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THE GENUS *MICROTIS* R. BR. (ORCHIDACEAE): A TAXONOMIC REVISION WITH NOTES ON BIOLOGY

R. Bates

38 Portmarnock Street, Fairview Park, South Australia 5126

Abstract

A taxonomic revision of *Microtis* is presented in which nine species are recognised; *M. globula* is described as new. *M. brownii*, *M. magnadenia* and *M. truncata* are placed in synonymy with *M. rara*. *M. media* is treated as a synonym of *M. unifolia*. The biology, taxonomic affinities and distribution are considered for each species, a key is provided and a detailed description of each species is supplemented with illustrations.

Introduction

Since Robert Brown (1810) described *Microtis* there have been numerous taxa added but no complete revision has appeared, nor has any flora dealt with all species. Bentham (1873, p. 269) when discussing the difficulty of determining many Australian orchids, including *Microtis*, from dried material wrote, "It is to be hoped that the revision of these . . . will be taken on by resident botanists who have the opportunity of studying them in the fresh state". With this in mind the present author has observed, photographed and collected all species of *Microtis* in the process of completing this revision. Plants were obtained from as many locations as possible and cultivated in Adelaide and populations of all Australian species studied in the field. Endophytic soil fungi on *Microtis* were isolated and identified by Dr J. Warcup (Waite Agricultural Research Institute). Chromosome counts were attempted but results were inconclusive.

Loans were obtained from numerous herbaria (see acknowledgements). Types of all taxa were examined unless otherwise indicated in the text. Where necessary lectotypes have been chosen. In some cases these are the ones selected by George (1971) but designated by him as holotypes. They should, however, be lectotypes as suggested by Stearn (1960). The terminology used follows Dressler (1981).

History of taxonomy

The genus

Brown (1810), when describing the genus, placed it in the Orchidaceae (as Orchideae), section *Monandrae* Sw., (flowers with a single terminal anther).

Lindley (1826, 1840) placed *Microtis* in tribe Arethusae Lindley, division Eu-arethuseae for plants with an opercular anther and a clinandrium, but he noted that the genus was, " . . . passing into Neottieae", (anther dorsal, inclined or erect, column without a definite clinandrium), the tribe in which Bentham (1873) placed the genus.

Bentham & Hooker (1883) included *Microtis* in the sub-tribe Diuridinae Lindley for plants with a very short column and terminal viscidium, but Schlechter (1911) placed the genus in his sub-tribe Prasophyllinae (plants with very short columns bearing lateral wings; leaves solitary and hollow-terete).

Rogers (1927) described from Western Australia, a new genus *Goadbyella*, recognised as being an aberrant *Microtis* by George (1961, 1971).

Mansfeld (1937) included the sub-tribe Prasophyllinae in sub-tribe Thelymitrinae Lindley (rostellum bifid, column with lateral appendages, leaf solitary, elongate, generally glabrous).

Vermeulen (1966) inferred that the genus belonged in sub-family Epidendroideae (Vermeulen) Vermeulen, contribe Neottianthae Vermeulen for plants with pollinia in tetrads, rostellum cleft, anther persistent or deciduous. This treatment, placing *Microtis* in tribe Neottieae, was followed by Cady (1967), Dockrill (1969) and Jacobs & Pickard (1981).

Dressler (1981) placed *Microtis* in the subfamily Orchidoideae Lindley, tribe Diurideae Endl. (pollinia in two pairs, anther erect and projecting beyond the stigma; characterised by plants with root-stem tuberoid) subtribe Prasophyllinae. This classification is accepted here with reservations.

The species (See table 1)

There has been much confusion over the identity of Brown's (1810) species and the extent of their variability. Brown's failure to place *Ophrys unifolia* Forster f. (1786) and *Epipactis porrifolia* Sw. (1800) with his *M. media* led to duplication of names which has persisted to the present. The very small size of *Microtis* flowers, the variable morphology of some species and the tendency for the shape of the flowers to change during drying has caused further confusion and numerous taxa (Table 1) have been erected on the basis of minor (perceived) differences in flower shape. This confusion is shown in the comments of major workers in the Orchidaceae during the nineteenth century. J.D. Hooker (1860, appendix p. 372) commenting on his own work, wrote, "On re-examining the Australian and Tasmanian species of *Microtis* with the descriptions and drawing in this work, I find them to be inextricably confused". Bentham (1873, p. 209) made similar comment and he (p. 348) apparently confused Brown's *M. media* and *M. rara*. His description of the former clearly belongs to the latter. He listed *M. rara* as a synonym of *M. porrifolia* (Sw.) Sprengel; an error perpetuated by most later authors.

The situation was even more difficult for resident Australian botanists who were unable to view type specimens. Mueller (1855) wrote that ". . . . . the *Microtis* so common through South Australia . . . . . is unquestionably *M. media* R. Br." yet in 1866 he used *M. viridis* F. Muell., nom. illeg. for the same plants and in 1882 replaced that name with *M. porrifolia*! Reichenbach (1871) and Bentham (1873) reduced many names to synonymy but added further taxa of their own. Bentham (1873) accepted just six Australian species but workers from 1900-1949, notably Rogers and later Nicholls added many new taxa. In 1950 the number of Australian taxa had grown to seventeen. George (1971) reduced some of these to synonymy and accepted only seven species from Western Australia and Green (1981) listed only six. Clements (1982) accepted ten Australian *Microtis* species, although (pers. comm. 1983) he has suggested that some were probably synonymous.

In Asia the first record for the genus was given by Reichenbach (1857) when he described *M. javanica*. Kraenzlin (1885) determined Asian plants as *M. unifolia* and this was accepted by Ames (1908) and Garay and Sweet (1974) although Schlechter (1911), Makino (1965) and others used different names (*M. formosana* Schltr, *M. parviflora* R. Br.). Garay & Sweet gave *M. parviflora* as a synonym of *M. unifolia* but they were referring to Asian plants and this treatment has never been accepted in Australia or New Zealand.

The most recent species to be described was *M. oligantha* L.B. Moore (1968) from New Zealand.

Table 1. Chronological chart of nomenclature

Original name	Accepted name, where different from original	Author affecting synonymy
Ophrys unifolia Forster f. 1786	= *Microtis unifolia*	Reichb. f. 1871
Epipactis porrifolia Sw. 1800, nom. illeg.	= *M. unifolia*	Reichb. f. 1871
Microtis alba R. Br. 1810		
M. media R. Br. 1810	= *M. unifolia*	syn. nov. Bates, 1984.
M. parviflora R. Br. 1810		
M. pulchella R. Br. 1810		
M. rara R. Br. 1810		
Serapias porrifolia (Sw.) Steudel 1824	= *M. unifolia*	syn. nov. Bates, 1984.
Microtis porrifolia (Sw.) Sprengel 1826	= *M. unifolia*	Reichb. f. 1871
M. banksii Hook. 1835	= *M. unifolia*	Ames 1908
M. atrata Lindley 1840a		
M. arenaria Lindley 1840b	= *M. unifolia*	Reichb. f. 1871
M. pulchella var. *vivax* Lindley 1840b	= *M. unifolia*	Reichb. f. 1871
Micropera banksii, M. media, M. parviflora and *Microtis pallida* Heynhold 1840	= Nomina dubia. See p. 81	
Microtis frutetorum Schltdl. 1847	= *M. unifolia*	Ames 1908
M. javanica Reichb. f. 1857	= *M. unifolia*	Ames 1908
M. minutiflora F. Muell. 1859	= *M. atrata*	F. Muell. 1866
M. viridis F. Muell. 1866 nom. illeg.	= *M. parviflora* p.p., *M. rara* p.p., = *M. unifolia* p.p.	
M. brownii Reichb. f. 1871	= *M. rara*	syn. nov. Bates, 1984.
M. benthamiana Reichb. f. 1871	= *M. parviflora*	Benth. 1873
M. unifolia var. *rara* (R. Br.) Reichb. f. 1871	= *M. rara*	syn. nov. Bates, 1984.
M. atrata var. *viridula* Reichb. f. 1871	= *M. atrata*	A.S. George 1971
M. parviflora var. *densiflora* Benth. 1873	= *M. unifolia*	A.S. George 1971
M. papillosa Colenso 1885	= *M. unifolia*	Cheeseman 1925
M. longifolia Colenso 1886	= *M. unifolia*	Cheeseman 1925
M. gymnadenioides Diels 1903	= *M. pulchella*	A.S. George 1971
M. porrifolia var. *parviflora* (R. Br.) Rodway 1903	= *M. parviflora*	W.M. Curtis 1953
M. aemula Schltr. 1907	= *M. unifolia*	Ames 1913
M. formosana Schltr 1907, nom. nud.	= Nomen dubium	
M. orbicularis R. Rogers 1907		
M. truncata R. Rogers 1920	= *M. rara*	syn. nov. Bates, 1984
M. oblonga R. Rogers 1920	= *M. rara*	W.M. Curtis 1981
Goadbyella gracilis R. Rogers 1927	= *M. alba*	A.S. George 1971
Microtis magnadenia R. Rogers 1930	= *M. rara*	syn. nov. Bates, 1984
M. biloba Nicholls 1949	= *M. unifolia*	D.L. Jones 1976
M. bipulvinaris Nicholls 1949	= *M. parviflora*	D.L. Jones 1976
M. holmesii Nicholls 1949	= *M. parviflora*	Beauglehole 1978
M. oligantha L.B. Moore 1968		

Biology

Germination

Orchid seed will germinate successfully in nature only with the aid of endo-mycorrhiza (Burgeff in Withner 1957). The process of infection of the orchid seed through the suspensor (micropyle) end by fungal hyphae is described briefly by Dressler (1981).

The fungal endophytes associated with *Microtis* include the Rhizoctonias, *Tulasnella* spp. particularly *T. calospora*, and *Sebacina vermifera* (Warcup 1981). *Microtis* seed has also been germinated asymbiotically in nutrient cultures (Stoutamire 1964). Stoutamire

(p. 265) illustrates a protocorm of *M. unifolia*. In nature, mature plants continue to grow in symbiotic association with soil fungi (Warcup pers. comm.) *Microtis* plants cultivated from seed have been observed to flower in their second year but observation of wild plants indicates that they do not normally flower until they are 3 years old.

Annual Growth

Each summer after forming 1-3 new tuberoids the *Microtis* plant dies down. The dormant period may begin as early as October for *M. unifolia* growing in dry areas and last up to six months. In the semi-aquatic *M. orbicularis* the new tuberoid may begin to sprout before the old plant has died off.

