper cups, the larger primary squamules and the squamulose podetia as opposed to sorediate podetia of *C. chlorophaea*.

***Cladonia scabriuscula*** (Delise) Nyl., *C. r.* hebd. Séanc. Acad. Sci., Paris 83: 88 (1876).

This species was represented amongst specimens from Macquarie Island sent to the second author by the Australian National Antarctic Research Expeditions for his determination. These specimens were without precise provenance and have not been available for re-examination for the present study.

***Cladonia subantarctica*** Filson & Archer, sp. nov.

*Thallus* primarius squamulis evanescentibus. *Podetia* gracilia, usque ad 70 mm elata, simplicia vel ramosa, rami dichotomi vel trichotomi, escyphi, cortice continuo. *Apothecia* ad apices podetiorum. Similis *Cladoniae crispatae* var. *cetariiiformi* (Delise) Vainio, sed barbatic acidum continens et base podetii moribunda anthracina.

TYPE: Macquarie Island, north east side of Major Lake, 19.ii.1964, *Rex Filson* 6158 & *Roger Peterson* (MEL 20294! HOLOTYPE).

*Thallus* fruticose, growing in dense clumps amongst grasses; primary squamules disappearing. *Podetia* simple or branched; branching dichotomous or trichotomous, slender, to 70 mm tall and to 1.0 mm diam.; ultimate tips smooth or becoming verrucose and misshapen with increasing exposure; lower parts dying away, the dead basal parts coal-black; podetia cupless, or having narrow cups formed by proliferations around a perforate axil; cortex continuous, smooth, dull to slightly shining, pale brownish-white when sheltered to dark brown when exposed, esorediate, rarely with one or two podetial squamules. *Apothecia* on apical proliferations (mature apothecia not seen). *Pycnidia* common, on apical proliferations or short branches, globose, black, slightly pointed apically; microconidia 6-8 x 1.0  $\mu$ m, straight or curved.

REACTIONS: K-, C-, KC-, P-.

CHEMISTRY: Barbatic acid.

ADDITIONAL SPECIMENS EXAMINED:

NE. side of Major Lake, *R. Filson* 6151 & *R. Peterson*, 19.ii.1964 (MEL 20261); SE. side of Major Lake, 19.ii.1964, *R. Filson* 6172 & *R. Peterson* (MEL 20267).

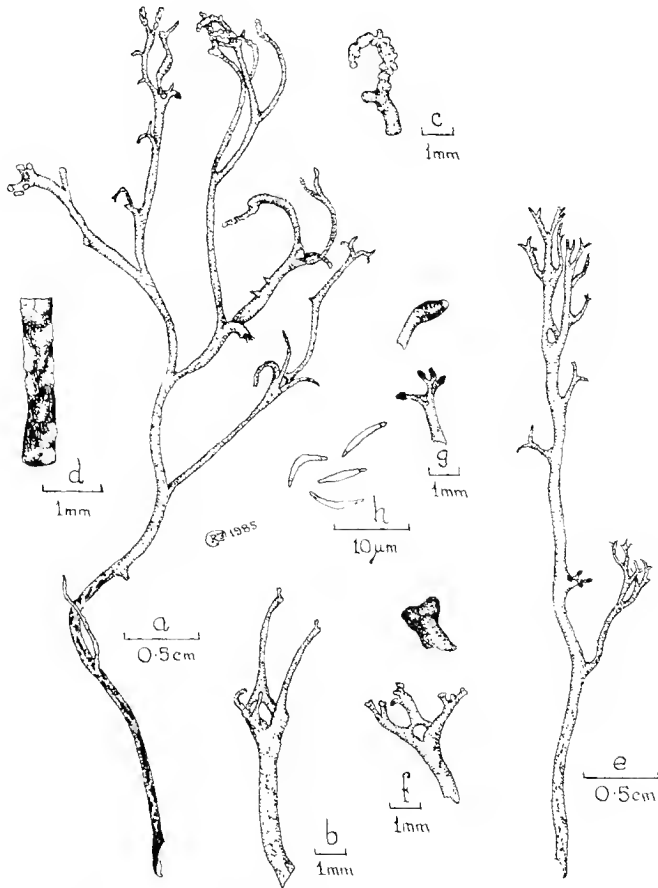


Fig. 12. *Cladonia subantarctica*. a — single podetium separated out from a clump, showing many branches with distorted tips caused by exposure; b — branch tip showing small cup formed by proliferations around an open axil; c — enlargement of rugulose, distorted tip of branch; d — enlargement of blackening lower portion of podetium; e — smooth podetium separated out from a clump from a sheltered habitat; f — ultimate tip showing developing apothecia, with enlargement of developing apothecium; g — ultimate tip showing pycnidia, with enlargement of pycnidium; h — microconidia. a-d, from MEL 20294; e-h, from MEL 20267.

#### DISCUSSION:

This new species forms part of the 'Cladonia crispata group'. It may be related to *C. crispata* var. *cetrariiformis* (Delise) Vainio, but it differs in the presence of barbatic acid and in the basal parts becoming coal-black when dying away. It is similar to *C. barbatica* Kristinsson (ined) which also contains barbatic acid but in that species the basal parts are yellowish-grey rather than black. Another barbatic acid-containing species, *C. patagonica* Evans, could be confused with *C. subantarctica* but is distinguished by its cup-like scyphi and many podetial squamules. *C. hondoensis* Asahina also contains barbatic acid but is often completely squamulose.

***Cladonia subdigitata*** Nyl., C. r. hebd. Séanc. Acad. Sci., Paris 83: 88 (1876). TYPE: "Expedition astronomique a l'île Campbell 1874, M. Filhol." (H-NYL 37858! LECTOTYPE; MEL 1048659! ISOLECTOTYPE).

*Cladonia subdigitata* var. *albinea* Dodge, B.A.N.Z. Antarctic Res. Exped.

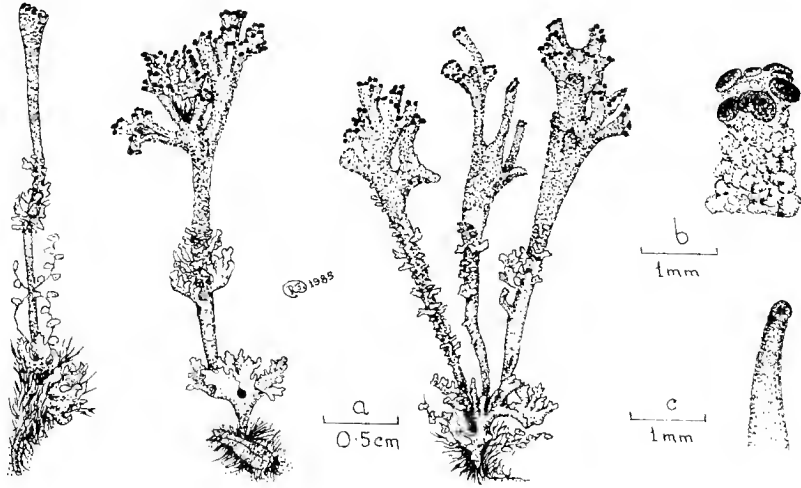


Fig. 13. *Cladonia subdigitata*. a — podetia, separated from a clump in a moss cushion, showing the habit; b — enlargement of the apothecia; c — enlargement of pycnidium on tip of subulate podetium. All from MEL 20277.

1929-31, Rep. Ser., B. Zool.-Bot. 7: 124 (1948). TYPE: "Macquarie Island, north end, Sta. 81, B.A.N.Z.A.R.E. B540-11." (Herb. Dodge, n.v.).

*Thallus* fruticose, growing thickly in depressions in moss cushions or on earth between the cushions; primary squamules mostly persistent, though sometimes dying away, to 7.0 mm long and 2.5 mm wide, crenate, incised to deeply lacerate and divided; upper side smooth, creamy-brown to creamy-yellow; lower side white, esorediate or slightly granular-soresdiate. *Podetia* arising from the upper surface of the primary squamules, up to 30 mm tall, with cups; cups narrow to broadly flaring, imperforate to perforate, with entire, regular to undulate margins; cups proliferating from the margins, the proliferations simple or scyphous; cortex continuous in the lower parts, grading to verrucose-squamulose and coarsely soresdiate above, yellowish-white in the upper parts, grading to ochre-yellow to brownish-yellow below. *Apothecia* scarlet, around the margins of the cups. *Pycnidia* brown to brownish-red, on the margins of the cups and on the upper parts of the podetia.

REACTIONS: K+ yellow, C-, KC-, P+ yellow.

CHEMISTRY: Usnic and thamnolic acids.

SPECIMEN EXAMINED:

1 mile N. of Bauer Bay, 28.i.1964, R. Filson 5832 (MEL 20277).

DISCUSSION:

*Cladonia subdigitata* may be confused with *C. pleurota*, the other red-fruiting species of *Cladonia* on Macquarie Island, as both contain usnic acid and are cup-forming. *C. subdigitata* can be distinguished by the cups abruptly flaring towards the top rather than gradually tapering from the bottom, and by the presence of thamnolic acid. The specimens of *C. subdigitata* from Macquarie Island appear inseparable from those collected elsewhere and therefore do not warrant the varietal status given to them by Dodge, loc. cit.

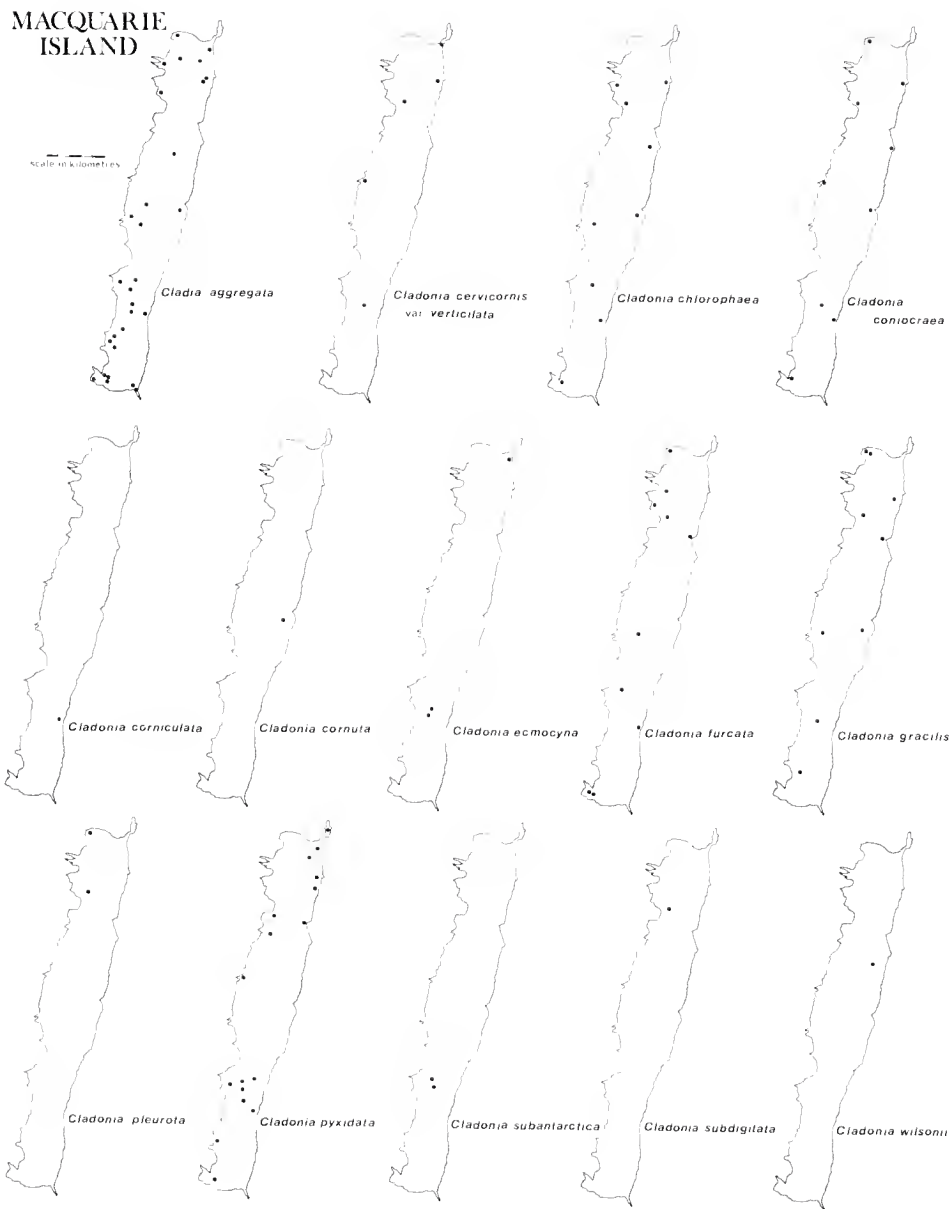


Fig. 14. Known distribution of the species of *Cladia* and *Cladonia* on Macquarie Island.

## TENTATIVE DETERMINATION

**Cladonia wilsonii** A. W. Archer, *Muelleria* 5: 274 (1984). TYPE: Australia, Australian Capital Territory, 35 km SSW. of Canberra, on soil by side of Corin Dam Rd., near Kangaroo Creek, alt. c. 1000 m, 2.v. 1982 *Archer 1315c* (MEL 1036222! HOLOTYPE; H!, NSW! ISOTYPES).

*Primary squamules* growing amongst mosses and litter, erect, long and narrow, to 7.0 x 0.6 mm, crenulate, lobed, sometimes deeply divided near the tips so as to appear two or three lobed; upper side very pale yellow-green to creamy-brown, smooth to slightly rugulose; lower side white, pale cream, greying towards the base. *Podetia* not seen.

REACTIONS: K+ pale yellow, C-, KC-, P+ yellow.

CHEMISTRY: Atranorin and stictic acid.

## SPECIMEN EXAMINED:

E. shore of Lake Prion, 21.ii.1964, *R. Filson 6211* & *R. Peterson* (MEL 20284).

## DISCUSSION:

Abundant primary squamules were found in a westerly aspect on the bank just above the shoreline of the lake. In southern Australia these squamules would be referable to *C. wilsonii* because of the chemical constituents; however positive determination is not possible without more material. Similar squamules, lacking podetia, are also found in Tasmania and New Zealand. A description of the podetia from the Australian holotype collection is as follows:

*Thallus* fruticose, growing amongst mosses and grasses; primary squamules usually persistent, sometimes disappearing, small, 1-2 mm long, 0.5-1.0 mm wide, crenulate to irregularly-lobed; upper side pale green to greyish-green; lower side white. *Podetia* arising from the primary squamules, to 25 mm tall, pale grey to whitish-grey, without cups, branching and splitting longitudinally; cortex continuous, rugulose below, discontinuous and almost areolate above, esorediate. *Apothecia* terminal on branches, single or in clusters.

## ACKNOWLEDGEMENTS

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# A REVISION OF POGONOLEPIS STEETZ (COMPOSITAE: INULEAE: GNAPHALIINAE)

by

P. S. SHORT\*

## ABSTRACT

Short, P. S. A revision of *Pogonolepis* Steetz (Compositae: Inuleae: Gnaphaliinae). *Muelleria* 6(4):237-253 (1986). — The endemic Australian genus *Pogonolepis* Steetz is revised. Two species, *P. stricta* Steetz and *P. muelleriana* (Sond.) P. Short, are recognised. They differ from each other in anther dimensions and pollen grain number. Both species exhibit variation in chromosome number. Evolution of the group and taxonomic concepts are discussed. Lectotypes are chosen for the names *P. stricta*, *Angianthus plumiger* Benth., *A. strictus* (Steetz) Benth. var. *lanigerus* Ewart & J. White and *Skirrophorus muellerianus* Sond.

## INTRODUCTION

The genus *Pogonolepis* Steetz has been reinstated following a revision of *Angianthus* Wendl. s. lat. (Short, 1983). It is readily distinguished from other segregate genera of *Angianthus* s. lat. by both the capitular bracts and the inner bracts of the general involucre which are papillate about the apex (these are the 'bearded scales' to which the generic name alludes) and by the fruit morphology.

In the above-mentioned revision I drew attention to the fact that although the genus was distinct it consisted of a number of somewhat ill-defined, closely related taxa which, as indicated by pollen-ovule ratios, exhibited different breeding systems and an array of chromosome numbers ( $n = 4, 5, 6, 7, c. 10, c. 12$ ). In the present study additional determinations of pollen-ovule ratios and chromosome numbers suggest that a number of biological species exist within the genus. However it is felt that only two morphological species can be recognised.

## MATERIALS AND METHODS

Descriptions of taxa were made from dried herbarium material and from specimens stored in 70% ethanol. Shapes were defined using the terms given by the Systematics Association Committee for Descriptive Terminology (1962).

Specimens were examined from the following herbaria: AD, BRI, CANB, CBG, K, KP (Kings Park, Western Australia), MEL, NSW, NT, PERTH, S and UWA (abbreviations after Holmgren & Keuken 1974). Much material was also obtained during field trips to Western Australia in 1977, 1979, 1982 and 1983 and during field work in South Australia and Victoria.

## POLLEN-OVULE RATIOS AND ANTHOR DIMENSIONS

Only bisexual florets, each with a single ovule, occur in *Pogonolepis* and thus to determine pollen-ovule ratios (henceforth abbreviated as P/Os) it was only necessary to ascertain the number of pollen grains per floret. P/Os were determined on a population basis, the number of pollen grains being determined for at least 15 florets, sampled from different plants.

Measurements pertaining to anther characteristics, i.e. total length, length of the microsporangium and length of the terminal anther appendage, were also determined on a population basis. The anther tails were not included in measurements.

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\* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

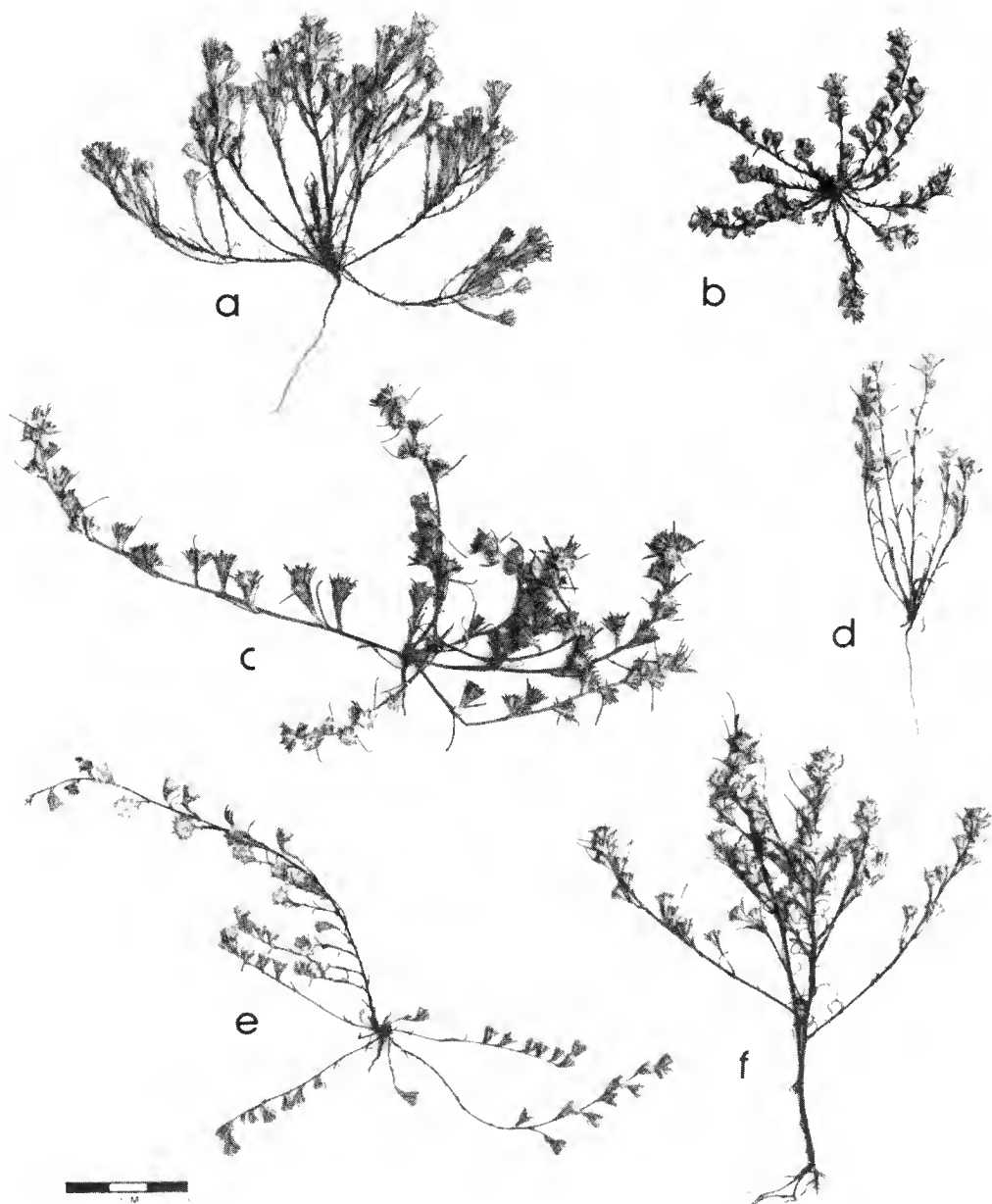


Fig. 1. Specimens of *Pogonolepis*. a — *P. muelleriana* (Chinnock 2115). b — *P. muelleriana* (Chinnock 4357). c — *P. stricta* (Short 1551). d — *P. stricta* (Short 2201). e — *P. stricta* (Short 1513). f — *P. stricta* (Short 1053).

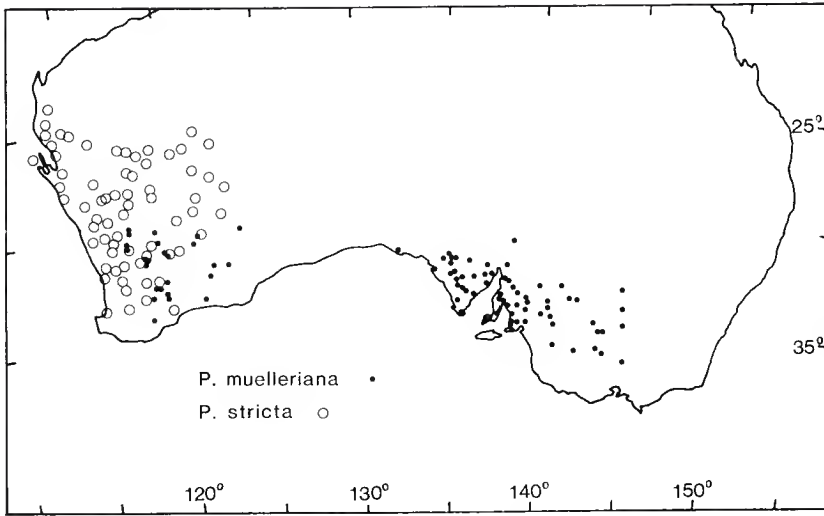


Fig. 2. Distribution of species of *Pogonolepis*.

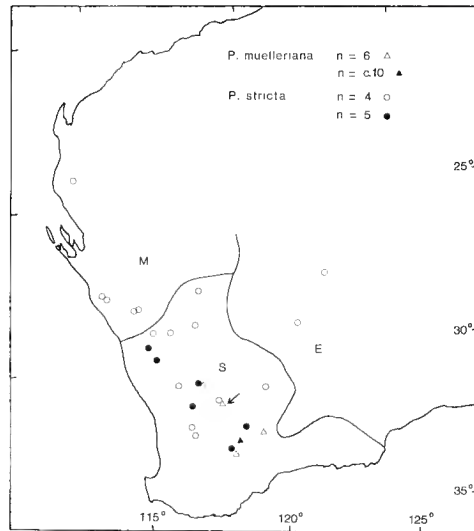


Fig. 3. Distribution of populations of *Pogonolepis* of known chromosome number. Major Drainage Divisions are marked: E = Eucla Division; M = Murchison Division; S = South West Division. The arrow indicates population *Short 648* ( $2n = 12 + 2Bs$ ).

As far as possible anther measurements and P/Os have been ascertained for populations for which chromosome numbers have been determined. In some cases this has meant that the same populations have been sampled at different times and are represented by different collector's numbers, e.g. *Short 960* & *Short 2219* represent the same population.

#### PERCENTAGE FRUIT SET

Sixteen populations, eight with high P/Os and eight with low P/Os (see Table 4) were examined for fruit set. Twenty plants were examined in each population and the percentage fruit set was determined for a single, mature, compound head from each plant. Mature fruits are swollen and therefore readily discernible; undeveloped fruits are shrivelled.

Seed viability has not been stringently tested. However the percentage germination of seeds at room temperature and under normal daylight conditions was often high (to c. 80%). Thus the visual method of determining the presence of mature, viable fruit was considered to be reliable.

#### CYTOLOGY

Cytological material was obtained from either floral buds fixed in the field or from root tips obtained from freshly germinated seed. The floral material was fixed in a solution of 4 parts chloroform, 3 parts absolute ethanol and 1 part glacial acetic acid and the chromosome counts determined from dividing pollen mother cells stained with aceto-carmin. Root tips were pretreated in a 20 ppm solution of o-isopropyl-N-phenylcarbamate (Storey & Mann 1967) for 2-3 hours. They were then fixed in a solution of 3 parts absolute ethanol and 1 part glacial acetic acid for 20 minutes, hydrolised in 1N HCl at room temperature for 10 minutes, then squashed in aceto-orcein stain.

Successful chromosome preparations have been photographed and the photographic negatives have been placed with the respective voucher collections which are housed in either AD or MEL.

### RESULTS AND DISCUSSION

#### MORPHOLOGY AND SPECIES CONCEPTS

In a previous publication (Short 1981) I suggested that perhaps six morphologically distinct taxa existed in *Pogonolepis*. It seemed that three or four taxa, all with high P/O values, and at least two taxa, each with low P/O values, would ultimately be distinguished. Apart from differences in P/O value it was felt that differences in habit (stem distinct or indistinct; major axes prostrate, decumbent, ascending or erect), leaf density (number per unit length of major axes), relative lengths of the leaves and the minor axes and vestiture and number of leaf-like bracts in the general involucre were a means by which a number of taxa could be recognised. Some of the variation exhibited within the genus is displayed in Fig. 1. As a result of this initial sorting I (Short 1981, 1983) formally made the combinations *Pogonolepis muelleriana* (Sond.) P. Short and *Pogonolepis lanigera* (Ewart & White) P. Short.

I have subsequently examined in more detail the morphological variation exhibited by *Pogonolepis* and it is now apparent that only two morphologically distinct species, i.e. *P. muelleriana* and *P. stricta*, can be recognised. Both are primarily distinguished by differences in P/O values and anther characteristics (Tables 1 & 2). The use of such features in distinguishing species has been discussed for the genus *Actinobole* Fenzl ex Endl. (Short 1985).

Macromorphological variation is such that, although there is sometimes an ecological and/or geographical basis to the variation, various combinations of characteristics tend to occur in different populations. This makes the recognition of taxa on macromorphological grounds untenable. Nonetheless some features can be a useful guide to the identification of species. Thus the majority of collections of *P. muelleriana* are not dissimilar to the specimen shown in Fig. 1a. This specimen is characterised by the apparently large number of leaf-like bracts of the general involucre and by having the leaves quite densely distributed along the major axes. However, particularly in Western Australia, there are specimens (e.g. *Chinnock 4357*, Fig. 1b) which display somewhat different macromorphological features and at times more or less resemble entities of *P. stricta*, so much so that I have not been able to find quantifiable, macromorphological differences between the species.

On the few occasions that I have found both species in the same locality they have tended to exhibit different ecological preferences (e.g. see Table 2, *Short 960* & *Short 963*) although there has always been some intermixing. Most importantly, specimens of possible hybrid origin have not been detected.