The author has all species in cultivation in Adelaide. The tuberoids sprout after the first soaking autumn rains; growth is rapid while the soil is warm but slows during winter, and becomes more rapid again in spring. There may be no sign that a plant will flower until 4-6 weeks before the event when a slight swelling can be seen (or felt) within the base of the tubular leaf. The spike develops quickly and emerges through a split or fissure which appears at a point along the longitudinal line seen on the leaf of flowering plants.

Flowering

Flowering in temperate regions occurs in spring and summer. The lowest flower on the raceme generally opens first and flowering proceeds upwards in a somewhat spiral fashion. In some species, i.e. *M. parviflora*, the seed capsules on the lowest flowers may have ripened and released their seed while the uppermost flowers are still in bud. The time from anthesis to dehiscence of seed capsules varies from 2-6 weeks.

Pollination

Microtis flowers are structurally suited for pollination by small insects. Most species have a nectary at the base of the labellum and many are lightly perfumed. The flowers are not colourful and face slightly downward. Because the plants are colonial with numerous flowers per raceme, one would expect them to be pollinated by gregarious low-flying or crawling insects. Observation in the field has shown *Microtis* flowers are commonly visited by flies, beetles, ants and small wasps. The latter two are often observed to successfully transfer pollinia (Jones 1975, Bates 1981a). If insect activity fails to bring about pollination, autogamy occurs 2-7 days after anthesis depending on the species (see later). Parthenocarpy has also been reported (Bates 1983b).

Insect Pollination

Jones (1975) documented the pollination of *M. parviflora* in Victoria by small black ants (chiefly *Iridomyrmex* sp.). The ants, attracted by nectar secretions, had the viscidium of the orchid cemented to their frons while feeding and on visits to subsequent flowers the pollen massulae were stripped away layer by layer. The present author has also observed similar ants as pollen vectors on *M. parviflora* near Adelaide, South Australia. As noted by Jones, the ants mainly visited flowers which had been open less than 4 days, as in older flowers autogamy had already begun and nectar was no longer produced. Most pollen transfer was to flowers on the same plant, but some outcrossing was observed.

Bates (1981a) described pollination of a mixed population of *Microtis rara*, *M. unifolia* and their putative natural hybrid by tiny wasps (*Ichneumonidae* and *Brachonidae*). The wasps collected the pollinarium on their heads and it was noted that the pollinia fell slightly under their own weight or by rotation of the caudicle so as to be in a position to contact the stigma of the next flower visited. The flying wasps ensured effective outcrossing. Wasps have also been noted as pollen vectors on *M. alba*, a fragrant species producing much nectar. The author has observed populations of *M. pulchella* and

M. orbicularis which had pollinia removed by small diptera, but these flies scraped the pollinia off their heads on to various parts of the raceme and were not seen to effectively transfer pollen.

Autogamy

Autogamy in *Microtis* was first described by Thompson (1879) who noted that the pollen grains in *M. unifolia*, if not removed, ". . . emit a great mass of tubes which penetrate the upper margins of the stigma". Rarely does one find a mature capsule of any *Microtis* species which does not contain numerous viable seeds, and in such cases the lack of seed appears due to injury or disease. Plants cultivated in an insect-free environment produce seed in every capsule (Bates unpubl.).

Flowers of *M. unifolia* at different stages of development were examined microscopically to determine the process of autogamy (Fig. 1). Immediately after anthesis the pollinia are enclosed by the anther cells. The threadlike caudicle and sticky spherical viscidium (Fig. 1A) situated on the apex of the rostellum are clearly visible. The stigma at this stage has a smooth concave lamina with regular margins, the rostellum erect above it. Over the next few days the upper border of the stigma grows over the rostellum, covering the viscidium, the whole surface of the stigma becoming tuberculate, the margins irregular. During this time the pollinia separate from the anther cells, the caudicle contracts as it dries and the pollen massulae separate (Fig. 1B). Depending on the population observed the pollinia contact the upward-growing stigma from 2-7 days after anthesis (Fig. 1C). Pollen tubes grow through the front, top and rear of this stigmatic extension. Nectaries at this stage have dried up and insects are no longer attracted. Jones (1975) described in detail a similar process in *M. parviflora.*

Apomixy

Bates (1983b) described how *M. orbicularis* flowers set viable seed even if the stigma is excised as the flowers open. In *M. unifolia*, a species with apparent heterozygous and homozygous races, the homozygous races appear to have resulted from apomixy as flowers from these monomorphic forms will set viable seed even if their stigma is excised. The flowers of polymorphic races tested did not set seed under the same circumstances (Bates unpubl.). Jones (1975) reported that the populations of *M. parviflora* studied by him did not appear to be apomictic. The success of *M. unifolia* as a species probably depends partly on its ability to utilise a wide range of fertilisation processes.

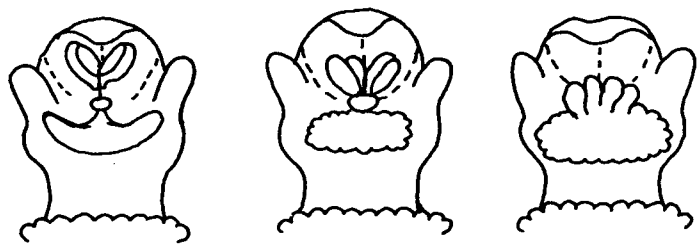


Fig. 1 Development of column in *M. unifolia*. A, at anthesis; B, 1-2 days after anthesis; C, 3-7 days after anthesis with autogamy having been effected. Illustration by G.R.M. Dashorst.

Seed dispersal

Seed develops rapidly after fertilisation and ripe seed may be shed after 14-21 days. Dehiscence of the seed capsule occurs along 3 or 6 vertical slits. Numerous seeds are released 0.2-0.4 mm long (Fig. 2A) and being very light these are dispersed by wind or, in the case of swamp species, by water, or in mud on the feet of water birds.

Stimulation by fire

All species appear to flower more profusely after a fire and two, *M. pulchella* and *M. globula* have only been observed to flower 9-12 months after a late summer fire (R. Heberle pers. comm. 1982). Burning of the surrounding vegetation increases the amount of light available to the orchids and boosts potassium and phosphorus in the mineral-deficient soils in which most species grow, but it seems likely that some other physiological stimulus may also be involved as *Microtis* plants provided with increased light and covered with ashes in cultivation are not stimulated to flower.

Photosynthesis by flowers

Arditti (pers. comm. 1981) suggests that most parts of the green flowers of *Microtis*, including the column are photosynthetic.

Vegetative reproduction

Species of the *M. unifolia* complex annually produce more than one tuberoid at the end of the 3-8 cm long roots (Fig. 2B). Non-flowering plants of this complex also produce a new tuberoid adjacent to the old. Clonal colonies of more than 1000 plants may develop (particularly with *M. unifolia*) in areas where flowering is not stimulated. Along creeks and where animals disturb the tuberoids these vegetatively increasing clones may spread over great distances. *M. orbicularis* sometimes produces two new tuberoids adjacent to the old so that the plants form clumps (Fig. 2C). *M. atrata* and *M. pulchella* produce new tuberoids adjacent to the old and also at the ends of their roots to produce very dense colonies (Fig. 2D). In cultivation an annual vegetative increase of fourfold has been achieved with *M. rara*.

Cytology

Dressler (1981) gave a chromosome number of 2n = 44 for the subtribe Prasophyllinae. Tanaka (1965) gave 2n = 44 as the number of chromosomes in some Japanese species (*M. unifolia* or *M. parviflora*). Preliminary investigations by Molloy (pers. comm. 1983) gives counts of 2n = 44 for *M. parviflora* from Australia and *M. oligantha* from New Zealand while he obtained 2n = 88 for New Zealand plants of *M. unifolia*.

Origin and Evolution

According to Dressler (1981) genuine fossil records of the Orchidaceae are unknown so that discussion of *Microtis* evolution is purely speculative. Hatch (1963) stated that *Microtis* was a ". . . truly Asian genus" without giving reasons but Rogers (1923, p. 230) had suggested that species in the genus originated in Australia, which is more likely as eight of the nine *Microtis* species occur in Australia and six of these are endemic. The genus reaches its greatest diversity and number of species in southern Australia and the hypothesis is that *Microtis* arose in that area some time after Australia separated from the rest of Gondwanaland, possibly quite recently. Most species of *Microtis* are swamp dwellers and this could indicate that the genus arose in the area during a very moist climatic period.

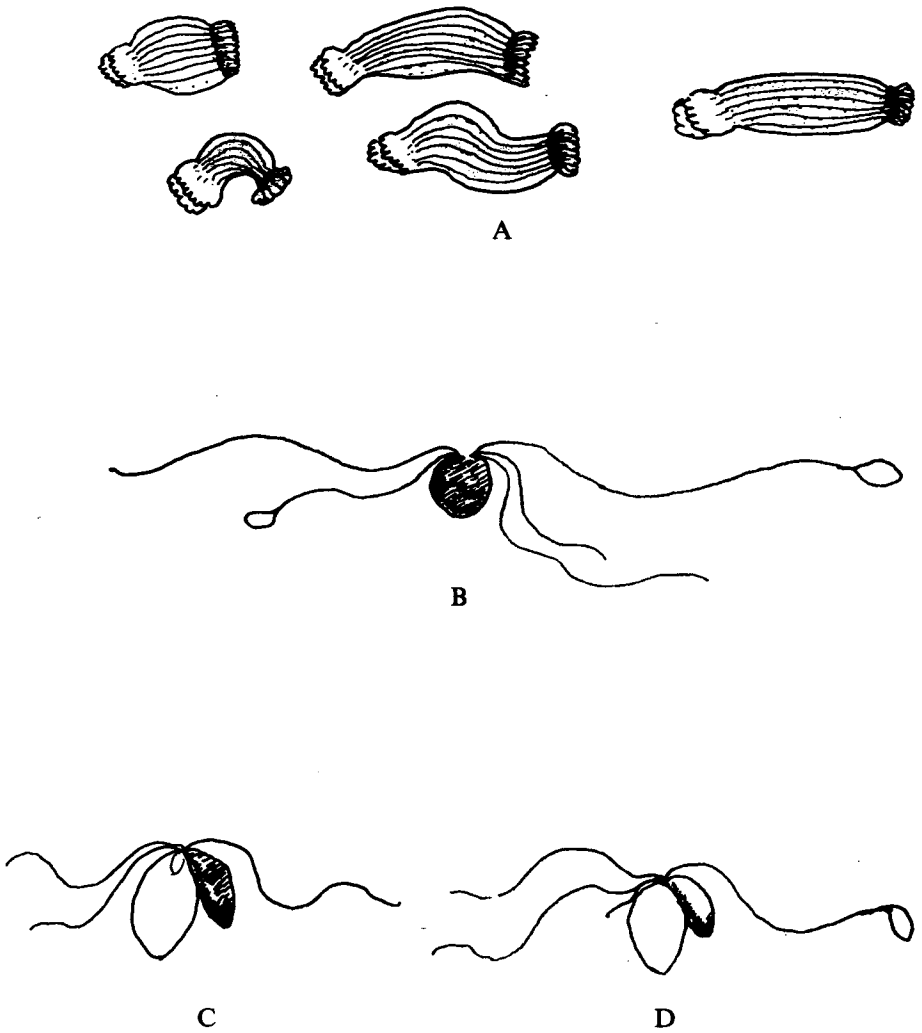


Fig. 2. A, seeds of *M. pulchella* showing variation found within a single capsule, ×100; B, tuberoid and root pattern of *M. alba*; C, tuberoid and root pattern of *M. orbicularis*; D, tuberoid and root pattern of *M. atrata*.