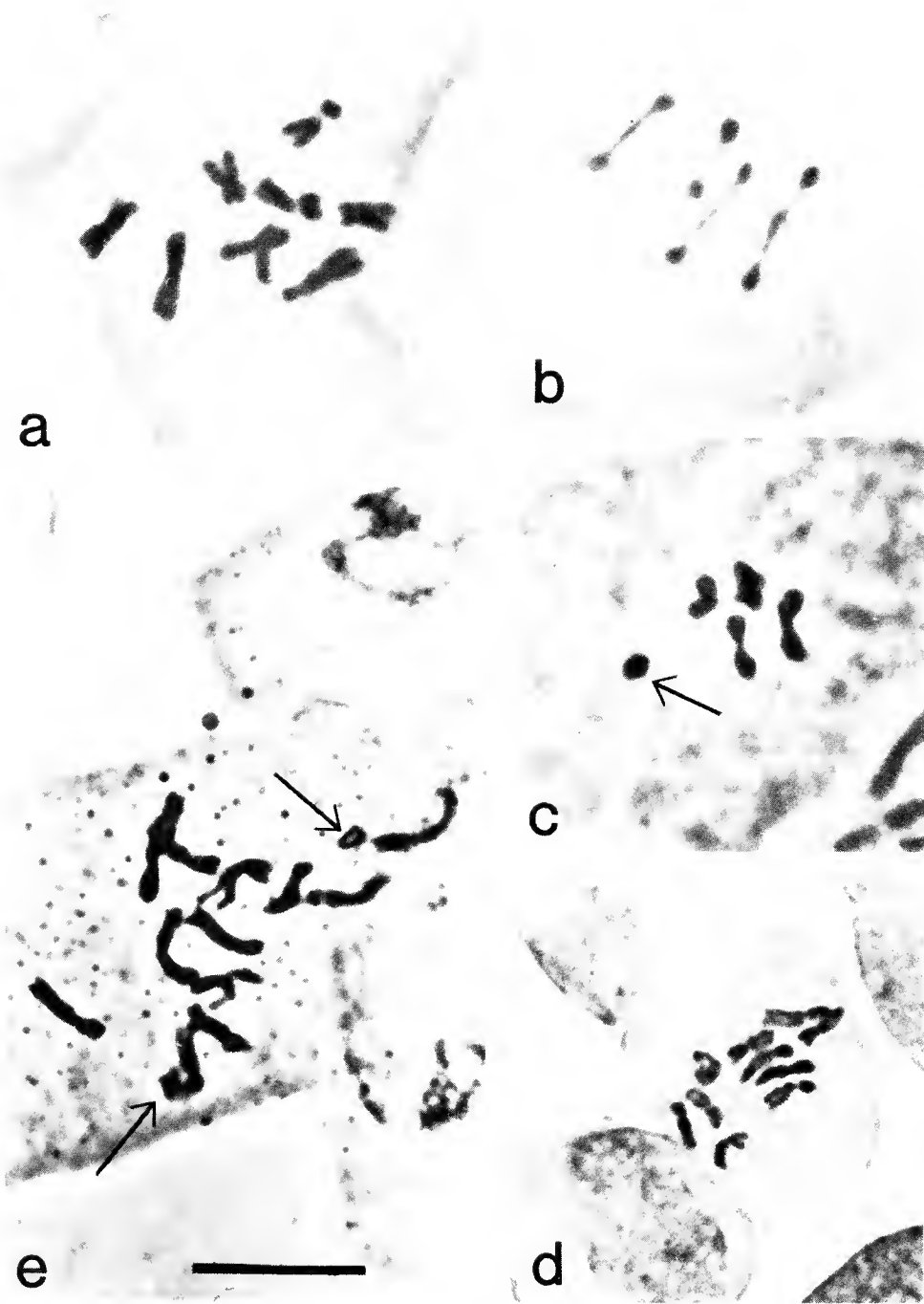


Fig. 4. Chromosomes in *Pogonolepis*. *P. stricta* a - d. a -  $2n = 8$  (Short 534.) b -  $n = 4$  (Short 1633). c -  $n = 4 + 1B$  (Short 1551). d -  $2n = 10$  (Short 1017). *P. muelleriana* e -  $2n = 12 + 2Bs$  (Short 648.) B chromosomes are indicated by arrows. All figures at same magnification. Scale:  $10 \mu\text{m}$ .

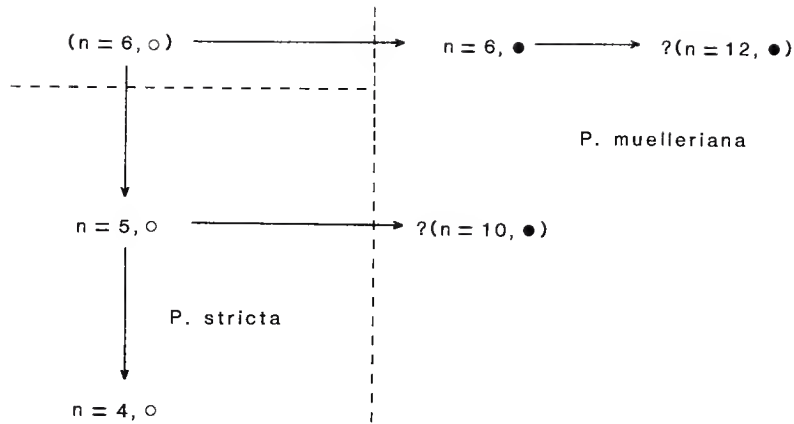


Fig. 5. Evolution in *Pogonolepis*. ( ) = hypothetical taxon. ?( ) = unsubstantiated or likely chromosome number. ○ = outcrosser. ● = selfer.

Table 1. P/Os and anther characteristics of *Pogonolepis*.

Characteristic	Species	$\bar{x}$	S.D.	S.E. $\bar{x}$	Range	n	Populations
Pollen grains per floret (P/O)	<i>P. stricta</i>	3,246.0	541.7	62.5	2,000-4,260	75	5
	<i>P. muelleriana</i>	239.3	65.0	5.3	62-404	150	9
Total anther length (mm)	<i>P. stricta</i>	1.04	0.01	0.001	0.85-1.3	90	6
	<i>P. muelleriana</i>	0.58	0.06	0.004	0.38-0.8	195	12
Length of microsporangia (mm)	<i>P. stricta</i>	0.83	0.09	0.01	0.65-1.07	90	6
	<i>P. muelleriana</i>	0.34	0.06	0.004	0.17-0.49	195	12
Length of terminal anther appendage (mm)	<i>P. stricta</i>	0.21	0.04	0.004	0.12-0.34	90	6
	<i>P. muelleriana</i>	0.24	0.05	0.003	0.10-0.48	195	12

In accepting a morphological species concept, there is the inherent problem that such species may not equate well with biological species. Thus from the cytological data (Tables 2 & 3) it is evident that both *P. muelleriana* and *P. stricta* are composed of two or more cytotypes. Furthermore, if the cytological data and the proposed cytoevolutionary pathway (Fig. 5) are correct, then at least *P. muelleriana* is polyphyletic.

#### POLLEN/OVULE RATIOS, BREEDING SYSTEMS AND FRUIT SET

The most detailed observations on breeding systems within the Australian Compositae have been made by Lawrence (1985) in *Senecio* L.. This work involved both the bagging and cross-pollination of individuals to ascertain self-compatibility, and the determination of P/Os. Not surprisingly there was a strong correlation of breeding system with P/Os, self-incompatible species having high P/Os (2315-7008) and self-compatible species low P/Os (43-237). The usefulness of P/Os has been documented by a number of other workers (e.g. Cruden 1977; Webb 1984) and I have also used P/Os to infer differences in breeding systems between related species of Australian Inuleae (Short 1981, 1983, 1985). In one paper (Short 1981) I noted that differences in P/Os existed between taxa of *Pogonolepis*. These preliminary observations are now confirmed.

Table 2. Chromosome numbers in *Pogonolepis*.

Collection	Chromosome Number		
	n	2n	No. of individuals
<b><i>Pogonolepis stricta</i></b>			
<i>Short 960</i> Saline depression c. 29.5 km N. of Wyalkatchem. Next to Cowcowing cemetery. 30°58'S, 117°27'E. Growing in sandy loam or loam with <i>Halosarcia</i> & <i>Carpobrotus</i> and extending into <i>Atriplex</i> zone. 14.xi.1979 (AD).		10	8
<i>Short 1009</i> Eastern edge of Yarra Yarra Lake c. 12 km N. of Carnamah. 29°38'S, 115°50'E. In open areas between <i>Acacia</i> shrubs c. 10 m above <i>Halosarcia</i> zone. 19.xi.1979 (AD).		10	4
<i>Short 1017</i> Salt lake c. 54.5 km from Nugadong toward Gunyidi. 30°07'S, 116°11'E. Upper edge of <i>Halosarcia</i> zone and amongst <i>Melaleuca</i> . 19.xi.1979 (AD).		10	3
<i>Short 1039</i> c. 3.5 km E. of Meckering in Mortlock R. flats. 31°37'S, 117°02'E. Amongst <i>Halosarcia</i> , <i>Acacia</i> , 20.xi.1979 (AD).		10	2
<i>Short 1083</i> c. 8.6 km W. of Lake Grace on Kukerin road. Lake Grace (North Lake). 33°06'S, 118°22'E. Growing amongst <i>Halosarcia</i> and <i>Atriplex</i> . 24.xi.1979 (AD).		10	5
<i>Short 1090</i> Saline depression c. 10.6 km from Hyden along road to Lake Varley. 32°28'S, 118°57'E. Amongst <i>Halosarcia</i> and <i>Melaleuca</i> . 25.xi.1979 (AD).		10	1
<i>Short 1551</i> 1 km N. of Boologooro Homestead along NW. coastal highway. 24°20'S, 114°02'E. Sand plain. In open areas between shrubs of <i>Eremophila</i> , <i>Hakea</i> , <i>Acacia</i> and chenopods. 25.viii.1982 (AD, CANB, MEL, NSW, PERTH).	4 + 1B		2
<i>Short 372</i> 13 km from Pindar on road to Mullewa. 28°31'S, 115°41'E. Loam. 16.viii.1977 (AD).	4		1
<i>Short 534</i> 15.3 km S. of Mt. Magnet on Paynes Find road. 28°12'S, 117°52'E. Sandy loam. <i>Acacia</i> sp. dominant. 17.ix.1977 (AD).		8	2
<i>Short 928</i> Edge of saline depression 4.7 km E. of Yellowdine. 31°17'S, 119°42'E. Extending from the upper edge of <i>Halosarcia</i> zone to <i>Melaleuca/Eucalyptus</i> zone. Sandy loam. 13.xi.1979 (AD).		8	3
<i>Short 988</i> & <i>1614</i> Saline depression 34.5 km N. of Perenjori along road to Morawa. 29°16'S, 116°01'E. Sand to sandy loam. Amongst <i>Halosarcia</i> . 15.xi.1979 (AD), 3.ix.1982 (MEL).	4	8	5
<i>Short 995</i> 10 km W. of Pindar. 28°31'S, 115°43'E. Salt lake. In upper <i>Halosarcia</i> zone and <i>Melaleuca</i> zone on sand. 15.xi.1979 (AD).		8	1
<i>Short 998</i> 2.5 km S. of Binnu. 28°03'S, 114°40'E. Salt flats. Amongst <i>Halosarcia</i> and extending into <i>Melaleuca</i> , <i>Acacia</i> scrub. 16.xi.1979 (AD).		8	4
<i>Short 1036</i> 8 km W. of Kalguddering. 30°59'S, 116°41'E. Saline depression in Mortlock River (North Branch). Amongst <i>Halosarcia</i> 20.xi.1979 (AD).		8	5
<i>Short 1047</i> 16 km from Brookton along road to Beverley. 32°14'S, 116°59'E. In sandy loam between <i>Acacia</i> shrubs in ± fresh to semi-saline depression. 21.xi.1979 (AD).		8	2
<i>Short 1050</i> Hotham R. crossing 7.2 km N. of Popanyinning. 32°36'S, 117°06'E. Between samphire and <i>Carpobrotus</i> . 21.xi.1979 (AD, MEL).		8	1
<i>Short 1513</i> 17 km from Menzies along road to Leonora. 29°35'S, 121°08'E. Sand. With chenopod ( <i>Atriplex</i> , <i>Maireana</i> ) and <i>Eremophila</i> shrubs. 19.viii.1982 (MEL).	4		1
<i>Short 1538</i> 38 km S. of Bandy Homestead on road to Laverton. 28°01'S, 122°19'E. In sand between shrubs of <i>Frankenia</i> , <i>Maireana</i> and <i>Carpobrotus</i> . 21.viii.1982 (MEL).	4		1
<i>Short 1596</i> 1.5 km W. of Ajana. 27°57'S, 114°37'E. <i>Acacia</i> scrub, gravel loam. 31.viii.1982 (MEL).	4		2
<i>Short 1601</i> 15.5 km W. of Mullewa along road to Geraldton. 28°36'S, 115°25'E. Mallee eucalypt — <i>Acacia</i> scrub. Loam. 1.ix.1982 (MEL).	4		1
<i>Short 1618</i> 4.5 km from Great Northern Highway along road to Fields Find. 29°13'S, 117°40'E. Growing in coarse sandy loam of depression in granite outcrop. 2.ix.1982 (MEL).	4		1

Table 2. Continued.

Collection	Chromosome Number		
	n	2n	No. of individuals
<i>Short 1633</i> Edge of Mongers Lake. 29°32'S, 116°41'E. In sandy loam amongst samphire. 3.ix.1982 (MEL).	4		1
<i>Short 1643</i> Saline depression 5 km S. of Morawa along road to Perenjori. 29°15'S, 116°02'E. In compact sand and sandy loam. Amongst low shrubs of <i>Halosarcia</i> and <i>Atriplex</i> . 3.ix.1982 (MEL).	4		6
<i>Short 1740</i> Salt flat on E. edge of Hines Hill. 31°33'S, 118°04'E. In sand in open areas between <i>Atriplex</i> shrubs and <i>Carpobrotus</i> . 17.ix.1982 (MEL).		8	1
<i>Short 1754</i> 4.7 km E. of Yellowdine. 31°17'S, 119°42'E. Edge of saline depression. In sand. Amongst samphire and <i>Carpobrotus</i> . 18.ix.1982 (MEL).	4		1
<b>Pogonolepis muelleriana</b>			
Western Australia			
<i>Chinnock 4357</i> Eclipse Lake. 32°57'S, 118°50'E. On upper reaches of lake on sandy clay. 11.xi.1978 (AD).		c. 20	1
<i>Short 648</i> 13.8 km S. of Merredin. 31°33'S, 118°12'E. <i>Eucalyptus</i> woodland. Sandy loam. 22.ix.1977 (AD).		12 + 2Bs	1
<i>Short 1076</i> 25 km N. of Pingrup. 33°18'S, 118°28'E. Amongst <i>Melaleuca</i> on sand ridge in salt lake. 24.xi.1979 (AD).		12	1
<i>Short 1093A</i> Southern edge of Lake Varley. 32°42'S, 119°21'E. In sand or sandy loam amongst <i>Halosarcia</i> , <i>Melaleuca</i> and <i>Carpobrotus</i> . 25.xi.1979 (AD).		12	2
<i>Short 963</i> c. 29.5 km N. of Wyalkatchem. Next to Cowcowing cemetery. 30°58'S, 117°27'E. In <i>Atriplex</i> association above saline depression. Loam. 14.xi.1979 (AD).		12	3
South Australia			
<i>Short 828</i> 6 km SW. of Pt Julia. 34°42'S, 137°49'E. Mallee scrub. Calcareous, sandy brown loam. 26.x.1978 (AD).		c. 24	2

Table 3. Chromosome number, P/O and anther length in populations of *P. muelleriana* and *P. stricta*.

Species	Population	Chromosome number		Pollen grains per floret (P/Os)			Total Anther Length (mm)		
		n	2n	x	S.E.	S.E.	x	S.D.	S.E.
<i>P. stricta</i>	<i>Short 1053</i>	—	—	3,185.4	397.7	102.6	1.16	0.099	0.025
	<i>Short 1083</i>	—	10	—	—	—	0.98	0.085	0.015
	<i>Short 960/2219</i>	—	10	3,091.5	523.8	135.2	1.02	0.073	0.019
	<i>Short 1551</i>	4 + 1B	—	2,968.2	532.1	137.3	1.1	0.092	0.023
	<i>Short 372</i>	4	—	3,761.4	516.7	133.4	1.05	0.098	0.025
	<i>Short 928</i>	—	8	3,223.3	413.5	106.7	0.94	0.062	0.016
<i>P. muelleriana</i> (Western Aust.)	<i>Short 648 &amp; 1743</i>	—	12	208.8	52.5	13.5	0.57	0.033	0.008
	<i>Short 1745</i>	—	—	318.4	38.9	10.05	0.59	0.025	0.006
	<i>Short 2287 &amp; Haegi</i>	—	—	217.0	84.8	21.9	0.52	0.037	0.009
	<i>Short 1093A</i>	—	12	—	—	—	0.58	0.056	0.014
	<i>Short 1070</i>	—	—	—	—	—	0.58	0.033	0.008
	<i>Short 1076</i>	—	12	—	—	—	0.55	0.038	0.009
	<i>Short 963 &amp; 1656</i>	—	12	286.0	70.3	18.1	0.63	0.034	0.008
<i>P. muelleriana</i> (Eastern Aust.)	<i>Short 769</i>	—	—	226.3	28.6	7.3	0.67	0.062	0.016
	<i>Short 777</i>	—	—	270.8	43.8	11.3	0.59	0.063	0.016
	<i>Short 811</i>	—	—	160.8	43.4	11.2	0.51	0.065	0.016
	<i>Short 821, 828 &amp; 870</i>	—	c. 24	229.9	34.9	6.3	0.59	0.054	0.009
	<i>Short 906</i>	—	—	245.4	53.1	13.7	0.64	0.054	0.007

The evidence presented (Tables 1 & 2) suggests that the *P. stricta* complex is composed of outcrossers, i.e. plants which, although possibly self-compatible, commonly cross-pollinate, whereas the *P. muelleriana* complex contains selfers, i.e. plants which predominantly self-pollinate. In the absence of bagging and cross-pollination experiments such an hypothesis is open to question but these results are comparable with P/O differences between the self-compatible taxa and self-incompatible taxa of *Senecio* examined by Lawrence (1985). The conclusions on breeding systems are also supported by the observations below on the percentage fruit set in each species.

It could be expected that plants which are self- or partially self-incompatible and/or have morphological characteristics that tend to prevent self-pollination would have a lower percentage fruit set than related self-compatible, self-pollinating species, i.e. species with high P/Os (e.g. 3,000) are likely to set on average a lower percentage of fruit than species with low P/Os (e.g. 200). Percentage fruit sets were determined for populations representing both the *P. stricta* and *P. muelleriana* complexes (Table 4, Fig. 6). An average percentage fruit set of 68.2% was determined for the *P. stricta* complex compared to 93.3% for the *P. muelleriana* complex. Fruit set in wild populations is likely to be influenced by a number of environmental parameters which are not directly related to the breeding system, e.g. severe frosts or water stress may seriously effect fruit maturation (e.g. Mott 1979). Hence such data must be examined with caution. However the results are such that they strongly support the above hypothesis.

Table 4. Percentage fruit set in populations of *P. muelleriana* and *P. stricta*

Species	Collection	Chromosome Number (n)	Percentage Fruit Set Range	Mean
<i>P. stricta</i>	<i>Short 960</i>	5	33.3-92.3	71.9
"	<i>Short 1009</i>	5	51.5-100	76.7
"	<i>Short 1090</i>	5	13.5-94.1	65.7
"	<i>Short 928</i>	4	0.0-96.8	54.7
"	<i>Short 995</i>	4	45.0-100	74.9
"	<i>Short 998</i>	4	37.7-97.3	75.4
"	<i>Short 1050</i>	4	30.0-78.3	58.1
"	<i>Short 2034</i>	4	30.3-93.5	68.2
Mean for species:				68.2
<i>P. muelleriana</i>	<i>Short 963</i>	6	83.3-100	95.0
"	<i>Short 1076</i>	6	84.2-100	95.7
"	<i>Short 1093A</i>	6	80.0-100	92.3
"	<i>Short 1096</i>	—	51.9-100	92.1
"	<i>Short 1097</i>	—	85.7-100	97.7
"	<i>Short 2384</i>	—	76.5-100	91.5
"	<i>Short 1070</i>	—	70.0-100	90.0
"	<i>Short 828</i>	c. 12	68.4-100	92.6
Mean for species:				93.3

The high percentage fruit sets in *P. muelleriana* require further comment. Over one half of the individuals examined had 95-100% fruit set and in the population *Short 1097* 100% fruit set was recorded in 13 of the 20 individuals examined. The lowest percentage fruit set recorded for an individual in this population was 85.7% (21 florets, 18 with mature fruit). Such high figures suggest that in this species, or some populations of the species, the possibility of apomixis should be considered. However there is no additional evidence to support this suggestion. Apomicts frequently show signs of reduced pollen fertility and/or the morphological variation is such that localised 'microspecies', such as in *Taraxacum* Weber, are discernible.

In *Pogonolepis* pollen formation appears to be quite normal. Thus, in the populations for which P/Os were ascertained, pollen size was not noticeably variable and percentage pollen fertility, determined by the double-stain technique (methyl green and phloxine: Owczarzac 1952) was, or was very close to, 100%. The macro-morphological variation in *P. muelleriana*, particularly if one excludes a few of the Western Australian collections, is also inconsistent with the concept of 'microspecies'.

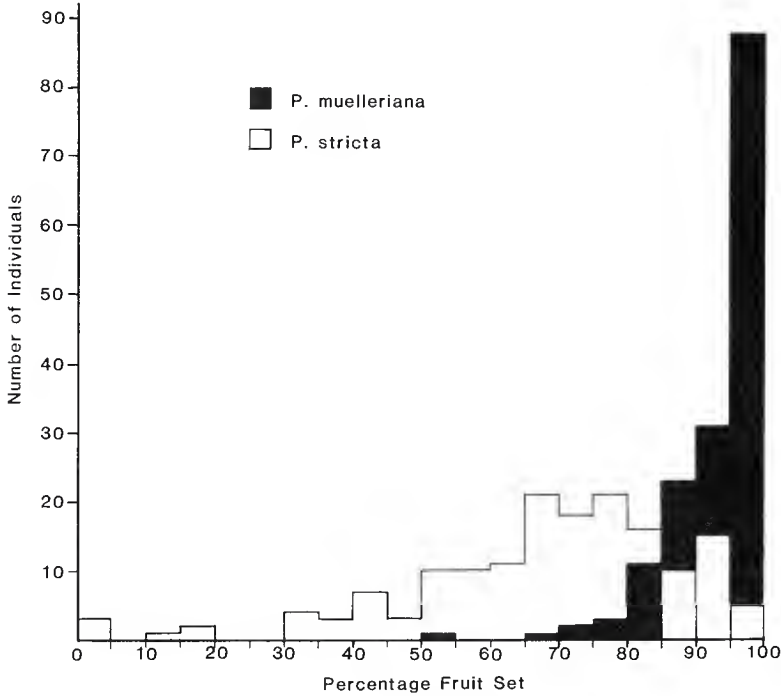


Fig. 6. Percentage fruit set in *Pogonolepis*.

#### CYTOLOGY

I previously reported (Short 1981) a determination of  $n = 6$  for an outbreeding entity of *Pogonolepis* but I now believe that this determination should be disregarded. There is no permanent slide, sketch or photograph to substantiate it and  $n = 6$  has not been recorded subsequently in *P. stricta*. Similarly a determination of  $2n = 14$ , previously reported as  $n = 7$  (Short 1983), for an inbreeding entity (Short 648) is now regarded as  $2n = 12 + 2$  supernumerary chromosomes (Fig. 4e).

Chromosome numbers were generally readily determined for *P. stricta* from both floral material and root tips. On the other hand, despite numerous attempts, the low number of pollen mother cells produced by members of the *P. muelleriana* complex prevented successful determinations from meiotic material. This is unfortunate as there were some difficulties in accurately determining chromosome numbers from root tip preparations. Thus unequivocal determinations have not been achieved for two collections of *P. muelleriana*, i.e. Short 828 ( $2n = c. 24$ ) and Chinnock 4357 ( $2n = c. 20$ ). However, the determination of  $2n = 24$  is strongly supported given the substantiated reports of  $2n = 12$ . Autogamous species are commonly found to consist of both diploid and higher ploid representatives. The determination of  $2n = c. 20$  should probably be discounted, having been obtained

from a single preparation and because  $n = 5$  has not been recorded in *P. muelleriana*. On the other hand there is little doubt that inbreeding is generally a derived condition, the evolution of autogamous taxa (low P/Os) from predominantly outcrossing taxa (high P/Os) being well documented in many families (e.g. Stebbins 1957, Ornduff 1969, Short 1981). Derived, autogamous taxa are also frequently polyploids. This suggests that the collection *Chinnock 4357* could be regarded as a tetraploid, having been derived from an outcrossing entity with a base of  $x = 5$ . Such an hypothesis could explain the above-mentioned similarity, on macro-morphological features, of this collection with some entities of *P. stricta*.

In any genus showing an array of chromosome numbers it can, in the absence of other information, be difficult to explain their derivation. In *Pogonolepis* the presence of autogamous taxa greatly assists the problem and a proposed phylogeny is displayed in Fig. 5. Thus aneuploid reduction, plus subsequent polyploidy, from a base of  $x = 6$  is suggested.

The cytoevolutionary pathway proposed for *Pogonolepis* has numerous parallels within the Compositae. For example a complete aneuploid reduction series from a base of  $x = 9$  to  $x = 2$  has been recorded in *Brachyscome* Cass. (Smith-White *et al.* 1970). In *Calotis* R.Br. Stace (1978) recorded reduction from  $x = 8$  to  $x = 4$  and polyploidy was also found to occur on all base numbers. Both of these genera, which are restricted to Australasia, belong to the Astereae. However from my own unpublished observations and from chromosome numbers determined by Turner (1970) it is clear that aneuploidy is widespread in the Gnaphaliinae.

#### CHROMOSOME NUMBERS AND DISTRIBUTION PATTERNS

Without taking into account ecological and geographical differences the distribution of populations with different chromosome numbers, i.e.  $n = 4$  and  $n = 5$ , within the *P. stricta* complex displays no obvious pattern other than the fact that the latter populations are more restricted in their distribution than populations with  $n = 4$ . However, in keeping with their wide distribution, populations with  $n = 4$  are found in a broad spectrum of habitats (see Table 2). This contrasts with populations with  $n = 5$  which are restricted to salt lakes, all of which form part of the South West Drainage Division (Mulcahy & Bettenay 1972; Bettenay & Mulcahy 1972; Beard 1973). The former populations are distributed across three Drainage Divisions, i.e. the South West, Murchison and Eucla Divisions.

Populations belonging to the *P. muelleriana* complex also occur in an array of habitats, including saline soils, and I believe it significant that different cytotypes (ie.  $2n = 12$ ,  $12 + 2B$ , c. 20) are, as with populations of *P. stricta*, found around lakes of the South West Drainage Division. These observations add further support to my earlier contention (Short 1983) that the lake systems of south-west Western Australia have been reservoirs for speciation and that, for some plant groups, they may have been important reservoirs from which colonization of the arid zone has occurred.

Only a single chromosome number determination has been made for the *P. muelleriana* complex outside Western Australia. The occurrence of a tetraploid population in South Australia may reflect a wider distribution of polyploids compared to the diploid relatives, a not uncommon situation in many plants, but clearly more determinations are required to support this suggestion.