Taxonomic criteria

Vegetative

Microtis species can be divided into three groups on the basis of vegetative characters.

The first group, containing *M. atrata*, *M. orbicularis* and *M. pulchella* has ovoid tubers (Figs 2C, 2D) with an outer epidermis which turns white and separates when dry. The leaf in these species is relatively solid above the fissure through which the flower spike emerges and has a comparatively short, rigid apex.

The most complex group containing *M. alba*, *M. oligantha*, *M. parviflora*, *M. rara* and *M. unifolia*, and here referred to as the *M. unifolia* complex, has globose tubers (Fig. 2B) which turn brown when dry and have the outer epidermis intact. The leaf of each is hollow above the fissure, with the apex loosely erect or drooping, rather long, but usually damaged. The flowers of species in the *M. unifolia* complex are similar in structure and vary considerably in size within each species.

The remaining species, *M. globula* does not fit into either group. It differs vegetatively in having very small tubers and swollen roots (Fig. 3A). Its distinctly globular flowers also serve to separate it from other species.

Floral

Features useful in distinguishing the species include the labellum structure (shape, size, texture of margins; number, size and shape of calli); the position of the lateral sepals and petals; the shape of the dorsal sepal; the flower size and colour; the length and density of the inflorescence. No one feature alone is sufficient to determine all species although labellum shape is most useful in separating all except *M. unifolia* and *M. oligantha*. The column is of very little value in identification of species as it is essentially uniform among species within the genus: yet there is always some degree of change in column morphology during the development of a single flower! (Fig. 1).

Hybrids

A number of probable hybrids between species of *Microtis* have been noted. The morphology of some of these putative hybrids has been studied and populations monitored in the field.

Effective interspecific transference of pollinia in *Microtis* by small hymenopterans has been observed (Bates 1981a), and Brown (1982) notes the occurrence of probable *Microtis* hybrids in Western Australia. All suspected hybrids have been between the closely related species of the *M. unifolia* complex. Such hybrids are intermediate in character between their putative parents and are quite fertile so that backcrossing results in formation of hybrid swarms. Such hybrids are not common and reasons for the breakdown of normal barriers to hybridising are unclear. Sympatric populations of two or more species in the *M. unifolia* complex are commonly encountered, usually with no sign of crossing. Hybrid populations encountered are usually in areas disturbed by cultivation or road making.

The hybrids are difficult to recognise once dried and collections cited below as possible hybrids are those which have been inferred as such by the collector, or have come from populations which have been studied by the author.

M. alba × *M. unifolia*:

Brown (1982) records this putative hybrid from Western Australia. A number of collections are morphological intermediates and may represent hybrids e.g. *Ashby 2681*, 22.x.1968, near Pemberton (AD).

M. rara × *M. unifolia*:

Observation of pollen vectors on putative hybrids of *M. rara* and *M. unifolia* was recorded by Bates (1981a). Collections at AD include *R. Bates 575*, 16.xi.1979, Glen Shera Swamp (specimens exhibiting hybrid vigour) and *D. Hunt 2723*, 6.xi.1966, Myponga. I have also examined specimens intermediate between *M. rara* and *M. unifolia* from New South Wales, Victoria and Tasmania.

Intermediates between *M. parviflora* and *M. unifolia* have been encountered.

Cultivation

The small flowers ensure that this has not become a popular genus with orchid growers, but French (1886), Nash (1967), Palmer (1967) and Bates (1981b) discuss some aspects of the cultivation of *Microtis*.

Pathology

The leaves of *Microtis* appear particularly susceptible to fungal diseases and it is unusual to find unblemished leaves in nature at flowering time. McAlpine (1895) records the rust *Uromyces microtidis* Cooke, as commonly found on the leaves of *M. unifolia*.

Chemistry

Brunnich (1914) and Lawler & Slaytor (1969) discuss the presence of alkaloids in *Microtis parviflora* and *M. unifolia*.

Ethnobotany

Lawler (1981) cites references which indicate that the Aborigines used *Microtis* tubers for food.

MICROTIS R.Br.

Microtis R. Br., Prod. 320 (1810); Lindley, Gen. sp. orch. pl. 395 (1840); Reichb. f., Beitr. Syst. Pfl. 24 (1871); Benth., Fl. Aust. 6: 346 (1873); Nicholls, Orch. Aust. 23 (1969); Dockr., Aust. Indig. Orch. 89 (1969); A.S. George, Nuytsia 1 (2): 184 (1971).

Lectotype: *M. rara* R. Br. vide Garay & Sweet, Fl. Ryukyu Isl. (1974).

Garay & Sweet state that the type of *M. rara* is closest to Brown's original description of the genus. (Halle (1976) gives *M. parviflora* R. Br. as the type species for the genus but Garay & Sweet's choice of lectotype must be given preference).

Goadbyella R. Rogers, Trans. Proc. R. Soc. S. Aust. 31: 293 (1927).
Holotype: *G. gracilis* R. Rogers.

Derivation of "Microtis" is from the Greek *'mikros'* meaning small, and *'otos'* an ear, and refers to the small membranous auricles of the column.

Perennial, erect, green geophytes, arising annually from ovoid or spheroid tuberoids. *Leaf* solitary, terete, tubular, elongate, erect, exuding clear mucilage if damaged; longitudinal furrow from base almost to apex splits to provide fissure through which flower spike emerges. *Inflorescence* a terminal raceme. *Flowers* very small, few to numerous and spirally arranged, resupinate, dichogamous, subtended by small clasping bract. *Perianth* zygomorphic, minutely tuberculate. *Dorsal sepal* cucullate, concave below. *Lateral sepals* free, narrower. *Lateral petals* smaller than sepals, of thin texture, spreading below or within the dorsal sepal. *Labellum* sessile, pendulous or decurved against the ovary, orbicular, ovate, oblong, cordate or cuneate; calli if present a smooth pair or single

one at the base, sometimes with a single irregular one near the apex; nectary indistinct or a shallow groove at base of labellum. *Column* within and below the dorsal sepal, semi-cylindrical. *Stigma* prominent, immediately below the anther; rostellum indistinct. *Anther* terminal, retuse. *Pollinarium*: two pairs of unequal, granular pollinia, loosely enclosed within the anther cells, often in massulae, connected basitonically directly or via a short mucilaginous, thread-like caudicle to the viscidium. *Ovary* large compared with flowers, tumescent, ellipsoid-cylindrical, minutely tuberculate; ventral surface flattened, with two marginal ribs; dorsal surface rounded, with a single median longitudinal rib. *Seeds* numerous, ovoid-cylindrical, 0.2-0.4 x 0.1 mm, shining brown with darker coloured longitudinal ridges.

Distribution (See table 2)

Microtis is the most widespread orchid genus of probable Australian origin, occurring throughout temperate Australia and into sub-tropical Queensland, throughout New Zealand as far south as Stewart Island and possibly Auckland Island; in the western Pacific (Norfolk, Lord Howe and Kermadec Islands and New Caledonia); Malaysia and Indonesia (mainly mountain areas); the Philippines, Taiwan, southern Japan, the Ryukyu Islands and probably on the Chinese mainland. *Microtis* is most commonly found in damp situations or in areas of high rainfall.

Table 2. Occurrence of *Microtis* species in Australian States, with indication of non-Australian distribution

Microtis	W.A.	Qld.	N.S.W.	Vic.	Tas.	S.A.	Other
1. *atrata*	*			*	*	*	
2. *orbicularis*	*			*	*	*	
3. *globula*	*						
4. *pulchella*	*						
5. *parviflora*		*	*	*	*	*	New Zealand; (Lord Howe? Norfolk Island? New Caledonia? & East Asia?)
6. *unifolia*	*	*	*	*	*	*	New Zealand, Indonesia, Polynesia, East Asia.
7. *oligantha*							New Zealand
8. *rara*	*	*	*	*	*	*	
9. *alba*	*						

Willis (1962) gives the vernacular name 'Onion-orchid' for all species of *Microtis*. The name probably derives from the hollow, terete mucilaginous leaves. Erickson (1951, 1965) uses 'Mignonette orchid' as a vernacular name.

Affinities

Microtis was placed with *Prasophyllum* R. Br. by Schlechter (1926) a position retained in the most recent classification (Dressler 1981). However, this classification is based on superficial resemblance and is not an indication of the true relationship. It was questioned by Dockrill (1969) who suggested *Microtis* and *Prasophyllum* could well be placed in different sub-tribes. He is supported by Warcup (1981) whose work with orchid mycorrhiza indicates that the fungal endophytes of *Microtis* and *Prasophyllum* are quite different.

Both *Prasophyllum* and *Microtis* have a single hollow, terete leaf with a terminal raceme of many small flowers, but those of *Microtis* are resupinate whilst those of *Prasophyllum* have the labellum above the column, due to the flower pedicel twisting through a further 180°. The similar appearance of the plants may have resulted from parallel

evolution caused by a similar pollination syndrome, for there are marked differences between column structure of the two, particularly with the species of *Prasophyllum* in the section *Eu-prasophyllum* (see Table 3).