#### FRUIT MORPHOLOGY AND ANATOMY

A survey of the fruit morphology and anatomy of Australian Gnaphaliinae has shown that fruit characteristics are most useful when determining generic limits. The absence or presence and type of mucilagenous cells, the structure of the carpophore, the number of vascular bundles and the presence (in medial transverse section) or absence of sclerenchyma are some features which may vary from genus to genus. Thus within *Angianthus* s. lat. only the segregate genera *Pogonolepis* and *Cephalosorus* A. Gray, both distinguishable on numerous non-carpological features (Short 1983), have large, mucilagenous cells covering much of the entire

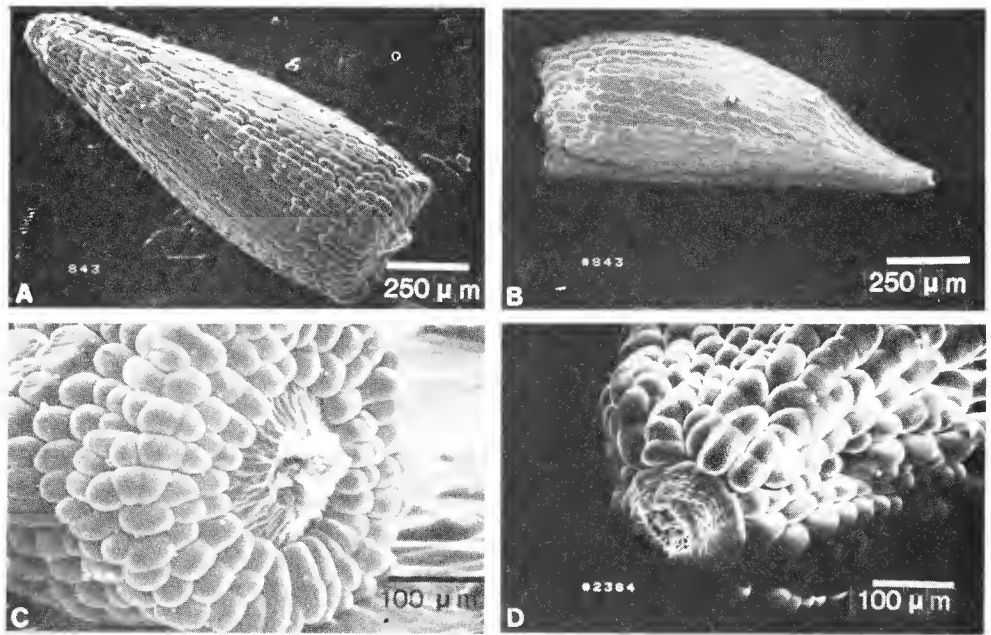


Fig. 7. Surface features of the fruit of *Pogonolepis*, as typified by *P. muelleriana* (Short 843; Short 2384 & Haegi). a & b — general view of entire fruit. c — apex of fruit. d — carpophore.

surface of the fruit (Fig. 7). More details of the fruit structure of *Angianthus* s. lat. will be presented, along with methodology, in a future paper.

As shown in Figs 7a & 7b fruit shape can vary slightly depending on the number of fruits and the position occupied on the general receptacle. Also of note in *Pogonolepis* is the presence of a well-defined carpophore (Fig. 7d), a feature lacking in some genera of Gnaphaliinae.

#### TAXONOMY

***Pogonolepis*** Steetz in Lehm. Pl. Preiss. 1:440 (1845); P. Short, *Muelleria* 4:404 (1981); Grieve, *W. Aust. Wildfls Suppl* 4:72 (1982); P. Short, *Muelleria* 5:203 (1983). — *Skirrophorus* DC. in Lindl. ex DC. sect. *Pogonolepis* (Steetz) A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:149 (1851); Sond., *Linnaea* 25:486 (1853). TYPE: *Pogonolepis stricta* Steetz

[*Angianthus* auct. non Wendl.: as to *A. strictus* (Steetz) Benth. & *A. lanigerus* Ewart & J. White]

[*Siloxerus* auct. non Labill.: as to *S. strictus* (Steetz) Ostenf.]

[*Skirrophorus* auct. non DC. in Lindl. ex DC.: as to *S. strictus* (Steetz) A. Gray & *S. muellerianus* Sond.]

[*Styloncerus* auct. non Spreng., nom. illeg.: as to *S. strictus* (Steetz) Kuntze]

*Annual herbs*. Major axes decumbent, ascending or erect, variably hairy; stem simple or forming major branches at basal and/or upper nodes. *Leaves* usually alternate (sometimes opposite), sessile, entire, glabrous or sparsely hairy, mucronate. *Compound heads* ± broadly obovoid; bracts subtending compound heads forming a conspicuous, multi-seriate involucre equal to or slightly longer than the length of the head, the outer bracts leaf-like, the inner ones primarily hyaline and with papillae at the apex; *general receptacle* a flat or ± concave, entire, glabrous axis. *Capitula* c. 5-40 per compound head. *Capitular bracts* 2-3, about the length of the florets, ± hyaline, whitish, the midrib ± inconspicuous, the bract apices papillose.



*Florets* 1 per capitulum, bisexual; corolla tubular, 5-merous, yellow. *Style* branches truncate, with short sweeping hairs, a distinct stylopodium present. *Stamens* 5; anthers with a sterile, deltate to  $\pm$  triangular, apical appendage; microsporangia tailed, endothecial tissue polarized; filament collar  $\pm$  straight in outline and composed of  $\pm$  uniform cells and basally not or barely thicker than the filament. *Cypselae*  $\pm$  obovoid, covered in mucilaginous cells, with 2 vascular bundles and a distinct carpophore. *Pappus* absent. Figs 1, 7.

Chromosome number:  $n = 4, 5, 6, c. 10, c. 12$  (Fig. 4).

DISTRIBUTION (Figs 2 & 3):

Both species recognised are found in Western Australia but *P. muelleriana* extends to South Australia, New South Wales and Victoria.

KEY TO THE SPECIES OF POGONOLEPIS

1. Anthers 0.85-1.3 mm long; pollen grains 2,002-4,260 per floret and c. 400-850 per anther (Western Australia) ..... 1. *P. stricta*  
 1. Anthers 0.38-0.8 mm long; pollen grains 62-404 per floret and 16-76 per anther (Western Australia and Eastern Australia) ..... 2. *P. muelleriana*

1. ***Pogonolepis stricta*** Steetz in Lehm. Pl. Preiss. 1:440 (1845); P. Short, *Muelleria* 4:404 (1981); Grieve, W. Aust. Wildfls Suppl. 4:72 (1982); P. Short, *Muelleria* 5:203 (1983). — *Skirrophorus strictus* (Steetz) A. Gray, Hook. J. Bot. Kew Gard. Misc. 3:149 (1851). — *Angianthus strictus* (Steetz) Benth., Fl. Austr. 3:568 (1867); Grieve & Blackall, W. Aust. Wildfls 816 (1975). — *Styloncerus strictus* (Steetz) Kuntze, Rev. Generum Pl. 367 (1891). — *Siloxerus strictus* (Steetz) Ostenf., Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3:137 (1921). TYPE: "In locis hyeme aqua marina inundatis prope Vasse-Inlet, mense Dec. 1839. Herb. Preiss. No. 39." LECTOTYPE (here designated): *Preiss 39*, In Nova Hollandia, (Swan River Colonia) in locis hyeme inundatis aqua marina, prope Vasse-Inlet leg. cl. Preiss . . . emi 1843, s.dat. (MEL 541613, ex herb. Steetz). ISOLECTOTYPES: LD, MEL 541612 (ex herb. Sond.), P (2 sheets, one ex herb. Schultz-Bip.), S (herb. Lehm.). POSSIBLE ISOLECTOTYPE: PERTH. See note 1 below.

*Angianthus plumiger* Benth., Fl. Austr. 3:568 (1867); Grieve & Blackall, W. Aust. Wildfls 816 (1975). TYPE: "Swan and Murchison Rivers, *Oldfield*." LECTOTYPE (here designated): *Oldfield 82*, Murchison, s.dat. (MEL 84616). REMAINING SYNTYPE: *Oldfield 82*, Swan R., W.A., s.dat. (MEL 84613). See note 2 below.

*Angianthus strictus* (Steetz) Benth. var. *lanigerus* Ewart & J. White, Proc. Roy. Soc. Vict. 22:92 (1909). — *Angianthus lanigerus* (Ewart & J. White) Ewart & J. White, Proc. Roy. Soc. Vict. 23:288 (1911); Grieve & Blackall, W. Aust. Wildfls 816 (1975). — *Pogonolepis lanigera* (Ewart & J. White) P. Short, *Muelleria* 5:204 (1983). TYPE: "Woorooloo, West Australia. Max Koch, Oct., 1907. No. 1873." LECTOTYPE (here designated): *Koch 1873*, Woorooloo, -x.1907 (MEL 541625). ISOLECTOTYPES: NSW (2 sheets), PERTH. See note 3 below.

*Annual herb*, the major axes prostrate to erect, 2.5-20(26) cm long,  $\pm$  glabrous to densely hairy in parts, the axes often reddish. *Leaves* narrowly triangular, lanceolate to narrowly lanceolate or  $\pm$  linear, 4-20(23) mm long, 0.5-1.5 mm wide, glabrous to  $\pm$  densely hairy, the base  $\pm$  dilated and the margins often hyaline, the apex barely to prominently mucronate. *Compound heads* 2.7-4.3 mm long, 0.9-4 mm diam., bracts of the general involucre c. 15-25 (c. 35); outer bracts 8-18(27), leaf-like,  $\pm$  narrowly triangular or lanceolate, 2.8-4 mm long, 0.5-1.1 mm wide, about the length of or exceeding the length of the capitula, sparsely to densely hairy,  $\pm$  straight to recurved, grading into inner, non-leaf-like bracts; inner bracts 6-13,  $\pm$  elliptic or  $\pm$  oblong or ovate or obovate, 2.1-2.7 mm long, 0.6-1 mm wide, with a  $\pm$  distinct midrib extending from about half to about the full length of the bract, all bracts variably hairy with papillae on the upper part, grading into capitular bracts. *Capitula* (6)15-50(103) per compound head. *Capitular bracts*  $\pm$

elliptic or obovate, (1.95)2-2.5 mm long, 0.4-0.6 mm wide,  $\pm$  flat to conduplicate, the midrib  $\pm$  indistinct or clearly extending to about three quarters the length of the bract. *Florets* 1 per capitulum; corolla tube 1.5-1.9 mm long. *Anthers* 0.85-1.3 mm long; microsporangia 0.65-1.07 mm long; terminal anther appendage 0.12-0.34 mm long. *Pollen grains* c. 2,000-4,200 per floret, c. 400-850 per anther. *Cypselae* 0.7-0.95 mm long, 0.3-0.45 mm diam. Fig. 1, c-f.

Chromosome numbers:  $n = 4, 5$  (Fig. 4, a-d).

#### DISTRIBUTION (Figs 2 & 3):

Restricted to Western Australia.

#### ECOLOGY:

Usually found in sandy soil. Commonly occurs on the edge of saline depressions with *Halosarcia* and other chenopods but also found in open shrubland of *Acacia*, *Eremophila*, etc. See Table 2 for further details.

#### NOTES:

1. Steetz described a number of species of Compositae in Lehmann's "Plantae Preissianae" and type specimens of such taxa are frequently found in GH, LD, MEL and S (Short 1983, p.152). It has been suggested that the principal types of all species described in this work are to be found in LD. However it is clear that in the case of taxa described by Steetz this is not, or usually not, the case. The collections from his own herbarium, now at MEL, should undoubtedly be selected as lectotypes (Short l.c.).

A collection "Preiss 901, In salsolis hieme aqua inundatis ad aestuary prope Vasse, 14.xii.1839" of *P. stricta* occurs in PERTH (ex TCD, ex K). Despite the different number this collection is probably an isolectotype of *P. stricta*. McGillivray (1975) has noted the existence of a differently numbered set of Preiss specimens in TCD which are undoubted duplicates of those cited in "Plantae Preissianae".

2. The application of the name *Angianthus plumiger* Benth. has previously been in doubt (Short 1983, p.210). Type specimens of this species could not be found at K, BM or E and the reference by Bentham (1867, p.568) to a "flat subtending [bract of the capitulum] which is much shorter than the involucre, but usually with the midrib produced into a jagged almost plumose appendage almost as long as the florets" suggested that the name should not be applied to a species of *Pogonolepis*. Only his reference to the "numerous inner scarious fringed or jagged bracts" of the general involucre suggested this possibility. Whether or not Grieve and Blackall (1975) saw type material is unclear but specimens of *Pogonolepis* were referred to by this name.

I have recently located at MEL undoubted type specimens of *A. plumiger* and they clearly belong to the *P. stricta* complex. Both the lectotype sheet and the remaining syntype contain eight or more plants but in some cases the individual specimens are poorly preserved. At least some individuals have suffered from fungal attack. Bentham's description clearly applied in part to some of the damaged bracts. Bracts of more or less undamaged plants are typical of *Pogonolepis*.

A further Oldfield collection of *Pogonolepis* from the Murchison River housed in MEL (MEL 84622) is not considered to be type material of *A. plumiger* but rather the collection cited by Bentham (l.c.) under *Angianthus strictus*. The label accompanying this specimen carries an unpublished name of Ferdinand Mueller's which commemorates Oldfield.

3. As far as can be ascertained Ewart and White (1909) saw both NSW and MEL material when describing *A. strictus* var. *lanigerus*. The MEL sheet bears several good specimens and also contains the original drawings published by the authors. Furthermore both Ewart and White worked in Melbourne and thus it seems best to select MEL 541625 as the lectotype collection.

SPECIMENS EXAMINED (Total c. 165).

For representative specimens see Tables 2 & 4.

2. *Pogonolepis muelleriana* (Sond.) P. Short, *Muelleria* 4:413 (1981). — *Skirrhophorus muellerianus* Sond., *Linnaea* 25:486 (1853). TYPE: "Inter portum et urbem Adelaide. Spencer's gulph." LECTOTYPE (here designated): *Mueller s.n.*, Inter portum & urbem Adelaide, s.dat. (MEL 541616, ex herb. O.W. Sonder). POSSIBLE ISOLECTOTYPES: GH (ex herb. O.W. Sonder) (Mueller collection but location given as "Adelaide"), MEL 541614 (ex herb. O.W. Sonder) (Mueller collection but location given as "Adelaide"), MEL 84611 (contains 2 labels, one with ". . . inter portum & urbem Adl. . .", the other with "propa sinum St. Vincent"). REMAINING SYNTYPE: MEL 541615 (ex herb. O.W. Sonder) (collection by Mueller from "Spencersgulph"). See note 1 below.

[*Angianthus strictus* auctt. non (Steetz) Benth.: Benth., *Fl. Austr.* 3:568 (1867), p.p.; J. M. Black, *Fl. S. Aust.* 1st. ed. 645 (1929), 2nd. ed. 924 (1957); Willis, *Handb. Pl. Vict.* 2:730 (1973); Grieve & Blackall, *W. Aust. Wildfls* 816 (1975), p.p.; Cunningham, Mulham, Milthorpe & Leigh, *Plants Western N.S.W.* 709 (1981).]

*Annual herbs*, the major axes prostrate to erect, 1-12 cm long,  $\pm$  glabrous but often densely hairy below the compound heads, all axes  $\pm$  brown but sometimes distinctly red or reddish brown. *Leaves* narrowly triangular, lanceolate to narrowly lanceolate or  $\pm$  linear, 3-10(16) mm long, 0.5-1 mm wide, glabrous or sometimes at least the upper ones conspicuously hairy, the base dilated and the margins often hyaline, the apex mucronate, green to purplish green. Compound heads 3.5-4.4 mm long, 2-4.5(4.8) mm diam.; bracts of the general involucre 16-40; outer bracts 7-28(34), leaf-like,  $\pm$  narrowly triangular or lanceolate, 3.2-4.7 mm long, 0.5-1 mm wide, about the length of or exceeding the length of the capitula, sparsely to densely hairy,  $\pm$  straight to recurved, green or sometimes purple-green, grading into inner, non-leaf-like bracts; inner bracts 7-20,  $\pm$  elliptic,  $\pm$  oblanceolate to obovate,  $\pm$  oblong or ovate, 2.5-3.4 mm long, 0.6-0.9 mm wide, with a distinct midrib extending about two-thirds the length of the bract, with all bracts variably hairy and with papillae on the upper part. *Capitula* 10-45 per compound head. *Capitular bracts*  $\pm$  elliptic or obovate,  $\pm$  flat to conduplicate, 1.9-3.3 mm long, 0.35-0.6 mm wide, midrib  $\pm$  indistinct or nearly extending to about two-thirds or four-fifths the length of the bract. *Florets* 1 per capitulum; corolla tube 1.55-2 mm long. *Anthers* 0.3-0.8 mm long; microsporangia 0.17-0.49 mm long; terminal anther appendage 0.18-0.48 mm long. Pollen grains 60-404 per floret, (12)20-64(84) per anther. *Cypselae* 0.9-1.2 mm long, 0.3-0.5 mm diam. Fig. 1, a-b.

Chromosome numbers:  $n = 6$ ,  $c. 10$ ,  $c. 12$  (Fig. 4e).

#### DISTRIBUTION (Figs 2 & 3):

Extends from southern Western Australia to South Australia, New South Wales and Victoria.

#### ECOLOGY:

Occurs in sand or loam. Extremely common amongst *Halosarcia* and other chenopods on the edge of both coastal and inland saline flats but is also commonly found in a variety of other habitats in which the soil is not saline (see Table 2 for additional data).

#### NOTES:

1. The species was described by Sonder from material sent to him by Mueller. Subsequently it appears that the material was probably returned to MEL when Sonder's collection of Australian plants was purchased by the herbarium (Court 1972). Possibly a number of duplicates exist in other herbaria but it seems reasonable

to choose a lectotype collection from the material held in MEL. The chosen sheet contains two individual plants in good condition, an envelope containing a few bracts and two labels, i.e. "*Pogonolepis Mulleri*" and "*Skirrophorus (Pogonolepis) Muellerianus*", in Sonder's hand. The collection was also chosen as the lectotype because of the existence of possible isolectotypes. No duplicates of the other syntype have been seen.

SPECIMENS EXAMINED (Total c. 170):

For representative specimens see Tables 2 & 4.

#### ACKNOWLEDGEMENTS

My work on the Australian Compositae commenced in 1977. Transport and/or funds for field work in Western Australia has been provided by the Botanic Gardens of Adelaide (1977), the Flinders University Research Committee (1979) and Australian Biological Resources Study grants from the Bureau of Flora and Fauna (1982, 1983). The latter body has also funded my survey of the fruit of Australian Gnaphaliinae.

I thank my colleagues at MEL who helped in the preparation of this paper, Dr B. A. Barlow (CANB) for his comments on the manuscript and also Mr J. Nailon of Monash University for the SEM photographs.

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**LECTOTYPIFICATION OF STUARTINA MUELLERI (COMPOSITAE:  
INULEAE) WITH NOTES ON STUARTINA IN VICTORIA AND SOUTH  
AUSTRALIA**

by

HELEN I. ASTON\* & D. A. COOKE†

**ABSTRACT**

Aston, Helen I. & Cooke, D. A. Lectotypification of *Stuartina muelleri* (Compositae: Inuleae) with notes on *Stuartina* in Victoria and South Australia. *Muelleria* 6(4):255-257(1986). — The occurrence of *Stuartina hamata* Philipson in Victoria and South Australia is discussed. Its distribution in those states is mapped and compared with that of *Stuartina muelleri* Sonder. Distinctions between the two species are given. As type material of *S. muelleri* consists of a mixture of both species a lectotype for that name is chosen.

**INTRODUCTION**

O. W. Sonder (1853) described both the genus *Stuartina* and a single species *S. muelleri* from South Australian collections of F. Mueller. No further species of this endemic Australian genus was recognised until W. R. Philipson (1937) described *S. hamata* with Coonabarrabra [Coonabarabran], New South Wales, 1883, *Lamont 215* (BM) as the type collection. Philipson also cited an 1886 collection (*Shaw s.n.*, K) from Linthwaite, Yorkshire, England, annotated as having been introduced in wool, and he commented "It is extraordinary that a species which has been introduced and collected in England should not have been recognised as distinct in Australia".

*S. hamata* and *S. muelleri* remain the only two species in the genus.

**DISTINCTIVE FEATURES**

Undoubtedly the vegetative similarity of the two species of *Stuartina* (they are indistinguishable except when flowering or fruiting) and the smallness of the flowers were partly responsible for *S. hamata* not having been recognised and described much earlier. It is, however, quite distinct when in flower, the midrib of each of the inner five (usually) involucre bracts being extended beyond the bract lamina into a rigid, terete, prominently recurved, yellow-stramineous hook. In *S. muelleri* the purple-brown laminal apex of each of the inner two (occasionally one or three) involucre bracts is outcurved to strongly recurved and sometimes hook-like but there is no extension of the midrib. Burbidge & Gray (1970) and Philipson (1937) illustrate these differences. In addition, the inflorescences are all terminal (or rarely some axillary) in *S. hamata* but are both terminal and axillary in *S. muelleri* except in very depauperate plants.

**S. HAMATA IN VICTORIA AND SOUTH AUSTRALIA**

Although the presence of *S. muelleri* in Victoria and South Australia is well known it is only recently that *S. hamata* has been recognised as occurring in these states. Neither Black (1957), Eichler (1965), Burbidge & Gray (1970), Willis (1973), nor Jacobs & Pickard (1981) recorded *S. hamata* for Victoria or South Australia, but listed it only for New South Wales or, in the latter reference, for New South Wales and Queensland. Examination in 1983 of *Stuartina* material in the National Herbarium of Victoria, Melbourne (MEL) and the State Herbarium, Adelaide (AD)

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\*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

†State Herbarium, Botanic Gardens, North Terrace, Adelaide, South Australia, Australia 5000.

showed that *S. hamata* is present in both Victoria and South Australia, occurring in drier, more inland areas than does *S. muelleri* (Fig. 1).

The dates (1968\*; 1976; 1978; 1979) of the four Victorian collections and their disjunction from the range of the species in South Australia and elsewhere apparently indicate that *S. hamata* has only recently extended into Victoria and that this extension is probably due to accidental introduction. However, the species has been long-established in South Australia as the type material of *S. muelleri*, collected between 1848 and 1853, includes a collection which is now referable to *S. hamata* (see below). In addition *S. hamata* was collected elsewhere in the Flinders Ranges in the 19th century (Mt Parry, c. 1885; Mt Lyndhurst, 1898); however, all specimens from the Eyre Peninsula — Port Augusta region are recent (1968; 1974; 1974; 1981) and may represent a current southward extension of range within South Australia.

All *Stuartina* collections mapped and/or examined in connection with this study have been annotated.

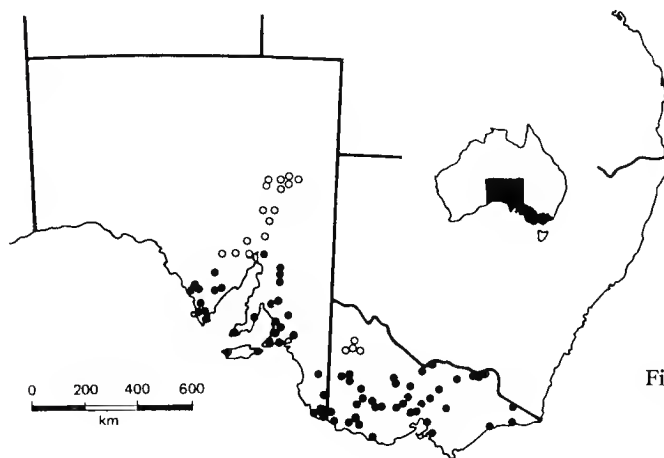


Fig. 1. Distribution of *Stuartina hamata* (circles) and *S. muelleri* (dots) in South Australia and Victoria.

#### LECTOTYPIFICATION OF *S. MUELLERI*

Lectotypification of *S. muelleri* is necessary because the material used by Sonder includes two distinct species. The following choice of lectotype suitably fits Sonder's description, maintains the traditional application of the name *S. muelleri* and allows the only other name available in *Stuartina*, *S. hamata*, to remain in use for the second species.

***Stuartina muelleri*** Sonder, *Linnaea* 25: 522 (1853). TYPE: "Lofty ranges. Onkaparinga. Cudnaka", South Australia, *F. Mueller s.n.* [1848-1853]. LECTOTYPE (here chosen): Onkaparinga, s. date. *F. Mueller s.n.* (MEL 604835, ex herb. O. W. Sonder, top left hand specimen on sheet). ISOLECTOTYPE: MEL 604835, bottom left hand specimen on sheet; ? two specimens on right hand side of sheet (see last paragraph below for explanation). SYNTYPE: Lofty ranges, s. dat., *F. Mueller s.n.* (MEL 604836, ex herb O.W. Sonder). SYNTYPE EXCLUDED BY LECTOTYPIFICATION: Cudnaka, s.dat., [*F. Mueller s.n.*] (MEL 604837, ex herb O. W. Sonder, — not *S. muelleri* but *S. hamata* Philipson). Cudnaka is believed to be Kanyaka in the southern Flinders Ranges, which Mueller visited in 1851.

\*This collection was inaccessible in unincorporated material when Willis (1973) was prepared.



All three MEL sheets cited above are from Sonder's herbarium (see Court, 1972) and all carry labels which are annotated in Mueller's handwriting with their respective locality and collector data and with a manuscript name suggested by Mueller. This name is the same on all labels and shows that Mueller considered all the material to be conspecific. Sonder, although not adopting Mueller's name, must have agreed with this view as he cited all three collections under *S. muelleri*.

Only one sheet (MEL 604837) bears Sonder's determination of *S. muelleri*, which is written on the reverse of Sonder's handwritten manuscript description. The reverse also carries pencil sketches, presumably done by Sonder, of floral dissections of *S. muelleri*. It is unfortunate that this manuscript has become attached to the only sheet now excluded from *S. muelleri* by the present lectotypification.

There has possibly been some accidental transposition of specimens between the three type sheets during the period between collection in the mid-1800's and mounting in 1982 as the two right hand specimens on MEL 604835 are apparently part of the "Lofty ranges" syntype gathering rather than the "Onkaparinga" lectotype collection. For this reason the isolectotype status of those two specimens is queried.

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# NEW SPECIES OF HEMIGENIA AND MICROCORYS (LABIATAE)

by

BARRY J. CONN\*

## ABSTRACT

Conn, B. J. New species of *Hemigenia* and *Microcorys* (Labiatae). *Muelleria* 6(4): 259-264 (1986). — *Hemigenia conferta*, *Microcorys cephalantha*, *M. wilsoniana* (all from Western Australia) and *M. elliptica* (from the Northern Territory) are described for the first time.

## INTRODUCTION

The completion of taxonomic revisions of *Hemigenia* and *Microcorys* must be delayed until field studies provide the necessary data to evaluate the status of several taxa in a number of apparent species complexes. Although it is desirable for new taxa to be described within taxonomic revisions, it is deemed important that the new species described herein be published immediately, since they all appear to be rare and are possibly endangered or vulnerable.

Terminology and presentation follows that used in my revision of *Prostanthera* section *Klanderia* (Conn 1984, pp. 211-220).

## HEMIGENIA

### *Hemigenia conferta* Conn, sp. nov.

*Frutices* 0.3-1.4 m. alti. *Rami* et ramuli partim sparse usque moderate tomentosi. *Folia* opposita, sessilia, glabra; *laminae* dimorphae, *folia florum* late subobtrullata usque subobtrullata, 7-10 mm. longa, 5.5-7 mm. lata, basi angustata, margine integro, apice late obtuso vel saepe abrupte obtuso, *folia non florum* anguste ovata usque anguste obovata, 9.5-15 mm. longa, 3-5 mm. lata, basi plus minusve cuneata, margine integro, apice obtuso. *Flores* in axibus abbreviatis congesti. *Pedicellus florum* 2.3-2.6 mm. longus, partim axe adhaerens, glaber, *prophyllis* anguste ellipticis, 5.7-7.3 mm. longis, 2-2.1 mm. latis, glabris, alibi marginem pilis sparsis. *Calyx* bilobatus, glaber, alibi lobi margine pilis sparsis; *lobus abaxialis* circa 4 mm. longus, circa 3 mm. latus, apice bilobato; *lobus adaxialis* 3-4 mm. longus, circa 3.5 mm. latus, apice trilobato. *Corolla* 13-14 mm. longa, malvina, alibi intra tubi albi vel cremei, extra glabra, intra in partibus dense tomentosa; *tubus* 5.6-5.9 mm. longus; *lobus abaxiali-medianus* spathulatus, circa 6-6.5 mm. longus, 6.5-7 mm. latus; *lobis lateralibus* plus minusve circularibus circa 4.5-4.8 mm. longis, circa 4.5 mm. latis; *pari loborum adaxiali-mediano* transverse late elliptico, 5.2-5.5 mm. longo, 6.8-7 mm. lato. *Androecium* circa 3.3 mm. e basi corollae affixum; filamenta abaxialia 3.4-3.6 mm. longa, anthera 1-1.2 mm. longa, anthera imperfecta circa 0.6 mm longa, connectivo circa 1.4 mm. longo; filamenta adaxialia 2.3-2.4 mm. longa, anthera 1-1.2 mm. longa, connectivo circa 1 mm. longo. *Pistillum* 9.8-10.2 mm. longum; ovarium 0.9-1 mm. longum; stylus 8.4-8.7 mm. longus. *Mericalpia* immatura.

TYPE: Conn 2243, 19.ix.1985, Wongan Hills, c. 1.5 km N. of Wongan Hills-Piawaning road and c. 13 km NW. (by road) of Wongan Hills township (Holo.: MEL 1538990; iso.: CANB, MO, PERTH).

Erect to spreading shrub, 0.3-1.4 m high. *Branches* sparsely to moderately hairy along a narrow longitudinal region between leaf bases and the next more basal node. *Leaves* opposite, sessile, glabrous; *lamina* dimorphic; *floral leaves* broadly subobtrullate to subobtrullate, 7-10 x 5.5-7 mm, base tapering, margin entire, apex broadly obtuse, often abruptly obtuse; *non-floral* leaves narrowly ovate to narrowly obovate, 9.5-15 x 3-5 mm, base  $\pm$  cuneate, margin entire, apex obtuse. *Inflorescence* a frondose racemiform corymbose with  $R_z$  internodes contracted; 8-16-flowered [per corymbose]. *Pedicel* 2.3-2.6 mm long, at least half adhering to  $R_z$  axis, glabrous; *prophylls* narrowly elliptic, 5.7-7.3 mm long, 2-2.1 mm wide,

\* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

glabrous except for a few hairs on margin, base cuneate, margin entire, apex acute. *Calyx* 2-lobed, glabrous except for a few hairs on margin of lobes; *tube* 2.5-3.3 mm long; *abaxial lobe* c. 4 mm long, c. 3 mm wide, apex bilobed with sinus c. 2 mm long; *adaxial lobe* 3-4 mm long, c. 3.5 mm wide, apex trilobed with sinuses c. 2 mm long, adaxial lateral lobes often narrower and more acute than adaxial median lobe. *Corolla* 13-14 mm long, mauve on lobes and outer surface of tube, white to cream-coloured with maroon dots on inner surface of tube; outer surface glabrous; inner surface densely hairy at base of stamens, with occasional shorter hairs distally; *tube* funnel-shaped, 5.6-5.9 mm long; *abaxial median lobe* spatulate, c. 6-6.5 mm long, 6.5-7 mm wide, margin often slightly irregular, apex emarginate to bilobed (sinus c. 0.3 or 1.6-1.7 mm long), if lobed then each lobe notched producing a small lateral secondary lobe or variously notched; *lateral lobes*  $\pm$  circular, c. 4.5-4.8 mm long, c. 4.5 mm wide, apex slightly emarginate; *adaxial median lobe-pair* transversely broad-elliptic, 5.2-5.5 mm long, 6.8-7 mm wide, apex bilobed (sinus 2-2.3 mm long), each lobe emarginate and so producing a small lateral secondary lobe. *Androecium* inserted c. 3.3 mm above base of corolla; *abaxial staminal filaments* 3.4-3.6 mm long; *anther* 1-1.2 mm long, *imperfect anther* c. 0.6 mm long, connective c. 1.4 mm long; *adaxial staminal filaments* 2.3-2.4 mm long, *anther* 0.8-0.9 mm long, connective c. 1 mm long, with sterile lobe c. 0.6-0.9 mm long and terminating in several narrowly triangular trichomes. *Pistil* 9.8-10.2 mm long; ovary 0.9-1 mm long; style 8.4-8.7 mm long. *Mericarps* immature.

DISTRIBUTION:

Endemic to the Wongan Hills, Western Australia.

ECOLOGY:

Occurring in *Petrophile*-dominated shrubland in shallow soils on lateritic rise.

NOTES:

This species is vegetatively very similar to *Microcorys obovata*, but the leaves are opposite in *H. conferta* and in whorls of three in *M. obovata*. The dimorphic leaves of this new species readily distinguish it from *M. obovata* and other *Hemigenia* species. The floral leaves remain on the plant for at least two flowering seasons. The short internodes of the  $R_z$  (conflorescence) axis and the adherence of the pedicel to the  $R_z$  axis are useful diagnostic features of this species.

The affinities of *H. conferta* are unclear, but it may be related to *H. obovata*. However, the latter has linear prophylls, a distinctly 'free' pedicel, hairy branches and  $R_z$  internodes of similar length to the vegetative internodes.

OTHER SPECIMENS EXAMINED:

Western Australia: South-West (Avon) — Conn 2244 (MEL 1538991, PERTH), 2251 (MEL 1538992, PERTH) & 2257 (MEL 1538993, MO, PERTH, RSA) [date and locality as for type collection].

MICROCORYS

*Microcorys cephalantha* Conn, sp. nov.

*Frutices* 0.2 m. alti. *Rami* et ramuli partim dense tomentosi. *Folia* verticillata terna, glabra vel pilis sparsis; *petiolus* absens; *lamina* anguste obovata, 10-12.5 mm. longa, 2.5-4 mm. lata, basi anguste cuneata, margine integro, apice obtuso. *Inflorescentiae* ad instar capitulorum. *Pedicellus florum* 0.3-0.5 mm. longus, dense tomentosus, *prophyllis* anguste deltoideis usque anguste suboblongis, 0.4-0.5 mm. longis, circa 0.1 mm. latis, sparse usque dense tomentosis. *Calyx* partim sparse usque moderate tomentosus, extra sparse usque moderate glandifer; *tubus* 2.8-3.1 mm. longus; *lobi* deltoidei usque late deltoidei, 2.8-3.1 mm. longi, 0.9-1.3 mm. lati, apice acuminato usque subcaudato. *Corolla* circa 6-8 mm. longa, alba et partim lutea, extra lobis moderate usque dense tomentosa, intra in partibus distalibus moderate tomentosa; *tubus* 4.3-5 mm. longus; *lobus abaxiali-medianus* plus minusve spatulatus, circa 4.5 mm. longus, circa 3 mm. latus; *lobis lateralibus* obovatis usque spatulatis, 2.3-3.9 mm. longis, 1.4-2.8 mm. latis; *pari loborum adaxiali-mediano* cuculliformi, 2.6-3.3 mm. longo. *Androecium* 3.5-3.8 mm. e basi corollae affixum; filamenta staminum 2.4-2.5 mm. longa; antherae

0.7-1 mm. longae, connectivo prope basim filamenti adnato, 0.8-0.9 mm. longo; filamenta staminodiorum circa 0.5 mm. longa; lobi staminodiorum circa 1 mm. longi. *Pistillum* 6.2-6.8 mm. longum; ovarium circa 0.3 mm. longum; stylus 5.7-6.3 mm. longus. *Mericarpi* 1.8-2 mm. longa.

TYPE: *Hnatiuk* 780068, 13.i.1978, 10 km WNW. of Jitarning, Western Australia (Holo.: PERTH; iso.: MEL 1538995). [Actually NW. of Jitarning, on 'Eighty Six Gate road', 4 km W. of junction with the 'Jitarning West road'.]

Shrub, 0.2 m high. *Branches* decumbent with erect new shoots, densely hairy along a narrow longitudinal region between axil of leaf and next more distal node, more basal internodes sparsely hairy. *Leaves* in whorls of 3, sessile or with a few scattered  $\pm$  patent, multicellular hairs near and/or on margin; *lamina* narrowly obovate, 10-12.5 x 2.5-4 mm, base narrowly cuneate, margin entire, apex obtuse. *Inflorescence* a head-like frondo-bracteose racemiform conflorescence, internodes of conflorescence (Rz axis) reduced; c. 10-flowered [per conflorescence]. *Pedicel* 0.3-0.5 mm long, densely hairy; *prophylls* narrowly triangular to narrowly suboblong, 0.4-0.5 mm long, c. 0.1 mm wide, sparsely to densely hairy, margin entire, apex obtuse. *Calyx* sparsely to moderately hairy on margin of lobes and distal inner surface of lobes; outer surface sparsely to moderately glandular, glands pedicellate, up to c. 0.1 mm long; *tube* 2.8-3.1 mm long; *lobes* triangular to broadly triangular, 1-1.6 mm long, 0.9-1.3 mm wide, apex acuminate to subcaudate. *Corolla* c. 6-8 mm long, 'white with maroon spots, hood [adaxial median lobe-pair] yellow with red-brown internal spots' (*Hnatiuk* 780068); outer surface with tube glabrous and lobes moderately to densely hairy; inner surface of tube glabrous, occasionally with a few hairs just below base of androecium, adaxial median lobe-pair and margin of abaxial and lateral lobes moderately hairy; *tube* narrowly tubular and abruptly expanded distally, 4.3-5 mm long; *abaxial median lobe*  $\pm$  spatulate, c. 4.5 mm long, c. 3 mm wide, apex irregular and emarginate; *lateral lobes* obovate to spatulate, 2.3-3.9 mm long, 1.4-2.8 mm wide, apex irregular; *adaxial median lobe-pair* hood-shaped, margin obovate in outline, 2.6-3.3 mm long, c. 2 mm wide, margin  $\pm$  recurved, 'apex' rounded. *Androecium* inserted 3.5-3.8 mm above base of corolla (in expanded distal part of tube); *staminal filaments* 2.4-2.5 mm long; *anthers* 0.7-1 mm long, connective displaced basally so that it is adnate c. 0.4 mm from base of filament, 0.8-0.9 mm long and terminated by several hairs, sterile end of connective not enlarged; *staminodal filaments* c. 0.5 mm long; *staminodal lobes* c. 1 mm long. *Pistil* 6.2-6.8 mm long; ovary c. 0.3 mm long; style 5.7-6.3 mm long. *Mericarps* 1.8-2 mm long.

#### DISTRIBUTION:

Only known from the South-West botanical province (Avon and possibly Roe districts) of Western Australia.

#### ECOLOGY:

Occurring in roadside closed heath community on sandy loam with lateritic gravel (*Hnatiuk* 780068).

#### NOTES:

This species has close affinities with *M. capitata*, since both have head-like conflorescences, acuminate to subcaudate calyx lobes and the staminal connective greatly removed from the anther. *M. cephalantha* is readily distinguished from *M. capitata* by the narrowly obovate sessile leaves (ovate and distinctly shortly petiolate in *M. capitata*), the narrowly cuneate leaf base (rounded in *M. capitata*), and by the floral leaves which are distally reduced to prophylls (broadened, hence broadly ovate and more or less covering the flowers in *M. capitata*).

#### OTHER SPECIMEN EXAMINED:

Western Australia: South-West (Avon) — Foreman 1141, 21.xi.1985, 18 km S. of Kulin (MEL 678390).

(? *Avon or Roe*) — *Humphreys s.n.*, 11.xii.1965, 119.5 miles [? from Perth] along Lake Grace road (PERTH).

***Microcorys elliptica* Conn, sp. nov.**

*Frutices parvi. Rami et ramuli moderate tomentosi. Folia verticillata terna, moderate tomentosa; petiolus* circa 2-2.5 mm. longus; *lamina* anguste elliptica, 15-21 mm. longa, 2.5-4 mm. lata, basi decurrens, margine integro et leviter recurvo, apice subacuto. *Pedicellus florum* 2-3 mm. longus, dense tomentosus, *prophyllis* anguste obovatis usque linearibus, 1.3-2.2 mm. longis, 0.2-0.3 mm. latis, dense tomentosus. *Calyx* extra dense tomentosus; *tubus* 2.7-3.3 mm. longus, interne ad basim glaber, alibi tomentosus; *lobi* deltoidei, 2.5-2.8 mm. longi, 1-2.2 mm. lati, apice obtuso. *Corolla* 7-11 mm. longa, alba, extra in partibus distalibus dense tomentosa, intra dense tomentosa ad basim androecii; *tubus* circa 3.5 mm. longus; *lobus abaxiali-medianus* late spathulatus usque depresso-spathulatus, 2.5-3.8 mm. longus, 3.5-3.8 mm. latus; *lobis lateralibus* plus minusve oblongis, (2-)2.7-2.9 mm. longis, circa 1.5-1.7 mm. latis; *pari loborum adaxiali-mediano* cuculliformi, 2.3-2.5 mm. longo. *Androecium* 1.7-1.8 mm. e basi corollae affixum; filamenta staminum 3.7-3.8 mm. longa; antherae 1.7-1.8 mm. longae, connectivo circa 1.5 mm. longo; filamenta staminodiorum 3.3-3.5 mm. longa; lobi staminodiorum circa 1.5 mm. longi. *Pistillum* circa 4.5-5 mm. longum; ovarium circa 0.9-1 mm. longum; stylus 3-4 mm. longus. *Mericarpia* immatura.

TYPE: *Craven 6647*, 30.iii.1981, c. 18 km SE. of Jabiru, Kakadu National Park, Northern Territory (Holo.: MEL 653914; iso.: CANB).

Small weak shrub (height not known). *Branches* moderately hairy. *Leaves* in whorls of 3, moderately hairy; *petiole* c. 2-2.5 mm long; *lamina* narrowly elliptic, 15-21 x 2.5-4 mm, base decurrent, margin entire, slightly recurved, apex subacute. *Inflorescence* a frondose racemiform confluence; to c. 54-flowered [per confluence]. *Pedicel* 2-3 mm long, densely hairy; *prophylls* narrowly obovate to linear, 1.3-2.2 mm long, 0.2-0.3 mm wide, densely hairy, base very narrowly cuneate, margin entire, apex obtuse. *Calyx* outer surface densely hairy, especially on tube; *tube* 2.7-3.3 mm long, with inner surface glabrous basally, densely hairy on distal half; *lobes* triangular, 2.5-2.8 mm long, 1-2.2 mm wide, apex obtuse. *Corolla* 7-11 mm long, white; outer surface glabrous basally, densely hairy distally; inner surface glabrous on basal 1.7-1.8 mm of tube, densely hairy in a narrow band where the androecium unites with the corolla, distally with occasional hairs; *tube* c. 3.5 mm long; *abaxial median lobe* broadly spathulate to depressed-spathulate, 2.5-3.8 mm long, 3.5-3.8 mm wide, apex irregular and rounded, emarginate; *lateral lobes* ± oblong, (2-)2.7-2.9 mm long, c. 1.5-1.7 mm wide at base, apex irregular and broadly obtuse; *adaxial median lobe-pair* hood-shaped, 2.3-2.5 mm long, margin recurved, apex bilobed (sinus c. 0.8 mm long), apex of each lobe-pair obtuse. *Androecium* inserted 1.7-1.8 mm above base of corolla; *staminal filaments* 3.7-3.8 mm long; *anthers* 1.7-1.8 mm long, connective c. 1.5 mm long and terminated by many narrowly triangular trichomes; *staminodal filaments* 3.3-3.5 mm long; *staminodal lobes* c. 1.5 mm long. *Pistil* c. 4.5-5 mm long; ovary c. 0.9-1 mm long; style 3-4 mm long. *Mericarps* immature.

DISTRIBUTION:

Only known by the type specimen from Kakadu National Park, Northern Territory.

ECOLOGY:

Occurs in 'crevices on exposed sandstone cliff [which is an] outlier of main plateau' (*Craven 6647*).

NOTES:

This new species is of biogeographical interest because of its large disjunction with the centre of diversity of the genus (*viz.* south-western Western Australia).

The affinities of this species are not known. *M. longiflora* is the only species which is superficially similar to *M. elliptica*. However, the two species are readily

distinguished. The leaves of *M. longiflora* are narrowly ovate or sometimes appear narrowly oblong because the margin is recurved (never narrowly elliptic), whereas *M. elliptica* has narrowly elliptic leaves. Furthermore, the corolla of *M. longiflora* is about 15 mm long, whereas the corolla is 7-11 mm long in *M. elliptica*.

***Microcorys wilsoniana* Conn, sp. nov.**

*Frutices* 0.5-0.6 m. alti. *Rami* et *ramuli* dense tomentosi. *Folia* verticillata terna vel opposita, moderate vel sparse tomentosa; *petiolus* absens aut si praesens tum usque ad circa 0.5 mm. longus; *lamina* late ovata usque ovata, 8-16 mm. longa, 3.5-12 mm. lata, basi obtusa usque subtruncata, margine integro et recurvo, apice obtuso. *Pedicellus florum* 1.5-1.9 mm. longus, dense tomentosus, *prophyllis* anguste obovatis, 2.5-2.7 mm. longis, 0.4-0.6 mm. latis, dense tomentosus. *Calyx* dense tomentosus; *tubus* 2.6-3.1 mm. longus; *lobi* late deltoidei, 2.5-2.6 mm. longi, 1.3-2 mm. lati, apice obtuso. *Corolla* 11-14 mm. longa, malvina vel purpurea, extra in partibus distalibus moderate usque dense tomentosa, intra in partibus distalibus moderate tomentosa; *tubus* 8-10 mm. longus; *lobus abaxiali-medianus* depresso-obovatus, 3.4-4.5 mm. longus, 5.5-6.5 mm. latus; *lobis lateralibus* late obovatis, 2.6-3.6 mm. longis, 3.3-3.9 mm. latis; *pari loborum adaxiali-mediano* cuculliformi usque depresso-ovato, circa 3.3 mm. longo. *Androecium* 3.8-4.6 mm. e basi corollae affixum; filamenta staminum 1.6-1.8 mm. longa; antherae 1-1.1 mm. longae, connectivo 1.5-2.3 mm. longo; filamenta staminodiorum 1.8-2 mm. longa; lobi staminodiorum 0.5-0.8 mm. longi. *Pistillum* 8.5-9 mm. longum; ovarium 0.7-0.8 mm. longum; stylus 7.5-9 mm. longus. *Mericarpi* 1-1.2 mm. longa.

TYPE: *Wilson 6934*, 8.viii.1968, N. side of Mt Short, c. 14 km NNW. of Ravens-thorpe, Western Australia (Holo.: MEL 1538613; iso.: MEL 1538612, PERTH, other duplicate to be distributed).

Shrub, 0.5-0.6 m high. *Branches* densely hairy. *Leaves* in whorls of 3 or opposite, sessile or very shortly petiolate, densely hairy basally, moderately or sparsely hairy distally; *petiole* up to c. 0.5 mm long; *lamina* broadly ovate to ovate, 8-16 x 3.5-12 mm, base obtuse to subtruncate, margin recurved, apex obtuse. *Inflorescence* a frondose racemiform confluence; 6-12 flowered [per confluence]. *Pedicel* 1.5-1.9 mm long, densely hairy; *prophylls* narrowly obovate, 2.5-2.7 mm long, 0.4-0.6 mm wide, densely hairy, base narrowly cuneate, margin entire and slightly incurved, apex obtuse. *Calyx* densely hairy; *tube* 2.6-3.1 mm long; *lobes* broadly triangular, 2.5-2.6 mm long, 1.3-2 mm wide, apex obtuse. *Corolla* 11-14 mm long, mauve or purple; outer surface glabrous basally, moderately to densely hairy distally; inner surface glabrous on basal 2.3-2.5 mm of tube, moderately hairy in distal parts of tube and base of lobes, especially on median lobes; *tube* 8-10 mm long; *abaxial median lobe* depressed obovate, 3.4-4.5 mm long, 5.5-6.5 mm wide, apex irregular, bilobed (sinus c. 1.3 mm long); *lateral lobes* broadly obovate, 2.6-3.6 mm long, 3.3-3.9 mm wide, apex irregular, emarginate; *adaxial median lobe-pair* depressed ovate, c. 3.3 mm long, 4.6-4.8 mm wide, apex irregular, emarginate to bilobed (sinus 0.4-0.7 mm long), apex of each lobe-pair obtuse. *Androecium* inserted 3.8-4.6 mm from base of corolla; *staminal filaments* 1.6-1.8 mm long; *anthers* 1-1.1 mm long, connective 1.5-2.3 mm long and terminated by many narrowly triangular trichomes on an expanded and flattened sterile end; *staminodal filaments* 1.8-2 mm long; *staminodal lobes* 0.5-0.8 mm long. *Pistil* 8.5-9 mm long; ovary 0.7-0.8 mm long; style 7.5-9 mm long. *Mericarps* 1-1.2 mm long.

DISTRIBUTION:

Only known from Mt Short, Western Australia.

ECOLOGY:

Occurs on disturbed margin of extensive quarry for road metal in dense Mallee on red-brown lateritic and sandstone-derived soil (*Barker 2543*).

NOTES:

This species appears to have close affinities with *M. purpurea*. *M. wilsoniana*

has a calyx tube to lobe ratio of 0.8-0.9 (2.5-3.3 in *M. purpurea*), the indumentum generally patent even though varying from subretorse to subantrorse but never appressed (subappressed to appressed antrorse hairs in *M. purpurea*) and the petioles absent or up to c. 0.5 mm long (consistently shortly petiolate and c. 0.8 mm long in *M. purpurea*).

#### ETYMOLOGY:

The specific epithet honours Paul G. Wilson of the Western Australian Herbarium for his significant contribution to the taxonomy of the Australian flora.

#### OTHER SPECIMEN EXAMINED:

*Western Australia: South-West (Eyre) — Barker 2543, 21.ix.1977, Mt Short (AD, MEL 1538996); Foreman 1203, 24.xi.1985, ibidem (MEL 678389); George 4440, 25.v.1963, ibidem (MEL 1538994, PERTH); Young Y269, 10.x.1967, ibidem (PERTH).*

#### ACKNOWLEDGEMENTS

I am indebted to the Directors/Curators and staff of AD and PERTH for making available loans of herbarium material held in their institutions.

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# THE ALPINE VEGETATION OF VICTORIA, EXCLUDING THE BOGONG HIGH PLAINS REGION

by

N. G. WALSH, R. H. BARLEY AND P. K. GULLAN\*

## ABSTRACT

Walsh, N.G., Barley, R.H. & Gullan, P.K. The alpine vegetation of Victoria, excluding the Bogong High Plains region. *Muelleria* 6(4):265-292(1986).—All alpine and subalpine areas of naturally treeless vegetation in Victoria, with the exception of the Bogong High Plains, were surveyed during the summer months between November 1980 and February 1982. Floristic information from 498 quadrats was analysed via a computer-based, numerical sorting and classification procedure to determine the major floristic vegetation types of the area. These were then arranged hierarchically into 10 floristic *communities*, each of which contained one or more distinct floristic *sub-communities*. Each of the 29 sub-communities is described and its distribution given in this paper.

Heathlands were the commonest structural category (almost two-thirds of all quadrats sampled) but these occupied a wide range of environments from deep, water-retentive bogs to dry, exposed, rocky outcrops. Grasslands occupied most of the remaining sites.

## INTRODUCTION

This paper presents the results of a systematic botanical survey of alpine vegetation in Victoria, with the exception of the Bogong High Plains region (which was the subject of a similar study by McDougall (1982)). The results of the survey have been interpreted to identify the major vegetation types and to indicate their broad-scale distribution within the study area.



Fig. 1 Distribution of alpine or subalpine treeless areas in Victoria.

## THE STUDY AREA

The study area is defined as all treeless alpine and subalpine country within the Victorian alps, excluding the Bogong High Plains (Fig. 1). The major mountain systems include, from west to east, Lake Mountain, the Baw Baw Plateau, Mts Skene and Buller, the Bluff, Mts Howitt and Cobbler, the Snowy Range, Mts Wellington and Buffalo, the Dargo High Plains, the Nunniong Plateau, the Cobberas and Davies Plain (Fig. 2). Approximately 70 km<sup>2</sup> of naturally treeless, alpine or subalpine vegetation, i.e. approximately one third of the total area covered by this kind of vegetation in Victoria, occurs fragmentedly within the study area. Most of the remainder of this type of vegetation is distributed almost continuously across the Bogong High Plains.

\* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

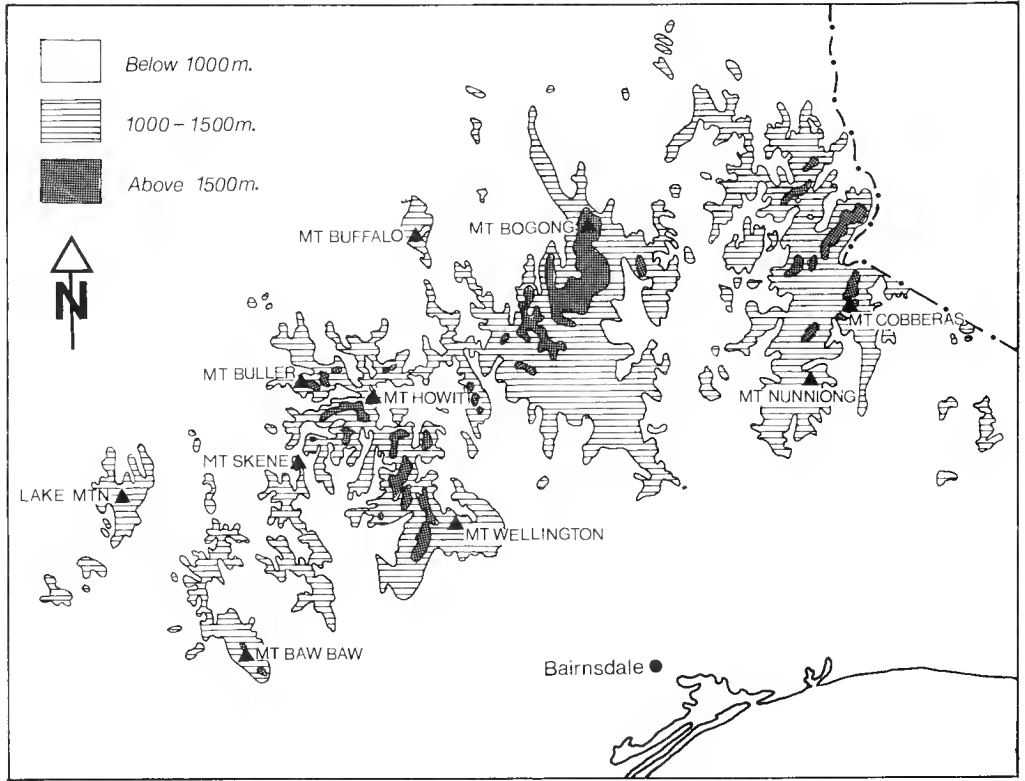


Fig. 2. Major mountain ranges above 1000 m in the study area.

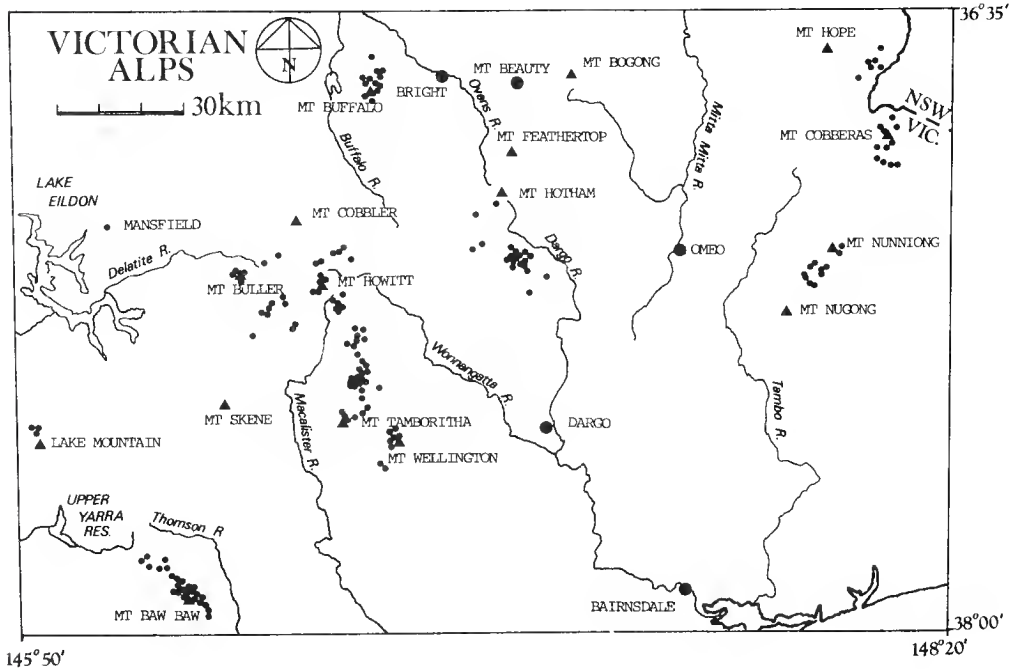


Fig. 3. Distribution of the 498 sample sites in the study area.