Microtis may be more closely allied with the Australasian genus *Thelymitra* placed by Dressler (1981) in the same tribe *Diurideae* Lindley but in the sub-tribe *Diuridinae* Lindley adjacent to the *Prasophyllinae*. Warcup (1981) has shown that both *Microtis* and *Thelymitra* are symbiotic with the same soil fungus, *Tulasnella calospora* while *Prasophyllum* is associated with *Ceratobasidium* spp. Like *Microtis*, the genus *Thelymitra* has a single leaf arising from an underground tuberoid and in some cases, e.g. *T. antennifera*, *T. cucullata*, the terminal raceme emerges through a fissure in the tubular base of the terete-elongate leaf after the fashion of the *Prasophyllinae* although in *Thelymitra* the leaf is never hollow above the fissure. Unlike *Prasophyllum* the flowers of both *Thelymitra* and *Microtis* are resupinate.

Table 3 below shows similarities and differences of column structure in the three genera.

Table 3. Relationship between *Microtis*, *Thelymitra* and *Prasophyllum*

Column feature	Microtis	Thelymitra	Prasophyllum (Micranthum)	Prasophyllum (Eu-prasophyllum)
Shape and development	semi cylindrical	semi cylindrical	semi cylindrical	undeveloped
Anther attachment	sessile	sessile	usually stalked	sessile
Anther position in relation to stigma	above	above	above (actually below in the reversed flower)	behind
Pollinia	granular/sectile	granular/mealy	sectile	sectile
Pollinia attachment to viscidium	basitonic, direct or via a short caudicle	basitonic direct or via a short caudicle	mainly basitonic via a stipe or caudicle	terminal via a stipe
Column appendages (shape & size)	simple, obtuse, small	simple, obtuse small to large complex and decorated with hairtufts, crests or tubes	bi- or trilobed large	usually bilobed, small to large

From Table 3 it can be seen that there are significant differences between the column structure of *Microtis* and *Prasophyllum*, particularly of the section Eu-prasophyllum, and there are many similarities between *Microtis* and *Thelymitra*. Yet the flowers of *Microtis* and *Thelymitra* are strikingly different in general appearance. *Thelymitra* has large colourful flowers with the labellum reduced to a simple petal, but this can be attributed to the different pollination syndromes of the two genera (Bates 1983a). I retain *Microtis* in the *Prasophyllinae*, but consider this to be a rather artificial sub-tribe.

Key to Species

1. Labellum without callosities.
   2. Labellum ovate to elliptic, lamina flat, lateral sepals spreading below petals ..... 1. *M. atrata*
   2. Labellum orbicular, lamina concave, lateral sepals appressed to the ovary, hidden below labellum ..... 2. *M. orbicularis*
1. Labellum with callosities.
   3. Labellum with one or two basal callosities but no apical callus, margins entire or undulate.
      4. Flowers globular, dorsal sepal with 3-5 longitudinal ridges, lateral sepals triangular, much incurved, roots thickened ..... 3. *M. globula*

Key to species (continued)

4. Flowers widely expanded, lateral sepals ovate-lanceolate to linear-lanceolate, spreading recurved or revolute, roots not thick.
    5. Labellum ± oblong; lateral sepals ovate-lanceolate, spreading on either side of the labellum, flowers white ..... 4. *M. pulchella*
    5. Labellum cordate; lateral sepals linear-oblong, recurved or revolute, flowers green ..... 5. *M. parviflora*
3. Labellum with conjoined basal callosities and with an apical callus, margins crenate, crenulate papillose or granular.
    6. Labellum with narrow basal portion expanding into two apical, divaricate lobes, margins undulate, granular, flowers white ..... 9. *M. alba*
    6. Labellum oblong, apex obtuse, truncate or emarginate, margins crenate or crenulate, flowers green.
        7. Flowers distant on the spike, dorsal sepal slightly concave below, petals spreading, below dorsal sepal, labellum at least 2/3 as long as the slender, elongate ovary ..... 8. *M. rara*
        7. Flowers more or less crowded on the spike, dorsal sepal markedly concave below, petals partly hidden within the dorsal sepal, labellum less than half as long as the turgid ovary.
            8. Flowers numerous, lateral sepals recurved or rolled ..... 6. *M. unifolia*
            8. Flowers 1-10, lateral sepals not recurved or rolled ..... 7. *M. oligantha*

1. **Microtis atrata** Lindley, Sketch Veg. Swan Riv. Colony, Append. 54 (1840); Lindley, Gen. sp. orchid. pl. 395 (1840); F. Muell., Fragm. Phyt. Aust. 5: 97 (1866); Woolls, Contrib. Fl. Aust. 15 (1867); Benth., Fl. Aust. 6: 347 (1873); Tepper, Trans. Proc. R. Soc. S. Aust. 6: 65 (1883); French, Vict. Nat. 2: 130 (1886); Fitzg., Aust. Orch. unpub. t. col.; R. Rogers in Black, Fl. S. Aust. edn. 1 (1): 136 (1922); Pescott, Orch. Vict. t. opp. p. 49 (1928); Dickins, Vict. Orch. t. 43 (1929); Pelloe, W. Aust. Orch. 20 (1930); Ewart, Fl. Vict. 333 (1931); Nicholls in Barret, Sun Nature Book 5: 16, t. col. (1934); Nicholls, Vict. Nat. 66: 99 Fig. R (1949); Erickson, Orch. West. 48 (1951); Willis, Handb. Pl. Vict. 1: 362 (1963); Firth, Orch. Tasm. 42 (1965); Cady, Aust. Pl. 4: 165 (1967); Nicholls, Orch. Aust. 23, t. 91, col. (1969); A.S. George, Nuytsia 1 (2): 184 (1971); Gray, Vict. Nat. Orch. 2: 8, col. photo (1971); Lothian, Rosa Fiveash Aust. Orch. t. 87 col. (1974); Weber & Bates in J.P. Jessop ed., Black, Fl. S. Aust. edn. 3 (1): 422, t. 400 (1978); W.M. Curtis, Stud. Fl. Tasm. 4a: 56, t. 8 (1980).

Type: *J. Drummond s.n.*, Swan River (Western Australia) 1839 (K-L, holo; K, iso.!).

M. minutiflora F. Muell., Fragm. Phyt. Aust. 1: 90, 244 (1859); Tate, Handb. Fl. extratrop. S. Aust. 164. [Orthographic variants include 'M. minor' F. Muell. Fragm. Phyt. Aust. 5: 235 (1866) and 'M. moutifolia' Lothian, Rosa Fiveash Aust. Orch. 33 (1974).]

Type: *F. Mueller s.n.*, "In planitiebus uliginosis apud, Mt. Abrupt (Victoria)", xi.1853, (MEL 99027, syn.!, K-L iso.); *F. Mueller s.n.*, Glenelg River, xi.1853, (BM, syn.!); *F. Mueller s.n.*, Moe Swamp (Victoria), not seen.

M. atrata var. *viridula* Reichb. f., Beitr. Syst. Pfl. 62 (1871).

Type: *L. Preiss 2403*, Swan River (W, lecto.) [Lectotypified by A.S. George, Nuytsia 1 (2): 184 (1971)]; *F. Mueller s.n.*, Australia felix (W. syn.) not seen. "M. nigrita Lindl.", Sullivan in obs., Wings South Sc. Rec. 3 (9): 217 (1882), is a probable orthographic variant of *M. atrata*.

Plant diminutive, 3-9 cm high, occasionally up to 20 cm if growing in water. *Tuberoid* ovoid, 3-5 x 2-4 mm; epidermis drying white, separating when mature. *Leaf* 3-7 (-15) cm long, 2-3 mm diam.; apex acute ± solid, erect; fissure c. 6 x 1 mm, at swelling in leaf, 2-6 cm from base. *Flowers* almost sessile, 2-40, sometimes fragrant, yellow-green, drying black, erect, thick textured, spirally arranged in moderately dense raceme, 1-3 cm long;

scape <2 cm long, c. 1 mm diam. *Floral bract* ovate, c. 0.5 x 0.4 mm, obtuse or sub-acute. *Dorsal sepal* orbicular to ovate, 1.2-1.5 x 1.2-1.5 mm, with short, depressed, obtuse apex. *Lateral sepals* oblong, 0.8 x 0.2 mm, spreading, slightly concave sub-acute. *Petals* ovate-falcate, 0.6 x 0.2 mm, concave, spreading below dorsal sepal. *Labellum* ovate to elliptic, 0.8-1.0 x 0.6 mm, straight or reflexed against ovary, margins entire; apex rounded, obtuse; lamina without callosities, minutely tuberculate, often with 2-6 longitudinal, granular lines turning black in mature flowers, abaxial side of labellum smooth. *Column* c. 0.6 x 0.3 mm, with prominent ovate-falcate auricles, c. 0.2 x 0.2 mm, arising alongside stigma. *Stigma* semi-lunate, 0.2 x 0.1 mm; rostellum dark green dot in upper border. *Anther* 0.2 x 0.2 mm, about as high as auricles. *Pollinia* granular, connected directly to viscidium. *Ovary* ovoid, larger than flower, c. 2 x 1.5 mm, appressed to or standing out from scape. *Seeds* the smallest in genus. Figs 6A; 8A, B.

Distribution (Map 1)

Restricted to chiefly coastal situations in southern temperate Australia, occurring in the south-west of Western Australia, southern and eastern Victoria, northern Tasmania, islands of Bass Strait and South Australia east from Adelaide.

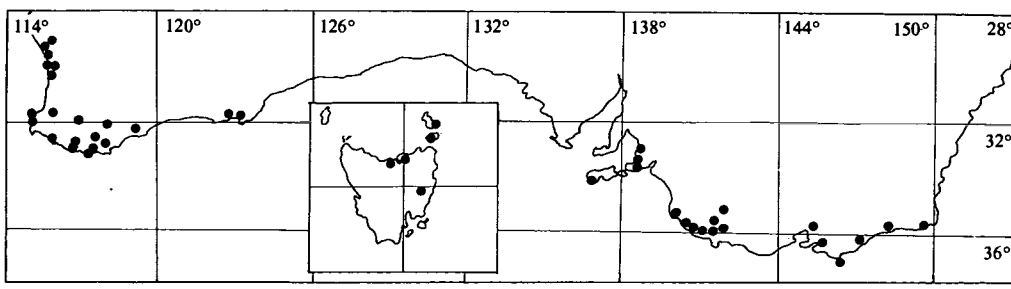
Flowering: September to December.

Ecology: Occurring is swamps or in soil which is very boggy in winter, but which may dry out completely in summer. Often forming dense colonies by vegetative increase. (Fig. 10).