## THE SURVEY

### Method

#### DATA COLLECTION

In each square kilometre of treeless vegetation at least three quadrats, each 4 x 5 m, were chosen to represent different vegetation types. Sampling intensity was increased in areas of apparent high diversity to ensure that all vegetation types were represented. A total of 498 sites were sampled (Fig. 3), an average of about 7 sites to each square kilometre. This high sampling intensity reflects the high degree of local variation of the vegetation and fragmented dispersal of (often small) areas of treeless vegetation in the study area. Each site was sampled in a uniform stand of vegetation. In very restricted occurrences of a vegetation type, quadrats may have been smaller than 4 x 5 m.

Every vascular plant species within a quadrat was identified and assigned a cover/abundance value (Gullan 1978) corresponding to a visual estimate of its performance in that quadrat. Dominant cryptogams (mosses and lichens) were similarly treated. Height and extent of cover of shrub and ground layers at each site were noted, as were slope, aspect, altitude and percentage cover of cattle faeces and exposed rock or earth.

#### PLANT IDENTIFICATION

All plants which could not be identified in the field were collected, labelled and taken to the National Herbarium of Victoria (MEL) for closer examination and comparison with the Herbarium's reference collection. This procedure allowed for the identification to species level of all but a few plants collected. Where suitable material was available, specimens of particularly difficult groups were submitted to recognised experts for identification. Nomenclature follows that of Forbes *et al.* (1984).

Availability of only sterile material for the following species reduced their determination to generic level:

*Agrostis hiemalis*, *A. parviflora*, *A. venusta*—recorded as *Agrostis* sp.  
*Chiloglottis cornuta*, *C. gunnii*—recorded as *Chiloglottis* sp.  
*Danthonia eriantha*, *D. setacea*—recorded as *Danthonia* sp.  
*Deyeuxia carinata*, *D. crassiusculus*—recorded as *Deyeuxia* sp.  
*Isolepis aucklandicus*, *I. montivagus*—recorded as *Isolepis* sp.

No attempt was made to discern between the four alpine species of *Sphagnum* (*S. australe*, *S. cristatum*, *S. falcatum*, *S. subsecundum*) and these have all been recorded as *Sphagnum* spp.. Costin *et al.* (1979) segregated alpine or subalpine forms of *Erigeron pappochroma* into three distinguishable taxa, A, B and C, and this arrangement has been adopted in the present study. *Craspedia glauca* is treated by the same authors as including six taxa, A-F. Five forms of this plant were recorded in the present study and listed as *Craspedia* C-G. These do not necessarily correspond to like-named taxa of Costin *et al.*, but C and D are in both cases similar, if not synonymous.

#### DATA STORAGE AND ANALYSIS

Information from each quadrat site (floristics, locality, altitude and sampling date) was stored on magnetic disc. Analyses utilized a computer-based, numerical classification procedure followed by a hand-sorting procedure, as outlined in Gullan (1978). The result of the analyses is a set of two-way tables, which present all of the data in a sorted form. However, because many species occur in relatively few of the quadrats and add little to the overall vegetation description, the two-way tables presented in this report do not contain all the species recorded in each quadrat. For a full explanation of the tables see Gullan *et al.* (1981).

Generally a trend of increasing wetness of the vegetation from left to right (quadrats) and top to bottom (species) is depicted in the tables.

### Terminology

The several terms given below have precise definitions in the context of this work (following Gullan *et al.* 1981). Other terms (such as alliance, formation, association) commonly used in vegetation description have been variously misapplied and are not universally understood. Their use has been avoided in this paper.

#### SUB-COMMUNITY

A sub-community is a group of quadrats which have a similar floristic composition. This term is synonymous with the "nodum" of Poore (1955) and is the basic unit of vegetation used in this study.

#### COMMUNITY

A community is a collection of sub-communities (or sometimes a single sub-community) which have floristic and environmental affinities. The community may represent either a floristic continuum along which arbitrary divisions have been made to form sub-communities, or a collection of sub-communities which are considered to be different temporal phases of the same vegetation type, or a single vegetation type having undergone different disturbance regimes (e.g. fire, grazing, clearing).

#### CHARACTER SPECIES

A character species is one which occurs frequently and consistently in the quadrats of a sub-community. The resolution of character species is based upon a formula which sets the lower limit for species occurrence in quadrats of a sub-community at 35%-55%, the exact value depending on the number of quadrats representing that sub-community (see Gullan *et al.* 1981).

#### COMMUNITY NAMES

These are descriptive names applied to the communities and utilize common rather than scientific terminology in an attempt to convey an impression of the structure and environment of the community. These names do not follow set rules such as those outlined by Specht (1970) or Braun-Blanquet (1928) because they are not intended to form the basis for a formal nomenclature.

### Limitations and Qualifications

#### FLORISTICS

Although all quadrats were sampled during summer, the main growing season for most alpine plants, certain seasonally-apparent species (particularly orchids) and ephemerals may have been unrecorded because they were absent or insufficiently represented at the time of sampling.

#### DISTRIBUTION OF SUB-COMMUNITIES

The distribution maps provided with the sub-community descriptions show sites where a sub-community has been positively recorded. They are intended only to show sub-community distribution in a broad sense within the study area and cannot be interpreted as maps indicating the entire ranges of the sub-communities.

#### WEEDS

Information on alien species (mean % occurrence, mean % cover) has been provided for each sub-community in order to give some indication of weed invasion into native plant communities. Certain areas, such as roadsides and muster yards, contain a very much higher weed composition than indicated for any sub-community but were generally not sampled in this study. For this and other reasons the weed information provided does not indicate the abundance or distribution of weeds within the entire study area.

## RESULTS

The results of the survey and its analyses are presented in three ways in order to provide easy access to any piece of information relevant to the aims of this paper.

### Two-way Tables

The two-way tables (Tables 1-3) provide a succinct description of the floristic composition of the vegetation and are the most important source of information about floristic variation within and between different kinds of vegetation. They contain almost all of the raw data. All character species of the sub-communities are listed and only those species which occur in fewer than about 5% of the quadrats are absent.

### Community Descriptions

Ten communities have been described for the study area. It is possible that a greater number of communities would have existed at the time of European settlement and certain that, of those communities described, at least some have undergone modification as a result of land management practices.

A brief description of each of the communities is given below.

ALP COMMUNITY 1: *Podocarpus* Heathland (1 sub-community; 11 sites. Alt. 1400-1740 m, av. 1606 m).

A floristically and ecologically well-defined closed-heathland forming thickets on rocky, usually igneous substrates occupying exposed ledges or steep gullies at high altitudes. Although widespread throughout the study area (with the exception of the Baw Baw and Nunniong Plateaux), individual stands of this community are confined to small and often isolated sites, usually covering 100 m<sup>2</sup> or less. Species composition is particularly constant, with a low floristic diversity and invariable dominance of the coniferous shrub *Podocarpus lawrencei*.

ALP COMMUNITY 2: Low Alpine Shrubland (2 sub-communities; 12 sites. Alt. 1460-1760 m, av. 1617 m).

A low-shrubland of medium to steeply graded slopes, comprising several species which are commonly associated with Snow Gum Woodlands at lower altitudes. Soils are typically shallow with igneous or sedimentary outcrops common. Herbaceous species are not common and grasses usually dominate the fairly sparse ground layer.

ALP COMMUNITY 3: Sparse, Rocky Alpine Heathland (4 sub-communities; 31 sites. Alt. 1400-1805 m, av. 1580 m).

A diverse community occupying rocky sites varying from exposed crags and summits to small, gentle rises within relatively flat snowplains. The constituent sub-communities are variously dominated by any of a number of low, spreading shrubs (e.g. *Phebalium squamulosum*, *Oxylobium alpestre*, *Grevillea australis*, or *Hovea longifolia*). The ground layer is usually sparse with a variety of herbs and grasses, various combinations of which represent local variants of the community.

ALP COMMUNITY 4: *Kunzea ericifolia* Heathland (3 sub-communities; 20 sites. Alt. 1380-1740 m, av. 1541 m).

The dominance of the procumbent, layering shrub *Kunzea ericifolia* makes this an easily recognizable community with local variants occurring on most ranges, with the exceptions of the eastern and western extremities of the study area. The community is invariably associated with shallow soils overlaying an extensive rocky substrate. Floristic richness is generally low, a trait common to vegetation dominated by a single species.

ALP COMMUNITY 5: Baw Baw Alpine Heathland (2 sub-communities; 18 sites. Alt. 1320-1535 m, av. 1410 m).

This community is restricted to the Baw Baw plateau where it usually occupies dry to damp sites of northerly aspect. Shrub cover is frequently dense, up to 1.5 m tall, dominated by *Helichrysum secundiflorum*, *Olearia phlogopappa*, *O. algida* and a low, dense, highland form of *Pultenaea muelleri*. The ground layer incorporates a wide variety of herbs. This community merges to Snow Gum Woodland at lower altitudes where many of the same species are common components of the shrub stratum.

ALP COMMUNITY 6: Alpine Heathland (4 sub-communities; 123 sites. Alt. 1160-1760 m, av. 1507 m).

This is the most abundant and widespread alpine community, occupying a wide variety of habitats throughout the study area. It is characterised by a low, discontinuous shrub cover of *Hovea longifolia* (and occasionally *Grevillea australis*) and a dense tussock-grass cover of *Poa fawcettiae* (or *P. phillipsiana* in basaltic areas). Other graminoid or herbaceous species are locally common and indicative of various edaphic or climatic conditions, but a number of small herbs are ubiquitous (e.g. *Microseris scapigera*, *Asperula gunni*, *Carex breviculmis*, *Leptorhynchos squamatus* and the introduced *Rumex acetosella*).

ALP COMMUNITY 7: Alpine Grassland (3 sub-communities; 64 sites. Alt. 1200-1680 m, av. 1481 m).

This community is closely allied, floristically and geographically, to community 6. It may be distinguished by a higher cover of grasses or the branching rope-rush *Empodisma minus* and a corresponding paucity of shrub species. The community frequently forms extensive, unbroken tracts on flat snow-plains. Soils are typically deep and water-retentive but are seldom waterlogged. This community contains representatives of the weediest vegetation encountered in the study area and includes the most heavily grazed areas sampled.

ALP COMMUNITY 8: Baw Baw Damp Alpine Heath (1 sub-community; 8 sites. Alt. 1305-1480 m, av. 1379 m).

This community occupies a position transitional between sodden, Wet Alpine Heathland (community 9) and Baw Baw Dry Alpine Heathland (community 5) on the Baw Baw Plateau. Soils are deep, damp and peaty. Granite boulders are common. The vegetation includes a fairly even mixture of shrub species (*Grevillea australis*, *Asterolasia trymaloides*, *Epacris petrophila*, *Orites lancifolia*, *Helichrysum hookeri*) and rarely exceeds a height of one metre. Although geographically and ecologically a transitional vegetation type, the above shrub species and several herbs are more abundant than in either of the adjacent communities.

ALP COMMUNITY 9: Wet Alpine Heathland (6 sub-communities; 112 sites. Alt. 980-1760 m, av. 1450m).

A low, open- to closed-heathland scattered throughout the study area on wetter sites. This community includes alpine bog vegetation dominated by *Sphagnum* spp., i.e. mosses with a high water-retentive capacity. These mosses contribute to an environment which is, in Australia, confined almost entirely to the alps and subalps. Vegetation which is not dominated by *Sphagnum* spp. usually supports a higher diversity and abundance of shrubs and has *Empodisma minus* as the main ground cover. This is the commonest wetland species throughout the study area but, on the Bogong High Plains, it is apparently confined to waterlogged depressions (McDougall, 1982). The epacrids *Richea continentis* and *Epacris paludosa* are ubiquitous in sites supporting community 9.

ALP COMMUNITY 10: Damp Alpine Heathland (3 sub-communities; 49 sites. Alt. 1120-1740 m, av. 1404 m).

This community is invariably associated with sphagnum

bogs, broad drainage platforms and deep, humus-rich soils at stream margins. It occurs on the Snowy Range, Dargo High Plains and mountains to the far east of the study area. Shrub cover is generally sparse whereas the ground layer is usually dense and varied, consisting mainly of low, matting herbs. *Sphagnum* clumps are occasional but rarely continuous (cf. community 9). Both the *Sphagnum* and the tender herb layer are commonly dissected by cattle or brumbies which are prevalent in some areas. A relatively high proportion of weeds (averaging 8% of species total) is consistent with utilisation of these areas for grazing.

### Sub-community Summary Sheets

The following three sets of information have been amalgamated to produce a summary sheet for each of the 29 sub-communities. These constitute the primary means of describing vegetation in this paper.

**SUB-COMMUNITY DISTRIBUTION MAPS:** The distribution of each sub-community throughout the study area is shown by means of a schematic map on which is marked the locations of all of its constituent quadrat sites.

**CHARACTER SPECIES TABLES:** These tables summarise information from the two-way tables and present it in a different format. The tables contain the character species of each sub-community listed in order of their frequency of occurrence, and the frequency (% FREQ) and mean cover/abundance (C/A) of each species. Species are arranged to show their relative importance within an individual sub-community, in contrast to the two-way tables in which they are arranged to demonstrate the inter-relationships between sub-communities.

**SUB-COMMUNITY DESCRIPTIONS AND ANNOTATIONS:** A simple description has been prepared for each sub-community which includes briefly summarised information on its distribution, environment, altitude, aspect, incline, structure, floristic richness and weed composition.

### ACKNOWLEDGEMENTS

The authors wish to express their gratitude to the following people and organisations who assisted in various aspects of this work—to Peter Durkin, Stephen Forbes, Knud Hansen, Sally Lloyd, Charles Meredith, John Renowden, Harm van Rees, Ron Walsh and Jan White for assistance with fieldwork and processing of raw data; to the (then) Forests Commission of Victoria for provision of accommodation during several stages of the fieldwork; to various officers of the National Parks Service for helpful advice and transport when working within Mt Baw Baw and Mt Buffalo National Parks; to Bob Chinnock (AD), Elizabeth Edgar (CHR), Max Gray (CANB), Tony Orchard (HO), Joy Thompson (NSW) and Karen Wilson (NSW) for identification or confirmation of specimens unable to be matched at the National Herbarium of Victoria (MEL).

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Table 3. Two-way table of Communities 9 and 10.

SUB-COMMUNITY		9.1	9.2	9.3	9.4
QUADRATS		111111111111	111111111111111111111111111111	11111111111111	11111111111111111111
SPECIES		666666666666	6666666666666666666666666666	6666668888666	33333333333333333999
		000000000000	0000000000000000000000000000	00000011110000	10010010000000011000
		140160140112	7557203736508745687678712555	126032222475	50551423000357638404
		9754943887152	585866381331864701562054230	813121245479	84502952624791316590
2796	Senecio pectinatus	++++ ++		1	
1503	Herpolirion novaezelandiae	+ ++ + +1 +		+	
2267	Pimelea alpina	11111+1++	+ + +	+	1 + +
1076	Epacris petrophila	+ 1+11 2211	+ + + +		
3325	Plantago alpestris	+1 + 1+ +1 +	+1 + + + 1+	1	
3343	Poa hienata	2+22211+1 12	+ 1	+ +1 1	+ + + +
1225	Euphrasia gibbsiae	+ +1 + 111 +	+ ++ +1	+ +1 11 +	
1875	Lycopodium fastigiatum	++ + + +1 +	11 + + + +1	11 +1 +	
3556	Craspedia sp. 'D'	11111+1++	+ + + 1 1 + ++ +1++	+++ +	
0620	Carpha nivicola	+ + + + 1	+ +12 1++ + 1 1 11 +	211 1	1+12 321
1301	Gentianella diemensis	++ +11+11+1	11++1+111+++ 1+ 1 11++	1++1++	+ +
2073	Olearia algida	+11+111++1	11++ +1++1+1+1 ++1 1+111	+++ 1++ 11 +	1 21
0278	Astelia alpina	1++111+11+	211++111111+1++1+12+11+1	1211111122	111 1 1 +
3015	Thelymitra venosa	+ + + 1	+1 +++ 11++ ++ 11++1 +	+++1 +	+ 1
2730	Isolepis aucklandica	+ + +	+ + +1 1 1 11 +1 1+	+++ +1 1	++1 1++ + 1 1
0531	Callistemon sieberi	1	+1 +2++ +++ 11++ +1	+1 +1 + 1	2+231 + 11 1
2048	Nertera depressa	+ 1 +1 1	+1++ +1 ++ 1+ ++ +1	11 + + 1 1 +	11121+ +
2948	Stylidium graminifolium	11++	+ 1 +1 +	++ +1	+ + +2+
2633	Richea continentis	+1221232121	+1 2+ 11 11++2+ ++1+++241	132+2121122	+2233 +111 21131522 3
3882	Sphagnum spp.	+1+	2 1 + 5 2111221342	2112121 5121	225313251332555+ 2414
0337	Baekkea gunniana	11++1111	111+1++1211 11++ 1+1 1	+1 +	11213+2124 +112131+
1075	Epacris paludosa	2121++1 +1	22312+ 2322++112+++111212	22222223132+	122131+22 11211122 3
2125	Oreobolus distichus	1 +111 1111	+++ +1 11+	1++ 1 + 2	++1 11 1 11
0265	Asperulla gunnii	11+ ++ +1	+1 1 + ++11 1 1++ ++	++++ +1	1 1 +1 +1 +1 +11
0559	Empodisma minus	5 24323442	22223444212122221111121212	21	2213332122223313232
1435	Gonocarpus micranthus	++ +++ +	++ + 1	+ + +	+ +++ +1 1 1
3337	Poa costiniana	+ +	2+ 2 1 + 12 +1 +1 +	+ + +	1+ 2 1 ++ 1 1 1 1 12+
0606	Carex gaudichaudiana	+ + 1+1	11	2	1 111+ 1121111 1
2621	Restio australis		2		1 21 11 + 1
1073	Epacris microphylla		1+	+	+1 + 2 3
0569	Caltha introloba	1+	1+ + 1	++ +	1
0097	Acaena anserinifolia			++ +	++ +++ +
1070	Epacris breviliflora			11 12+1 12	11 +
3303	Luzula modesta			++ +1++1	++ + 1
0591	Carex appressa			11 1 +1 1++ 11 1+22	1+ 1
1551	Hydrocotyle algida	1 +	1 + 11 +1+	1+ ++ 111 +	
1085	Epilobium gunnianum		+ 1 ++ 1+	+ 11 1 +2	+11 +
1573	Hypericum japonicum		1 + +	+1 1	1 1+ 1
0452	Brachycome scapigera				1 + + +1 +
0793	Cotula alpina				+ + 1 1
2129	Oreomyrrhis ciliata		+ 1	2	+ +1+ 1 1
3066	*Trifolium repens				+ + + 1
2602	Ranunculus pimpinellifolius				1 11 112+ 1 ++
1618	Juncus falcatus				
3171	Wahlenbergia ceracea				+ 1+ +
2652	*Rumex acetosella				+
0442	Brachycome nivalis				
1003	Diuris pedunculata				+ +
2758	Scleranthus biflorus				
1083	Epilobium billardierianum				
0685	*Cerastium fontanum	+ 21 + +1	++ +		1+ 2+ + + 22
1381	Grevillea australis				+ ++ +
2590	Ranunculus graniticola				+ ++ +
0611	Carex jackiana			1 + + + 1	+ +1 +
3383	Isolepis subtilissima	+ + +		++1 1	+ + +
1754	Leptorhynchus squamatus	+ + + +		1	+ + +
2974	*Taraxacum officinale			+	1 + +
3143	Veronica serpyllifolia				
3328	Plantago euryphylla				+ +
0144	Agrostis venusta				
0797	Cotula filicula		+	+	
1241	Pestuca hookeriana				+
3119	Velleia montana				+
2711	Schoenus apogon				+
1585	Hypoxis hygrometrica				+
0945	Deyeuxia crassiuscula				11 +
1415	Hakea microcarpa				
2586	Ranunculus collinus	+ +	1 1+ 1+	+1 1 11	1 +
0392	Blechnum pennamarina	+++ +		++++	1 + +
3336	Poa clivicola				+ ++ 1 2



## PODOCARPUS HEATHLAND : SUB-COMMUNITY ALP 1.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Podocarpus lawrencei</i>	100	4	<i>Olearia philogopappa</i>	64	1			
<i>Tasmannia xerophila</i>	73	1	<i>Polystichum proliferum</i>	64	1			

NO. OF SITES: 11

STRUCTURE: Low closed-heathland

DISTRIBUTION: Scattered on higher peaks of the Study Area.

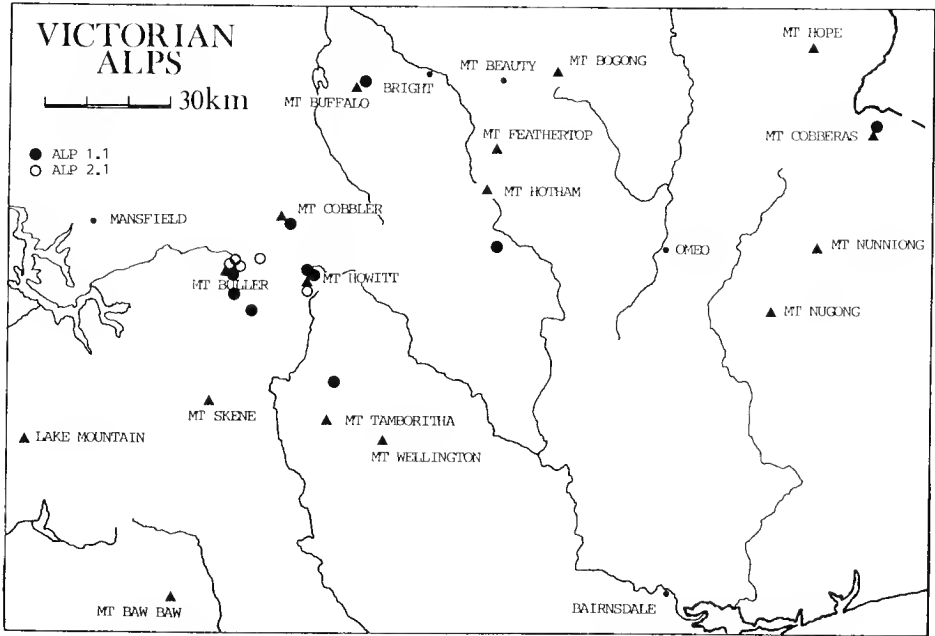
ENVIRONMENT: Restricted to well-drained rocky sites and boulder scree slopes. Most common on igneous substrates (e.g. Mt. Buffalo and The Cobberas) but sometimes occurring on sedimentary rock (e.g. the Snowy Range area).

ALTITUDE: Mean = 1606m, Highest = 1740m, Lowest = 1400m

MEAN FLORISTIC RICHNESS: 13 species per site

MEAN WEED COMPOSITION: 3% of species, 1% of cover

NOTES: Sub-community ALP 1.1 is dominated by the shrub *Podocarpus lawrencei*. This fire-sensitive plant is one of only two coniferous genera which are native to Victoria. Although seldom reaching heights in excess of 2 metres, it often lives for several hundred years, with a growth rate of as little as .25mm in trunk diameter per year (Costin et al. 1979). The low canopy formed by this species is frequently continuous. Light availability for other plants is therefore low. This is reflected in the low species diversity in this sub-community.



## LOW ALPINE SHRUBLAND : SUB-COMMUNITY ALP 2.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Oxylobium alpestre</i>	83	2	<i>Tasmannia xerophila</i>	67	1	<i>Rumex acetosella</i>	67	1
<i>Olearia philogopappa</i>	83	1	<i>Stellaria pungens</i>	67	1			

NO. OF SITES: 6

STRUCTURE: Low shrubland

DISTRIBUTION: Upper slopes of some of the higher peaks in the Study Area, including Mt. Magdala, Mt. Buller and Mt. Stirling.

ENVIRONMENT: Steep slopes with rocky soil, generally of eastern aspect.

ALTITUDE: Mean = 1640m, Highest = 1760m, Lowest = 1460m

MEAN FLORISTIC RICHNESS: 17 species per site

MEAN WEED COMPOSITION: 9% of species, 6% of cover

NOTES: A floristically poor sub-community, with little ground cover. Its species composition is similar to the understorey of some of the Snow Gum Woodlands found at lower altitudes (see Gullan and Norris 1981; Gullan et al. 1981). Sub-community ALP 2.1 is possibly a variation of sub-community ALP 1.1, caused by a disturbance such as fire. This is suggested by the absence of the fire-sensitive shrub *Podocarpus lawrencei*, and increased cover of *Oxylobium alpestre*, a shrub which grows well after fire. The weeds *Hypochoeris radicata* and *Rumex acetosella* are also more frequent in this sub-community, suggesting intrusion after fire or colonization of exposed substrate as on the scarp-fronts of the Mt. Howitt and The Bluff ridge.

**LOW ALPINE SHRUBLAND : SUB-COMMUNITY ALP 2.2**

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Carex breviculmis	83	1	Prostanthera cuneata	67	2	Poa fawcettiae	67	1
Oxylobium alpestre	67	2	Gonocarpus montanus	67	+			

NO. OF SITES: 6

STRUCTURE: Low shrubland

DISTRIBUTION: The Bluff, Mt. McDonald, The Viking, The Razor, Mt. Speculation and Mt. Stirling.

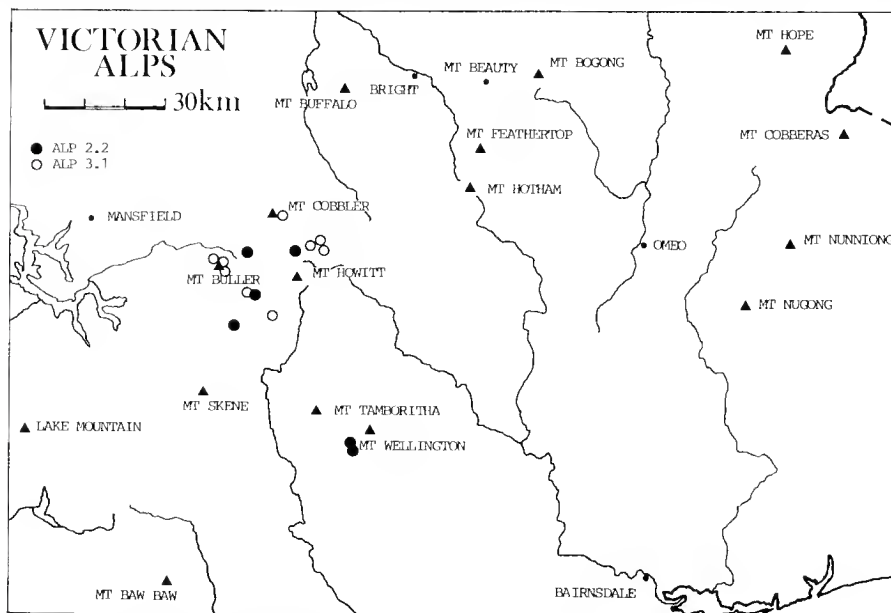
ENVIRONMENT: Shallow, rocky soil of exposed ridges and slopes, usually of southern aspect and moderate slope.

ALTITUDE: Mean = 1595m, Highest = 1720m, Lowest = 1530m

MEAN FLORISTIC RICHNESS: 15 species per site

MEAN WEED COMPOSITION: 1% of species, 1% of cover

NOTES: A shrubland sub-community containing two variations. The first, dominated by Prostanthera cuneata, Oxylobium alpestre and Pimelea axiflora, occurs in damper or more sheltered sites than those of the second variant, dominated by Acacia alpina, Grevillea australis, Baeckea ramosissima and Phebalium squamulosum. This sub-community is not common in the Study Area, and more closely resembles the understorey of Snow Gum Woodlands (Gullan et al. 1981 Forbes et al. 1932). Most of these sites are close to woodland, and the lack of tree species may be attributed to the effects of cold-air drainage, unstable rocky substrates, or other local factors.


**SPARSE ROCKY ALPINE HEATHLAND : SUB-COMMUNITY ALP 3.1**

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Poa fawcettiae	100	2	*Hypochoeris radicata	62	1	Danthonia alpicola	54	+
Helipterum albicans	77	1	Luzula novae-cambriae	62	1	Oxylobium alpestre	54	1
Bulbine bulbosa	69	1	Carex breviculmis	62	1			
Microseris scapigera	62	1	Stellaria pungens	62	1			

NO. OF SITES: 13

STRUCTURE: Low open-heathland

DISTRIBUTION: Rocky peaks of the Howqua, Jamieson, Delatite and Macalister River catchments.

ENVIRONMENT: Rocky gullies, shale and scree slopes, and on isolated rock outcrops.

ALTITUDE: Mean = 1571m, Highest = 1805m, Lowest = 1400m

MEAN FLORISTIC RICHNESS: 17 species per site

MEAN WEED COMPOSITION: 6% of species, 6% of cover

NOTES: This sparse, ledge-herbfield vegetation is structurally distinct from any other in the Study Area. It bears floristic affinities nearest to the dry shrubland of community 2, but the several shrub species characteristic of that community are lacking, whilst several specialist crag and ledge species occur commonly in ALP 3.1, (e.g. Luzula novae-cambriae, Helipterum albicans, Bulbine bulbosa and Danthonia alpicola).

## SPARSE ROCKY ALPINE HEATHLAND : SUB-COMMUNITY ALP 3.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex breviculmis</i>	100	1	<i>Helipterum albicans</i>	80	1	<i>Brachycome rigidula</i>	60	1
<i>Grevillea australis</i>	100	1	* <i>Hypochoeris radicata</i>	80	+	<i>Leptorhynchus squamatus</i>	60	1
<i>Poa hothamensis</i>	100	1	<i>Leucopogon suaveolens</i>	80	1	<i>Microseris scapigera</i>	60	1
<i>Celmisia asteliifolia</i>	80	1	<i>Luzula novae-cambriae</i>	80	1	<i>Oxylobium alpestre</i>	60	1
<i>Stellaria pungens</i>	80	1	<i>Aciphylla glacialis</i>	60	+	<i>Scleranthus biflorus</i>	60	+
<i>Crassula sieberiana</i>	80	1	<i>Asperula gunnii</i>	60	1	<i>Trisetum spicatum</i>	60	1

NO. OF SITES: 5 STRUCTURE: Low open-heathland

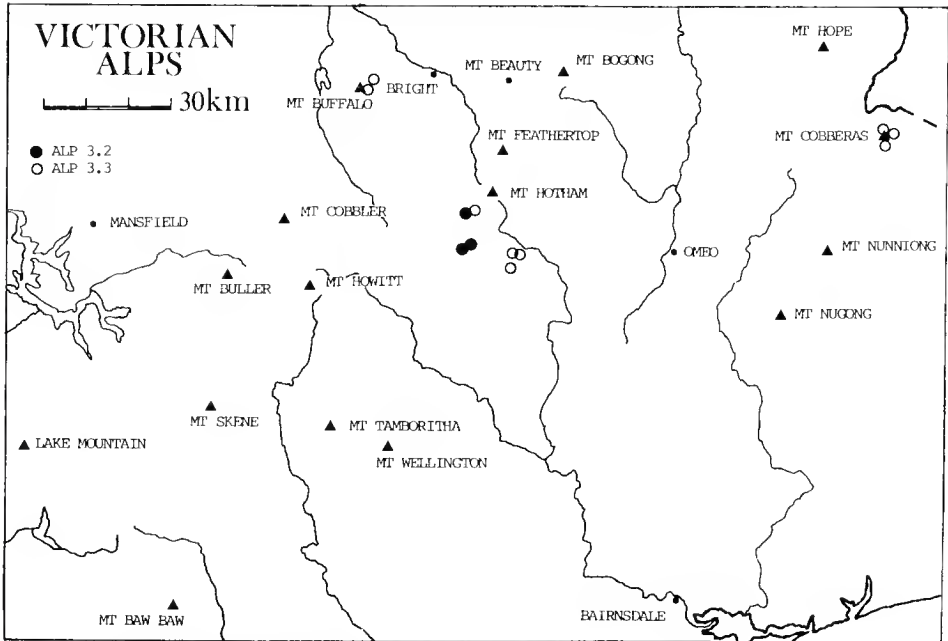
DISTRIBUTION: Restricted to the vicinity of The Twins and Mt. Blue Rag.

ENVIRONMENT: Shaley, often steep slopes with very little soil development.

ALTITUDE: Mean = 1628m, Highest = 1680m, Lowest = 1580m

MEAN FLORISTIC RICHNESS: 22 species per site MEAN WEED COMPOSITION: 4% of species, 3% of cover

NOTES: Many of the character species of ALP 3.2 are lithophilic herbs (e.g. *Brachycome rigidula*, *Crassula sieberiana*, *Helipterum albicans* and *Luzula novae-cambriae*) which occur predominantly on shale or in rock crevices. Shrubs such as *Grevillea australis* and *Leucopogon suaveolens* are occasional on intervening ledges along with *Poa hothamensis* (Ledge Grass), a species which is uncommon in alpine grassland or wet shrubland.



## SPARSE ROCKY ALPINE HEATHLAND : SUB-COMMUNITY ALP 3.3

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex breviculmis</i>	89	1	<i>Bossiaea foliosa</i>	67	1	<i>Stellaria pungens</i>	56	1
* <i>Hypochoeris radicata</i>	67	1	* <i>Cerastium glomeratum</i>	56	+	<i>Poa phillipsiana</i>	56	1
* <i>Rumex acetosella</i> sp. agg.	67	1	<i>Grevillea australis</i>	56	2			

NO. OF SITES: 9 STRUCTURE: Low open-heathland

DISTRIBUTION: Occasional on the Dargo High Plains, Mt. Buffalo and The Cobblers.

ENVIRONMENT: Well-drained sites; dry or rocky slopes or granitic peaks.

ALTITUDE: Mean = 1594m, Highest = 1800m, Lowest = 1450m

MEAN FLORISTIC RICHNESS: 20 species per site MEAN WEED COMPOSITION: 2% of species, 1% of cover

NOTES: ALP 3.3 is represented by sites sharing shrubland or herbland species, but the histories of some of these sites indicate that they may have supported different vegetation types in the recent past. Some sites are presently being grazed, or are being maintained as ski slopes. The areas in these situations have a high incidence of introduced species (e.g. *Rumex acetosella*, *Hypochoeris radicata*, *Trifolium repens* and *Cerastium glomeratum*), and several resilient native species. Natural open-shrubland occurs on the rocky summits and slopes of The Cobblers where other low shrubs *Phebalium phyllifolium* and *Bossiaea foliosa* occur. Sub-community ALP 3.3 is therefore floristically cohesive, but not necessarily representative of a particular environment.



## SPARSE ROCKY ALPINE HEATHLAND : SUB-COMMUNITY ALP 3.4

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Lonandra micrantha</i>	100	1	* <i>Hypochoeris radiata</i>	75	1	<i>Grevillea australis</i>	75	2
<i>Microseris scapigera</i>	100	1	<i>Poa hiemata</i>	75	2	<i>Hovea longifolia</i>	75	1
<i>Oreomyzris eriopoda</i>	100	1	<i>Carex breviculmis</i>	75	1	<i>Pratia pedunculata</i>	75	+
* <i>Rumex acetosella</i> sp. agg.	100	+	* <i>Chrysanthemum leucanthemum</i>	75	1	<i>Poa faucoxettiae</i>	75	1
<i>Stellaria pungens</i>	100	+	<i>Cotula filicula</i>	75	+			

NO. OF SITES: 4 STRUCTURE: Low open-heathland

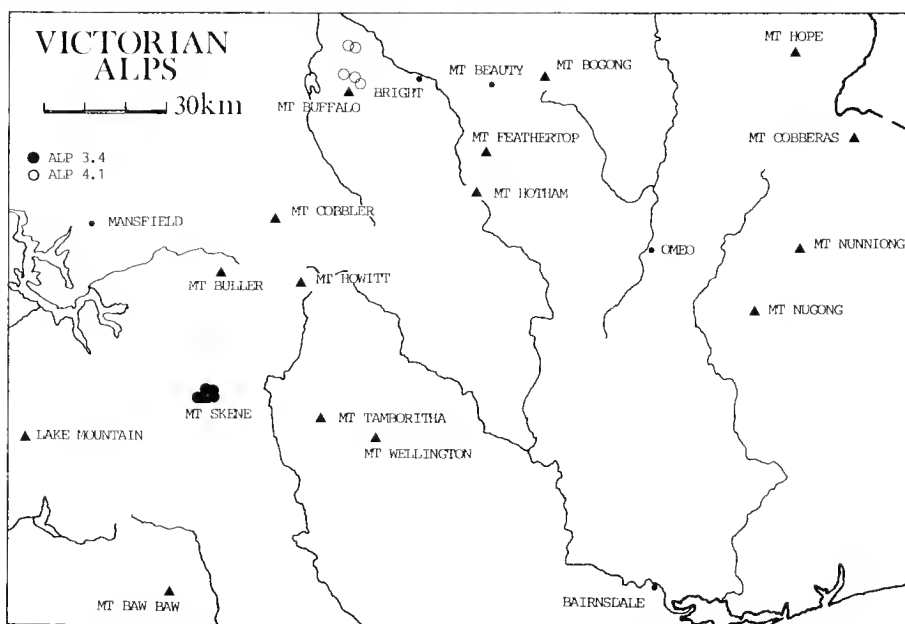
DISTRIBUTION: Restricted to the summit of Mt. Skene.

ENVIRONMENT: Exposed slopes of gentle gradient. Soils are quite deep and water-retentive, and overlay sedimentary bedrock.

ALTITUDE: Mean = 1545m, Highest = 1560m, Lowest = 1520m

MEAN FLORISTIC RICHNESS: 18 species per site MEAN WEED COMPOSITION: 13% of species, 10% of cover

NOTES: *Lonandra micrantha* var *serotia* is confined to this sub-community on Mt. Skene and only a few isolated peaks in eastern Victoria, including areas of the Snowy Range and Mt. Wellington. The treeless areas of vegetation on Mt. Skene consist of narrow clearings within the Snow Gum Woodland and are probably the result of wind exposure rather than a response to true alpine conditions on the peak.



## Kunzea ericifolia HEATHLAND : SUB-COMMUNITY ALP 4.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Kunzea ericifolia</i>	100	3	<i>Micranthemum hexandrum</i>	80	1	<i>Brachycome spathulata</i>	80	+
<i>Carex breviculmis</i>	100	1	<i>Hovea longifolia</i>	80	1			
<i>Stipa nivicola</i>	100	1	<i>Poa philipsiana</i>	80	1			

NO. OF SITES: 5 STRUCTURE: Low closed-heathland

DISTRIBUTION: Frequent within treeless areas of the Buffalo Plateau.

ENVIRONMENT: Granitic rises within the depressions of the plateau. Soils are very shallow and coarse. Large granite tors are common nearby.

ALTITUDE: Mean = 1420m, Highest = 1560m, Lowest = 1380m

MEAN FLORISTIC RICHNESS: 15 species per site MEAN WEED COMPOSITION: 2% of species, 1% of cover

NOTES: This *Kunzea ericifolia* dominated low-heathland is structurally and floristically similar to Unit 4 of McDougall (1982) and sub-communities ALP 4.2 and ALP 4.3 but differs in the presence of *Micranthemum hexandrum*, *Aciphylla simplicifolia* and *Poa philipsiana* as character species. These species are uncommon elsewhere within the Study Area, but occur occasionally in rocky situations. Their frequency on the Buffalo Plateau is indicative of the extent and uniformity of this granite massif.



## BAW BAW DRY ALPINE SHRUBLAND : SUB-COMMUNITY ALP 5.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex breviculmis</i>	92	1	<i>Viola hederacea</i>	77	1	<i>Poa hiemata</i>	62	1
<i>Hydrocotyle algida</i>	92	1	<i>Celmisia asteliifolia</i>	77	1	* <i>Cerastium fontanum</i>	54	+
* <i>Hypochoeris radicata</i>	92	1	<i>Gonocarpus montanus</i>	62	+	<i>Helichrysum secundiflorum</i>	54	1
<i>Oreomyrrhis eriopoda</i>	85	1	<i>Olearia phlogopappa</i>	62	1	<i>Olearia algida</i>	54	1
<i>Styidium graminifolium</i>	85	1	<i>Asperula gunnii</i>	62	+	<i>Orites lancifolia</i>	54	1
<i>Pultenaea muelleri</i>	77	2	<i>Luzula modesta</i>	62	1	* <i>Rumex acetosella</i> sp. agg.	54	+
<i>Senecio gunnii</i>	77	+	<i>Lycopodium fastigiatum</i>	62	1			

NO. OF SITES: 13 STRUCTURE: Low shrubland

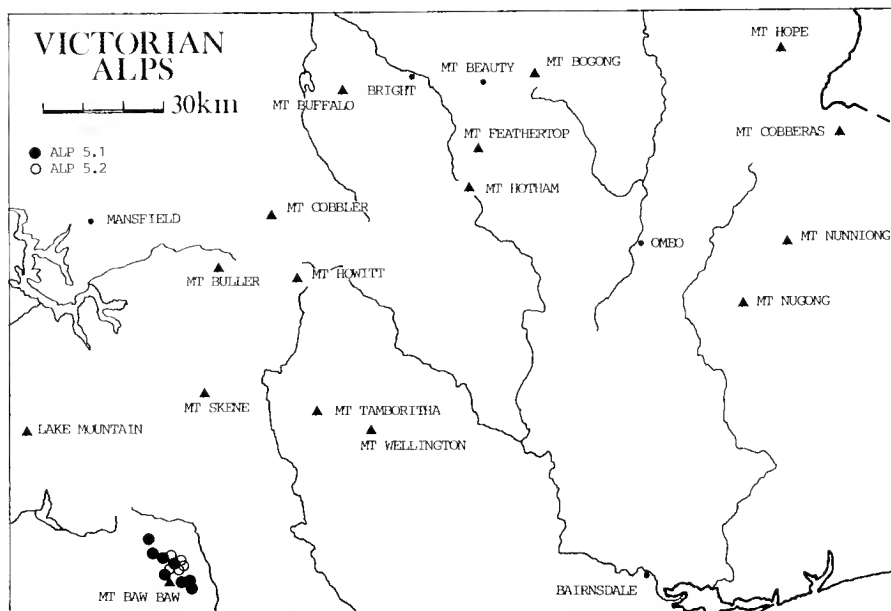
DISTRIBUTION: Common throughout the more northerly peaks of the Baw Baw Plateau (from Mt. Whitelaw to Mt. Erica).

ENVIRONMENT: Dry granitic slopes of northerly aspect, associated with the highest peaks.

ALTITUDE: Mean = 1400m, Highest = 1535m, Lowest = 1320m

MEAN FLORISTIC RICHNESS: 22 species per site MEAN WEED COMPOSITION: 12% of species, 10% of cover

NOTES: A structurally uniform shrubland made up of low, dense thickets of *Pultenaea muelleri* interspersed with the taller shrubs *Olearia phlogopappa*, *Helichrysum secundiflorum* or *Orites lancifolia*. Other shrubs are rare and the ground layer, although floristically diverse, is generally sparse. The same species occur with in Snow Gum woodland at lower altitudes or in more sheltered sites.



## BAW BAW DRY ALPINE SHRUBLAND : SUB-COMMUNITY ALP 5.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Asperula gunnii</i>	100	1	<i>Prasophyllum</i> spp.	100	+	<i>Pultenaea muelleri</i>	80	1
<i>Carex breviculmis</i>	100	1	* <i>Rumex acetosella</i> sp. agg.	80	+	<i>Styidium graminifolium</i>	80	+
<i>Celmisia asteliifolia</i>	100	1	* <i>Cerastium fontanum</i>	80	+	<i>Asterolasia trymalioides</i>	60	+
<i>Danthonia nudiflora</i>	100	2	<i>Luzula modesta</i>	80	1	<i>Craspedia</i> sp. 'D'	60	+
* <i>Hypochoeris radicata</i>	100	1	<i>Scaevola hookeri</i>	80	1	<i>Helichrysum hookeri</i>	60	+
<i>Olearia algida</i>	100	+	<i>Senecio gunnii</i>	80	+	<i>Leptorhynchus squamatus</i>	60	+
<i>Oreomyrrhis eriopoda</i>	100	+	<i>Gonocarpus montanus</i>	80	+	<i>Prostanthera cuneata</i>	60	1
<i>Pimelea alpina</i>	100	+	<i>Hydrocotyle algida</i>	80	+	<i>Scleranthus biflorus</i>	60	+
<i>Poa hiemata</i>	100	1	<i>Plantago alpestris</i>	80	1	<i>Trochocarpa clarkei</i>	60	1
<i>Viola hederacea</i>	100	+	<i>Podolepis robusta</i>	80	1			

NO. OF SITES: 5 STRUCTURE: Low shrubland

DISTRIBUTION: Common throughout the more northerly mountains of the Baw Baw Plateau (from Mt. Whitelaw to Mt. Erica).

ENVIRONMENT: Saddles and flatter areas on northerly faces of the plateau. Surrounding areas usually contain large granite tors.

ALTITUDE: Mean = 1436m, Highest = 1490m, Lowest = 1340m

MEAN FLORISTIC RICHNESS: 30 species per site MEAN WEED COMPOSITION: 9% of species, 8% of cover

NOTES: This sub-community is characterized by a lack of shrubs, which accounts for the diverse continuous ground layer. Granite outcrops are frequent, and it is on the lee side of these that the only shrubs of the sub-community occur.

## ALPINE HEATHLAND : SUB-COMMUNITY ALP 6.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Poa fawcettiae</i>	88	2	<i>Stellaria purgens</i>	72	1	* <i>Rumex acetosella</i> sp. agg.	59	+
<i>Microseris scapigera</i>	88	1	<i>Hovea longifolia</i>	69	2	<i>Asperula gunnii</i>	59	1
<i>Carex breviculmis</i>	88	1	<i>Leucopogon suaveolens</i>	63	1			

NO. OF SITES: 32 STRUCTURE: Low open-heathland

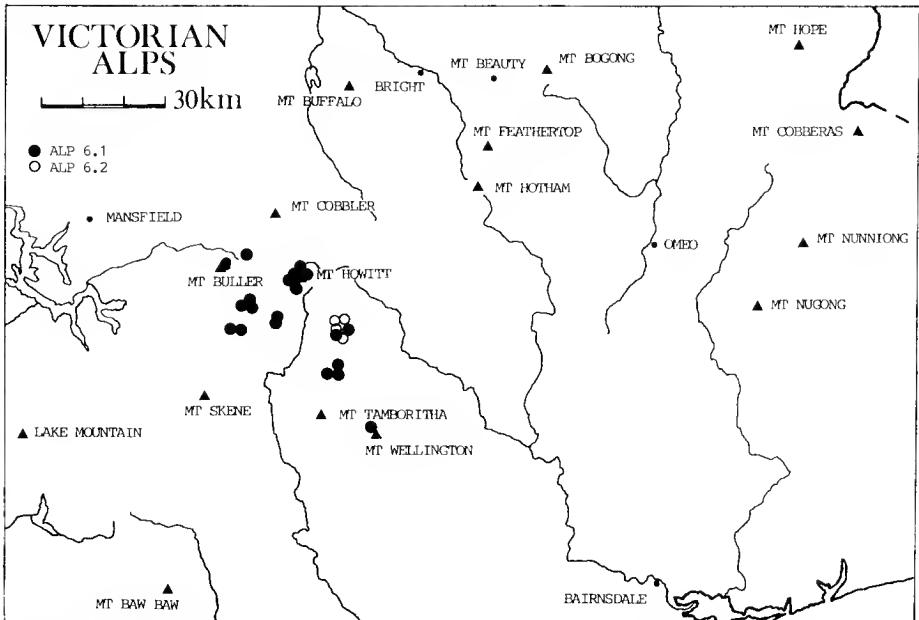
DISTRIBUTION: Common on ridges and slopes of The Viking and in the region of Mt. Speculation, Mt. Howitt and The Bluff.

ENVIRONMENT: Usually areas of sedimentary boulders or shale, or sedimentary substrate with shallow soil.

ALTITUDE: Mean = 1620m, Highest = 1740m, Lowest = 1400m

MEAN FLORISTIC RICHNESS: 22 species per site MEAN WEED COMPOSITION: 6% of species, 4% of cover

NOTES: Sub-community ALP 6.1 shares many species with the previously described ledge-herbfield community (ALP 3.1). Reduced exposure and gentler inclines permit the development of richer soils. This enables the establishment of a less patchy vegetation, comprising a perennial shrub layer with *Hovea longifolia*, *Leucopogon suaveolens* and occasionally *Grevillea australis*, and perennial herbs *Celmisia astelliifolia*, *Stylidium graminifolium* and *Goodenia hederacea*.



## ALPINE HEATHLAND : SUB-COMMUNITY ALP 6.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Hakea microcarpa</i>	100	1	<i>Podolepis jaceoides</i>	86	1	<i>Baeckea ramosissima</i>	71	1
<i>Hovea longifolia</i>	100	1	<i>Viola betonicifolia</i>	86	+	<i>Stylidium graminifolium</i>	71	1
<i>Leptorhynchos squamatus</i>	100	1	<i>Poa fawcettiae</i>	86	2	<i>Ajuga australis</i>	71	+
<i>Carex breviculmis</i>	100	1	<i>Asperula gunnii</i>	86	+	<i>Leucopogon suaveolens</i>	71	1
<i>Microseris scapigera</i>	100	1	<i>Bossiaea foliosa</i>	86	1	<i>Lonandra micrantha</i>	71	1
* <i>Hypochoeris radicata</i>	86	1	<i>Trisetum spicatum</i>	86	+	<i>Ranunculus graniticola</i>	71	1
<i>Leucopogon stuartii</i>	86	1	<i>Erigeron</i> sp. 'C'	86	1			

NO. OF SITES: 7 STRUCTURE: Open-heath

DISTRIBUTION: Sampled only in the Bryce Plain region of the Study Area.

ENVIRONMENT: Flat or gently sloping raised sites adjacent to creeks or drainage lines. Soils are shallow, derived from basalt.

ALTITUDE: Mean = 1440m, Highest = 1490m, Lowest = 1390m

MEAN FLORISTIC RICHNESS: 33 species per site MEAN WEED COMPOSITION: 8% of species, 6% of cover

NOTES: The occurrence of a shallow soil layer over a largely impervious basalt substrate promotes a curious combination of wet and dry shrubland species in this sub-community. Deep-rooting shrubs such as *Epacris microphylla* and *Hakea microphylla* are more common in subalpine wetlands, but in this sub-community occur with species more typical of dry sites (e.g. *Leucopogon stuartii* and *Baeckea ramosissima*).

## ALPINE HEATHLAND : SUB-COMMUNITY ALP 6.3

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex breviculmis</i>	95	1	<i>Microseris scapigera</i>	69	+	<i>Craspedia</i> sp. 'E'	48	1
<i>Poa fawcettiae</i>	88	2	<i>Leucopogon suaveolens</i>	64	1	<i>Celmisia astelifolia</i>	45	+
<i>Asperula gunnii</i>	86	1	<i>Viola betonicifolia</i>	64	+	<i>Grevillea australis</i>	45	1
<i>Hovea longifolia</i>	86	1	* <i>Rumex acetosella</i> sp. agg.	60	1	<i>Poa costiniana</i>	43	2
<i>Ranunculus graniticola</i>	86	1	<i>Oreomyrrhis eriopoda</i>	55	+	<i>Stipa nivicola</i>	40	1
<i>Leptorhynchus squamatus</i>	79	1	<i>Pimelea alpina</i>	50	1			
<i>Scleranthus biflorus</i>	74	+	<i>Trisetum spicatum</i>	48	+			

NO. OF SITES: 42 STRUCTURE: Open-heath to grassland

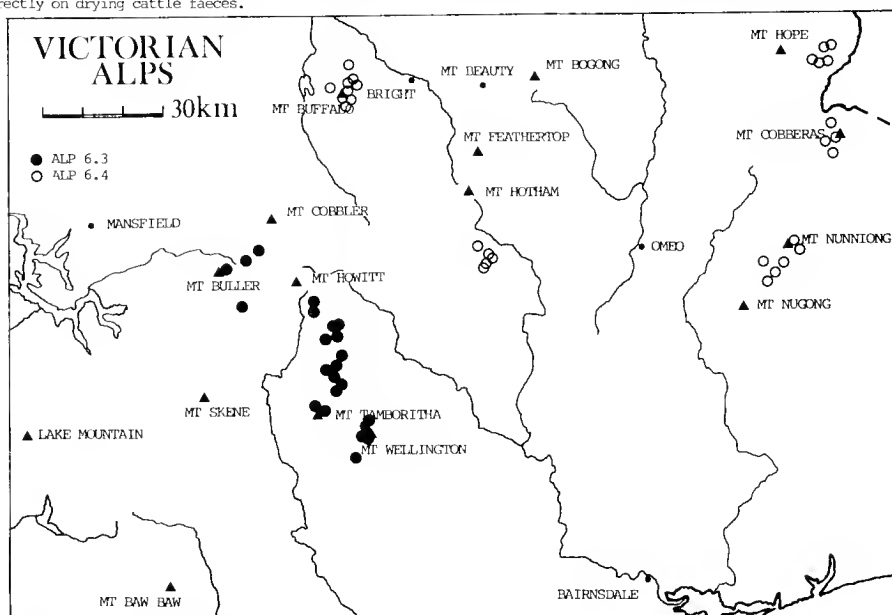
DISTRIBUTION: Common on alpine and subalpine plains of the Snowy Range area.

ENVIRONMENT: Raised areas of plains, usually with poor drainage, but not permanently wet.

ALTITUDE: Mean = 1490m, Highest = 1680m, Lowest = 1220m

MEAN FLORISTIC RICHNESS: 27 species per site MEAN WEED COMPOSITION: 8% of species, 6% of cover

NOTES: This is one of the most common types of vegetation in the Snowy Range area. It is floristically similar to sub-community ALP 6.1, but is found at lower altitudes and in wetter soils. Several wetland species occur in ALP 6.3, including the grass *Poa costiniana* which also grows amongst the sphagnum bogs, and is part of the preferred diet of cattle on the high plains (H. Van Rees pers. comm.). Introduced species *Rumex acetosella* and *Hypochaeris radicata* are common and indicate considerable disturbance, while the presence of the weeds *Cerastium glomeratum* and *Trifolium repens* may indicate increased nutrient supply. These species are often found growing directly on drying cattle faeces.



## ALPINE HEATHLAND : SUB-COMMUNITY ALP 6.4

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex breviculmis</i>	95	1	<i>Hovea longifolia</i>	64	1	<i>Brachycome spathulata</i>	48	1
<i>Leptorhynchus squamatus</i>	81	1	<i>Poa phillipsiana</i>	64	2	<i>Oreomyrrhis eriopoda</i>	48	+
<i>Scleranthus biflorus</i>	76	1	<i>Ranunculus graniticola</i>	57	1	<i>Microseris scapigera</i>	45	1
<i>Danthonia pilosa</i>	74	1	* <i>Rumex acetosella</i> sp. agg.	55	+	<i>Asperula gunnii</i>	45	1
<i>Craspedia</i> sp. 'E'	64	1	<i>Ajuga australis</i>	50	+	<i>Luzula modesta</i>	43	+

NO. OF SITES: 42 STRUCTURE: Open-heath to grassland

DISTRIBUTION: Widespread in the Eastern Highlands, where recorded from Mt. Buffalo, Dargo High Plains, Nunniong Plateau, The Cobberas, Cowanbat Flat and Davies Plain.

ENVIRONMENT: Dry, shallow soils, developed over igneous or sedimentary substrate with occasional outcrops.