Affinities

Seven years after describing *M. minutiflora*, Mueller (1866) cited the type specimens under *M. atrata* Lindl. Perhaps he was originally misled by the epithet 'atrata', as on a type sheet he wrote the words "viridis non atrata".

Although I have not seen the type of *M. atrata* var. *viridula* Reichb. f., George (1971) in reducing the variety to synonymy, stated that: "The granular surface of the labellum by which the variety was distinguished is typical of the species". Plants from the type collection of *M. atrata* do have labella with granular lines visible through a microscope. *M. atrata* is a very uniform species and cannot readily be divided into forms or varieties.



Map 1. Distribution of *M. atrata*.

The flowers of *M. atrata* are the smallest of any Australian terrestrial orchid. The species is very distinctive, not closely related to any other. It differs from species in the *M. unifolia* complex by having the leaf above the fissure rigidly erect and almost solid. In having a labellum without callosities it is like *M. orbicularis*, but differs from that species in labellum shape, and also in having lateral sepals not hidden below the labellum. *M. atrata* is also the only species which dries black.

Selected specimens (from c. 400 collections examined)

WESTERN AUSTRALIA: *E. Andrews s.n.*, x.1913, Kalamunda (PERTH); *R. Bates 2910*, 22.xii.1982, Walpole (AD); *R. Cranfield 1168*; 7.xi.1979, 7.5km NE of Byford (PERTH); *A.S. George 6486*, 9.xii.1964, swamp south of Narrikup (PERTH); *A.S. George 9705*, 12.x.1969, Bow River in burnt swamp (MEL); *A.S. George 14998*, 1.xi.1977, Frankland R. (AD, PERTH); *R. Helms s.n.*, 9.x.1897, Pinjarra (PERTH); *G.J. Keighery 328*, 8.x.1974, 10km north of Cape Arid (AD); *T.B. Muir 4269*, 7.x.1966, Cape le Grande (MEL); *A. Purdie s.n.*, 7.x.1900, Cannington (AD); *P. Wilson 316*, 1.x.1967, Manjimup (MEL).

VICTORIA: *A.C. Beauglehole 34374*, 24.x.1970, north of Mallacoota (MEL); *A.B. Braine s.n.*, 2.xi.1920, Ringwood (MEL 99024); *A.H. Corrick 609B*, 19.xi.1980, Casterton in swamp (AD); *D.L. Jones s.n.*, 9.x.1961, Wartook Reservoir in water (MEL 99026); *I. Morrison s.n.*, 8.xi.1970, Wilson's Promontory in swamps (MEL 99014); *F. Mueller s.n.*, xi.1861, Warrandyte has label "M. minutiflora viridis non atrata" in Mueller's hand. (MEL 99019); *J.H. Willis s.n.*; ix.1932, Wonthaggi (MEL 200982); *J.H. Willis s.n.*, 23.xi.1952, Quail Island in swamp among rushes (MEL 99034).

TASMANIA: *T. Burns s.n.*, 12.xi.1961, Georgetown Aerodrome (HO 37489); *A. Moscal 69*, 5.xi.1979, Bridport west of sewerage plant (HO); *G. Perrin s.n.*, xi.1970, Swansea (NSW 123892); *J.S. Whinray 137*, 26.x.1970, Cape Barren Island (AD, HO); *J.S. Whinray 172*, 27.x.1967, Flinders Is. old tin mine (AD, HO, MEL).

SOUTH AUSTRALIA: *R. Bates 2093*, 20.x.1981, Peter Creek, Kuitpo Forest (AD); *J.B. Cleland s.n.*, 17.xi.1930, Encounter Bay (AD 97148297); *D. Hunt 1646*, 9.xi.1963, Bool Lagoon (AD); *R. Tate s.n.* sub *R.S. Rogers 2178*, 24.xi.1882, Mt. Julian (AD); *J.G.O. Tepper 567*, 8.xii.1903, Square Waterhole (AD, MEL).

2. **Microtis orbicularis** R. Rogers, Trans. & Proc. R. Soc. S. Aust. 31: 63, t. 20, fig. 1 (1907); Some S. Aust. Orch., t. 27 (1909); Trans. & Proc. R. Soc. S. Aust. 44: 329 (1920); in Black, Fl. S. Aust. edn 1 (1): 218 (1922); Nicholls in Barrett, Sun Nature Bk. 1: 23, t. 6. col. (1932); Rupp, Vict. Nat. 62: 68 (1945); Erickson, Orch. West 48 (1951); Willis, Handb. Pl. Vict. 1: 363 (1963); Firth, Nat. Orch. Tasm. 54 (1965); Cady, Aust. Pl. 4: 165 (1967); Nicholls, Orch. Aust. 23, t. 92, col. (1969); Gray, Vict. Nat. Orch. 76, col. photo (1971); A.S. George, Nuytsia 1 (2): 184 (1971); Weber & Bates in J.P. Jessop ed. Black, Fl. S. Aust. edn 3 (1): 422, t. 402 (1978); Bates, J. Nat. Orch. Soc. S. Aust. 2: 3 (1978); W.M. Curtis, Stud. Fl. Tasm. 4a: 56 (1980); Woolcock, Orchadian 6: 100, t. (1980).

Type: *R.S. Rogers 2213*, Myponga Swamp (South Australia), 2.xi.1906 (AD, holo.!, AD!, AK!, BM, NSW!, PERTH!, iso.).

Plant slender, 5-30cm high, wholly green or variously pigmented with red. *Tuberoid* ovoid, 0.3-0.5 x 0.2-0.3cm; epidermis white, drying and separating when mature. *Leaf* 5-20cm long, 2-3mm diam.; apex acute, ± solid, erect, narrowing abruptly; fissure 6-10 x 2-6mm, developing at characteristic swelling in leaf. *Flowers* almost sessile, 3-30, not scented, green or red, thick textured, erect, spirally to alternately arranged in moderately loose raceme, 1-5cm long, higher than leaf apex; free scape < 5cm long, c. 1mm diam. *Floral bract* ovate-lanceolate, 2-3 x 1-1.5mm, acute. *Dorsal sepal* ovate, 1.2-2 x 0.8-1.6mm, deeply concave, with broad, obtuse, decurved apex. *Lateral sepals* linear, 0.5-1.2 x 0.2-0.4mm, appressed to ovary, hidden below labellum, sub-acute. *Petals* ovate-lanceolate, 1-2 x 0.6-1mm, spreading below dorsal sepal; apex incurved, sub-acute. *Labellum* orbicular, 1.3-2.5 x 1.3-2.5mm, pendulous, fleshy; margins entire; apex obtuse, recurved or decurved; lamina without callosities, smooth, concave, often with small circular pit in centre; nectary obscure, darker hued, glistening, near base. *Column* 0.5-1 x 0.3-0.8mm with minute, fleshy, conical auricles c. 0.15 x 0.1mm. *Stigma* ovate, 0.2 x

0.3 mm, concave; rostellum beak shaped, c. 0.2 x 0.1 mm, at right angles to stigma and overhanging. *Anther* c. 0.2 x 0.2 mm, cucullate, retuse, apex higher than auricles. *Pollinia* coherent, caudicle 0.2-0.4 mm (long for the genus); viscidium ovate, minute. *Ovary* ovoid, 2-3 x 1.5-2 mm, erect, standing well out from spike; *Seeds* very pale. (Figs 6B, 8C, D).

Distribution (Map 2)

South-west Western Australia and from eastern Victoria, through Bass Strait islands to Tasmania, and into South Australia as far west as Eyre Peninsula. Mainly coastal.

Flowering: September to December.

Ecology

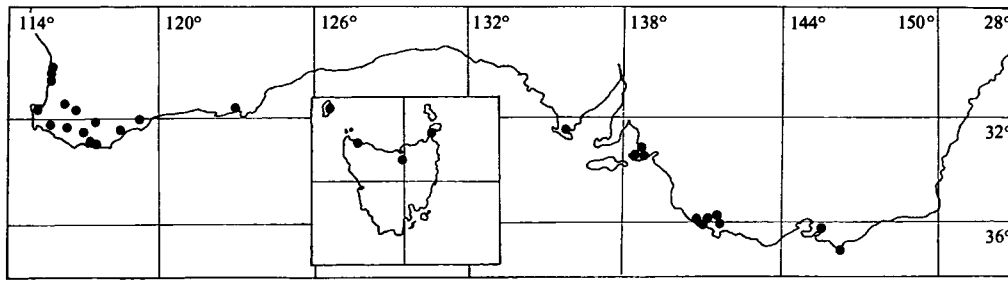
Semi-aquatic or swamp plants often submerged in water to 150 cm deep in winter; elongating in the spring, the flower spike usually opening above the, by then, shallow water. By the time the seed is released some 2-3 weeks after flowering the plant may be in mud only, although following heavy spring rains I have seen the plants flower under water. The seeds are probably transferred from swamp to swamp in mud on the feet of water birds or transported by water flow. Plants occur singly or may be clumped due to vegetative reproduction, the new tubers being produced next to the old ones and, not distant as in other species.

Affinities

Vegetatively *M. orbicularis* is indistinguishable from *M. atrata*. The major difference lies in labellum shape; *M. orbicularis* has an orbicular labellum with concave lamina (Figs 8C, D), *M. atrata* has an ovate to elliptic labellum with a flat lamina (Figs 8A, B). Other differences include flower colour and the larger flower size of *M. orbicularis* which has linear lateral sepals hidden below the labellum in comparison to the spreading, oblong lateral sepals of *M. atrata*. Unlike *M. atrata*, *M. orbicularis* does not dry black. All other species differ in having labella variously adorned with callosities.

Selected specimens (from c. 150 collections examined)

WESTERN AUSTRALIA: *A.S. George s.n.*, 9.xi.1957, Banganup Swamp, Jandakot (PERTH); *A.S. George 9733*, 12.x.1969, Broke Inlet (MEL); *A.S. George 14997*, 1.xi.1977, Frankland River in wet clay by creek (PERTH); *V. Mann and A.S. George 114*, 12.xi.1969, Bow River in burnt swamp (PERTH); *F. Mueller s.n.*, x.1867, Mt. Barker (MEL 99042); *R.D. Royce 4352*, 17.ix.1953, Elgin in clay swamps (PERTH); *O.H. Sargent 1385*, 10.ix.1921, Kenwick & Moora (AD), *D. Voigt s.n.*, x.1979, Cape le Grande (PERTH); *W. Wittwer 1165*, xi.1970, Lake Muir in water (PERTH).



Map 2. Distribution of *M. orbicularis*.

VICTORIA: *J. Anderson s.n.*, xi.1931, Wonthaggi (MEL 99066); *R. Bates 327*, xi.1978, Poolaigelo in shallow lagoon (AD); *A.C. Beauglehole s.n.*, 25.xi.1942, Gorae West (MEL 582288); *A.H. Corrick 609*, 19.xi.1980, Casterton, Glenelg River (MEL); *I. Morrison s.n.*, 8.xi.1970, Vereker Range, Wilson's Promontory (MEL 1514612); *E.M. Tucker s.n.*, 10.xi.1963, Woolpooer, Grampians (MEL 584377).

TASMANIA: *M.J. Firth s.n.*, 6.xii.1964, Rocky Cape in water (MEL 584378); *A. Moscal 68*, 5.xi.1979, Bridport (HO); *J.S. Whinray 135*, 27.x.1973, Cape Barren Island in old quarry (AD, HO, MEL).

SOUTH AUSTRALIA: *R. Bates 2094*, 20.x.1981, Peter Creek Swamps, Kuitpo (AD); *R. Bates 2269*, 23.ix.1982, 10 km east of Wanilla, Eyre Peninsula (AD).

3. **Microtis globula** R. Bates, sp. nov.

Ab *Microtis* speciebus aliis radicibus tumidis succulentis fragilibus et tuberibus minus quam 0.5 cm diametro; floribus globularibus, sepalo dorsali orbiculari, 3-5-porcato, 2.0 x 2.0 mm, sepalis lateralibus triangularibus, c. 2 x 1.2 mm, concavis, multo incurvatis apicibus crassulatis; petalis ovatis, c. 1.4 x 0.8 mm, inclusis a sepalis; labello 1.5-2 mm longo, base suborbiculari, apice oblongo, marginibus integris et callis basalibus connatis rectangularibus; ovario ovoido tumescenti, c. 3.2 x 2 mm; seminibus atrobruneis differt.

Type (Fig. 3): *R. Bates 2922*, 15 km west of Walpole (Western Australia), 22.xii.1982 (AD, holo.; PERTH, iso.).

Plant slender, 18-28 cm high, wholly greenish. *Tuberoid* ovoid, 0.2-0.4 x 0.2-0.3 cm, white; epidermis not separating when dry. *Roots* 3-5, swollen and fleshy, brittle, 1-4 cm long, 0.2-0.4 cm diam. *Leaf* hollow, terete, 8-20 cm long, 0.2-0.4 mm diam.; apex ± hollow, acuminate, erect or drooping; fissure c. 1 cm long forming 2-5 cm from base of leaf. *Flowers* 8-30, not scented, pale or yellow-green, decurved, globular due to incurved sepals, spirally arranged in loose to moderately dense raceme, 2-8 cm long; free scape 5-15 cm long, 0.1-0.2 cm diam. *Pedicel* c. 1 x 0.4 mm. *Floral bract* ovate, 1.5 x 0.8 mm, obtuse. *Dorsal sepal* orbicular to ovate, 2-2.2 x 2 mm, deeply concave below, cucullate, with 3-5 raised longitudinal ridges, apex conical, straight. *Lateral sepals* triangular, 2 x 1-1.2 mm, much incurved with upper margins partly overlapping dorsal sepal, inner surface concave; apex crassulate, sub-acute. *Petals* ovate, c. 1.4 x 0.8 mm, incurved, enclosed within sepals; lower margin sinuate, apex obtuse. *Labellum* 1.5-2 mm long; basal half sub-orbicular, c. 1 mm diam.; apex ± oblong, 0.6-1 x 0.5 mm, broadest distally, obtuse; margins entire, slightly sinuate; basal callus rectangular, 0.8 x 0.9 mm, concave about centre, surface irregular; nectary a transverse depression near base, no apical callus, but a circular, rugulose area 0.2 x 0.2 mm on lamina near apex in many flowers. *Column* c. 0.84 x 0.4 mm with membranous, oblong auricles, c. 0.3 x 0.08 mm, spreading on either side of anther. *Stigma* slightly prominent, semi-lunate, 0.2 x 0.3 mm, rostellum broadly triangular, 0.2 x 0.3 mm, apex becoming emarginate. *Anther* broadly hemispherical, 0.2 x 0.3 mm, cucullate, retuse with minute mucro. *Pollinia* friable, attached directly to ovate viscidium. *Ovary* ovoid, 3-4 x 1.5-2.5 mm, erect but decurved at apex. *Seeds* very dark brown (Figs 3, 6C).

Distribution (Map 3)

M. globula seems to be endemic to an area along the south-west coast of Western Australia from near Albany to west of Walpole, a distance of less than 200 km.

Flowering: December-January.

Ecology

All collections of *M. globula* have been made along swamp margins which had been burnt over in late summer, 9-10 months prior to collecting. The author found the species in damp sand around a *Cephalotus* bog which contained a large population of *M. pulchella*

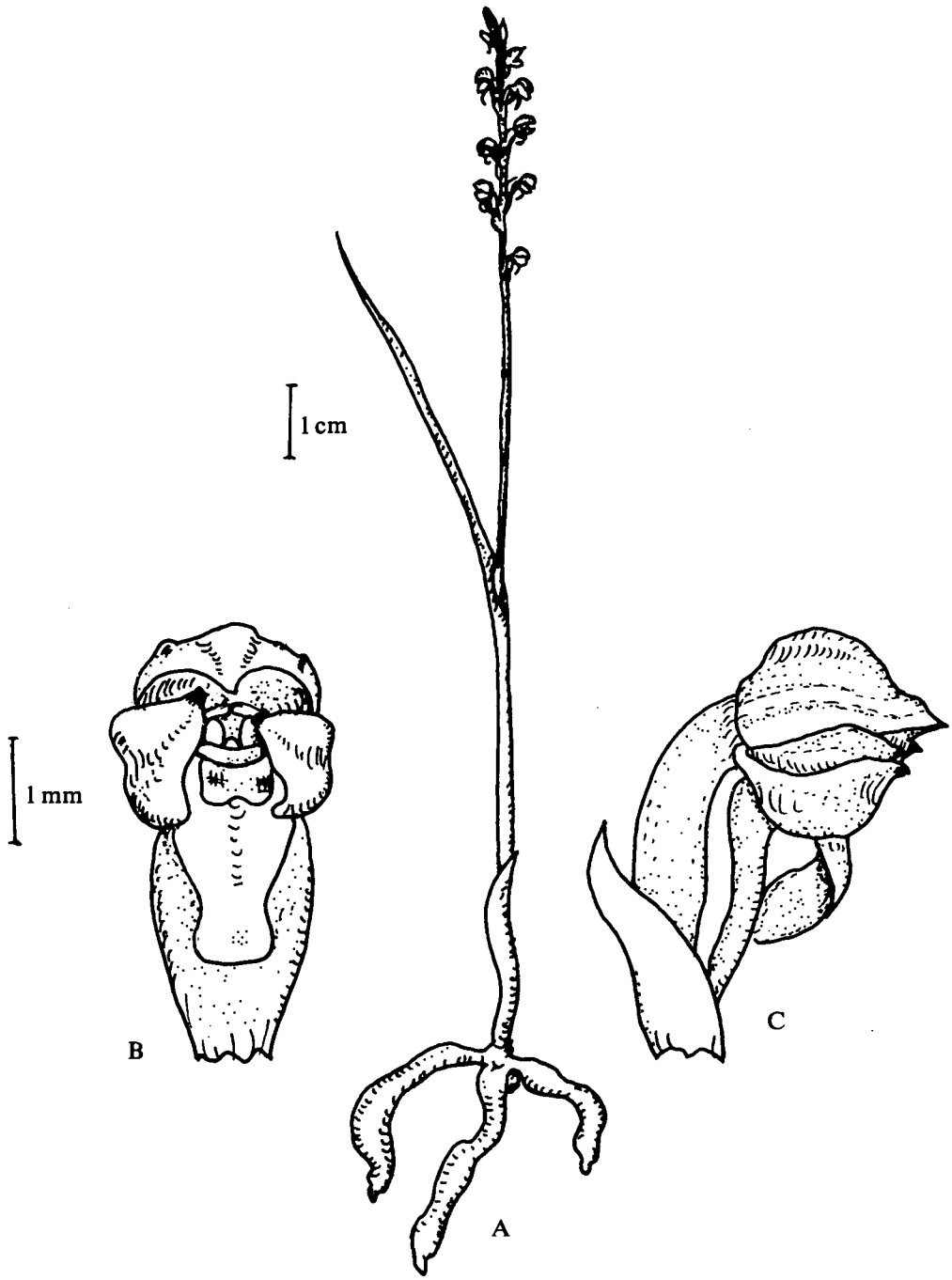


Fig. 3. *M. globula*. A, plant; B, flower in front view; C, flower in side view. (*R. Bates 2922* from near Walpole, W. Australia). Illustration by L. Dutkiewicz.

in flower. Whereas *M. pulchella* grew only in areas of permanently seeping water, the *M. globula* grew where the soil dried out in summer. With R. Heberle of Albany, I had previously visited locations where both *M. pulchella* and *M. globula* had flowered in abundance a year earlier. In these locations the species could be located only from the dried inflorescences of the previous year and much searching was necessary to reveal filiform leaves 1-2 cm long, indicating that both *M. pulchella* and *M. globula* flower only after fires. The restricted environment, the fire stimulated flowering, the late flowering season (December-January) and the small green flowers of *M. globula* would all seem to be reason why the species has only recently been 'discovered'. Heberle (pers. comm. 1982) believes there are other unnamed *Microtis* species occurring in the Albany area, restricted to permanent bogs and seldom flowering.