ALTITUDE: Mean = 1450m, Highest = 1760m, Lowest = 1160m

MEAN FLORISTIC RICHNESS: 22 species per site MEAN WEED COMPOSITION: 6% of species, 4% of cover

NOTES: A common vegetation with many variants. On Mt. Buffalo it occurs near the rim of depressions or basins and frequently includes the uncommon grass *Stipa nivicola*. At lower sites it merges into a damp grassland dominated by *Poa fawcettiae*. On the Dargo Plains ALP 6.4 is often dominated by extensive tracts of *Poa phillipsiana* and *P. costiniana* or *P. fawcettiae*. These areas have long been subject to spring or autumn burning to promote summer fodder, a practice which has led to depletion of the shrub element in this vegetation. A similar situation exists on the western snowplains of the Nunniong Plateau but eastern plains of the plateau are apparently not burnt and the bush pea *Pultenaea fasciculata* is common. A higher proportion of non-graminoid herbs is usually supported on higher altitude plains of the Davies Plain and Mt. Cobberas regions than other areas where this sub-community occurs.

## ALPINE GRASSLAND : SUB-COMMUNITY ALP 7.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Ranunculus graniticola	89	1	Empodisma minus	64	2	Scleranthus biflorus	54	+
Carex breviculmis	86	1	Carex gaudichaudiana	64	1	Celmisia asteliifolia	50	1
Asperula gunnii	86	1	Leptorhynchus squamatus	61	1	Craspedia sp. 'F'	50	+
Viola betonicifolia	75	+	Microseris scapigera	61	1	Hovea longifolia	50	1
Poa fawcettiae	71	2	Poa costiniana	57	2	*Trifolium repens	46	1
Cotula alpina	71	1	Luzula modesta	54	1			
Brachycone decipiens	71	1	*Rumex acetosella sp. agg.	54	+			

NO. OF SITES: 28

STRUCTURE: Grassland to open-heath

DISTRIBUTION: The plains of the Snowy Range, Mt. Howitt areas.

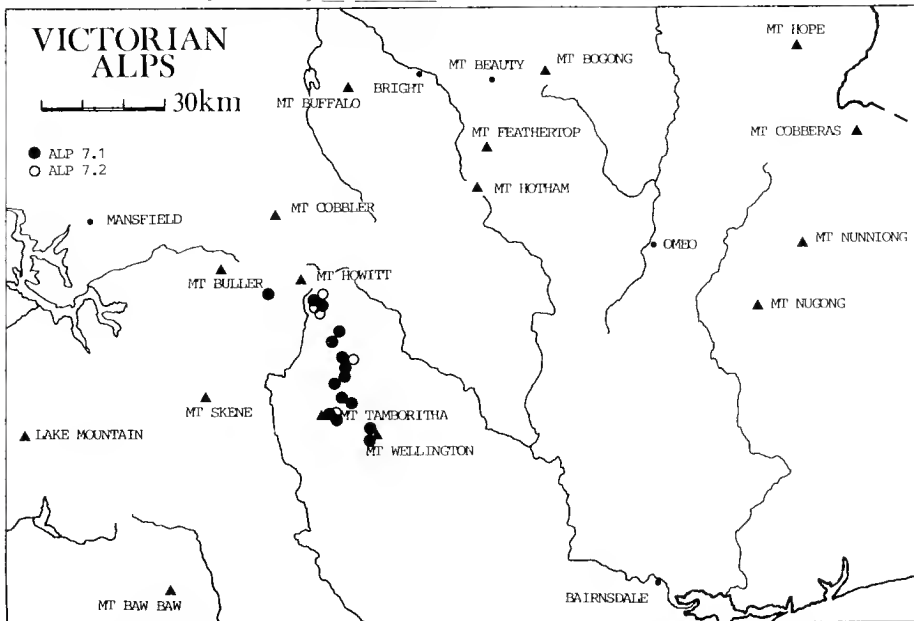
ENVIRONMENT: Level, low-lying areas of subalpine plains

ALTITUDE: Mean = 1500m, Highest = 1680m, Lowest = 1260m

MEAN FLORISTIC RICHNESS: 32 species per site

MEAN WEED COMPOSITION: 7% of species, 6% of cover

NOTES: Spatially and ecologically this vegetation links the shrublands of community ALP 6 with the sedgeland/wet heathland of community ALP 9. A decreased incidence of *Hovea longifolia*, *Leucopogon suaveolens* and other shrubs characteristic of the drier vegetation, and the occurrence of the heath *Epacris breviflora* and the woody everlasting *Helichrysum hookeri* demonstrate the increased wetness of this sub-community. The soils are deep and peaty, the water retentive properties permitting *Carex gaudichaudiana* and *Empodisma minus* (a species commonest in the true wetlands), to form dense turfs with large tussocking *Poa costiniana*.



## ALPINE GRASSLAND : SUB-COMMUNITY ALP 7.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Carex gaudichaudiana	100	1	Ranunculus gunnianus	86	1	Empodisma minus	71	2
Gonocarpus micranthus	100	+	Viola betonicifolia	86	1	Carex breviculmis	71	1
Asperula gunnii	86	1	Hypericum japonicum	86	1	Celmisia asteliifolia	71	+
Brachycone decipiens	86	1	Poa hiemata	86	1	Scleranthus biflorus	71	1
Cotula alpina	86	1	Agrostis hiemalis	71	+			
Ranunculus graniticola	86	1	Ajuga australis	71	1			

NO. OF SITES: 8

STRUCTURE: Grassland

DISTRIBUTION: Howitt Plain and near airstrip on Snowy Range.

ENVIRONMENT: Damp, low-lying areas in open grassland situations.

ALTITUDE: Mean = 1595m, Highest = 1630m, Lowest = 1580m

MEAN FLORISTIC RICHNESS: 29 species per site

MEAN WEED COMPOSITION: 4% of species, 3% of cover

NOTES: This is a minor variant of sub-community ALP 7.1, slightly wetter and with a further reduction in *Hovea longifolia*, *Leucopogon suaveolens* and *Grevillea australis* shrub cover. The majority of sites containing this sub-community are on Howitt Plain. This fenced area has in the past been intensively grazed and occasionally burnt. The present tussock-grassland structure of this plain reflects such a history, and parallels the present situation over much of the Bogong High Plains (Carr and Turner 1959).

## ALPINE GRASSLAND : SUB-COMMUNITY ALP 7.3

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
* <i>Trifolium repens</i>	97	1	* <i>Cerastium glomeratum</i>	66	+	<i>Brachycome scapigera</i>	55	1
<i>Poa hienata</i>	93	2	<i>Hypericum japonicum</i>	62	1	<i>Carex breviculmis</i>	55	1
<i>Epilobium billardierianum</i>	76	+	<i>Luzula modesta</i>	59	1	<i>Oreomyrrhis eriopoda</i>	52	+
* <i>Rumex acetosella</i> sp. agg.	69	1	<i>Dichondra repens</i>	55	1	* <i>Taraxacum officinale</i> spp.agg.	48	1

NO. OF SITES: 28 STRUCTURE: Grassland/sedgeland

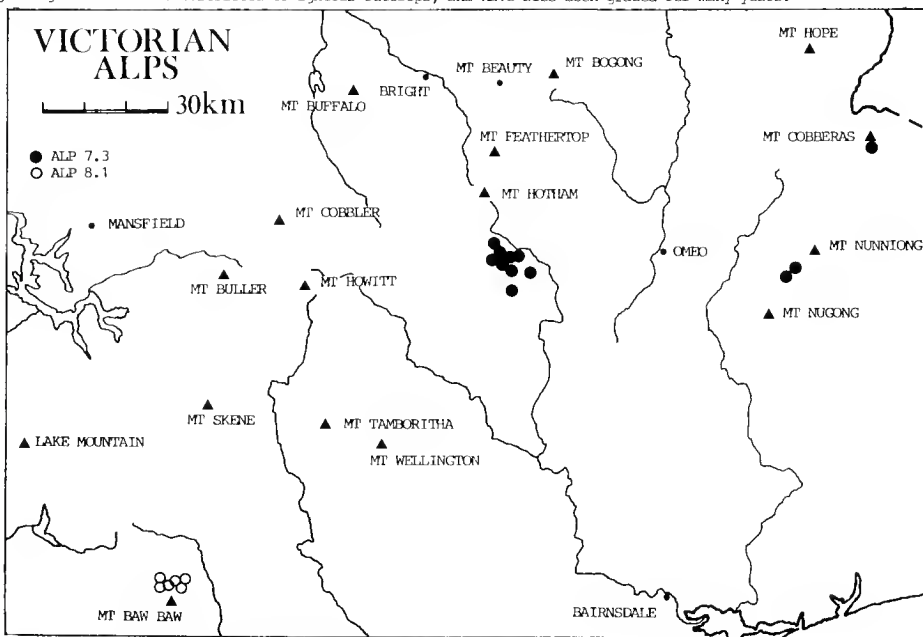
DISTRIBUTION: Common in the Dargo High Plains region with isolated occurrences in the far east Nunniong-Cobberas area.

ENVIRONMENT: Dry basalt or granite-derived soils on flat or gently sloping ground. Rock outcrops usually not present.

ALTITUDE: Mean = 1450m, Highest = 1620m, Lowest = 1200m

MEAN FLORISTIC RICHNESS: 28 species per site MEAN WEED COMPOSITION: 17% of species, 17% of cover

NOTES: One of the weediest and most species-poor sub-communities in the Study Area. The Dargo High Plains are heavily stocked and extensively grazed by cattle from early summer to late spring. Freehold land on the plains encompasses a large proportion of their treeless areas and pasture improvement has been carried out here by seasonal burning or spreading of fertilizer and sowing of European grasses such as *Phleum pratense*. Despite this disturbance, several rare or endemic alpine herbs persist, though they are infrequently encountered in this sub-community (e.g. *Epilobium curtisiae*, *E. willisii*, *Wahlenbergia densiflora*, *Brachycome tenuiflora*, *Oreomyrrhis argentea* and *Carex paupera*, a sedge recorded twice in Victoria). The sites supporting this sub-community to the east of the Dargo High Plains are restricted to igneous outcrops, and have also been grazed for many years.



## BAW BAW DAMP ALPINE HEATHLAND : SUB-COMMUNITY ALP 8.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Asperula gunnii</i>	100	1	<i>Poa hienata</i>	100	1	<i>Celmisia asteliifolia</i>	75	1
<i>Asterolasia trymalioides</i>	100	1	<i>Pimelea alpina</i>	88	1	<i>Orites lancifolia</i>	63	1
<i>Empodisma minus</i>	100	1	<i>Podolepis robusta</i>	88	1	<i>Olearia algida</i>	63	1
<i>Epacris petrophila</i>	100	1	<i>Craspedia</i> sp. 'D'	88	1	<i>Helichrysum hookeri</i>	63	2
<i>Grevillea australis</i>	100	1	<i>Carex breviculmis</i>	75	1	<i>Pratia pedunculata</i>	63	+

NO. OF SITES: 8 STRUCTURE: Open-heath

DISTRIBUTION: Headwaters of the East and West Tanjil Rivers, Mustering Flat and St. Gwinnear Flat, on the Baw Baw Plateau.

ENVIRONMENT: Edges of broad depressions and open gully heads where soils are generally sodden and deep. Frequently associated with raised areas within bogs or Wet Alpine Heath vegetation.

ALTITUDE: Mean = 1380m, Highest = 1480m, Lowest = 1305m

MEAN FLORISTIC RICHNESS: 23 species per site MEAN WEED COMPOSITION: 0% of species, 0% of cover

NOTES: This heathland generally forms a band between the Dry Alpine Shrubland (ALP 5.1) and various Wet Alpine Heath sub-communities. Consequently most of the species are indicative of one of these sub-communities, but a few, such as *Asterolasia trymalioides* and *Pratia pedunculata* (an uncommon alpine herb) appear to be more or less restricted to this transitional zone.

WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Astelia alpina	100	1	Asperula gunnii	82	+	Euphrasia gibbsiae	64	1
Celmisia asteliifolia	100	+	Epacris paludosa	82	1	Senecio pectinatus	64	+
Olearia algida	100	1	Herpollirion novaezelandiae	82	+	Baeckea gunniana	64	1
Richea continentis	100	2	Oreobolus distichus	82	1	Gonocarpus micranthus	55	+
Poa hienata	91	1	Epacris petrophila	73	1	Nertera depressa	55	1
Gentianella diemensis	91	1	Plantago alpestris	73	1	Schoenus calypttratus	55	+
Pimelea alpina	91	1	Empodisma minus	73	3			
Craspedia sp. 'D'	82	1	Lycopodium fastigiatum	73	+			

NO. OF SITES: 12

STRUCTURE: Open-heath to herbfield

DISTRIBUTION: Scattered over the entire Baw Baw Plateau.

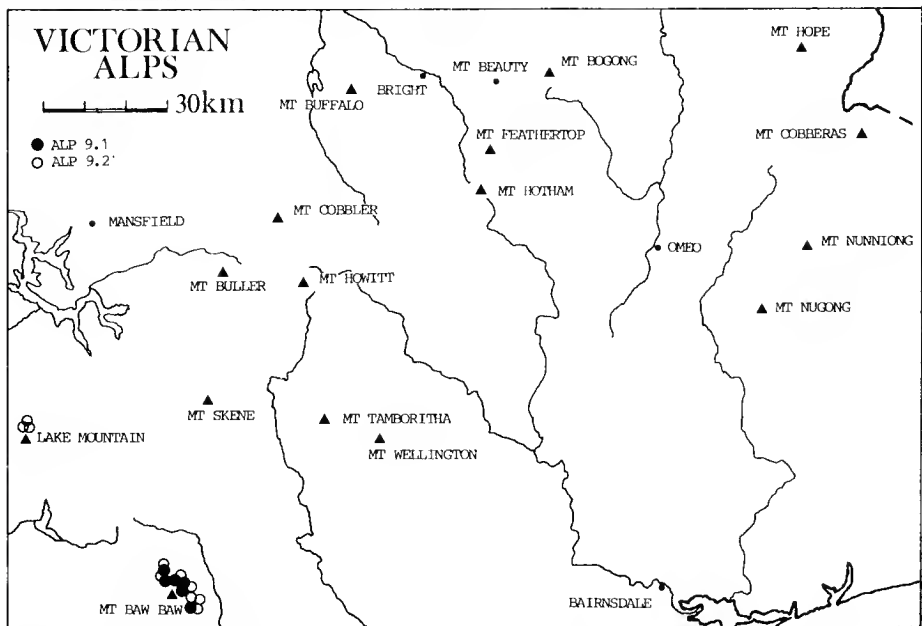
ENVIRONMENT: Depressions where the rocky substrate is exposed or thinly overlain by peat. Shallow, gravel-based pools are often nearby.

ALTITUDE: Mean = 1440m, Highest = 1500m, Lowest = 1340m

MEAN FLORISTIC RICHNESS: 27 species per site

MEAN WEED COMPOSITION: 0% of species, 0% of cover

NOTES: This sub-community is characterized by a dense turf of *Empodisma minus* and *Poa hienata*, with *epacrids* *Richea continentis* and *Epacris paludosa* forming a medium-dense shrub layer. It is typical of the heads of watercourses and margins of deeper and more water-retentive sphagnum bogs. The otherwise rare clubmosses, *Lycopodium scariosum* and *Huperzia selago*, are frequent in this sub-community.



WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Astelia alpina	100	1	Thelymitra venosa	70	+	Nertera depressa	52	+
Empodisma minus	100	2	Baeckea gunniana	70	1	Craspedia sp. 'D'	52	+
Epacris paludosa	96	1	Carphe nivicola	59	1	Euphrasia gibbsiae	48	+
Gentianella diemensis	89	1	Sphagnum spp.	59	2	Poa costiniana	48	1
Olearia algida	89	+	Callistemon sieberi	59	1			
Richea continentis	81	1	Asperula gunnii	59	+			

NO. OF SITES: 27

STRUCTURE: Low heathland/mossland

DISTRIBUTION: Widespread on Baw Baw Plateau and at Echo Flat near Lake Mountain.

ENVIRONMENT: Perpetually wet areas with a deep, peaty substrate.

ALTITUDE: Mean = 1400m, Highest = 1485m, Lowest = 1270m

MEAN FLORISTIC RICHNESS: 21 species per site

MEAN WEED COMPOSITION: 0% of species, 0% of cover

NOTES: This is the most frequent treeless vegetation on the Baw Baw Plateau. Wet Alpine Heath or sphagnum bogs occupy a greater proportion of the plateau than of any other Victorian alpine area. Deep, spongy hummocks of water-retentive *Sphagnum* spp. and *Empodisma minus* provide a substrate for the shrubs of this sub-community which is usually moist all year round. Summer-flowering herbs, shrubs and annuals (particularly *Thelymitra venosa* and *Gentianella diemensis*) make this one of the showiest of the alpine sub-communities of the Central Highlands.



WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.3

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Richea continentis	92	1	Carex appressa	77	1	Iscolepis aucklandica	54	+
Sphagnum spp.	92	2	Olearia algida	69	+	Celmisia asteliifolia	54	1
Epacris paludosa	92	2	Hydrocotyle algida	69	1	Nertera depressa	54	1
Blechnum penna-marina	77	+	Thelymitra venosa	62	+			
Astelia alpina	77	1	Epilobium gunnianum	62	1			

NO. OF SITES: 13 STRUCTURE: Low heathland/mossland

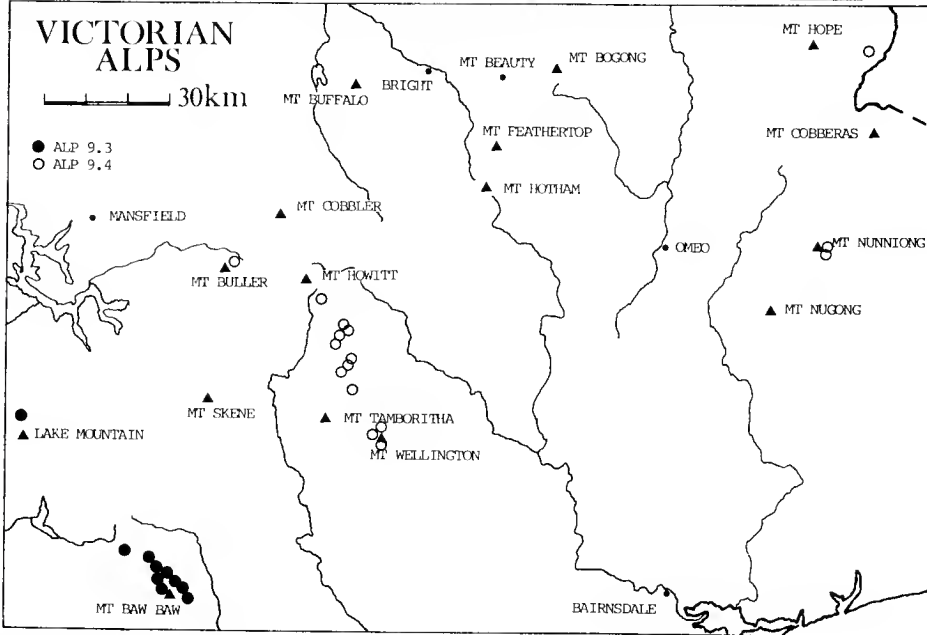
DISTRIBUTION: Scattered over the Baw Baw Plateau, and occasional at Echo Flat near Lake Mountain.

ENVIRONMENT: Restricted to the vicinity of permanent water, either on the verge of steeply-banked creeks, near springs on hillsides or by pools in snow-plain depressions. Substrate is sodden peat, with little inorganic matter.

ALTITUDE: Mean = 1375m, Highest = 1570m, Lowest = 980m

MEAN FLORISTIC RICHNESS: 24 species per site MEAN WEED COMPOSITION: 0% of species, 0% of cover

NOTES: ALP 9.3 is a wetter variant of ALP 9.2. The most significant difference between the two is the virtual absence of Empodisma minus (a dominant species in ALP 9.2) and a reduced abundance of the shrub Baeckea gunniana in ALP 9.3. The latter species is replaced by the small shrub Baeckea utilis var. latifolia.



WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.4

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
Empodisma minus	100	2	Richea continentis	85	2	Poa costiniana	55	1
Sphagnum spp.	95	3	Asperula gunnii	70	1	Ranunculus pimpinellifolius	50	1
Baeckea gunniana	90	1	Carex gaudichaudiana	65	1	Luzula modesta	50	+
Epacris paludosa	90	1	Epacris breviflora	59	1			

NO. OF SITES: 20 STRUCTURE: Low heathland/mossland

DISTRIBUTION: Mt. Buller, the plains of the Snowy Range area, and three isolated sites in the Digger's Holes and Davies Plain areas.

ENVIRONMENT: Permanently wet drainage lines and valley floors, usually of low to moderate incline.

ALTITUDE: Mean = 1520m, Highest = 1760m, Lowest = 1400m

MEAN FLORISTIC RICHNESS: 24 species per site MEAN WEED COMPOSITION: 2% of species, 1% of cover

NOTES: This is the true sphagnum bog vegetation common through the alps and subalps of Victoria. A dense cushion is formed by the moss, interspersed with epacrids Richea continentis and Epacris paludosa and the rope-rush Empodisma minus. The water-retentive qualities of these moss-beds are believed to effect the catchments and reservoirs draining the high areas. Observations indicate that cattle graze in the bogs only towards the end of summer as surrounding fodder dries off (H. Van Rees pers. comm.). During this period, degradation of the bog occurs through trampling and faecal coverage.

## WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.5

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Empodisma minus</i>	90	2	<i>Carex gaulichaudiana</i>	67	1	<i>Gonocarpus micranthus</i>	60	+
<i>Baeckea gunniana</i>	83	1	<i>Pultenaea tenella</i>	67	1	<i>Sphagnum</i> spp.	60	3
<i>Poa fawcettiae</i>	71	1	<i>Gentianella diemensis</i>	63	1	<i>Carex blakei</i>	50	1
<i>Asperula conferta</i>	77	1	<i>Poa costiniana</i>	63	1	<i>Erigeron</i> sp. 'A'	47	1
<i>Richea continentis</i>	70	1	<i>Epacris paludosa</i>	63	1			

NO. OF SITES: 29

STRUCTURE: Low heathland/mossland

DISTRIBUTION: Frequent on the Buffalo Plateau, with a few isolated occurrences near Mt. Nunniong and the high areas of Davies Plain.

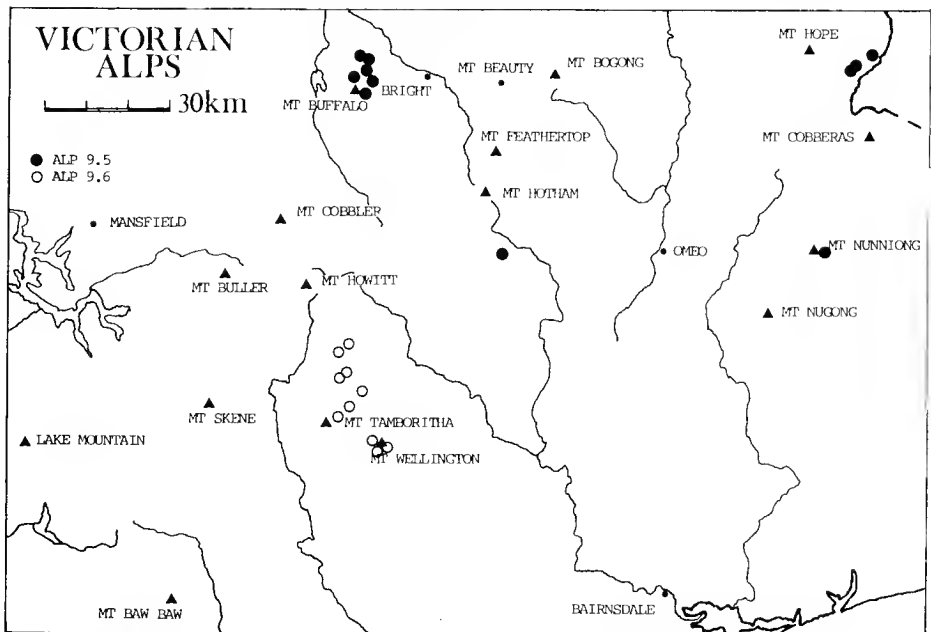
ENVIRONMENT: Broad valley floors and basins, heads of springs and gently sloping seepage lines. Soils are mainly granitic (Mt. Buffalo and Mt. Nunniong) or rhyolitic (Davies Plain).

ALTITUDE: Mean = 1460m, Highest = 1720m, Lowest = 1310m

MEAN FLORISTIC RICHNESS: 20 species per site

MEAN WEED COMPOSITION: 1% of species, 0% of cover

NOTES: See also description for sub-community ALP 9.2 and ALP 9.4, and 8A (McDougall 1982). The sphagnum bogs on Mt. Buffalo have floristic affinities with those of the Baw Baw Plateau. Several restricted species are common to both mountains (e.g. *Nertera depressa*, *Carex blakei* and *Coprosma moorei*) and other species, which are usually common in alpine bogs, are absent (e.g. *Restio australis*). Sphagnum bogs on Targo and Davies Plains support a variant which includes *Epacris coriacea*, a newly recorded species for Victoria.



## WET ALPINE HEATHLAND : SUB-COMMUNITY ALP 9.6

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Callistemon sieberi</i>	100	2	<i>Celmisia asteliifolia</i>	80	+	<i>Asperula gunnii</i>	70	1
<i>Empodisma minus</i>	90	2	<i>Epacris breviflora</i>	80	2	<i>Gonocarpus micranthus</i>	60	+
<i>Baeckea gunniana</i>	80	2	<i>Poa clivicola</i>	80	1	<i>Oreobolus distichus</i>	60	1

NO. OF SITES: 10

STRUCTURE: Closed-heath

DISTRIBUTION: Mt. Wellington and Snowy Range areas.

ENVIRONMENT: Permanently wet drainage lines of moderate slope, often with pools of water.

ALTITUDE: Mean = 1500m, Highest = 1700m, Lowest = 1280m

MEAN FLORISTIC RICHNESS: 23 species per site

MEAN WEED COMPOSITION: 2% of species, 1% of cover

NOTES: This wet heathland sub-community invariably occurs in close proximity to the subalpine woodlands. It frequently forms pockets along seepage lines and springs within the woodland, or fringing sphagnum mossbeds. When the fringe completely surrounds the bogs, it forms a very effective buffer and disturbance is minimized. Unlike the water-retentive mossbeds this vegetation is more often associated with moving water, and therefore generally occurs on sloping sites.

## DAMP ALPINE HEATHLAND : SUB-COMMUNITY ALP 10.1

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Carex gaudichaudiana</i>	100	1	<i>Hydrocotyle algida</i>	86	1	<i>Restio australis</i>	57	1
<i>Gonocarpus micranthus</i>	93	1	<i>Hypericum japonicum</i>	86	1	<i>Callistemon sieberi</i>	57	1
<i>Ranunculus pimpinellifolius</i>	93	1	<i>Luzula modesta</i>	86	1	<i>Sceleranthus biflorus</i>	57	+
<i>Oreomyrhis ciliata</i>	93	1	<i>Poa costiniana</i>	79	1	<i>Acaena anserinifolia</i>	57	+
<i>Baeckea gunniana</i>	86	1	<i>Epacris breviflora</i>	71	1	<i>Brachycome nivalis</i>	57	1
<i>Empodisma minus</i>	86	1	<i>Juncus falcatus</i>	71	1	<i>Diuris pedunculata</i>	57	+
<i>Epilobium gunnianum</i>	86	+	<i>Grevillea australis</i>	71	+	<i>Epilobium billardieranum</i>	57	+
<i>Asperula gunnii</i>	86	1	<i>*Trifolium repens</i>	71	+	<i>*Rumex acetosella</i> sp. agg.	57	+
<i>Cotula alpina</i>	86	1	<i>Poa hienata</i>	71	1			

NO. OF SITES: 14 STRUCTURE: Heathland/herbfield

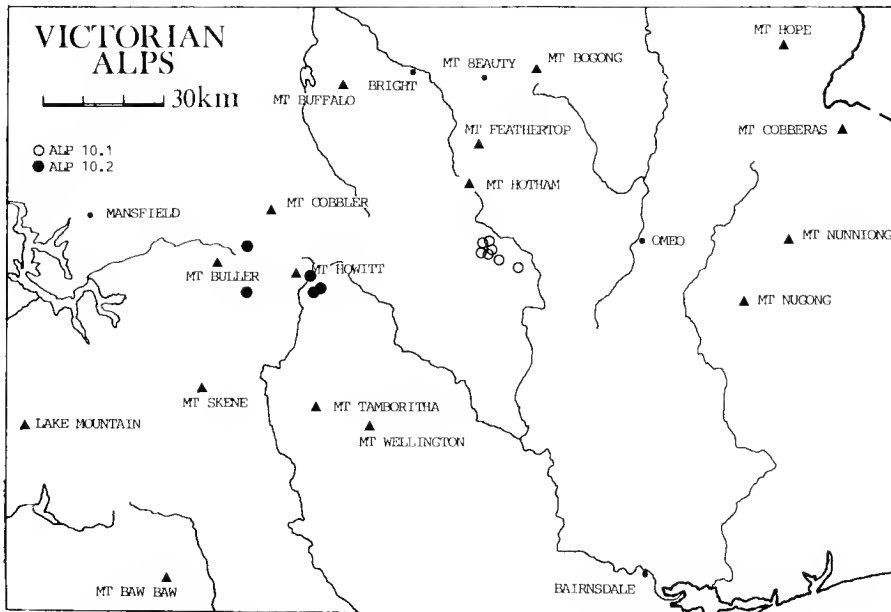
DISTRIBUTION: High spurs of eastern aspect in the Dargo High Plains area.