Affinities

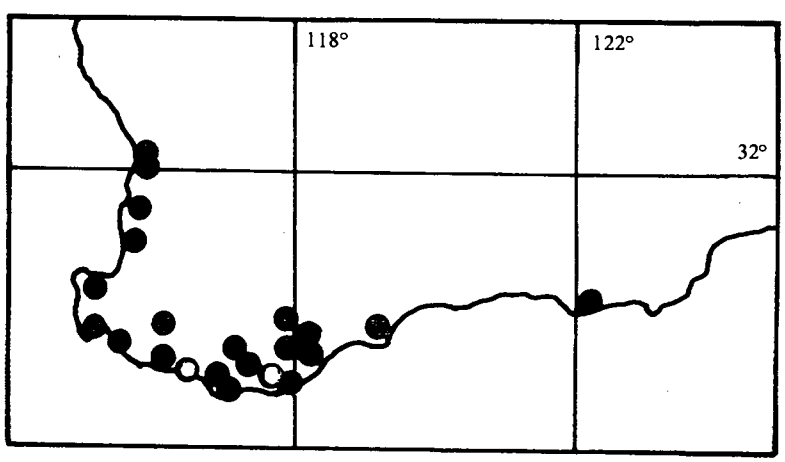
M. globula does not seem to be closely allied to any other species. If the swollen fleshy, brittle roots are a feature of all populations, they alone would set the species apart. The flowers too are very distinctive; the much incurved, triangular, lateral sepals give the flowers the globular appearance which suggested the specific epithet. The ribbing on the dorsal sepal does not occur in any other species and the labellum is distinctive, although most closely allied to that of *M. pulchella* with its basal callus and minute rugulose area near the apex.

Conservation status:

As the known populations are all in conservation parks the species may be considered rare but not endangered.

Specimens examined

WESTERN AUSTRALIA: *R. Bates 2922*, 22.xii.1982, 15 km west of Walpole (AD, PERTH); *R. Bates 2923*, 22.xii.1982, 14 km west of Walpole (AD); *R. Heberle s.n.*, 10.i.1982, 10 km NE of Albany (AD); *H. Webster* sub *R. Bates 2843*, 26.xii.1981, 10 km NE of Albany (AD).



Map 3. Distribution of *M. alba* ● and *M. globula* ○

4. **M. pulchella** R. Br., Prod. 321 (1810); Sprengel. Syst. Veg. 3: 713 (1826); Woolls, Contrib. Fl. Aust. 15 (1867); Reichb. f., Beitr. Syst. Pfl. 62 (1871); Benth., Fl. Aust. 6: 349 (1873); Schltr., Bot. Jahrb. 45: 382 (1911); R. Rogers, Trans. & Proc. R. Soc. S. Aust. 44: 328 (1920); Pelloe, W. Aust. Orch. 20 (1930); Erickson, Orch. West 48 (1951); Cady, Aust. Pl. 4: 167 (1967); A.S. George, Nuytsia 1 (2): 185 (1971); Oliver, Nature Walkabout W. Aust. 12: 64, col. photo 26 (1976).

Type: *R. Brown, s.n.*, King George Sound (W. Aust.) Dec. 1801 (BM, lecto.!, K, iso.!). The sheet at BM bears the information in Brown's hand "Ophrys pulchella, in paludibus ad portum regis Georgiv III Dec. 1801". The lectotype was selected by A.S. George (1971) as holotype.

M. gymnadenioides Diels, J. Muell. Bot. Soc. W. Aust. 1 (2): 79 (1903); R. Rogers, Trans. & Proc. R. Soc. S. Aust. 44: 328 (1920); Pelloe, W. Aust. Orch. 20 (1930); Erickson, Orch. West 49 (1951); Blackall & Grieve, W. Aust. Wildfl. 90 (1954), Cady, Aust. Pl. 4: 167 (1967).

Type: *L. Diels s.n.*, wet sandy flats north of Albany (W. Aust.), xi.1901 (not located).

Plant slender, 10-30 cm high. *Tuberoid* ellipsoid, 0.4-1.0 x 0.3-0.8 cm; epidermis white, peeling free when mature. *Leaf* 6-20 cm long, 0.3-0.6 mm diam., apex acute, ± solid, erect; fissure c. 1 x 0.2 cm, forming 2-8 cm from leaf base. *Flowers* 5-25, lightly perfumed or not, white, thinly textured, at first erect, drooping in older flowers, spirally arranged in loose raceme, 1.5-8 cm long, on free scape 7-14 cm long, only 1-1.5 mm diam. *Pedicel* slender, 0.8 x 0.3 mm. *Floral bract* ovate, 1.5-2 x 1-1.2 mm, acute. *Dorsal sepal* ovate, 2.5-2.8 x 2 mm, almost flat to slightly concave, sub-acute. *Lateral sepals* ovate-lanceolate, 2.2-2.5 x 1-1.2 mm, depressed and spreading on either side of labellum, slightly concave, apex straight or recurved, acute. *Petals* falcate-lanceolate, 2-2.2 x 0.8 mm, flat, spreading widely below dorsal sepal; apex straight, sub-acute. *Labellum* ± oblong, 3-3.5 x 1-1.3 mm, standing out at right angles to ovary, narrowest about middle; margins entire or slightly crenulate near middle; basal calli ovate to orbicular, c. 1.2 x 1.2 mm, green, conjoined, surface smooth with deep V-shaped nectary below two conical protruberances at base; no apical callus but often an irregular rugulose area on lamina near apex; apex downturned, rounded or retuse. *Column* c. 1.6 x 1 mm, with prominent oblong-lanceolate auricles, c. 0.5 x 0.2 mm, spreading at right angles to column. *Stigma* semi-lunate, c. 0.3 x 0.2 mm, 0.8 mm from column foot; rostellum triangular, c. 0.3 x 0.2 mm, widely beaked. *Anther* broad, 0.6 x 0.8 mm, cucullate, retuse with minute recurved mucro. *Pollinia* mealy; caudicle 0.1 mm long; viscidium ovate, 0.1 mm long. *Ovary* elongate, 3-4 x 1-1.5 mm, erect, straight, standing well out from scape. *Seeds* brown. (Figs 2A; 6D; 8E, F).

Distribution (Map 4)

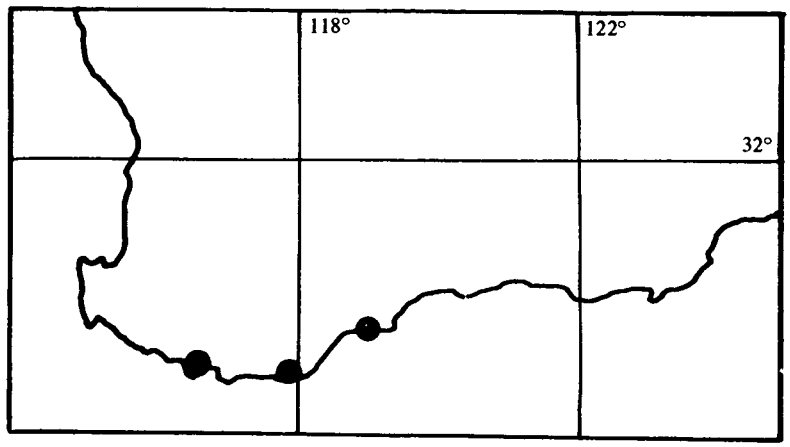
Restricted to a small area in the far south-west of Western Australia from east of Albany to near Pemberton.

Flowering

November to January. In seasons not following fire plants of *M. pulchella* are reduced to filiform leaves only 1-2 cm long (*R. Bates 2927*, AD), or these leaves may be completely absent, the plant being reduced to a subterranean system of tuberoids and rootlets in mycorrhizal association with soil fungi.

Ecology

Occurring only in near coastal swamp, or damp sandy heathlands and generally stimulated to flower by late summer bushfires.



Map 4. Distribution of *M. pulchella.*

Affinities

Diels (1903) stated that *M. gymnadenioides* differed from *M. pulchella* in having a ". . . longer leaf, the dorsal sepal wider and more concave, the crisped margin of the labellum and larger flowers". George (1971) agreed with Schlechter (1911) in treating it as a synonym of *M. pulchella* and he stated "Diels did not see Brown's specimens and his characters for distinguishing *M. gymnadenioides* in fact fall down when a range of specimens is examined." George pointed out that the correct spelling of the epithet is "gymnadenioides" not "gymnadenoides" as used by most authors.

M. pulchella is a very distinct species not closely allied to any other. In general appearance its raceme of delicate, white, widely opened flowers resembles that of *M. alba*, but the latter species has the labellum cuneate with bilobed apex, papillose margins and a large apical callus. The lateral sepals of *M. pulchella* are spreading while those of *M. alba* are revolute. The labellum of *M. pulchella* is like that of *M. globula* and *M. parviflora* in having basal callosities but no apical callus, and all three may have an indistinct rugulose area on the lamina near the apex. *M. globula* differs however in its globular flowers. *M. parviflora* differs in having revolute lateral sepals and both have smaller, greenish flowers and a different labellum shape.

Conservation status

M. pulchella is included by Leigh, Briggs and Hartley (1981) in their list of rare Australian plants. Despite its uncommon nature and restricted distribution it appears to be well conserved.

Specimens examined

WESTERN AUSTRALIA: *R. Bates 2916*, 22.xii.1982, 10km NW of Walpole (AD, CHR, HO, MEL, NSW, PERTH); *W.E. Blackall s.n.*, xii.1945, Albany (PERTH); *J. Drummond 307*, 1843, South-West Australia (AD, BM, MEL); *A.S. George 6491*, 6.xii.1974, Albany to Bremer Bay (PERTH); *R. Heberle* sub *R. Bates 2128*, 25.xii.1981, Albany area (AD); *J. Tonkinson s.n.*, xii.1968, Albany (PERTH); *J. Tonkinson s.n.*, i.1966, Albany (PERTH).

5. **M. parviflora** R. Br., Prod. 321 (1810); Sprengel, Syst. Veg. 3: 71 (1826); Bauer, in Curtis' Bot. Mag. 62, t. 3377 col. (1835); Endl., Icon. Gen. Pl. t. 15 (1838); Lindley, Gen. sp. orchid. pl. 395 (1840); Benth., Fl. Aust. 6: 349 (1873); F.M. Bail., Syn. Qld. Fl. 520 (1883); French, Vict. Nat. 2: 130 (1886); R. Rogers, Trans. & Proc. Roy. Soc. S. Aust. 37: 128 (1913); Domin, Beitr. Fl. Pfl. Aust. 2: 237 (1915); R. Rogers, Trans. & Proc. Roy. Soc. S. Aust. 44: 326 (1920); R. Rogers in Black, Fl. S. Aust. edn 1 (1): 123 (1922); Pescott, Orch. Vict. 36 (1928); Dickins, Vict. Orch. 42 (1929); Rupp., Orch. N.S. Wales 21 (1930); Ewart, Fl. Vict. 334 (1931); Nicholls, in Barrett, Sun Nature Bk. 5: 16 (1934); Nicholls, Vict. Nat. 66: 90 (1949); Willis, Handb. Pl. Vic. 1: 364 (1963); Firth, Nat. Orch. Tasm. 54, t. 3 (1965); Cady, Aust. Pl. 4: 164 (1967); Dockr., Aust. Indig. Orch. 23, t. 94 col. (1969); Burbidge & Gray, Fl. A.C.T. 116, t. 112A (1970); Moore & Edgar, Fl. N. Zeal. 2: 153 (1970); Cady & Rotherham, Aust. Nat. Orch. 22, col. photo (1970); A.S. George, Nuytsia 1 (2): 155 (1971); D.L. Jones, Ann. Bot. n.s. 39: 585 (1975); D.L. Jones, Orchadian 5: 83 (1976); Lavarack, Orchadian 5: 65 (1976); Weber & Bates in J.P. Jessop ed., Black, Fl. S. Aust. edn 3 (1): 423, t. 403 (1978); W.M. Curtis, Stud. Fl. Tasm. 4a: 56 (1980); Beadle et al., Fl. Sydney Reg. 568 (1982).