ENVIRONMENT: Depressions within grassland, fringes of streams or sphagnum bogs. Sites are seldom inundated with water, and the deep, basaltic soils are firm and dark.

ALTITUDE: Mean = 1520m, Highest = 1590m, Lowest = 1310m

MEAN FLORISTIC RICHNESS: 38 species per site MEAN WEED COMPOSITION: 8% of species, 6% of cover

NOTES: This vegetation is intermediate between the grassland-herbfield communities of community ALP 6, and the Wet Heathlands of community ALP 9. *Sphagnum* spp. is present in some sites, but rarely forms a continuous layer as it does in community ALP 9. This non-continuity appears to be the result of incursions by cattle grazing or *Poa costiniana* and other moist herbage, which create muddy channels in the substrate. These channels act as drains for surface water, thereby dissecting and slowly drying the surrounding vegetation. In slightly less sodder areas several herbaceous species form a dense, low turf which although cropped short by cattle is resilient to trampling. These species include *Juncus falcatus*, *Hypericum japonicum*, *Oreomyrhis ciliata*, *Gonocarpus micranthus* and *Ranunculus pimpinellifolius*.



## DAMP ALPINE HEATHLAND : SUB-COMMUNITY ALP 10.2

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Baeckea gunniana</i>	100	1	<i>Oreobolus distichus</i>	100	1	<i>Carex appressa</i>	80	1
<i>Brachycome scapigera</i>	100	1	<i>*Cerastium fontanum</i>	100	1	<i>Carex jackiana</i>	80	1
<i>Cotula alpina</i>	100	1	<i>*Trifolium repens</i>	100	1	<i>*Taraxacum officinale</i> spp.agg.	80	+
<i>Epilobium gunnianum</i>	100	1	<i>Caltha introloba</i>	80	1	<i>Veronica serpyllifolia</i>	80	1
<i>Gonocarpus micranthus</i>	100	1	<i>Carex gaudichaudiana</i>	80	1	<i>Luzula modesta</i>	80	+
<i>Hypericum japonicum</i>	100	1	<i>Grevillea australis</i>	80	1	<i>Plantago euryphylla</i>	80	1
<i>Oreomyrhis ciliata</i>	100	1	<i>Ranunculus graniticola</i>	80	+	<i>Poa costiniana</i>	80	1

NO. OF SITES: 5 STRUCTURE: Low heathland/herbfield

DISTRIBUTION: Howitt Plain, The Bluff and Mt. Stirling.

ENVIRONMENT: Snow-melt zones and bog-margins in cold air drainage pockets.

ALTITUDE: Mean = 1640m, Highest = 1740m, Lowest = 1560m

MEAN FLORISTIC RICHNESS: 41 species per site MEAN WEED COMPOSITION: 11% of species, 10% of cover

NOTES: This is floristically the richest vegetation in the Study Area, and also the weediest. Like lowland riparian vegetation, this rivulet sub-community supports species of the drier surrounding vegetation as well as those characteristic of wetlands, due to the narrow transition zone created by the stream bank. It also has a flora peculiar to itself, and by virtue of the unstable state of the soil caused by rapid runoff throughout much of the year, provides a disturbed substrate for weed species to invade.

## DAMP ALPINE HEATHLAND : SUB-COMMUNITY ALP 10.3

CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A	CHARACTER SPECIES	%FREQ	C/A
<i>Empodisma minus</i>	87	2	<i>Luzula modesta</i>	65	1	<i>Deyeuxia crassiuscula</i>	47	1
<i>Restio australis</i>	87	1	<i>Stylidium graminifolium</i>	62	1	<i>Hakea microcarpa</i>	47	1
<i>Asperula gurnii</i>	81	1	<i>Epacris breviflora</i>	62	1	<i>Ranunculus collinus</i>	47	1
<i>Epacris microphylla</i>	71	1	<i>Cotula alpina</i>	59	1	<i>Ranunculus pimpinellifolius</i>	47	1
<i>Gonocarpus micranthus</i>	71	1	<i>Hydrocotyle algida</i>	56	1	<i>Carex gaudichaudiana</i>	44	1
<i>Poa costiniana</i>	71	1	<i>Schoenus apogon</i>	53	1	* <i>Trifolium repens</i>	44	1
<i>Hypericum japonicum</i>	68	1	<i>Oreomyrrhis ciliata</i>	53	1	<i>Wahlenbergia ceracea</i>	44	1
<i>Festuca hookeriana</i>	65	1	<i>Hypoxis hygrometrica</i>	47	1			
<i>Velleia montana</i>	65	1	<i>Brachycone scapigera</i>	47	1			

NO. OF SITES: 30

STRUCTURE: Heathland

DISTRIBUTION: Highlands in the far east, from Mt. Nugong north to Davies Plain.

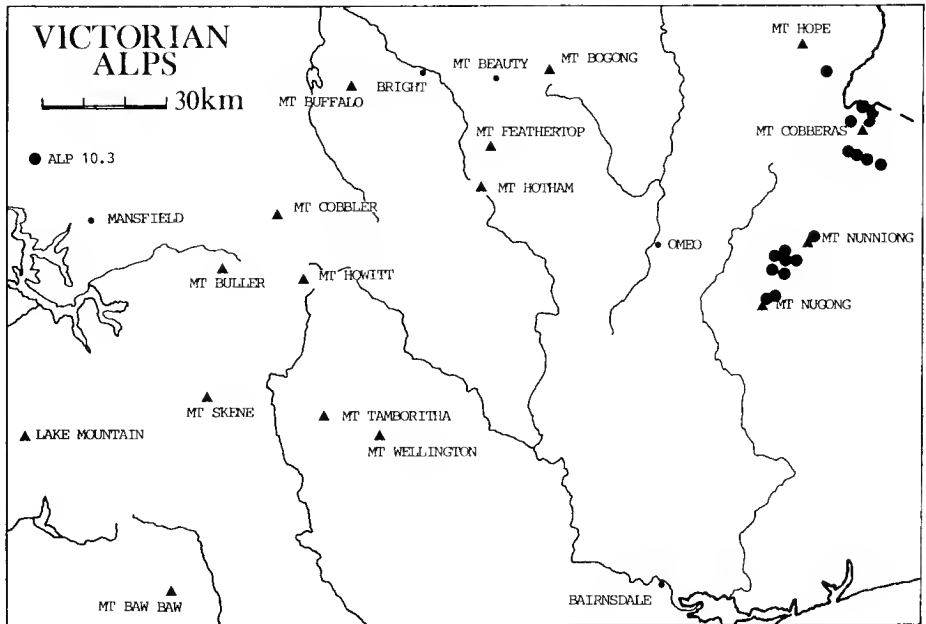
ENVIRONMENT: Broad, shallow drainage lines and seepage platforms on hillsides. Soils are basaltic (on Nunniong Plateau) and rhyolitic (on the Cobberas-Davies Plain ridge).

ALTITUDE: Mean = 1320m, Highest = 1680m, Lowest = 1120m

MEAN FLORISTIC RICHNESS: 34 species per site

MEAN WEED COMPOSITION: 4% of species, 3% of cover

NOTES: A local variant of alpine heathland or damp grassland characterized by a dense, turf-like ground layer, including *Festuca hookeriana*, (an uncommon alpine grass), *Empodisma minus*, *Poa costiniana* and several uncommon herbs (e.g. *Arthropodium minus*, *Epilobium curtisiae*, *Euphrasia caudata* and a short, fine-leaved form of *Stylidium graminifolium*). Two rare alpine grasses are also found in this sub-community (*Deyeuxia parviseta* and an undescribed species with affinities for *Deyeuxia microseta*). At the time of sampling most of these sites were regenerating from autumn burning, a common practice in Victorian high country to encourage summer fodder growth for cattle. The paucity of woody species and prevalence of grasses and annual herbs may be attributable to a long history of natural and deliberately-lit fires.



## TWO NEW SPECIES OF CALLISTEMON R.Br. (MYRTACEAE)

by

R. D. SPENCER AND P. F. LUMLEY\*

### ABSTRACT

Spencer, R. D. & Lumley, P. F. Two new species of *Callistemon* R.Br. (Myrtaceae). *Muelleria* 6(4): 293-298 (1986). — The new species *Callistemon pearsonii* from the Blackdown Tableland, Queensland and *C. pauciflorus* from Central Australia are described and illustrated together with notes on their distribution, habitat and diagnostic features.

### INTRODUCTION

The two species described here are generally recognised as distinct but have never been formally described. One of them, *C. pearsonii*, is also cultivated as an ornamental plant. It is therefore considered desirable to make names available for them prior to completion by the authors of a more detailed generic treatment.

### TAXONOMY

***Callistemon pearsonii*** R. D. Spencer & P. F. Lumley, sp. nov.

*Callistemon* sp. "Blackdown". M. Hodge *et al.*, Hort. Guide Austral. Pl. set 5, sheet 6 with plate. Soc. Growing Austral. Pl. (1979).

*Callistemon* species (Blackdown Tableland). W. R. Elliot & D. L. Jones, Encycl. Austral. Pl. 2:423 (1982).

*Callistemon* sp., Blackdown Callistemon. K. A. W. Williams, Native Pl. Queensland, ed. 3, 1:48, plate p. 49 (1984).

*Frutex* rigidus effusus usque 1 m. altus, raro usque 2 m. *Ramuli* rigidi. *Surculi juvenes* subrosei viridiscentes sericei. *Cortex* leviter fissuratus fuscus. *Folia* sessilia vel petiolo 1 (2) mm. longo, rigida coriacea plus minusve linearia vel anguste oblanceolata interdum subulata saepe subfalcata (10)15-25(30) mm. longa et (1.5)2-3(4) mm. lata, pungenti mucrone rufo 0.5-1 mm. longo, costa et venis marginalibus aliquantum prominentibus apprime supra, venis lateralibus sub angulo 45° patentibus, obscuris apprime infra, glandulis sparsis praecipue infra. *Conflorescentia* saepe frondosa 20-30(40) mm. longa et 45-50(55) mm. lata, axe pubescenti. *Bracteae* caducae, anguste vel late lanceolatae, striatae, ferrugineae. *Bracteolae* non visae. *Perigynium* 2-3 mm. longum, glabrum. *Sepala* late ovata 2 mm. longa et 2-3 mm. lata, primo plerumque ciliata, viridula. *Petala* 5, ovata, in basem contracta, 4 mm. longa et 4 mm. lata, primo ciliata, viridia saepe suffusa rosea. *Stamina* libra, plerumque 40-45; filamenta 18-23 mm. longa, coccinea; antherae c. 0.75 mm. longa, aureae, glande prominenti. *Ovarium* triloculare tomentosum supra. *Stylus* plerumque stamina superans interdum fere 7 mm. longior. *Stigma* capitatum. *Fructi* globosi, primo anno c. 6 mm. longi et 5 mm. lati, orificio c. 25 mm. lato. *Semen* angulare, c. 1 mm. longum.

TYPUS: Queensland, Blackdown Tableland. Mimoso Creek, 23°38'S., 149°00'E., 14.x.1984, R. D. Spencer 84 (HOLOTYPUS: MEL 1535969. ISOTYPI: BRI, NSW).

*Shrub* stiff, low and spreading, mostly less than 1 m tall, rarely to 2 m; small plants quite densely branched; new growth sericeous, pale pink, soon becoming green. *Bark* shallowly fissured, dark. *Leaves* densely distributed, sessile or with a short petiole 1(2) mm long; lamina stiff and coriaceous, more or less linear to narrow-oblanceolate, sometimes subulate, often slightly falcate, (10)15-25(30) mm long, (1.5)2-3(4) mm wide, pungent with a reddish-brown mucro 0.5-1 mm long; marginal veins and midrib slightly raised, more so on upper surface; lateral veins at an angle of about 45° to midrib, obscure though more distinct on upper surface; oil glands few, mostly on the lower surface. *Conflorescence* usually distally frondose, 20-30(40) mm long, 45-50(55) mm wide; axis finely pubescent. *Bracts* narrow- to broad-lanceolate, striate, reddish-brown, chartaceous, caducous. *Bracteoles* not

\*Royal Botanic Gardens, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

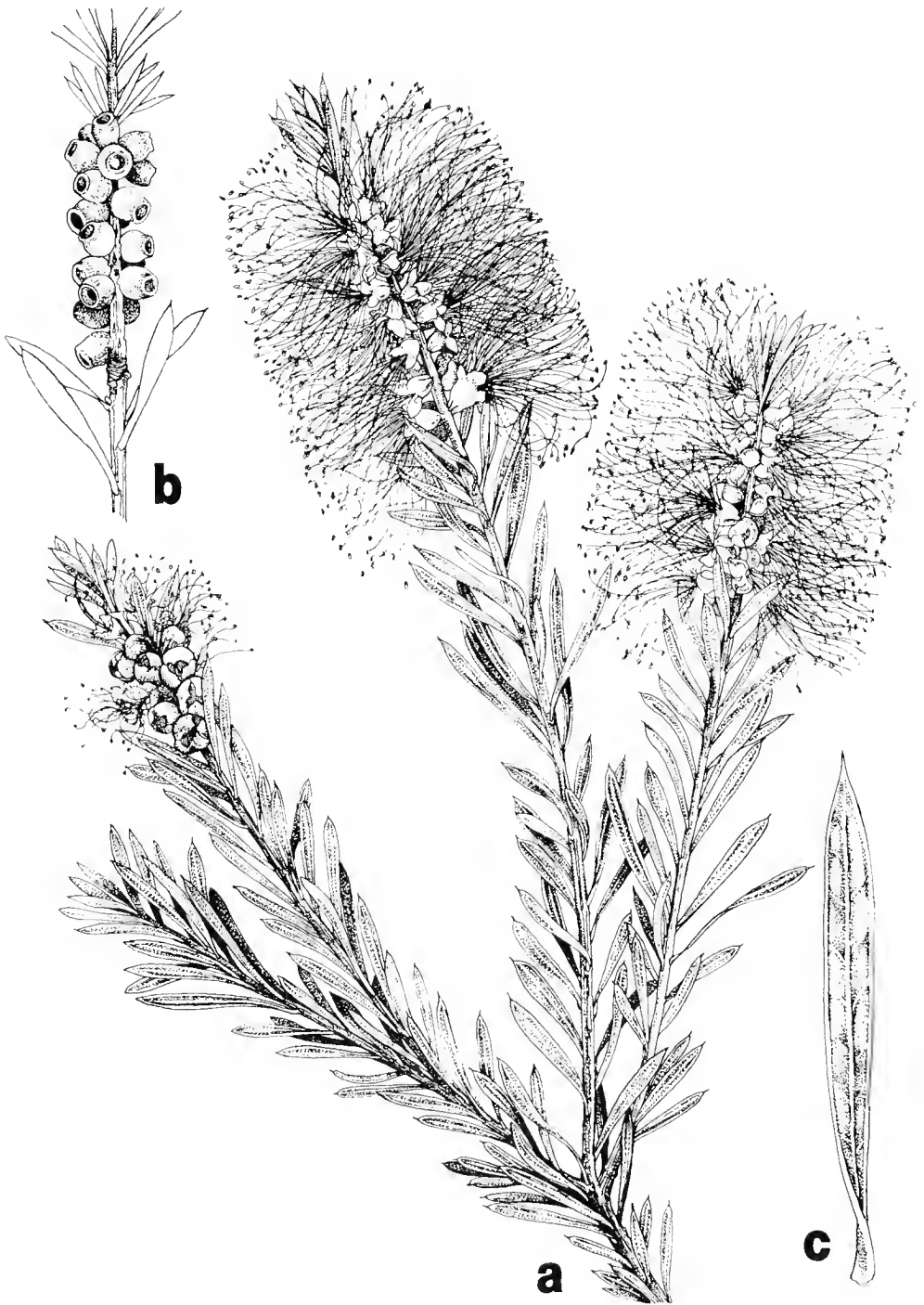


Fig. 1. *Callistemon pearsonii*. a — flowering twig, x 1. b — fruits, x 1. c — upper surface of leaf, x 3. All from Spencer 84 (MEL 1535969).

seen. *Perigynium* 2-3 mm long, glabrous. *Sepals* depressed- to very broad-ovate, 2 mm long, 2-3 mm wide, generally ciliate at first, greenish. *Petals* very broadly ovate, slightly contracted towards the base, 4 mm long, 4 mm wide, ciliate at first, green often with pink tinge. *Stamens* mostly 40-45, 18-23 mm long; filaments free, deep red; anthers c. 0.75 mm long, bright yellow, gland prominent. *Ovary* trilobular, tomentose on upper surface; style generally exceeding the stamens, sometimes by up to 7 mm, deep red; stigma capitate. *Fruit* globose, occasionally truncate-globose, c. 5 mm long and 6 mm wide in first year; orifice c. 3 mm wide. *Seed* c. 1 mm long, angular.

DISTRIBUTION:

Queensland. Found only on the Blackdown Tableland where frequent along Mimosa and Rainbow Creeks and in heathland.

ECOLOGY:

In open heath on shallow sandy soils which are subject to periodic flooding and along rocky sandstone of permanent creeks at an altitude of 700-900 m; more rarely in heathland or open eucalypt forest. Flowering time: October to December. Conservation status: although of restricted distribution this species is locally frequent and not considered to be in any danger.

REPRESENTATIVE SPECIMENS (total number examined, c. 20):

Queensland (*Leichardt District*) — Blackdown Tableland, -.ix.1937, *Simmonds* 62 (BRI 287829, BRI 287830); Blackdown, -.v.1962, *Gittins* 460 (NSW); Blackdown, -.ix.1965, *Gittins* S/75 (NSW); c. 32 km SE. of Blackwater (campsite on Mimosa Creek), alt. 600-900 m, 17.iv.1971, *Henderson, Andrews & Sharpe* 586 (NSW); Sandstone banks of Mimosa Creek, 4.xi.1973, *Williams* 341 (BRI 160737, BRI 160738, BRI 160739).

NOTES:

A distinctive and attractive species most closely resembling *C. subulatus* from which it differs chiefly in having a shorter and less frondose confluence, leaves with raised midrib and marginal veins, darker coloured filaments and yellow anthers. The anthers of *C. subulatus* are dark crimson.

The specific epithet commemorates the work of Queensland National Parks and Wildlife Service Ranger Steven Pearson who, with his wife Alison, has extensively collected, catalogued and photographed the remarkable flora of the Blackdown Tableland.

*C. pearsonii* is known locally on the Blackdown Tableland as "Rainbow Callistemon". It was introduced to cultivation from seed collected by Mr K. A. W. Williams in 1973 (Williams 1984).

**Callistemon pauciflorus** R. D. Spencer & P. F. Lumley, sp. nov.

*Callistemon* sp. A. S. George in J. P. Jessop (ed.), Fl. Central Austral. 253, t. 334 (1981).

*Frutex* vel interdum arbor effusa 2-3(10) m. altus. *Ramuli* flexuosi, penduli. *Surculi juvenes* confluentian sub anthesi paulo superantes primo rosei sericei. *Cortex* leviter fissuratus fuscus. *Folia* forma et amplitudine variabilia, sessilia vel petiolo usque 3 mm. longo, anguste rhombica, saepe falcata versus apicem et basem attenuata, (20)60-90(120) mm. longa et (2)5-8(12) mm. lata, glauca, infirme pungentia mucrone 1-2 mm. longo, venis lateralibus sub angulo 30°-45° e costa abeuntibus, raro minus, reticulatis vel aliquando obscuris, venis intramarginalibus et costa prominulis, glandulis praecipue infra, relative inconspicuis. *Con-florescentia* relative pauciflora (10)20-40(50) mm. longa et 22-25 mm. lata, saepe frondosa, versus apicem axis pubescenti. *Flores* apicem versus conflorescentiae sub angulosa c. 45° inclinatae. *Bractea* caduceae, anguste vel late lanceolatae, striatae, chartaceae, ferrugineae. *Bracteolae* ovatae usque lanceolatae, concavae, infra villosae, supra glabrae (basi pubescenti excepto), c. 0.7 mm. longae et c. 0.7 mm. latae, margine ciliato. *Perigynium* truncatum in basi, dense cinereosericeum, c. 3 mm. longum et 2 mm. latum. *Sepala* c. 1.5 mm. longa et 2 mm. lata, infra dense pubescentia, supra pubescentia, margine ciliato. *Petala* viridia, concava, basi paulo attenuata c. 2 mm. longa et 3 mm. lata, plus minusve glabra, margine ciliato. *Stamina* (40)45-69(70) mm. longa, filamentis libris vel interdum brevissime et irre-

gultim conjunctis, (5)8-9(10) mm. longis, roseis interdum cremeis, antheris c. 0.75 mm. longis, subroseis vel flavis, glande prominenti. *Ovarium* supra tomentosum, triloculare. *Stylus* longior quam stamina, 10-12 mm. longus, pallidus vel supra subroseus. *Stigma* capitatum. *Fructi* plerumque exuti primo vel secundo anno, glabri, globosi vel truncati, fusci, orificio minimum latitudine  $\frac{1}{2}$  fructi. *Semen* angulare, c. 0.75 mm. longum.

TYPUS: Northern Territory, Central Australia. Serpentine Gorge, Heavitree Range, 23°45'S., 132°58'E., 5.viii.1985, *H. I. Aston 2564* (HOLOTYPUS: MEL 1536620. ISOTYPI: CANB, MEL 1536618, MEL 1536619, NT, PERTH).

*Shrub* or occasionally straggling tree 2-3(10)m tall; branchlets flexuose, pendulous; new growth sericeous, slightly exceeding confluence at flowering, pink at first. *Bark* shallowly fissured, dark. *Leaves* variable in shape and size, sessile or with petiole to about 3 mm long, narrowly rhombic, often falcate, attenuate to the base and apex, (20)60-90(120) mm long, (2)5-8(12) mm wide, glaucous, weakly pungent with a mucro 1-2 mm long; lateral veins inclined at 30°-48° to the midvein, rarely less; intramarginal veins and midrib distinct; lateral veins reticulate or occasionally obscure; oil glands relatively inconspicuous, more numerous on the lower surface. *Confluence* generally distally frondose, (10)20-40(50) mm long, 22-25 mm wide; flowers rather distant, mostly less than 20, inclined to axis at an angle of c. 45°; axis finely pubescent. *Bracts* narrow- to broad-lanceolate, striate, reddish-brown, chartaceous, caducous. *Bracteoles* when present broad-ovate to lanceolate, concave, c. 0.7 mm long, c. 0.7 mm wide, long-pubescent on outer surface, glabrous within except at the base; margin ciliate, *Perigynium* truncate at base, c. 3 mm long, 2 mm wide, densely grey-sericeous. *Sepals* c. 1.5 mm long, c. 2 mm wide, densely pubescent without, pubescent within; margin ciliate. *Petals* concave, slightly narrowed at the base, c. 3.5 mm long, c. 3 mm wide, more or less glabrous on both surfaces, green; margin ciliate. *Stamens* (40)45-60(70); filaments free or occasionally shortly and irregularly united at the base, (5)8-9(10) mm long, deep pinkish-red, less commonly pale yellow; anthers c. 0.75 mm long, pale pink or yellow, with prominent gland. *Ovary* trilocular, tomentose on upper surface; style generally exceeding the stamens, 10-12 mm long; stigma capitate. *Fruit* globose, occasionally truncate-globose, 3(4) mm long, 3(5) mm wide, smooth, grey-brown and mostly shed in first or second year; orifice c. 2 mm wide. *Seed* c. 0.75 mm long, angular.

#### DISTRIBUTION (Fig. 3):

Northern Territory (Central Australia). Macdonnell, Petermann and Harts Ranges.

#### ECOLOGY:

Among sandy or rocky (quartzite) edges of pools and waterholes or in steep, sheltered gullies and rocky gorges. Flowering time: irregular, December to August. Conservation status: not under threat.

#### REPRESENTATIVE SPECIMENS (total number examined, c. 30)

Northern Territory — Serpentine Gorge, Alice Springs, -v.1963, *Funk s.n.* (BRI 038676); Kings Canyon, 10.xii.1968, *Latz 279* (NT 15809, BRI 112004, BRI 112005); 24°56'S., 129°20'E. Ewallaura Waterhole, N. side of Petermann Ranges, 19 miles E. of Docker Creek Settlement, 19.i.1969, *Maconochie 678* (NT 15607); 23°24'S., 131°34'E., Mt Crawford, Haast Bluff Stn, 14.xii.1977, *Latz 7561* (NT 64786, BRI; CBG n.v.); 24°58'S., 129°19'E., Mannanana Range, E. of Ruined Ramparts, 20.iii.1983, *Kalotas 1519* (NT 76181). Arid Zone Research Institute, Alice Springs, from a plant in cultivation, originally collected as a seedling from Serpentine Gorge, 20.xii.1973, *Maconochie 1933* (BRI, NT; also AD, CANB, CBG, DNA, K, NSW, PERTH, all n.v.).

#### NOTES:

An arid zone species characterised by the short confluences with few (rarely more than 20) deep pink or occasionally yellow flowers distinctly angled on the axis, the tendency of the stamens to adhere shortly at the base and the grey-





Fig. 2. *Callistemon pauciflorus*. a — flowering twig, x 1. b — perigynium, x 10. From *Latz 7561* (BRI 264343).

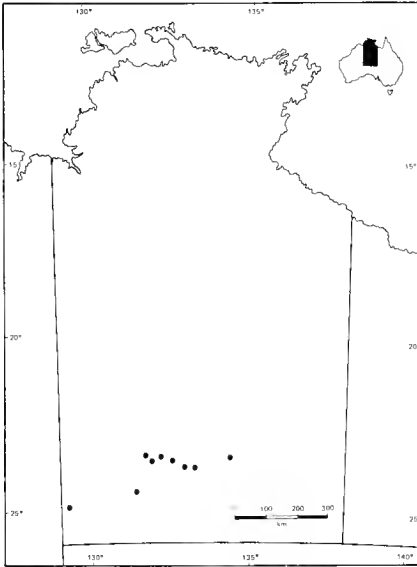


Fig. 3. The known distribution of *Callistemon pauciflorus*.

sericeous perigynium. Its closest affinities are with what is currently incorrectly known as *C. paludosus* F. Muell., but *C. pauciflorus* differs in the above characters and also in having generally larger, more glaucous and loosely dispersed leaves and in having the perigynium basally attenuate with an indumentum of appressed hairs. In contrast, the perigynium indumentum of pubescent specimens of *C. paludosus* is more woolly and erect. The presence of stamens occasionally shortly united at the base shows affinities with *C. viminalis*. However, typical plants of *C. viminalis* differ quite markedly from *C. pauciflorus* in having more linear leaves, much longer crimson stamens with dark anthers and larger, more truncate fruits.

Yellow-flowered specimens have only been collected from the Talipata Gorge (Palmer Range) and Mount Sonder.

#### ACKNOWLEDGEMENTS

We are most grateful to Mr Steven Pearson and his wife Alison for assistance in locating specimens on the Blackdown Tableland; to Ms Helen Aston for the collection of type material of *C. pauciflorus*; to Ms Anita Podwyszynski for the illustrations; to the Australian Biological Resources Study for a grant of monies for a collecting trip to northern New South Wales and southern Queensland; to the Directors/Curators of BRI, CANB, CBG, K, NSW, NT, PERTH and UNE for the loan of specimens.

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