Type: *R. Brown s.n.*, Port Jackson (New South Wales) 1803-5 (BM lecto.!, K!, AD!, iso? syn.). The smallest plant on the sheet at BM is here selected as lectotype as it is closest to Brown's original description.

M. viridis F. Muell., Fragm. Phyt. Aust. 5: 97 (1865), nom. illeg., pro. parte. The name was used by Mueller to include *M. media* R. Br., *M. parviflora* R. Br., *M. rara* R. Br., *M. arenaria* Lindley and *M. frutetorum* Schltdl.

M. benthamiana Reichb. f., Beitr. Syst. Pfl. 24 (1871); Maiden, Proc. R. Soc. N.S. Wales 60: 130 (1908).

Type: *R. Brown s.n.*, Sydney, ix.1803 (W holo.!, K iso.!).

M. parviflora var. *densiflora* auctt. non Benth. sensu R. Rogers, Trans. Proc. R. Soc. S. Aust. 37: 129 (1913); Nicholls, Vict. Nat. 66: 91 (1949) as "M. parviflora var. densiflora Rogers" in obs. (Based on plants of *M. parviflora* with very crowded flower spikes from Myponga, S. Australia i.e. *R. Rogers 2225* AD).

M. porrifolia var. *parviflora* (R. Br.) Rodway, Tasm. Fl. 195 (1903). Based on *M. parviflora* R. Br.

M. bipulvinaris Nicholls, Vict. Nat. 66: 92, figs. A, F (1949); Willis, Handb. Pl. Vict. 1: 362 (1963); Firth, Nat. Orch. Tasm. 54 (1965); Cady, Aust. Pl. 4: 162 (1967); Nicholls, Orch. Aust. 24, t. 95 col. (1969); Gray, Vict. Nat. Orch. 2: photo 7 (1971); Beadle at al., Fl. Sydney Reg. edn 3: 568 (1982).

Type: *P. Morris s.n.*, Quail Island, Westernport Bay (Victoria), ix.1943 (MEL 70474, holo.!).

M. holmesii Nicholls, Vict. Nat. 66: 94, figs. G, E (1949); Willis, Handb. Pl. Vict. 1: 363 (1963); Cady, Aust. Pl. 4: 164 (1967); Nicholls, Orch. Aust. 2, t. 93, col. (1969); Gray, Vict. Nat. Orch. 2: 1 (1971).

Type: *N. Holmes s.n.*, Moe (Victoria) "Along the railway enclosure on the western outskirts of town", xi.1946 (MEL 70479, holo.!).

Plant slender to robust, 8-40 (-50) cm high. *Tuberoid* globose, 0.5-1 cm diam.; epidermis drying brown and not separating. *Leaf* 10-40 cm long, 3-8 mm diam., apex acuminate, ± hollow, erect or drooping, usually damaged; fissure 1-2 cm long, forming 5-15 cm from leaf base. *Flowers* (10-) 20-50 (-80), rarely scented, green, sub-erect, spirally arranged in moderate to very dense raceme, 3-10 cm long; free scape 3-12 cm long, 1-2 mm diam. *Pedicel* slender or thick, 0.5-1.5 mm long. *Floral bract* ovate, acuminate 3-4 x 2 mm. *Dorsal sepal* orbicular to ovate, 1.5-2.2 x 1.2-2 mm, markedly concave below, apex acute, straight or recurved, usually with small apiculus. *Lateral sepals* linear-oblong, 1.2-2 x 0.8 mm, sub-acute, at first deflexed, becoming recurved or with age. *Petals* falcate-lanceolate, 1-1.5 x 0.3-0.5 mm, sub-acute, partly hidden within dorsal hood. *Labellum* ± cordate (0.8-) 1-1.8 (-2) x 0.3-0.8 mm, decurved through semi-circle; margins entire, sometimes undulate, apex rounded or acute, with short, decurved apiculus; basal calli ovate, c. 0.1 x 0.1 mm, dark green, smooth, conjoined or surrounding small pouch which forms

bulge on underside of labellum; nectary a "W" shaped furrow at base; labellum lamina minutely tuberculate, often with a minute rugulose patch toward apex which is not raised in live material, often drying as a raised area. *Column* 1-1.2 x 0.8 mm, with oblong white-tipped auricles, 0.2 x 0.1 mm. *Stigma* semi-lunate, c. 0.3 x 0.2 mm, becoming convex; rostellum obscurely triangular, 0.2 x 0.1 mm. *Anther* c. 0.2 x 0.1 mm, cucullate, retuse. *Pollinia* at first coherent, soon becoming friable, caudicle c. 0.1 mm at first, contracting as it dries; viscidium orbicular, minute. *Ovary* ovoid, larger than flower, 2-5 x 1.5-3 mm, erect but standing well out from spike on some plants. *Seeds* dark brown. (Figs 4, 7A, 8G, H).

Distribution (Maps 5, 6)

Widespread but mainly coastal, from central eastern Queensland through New South Wales, Victoria and Tasmania, and as far west as the Flinders Ranges in South Australia; also in New Zealand and probably New Caledonia and eastern Asia but specimens not seen.

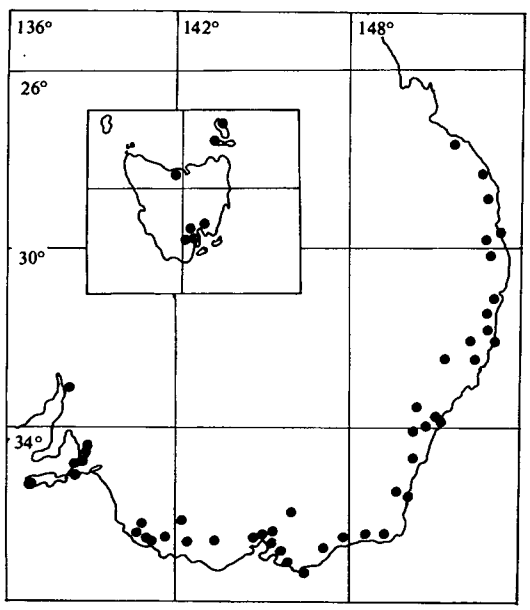
Flowering: Spring and summer.

Ecology

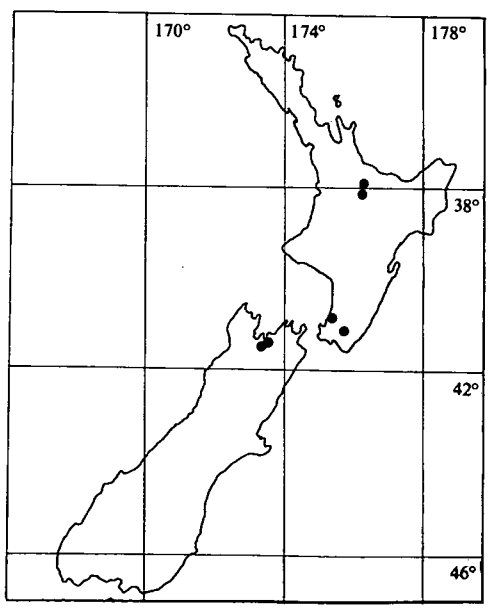
Generally occurring on bogs or damp grassland where it forms extensive, open colonies. Also found in cleared farmland in short pastures, where it is more persistent than other orchids. Rapidly colonises disturbed ground in wet places.

Affinities

M. parviflora is closely related to *M. unifolia*, especially to small-flowered forms. The two species are usually inseparable on a basis of vegetative material; both may be slender or robust plants with flowers moderate to very dense on the spike. In Australia however, plants with small flowers most likely belong to *M. parviflora* and plants with large flowers



Map 5. Distribution of *M. parviflora* in Australia.



Map 6. Distribution of *M. parviflora* in New Zealand.

will usually be *M. unifolia*. The dorsal sepal, lateral sepals, petals and their relative positions are very similar in both species. The most contant differences lie in labellum structure. (Figs 8G, 9A). The labellum of *M. parviflora* is cordate, the margins entire with an apiculus, and the lamina without an apical callus, whereas the labellum of *M. unifolia* is oblong, the margins crenulate, the apex truncate to bifid, the lamina with a large apical callus. *M. parviflora* is frequently pollinated by ants, *M. unifolia* by wasps. Poorly pressed material of *M. parviflora* may be difficult to identify as the labellum wrinkles and loses its shape, in which case boiling the flowers may be necessary to allow a positive identification. Fig. 4 indicates the similarity of the labellum shape in *M. parviflora* from Australia and *M. unifolia* from the Asian and Polynesian regions.

Both *M. bipulvinaris* and *M. holmesii* were described in 1949 from Victorian material. Willis (1953) wrote of the first: "I am inclined to regard *M. bipulvinaris* as a development of *M. parviflora*". Jones (1976) reduced it to synonymy with *M. parviflora*. Nicholls' illustrations (1949, 1969) of this species clearly show it to be a form of *M. parviflora*. Jones (1976) also reduced *M. holmesii* to a synonym of *M. parviflora*, stating that, " . . . the rolling of the lateral sepals (of *M. holmesii*) is a variable feature but is related to the age of the flowers and hence is an unreliable character." Older flowers of *M. parviflora* generally possess rolled lateral sepals, the main feature by which Nicholls distinguished *M. holmesii*. Nicholls' illustrations of *M. holmesii* (1969, t. 93) indicate the presence of a minute callus near the labellum apex and this feature, although unusual in *M. parviflora*, was not present on all the type specimens of *M. holmesii*; consequently there appears to be no reason to regard *M. holmesii* as a distinct taxon.

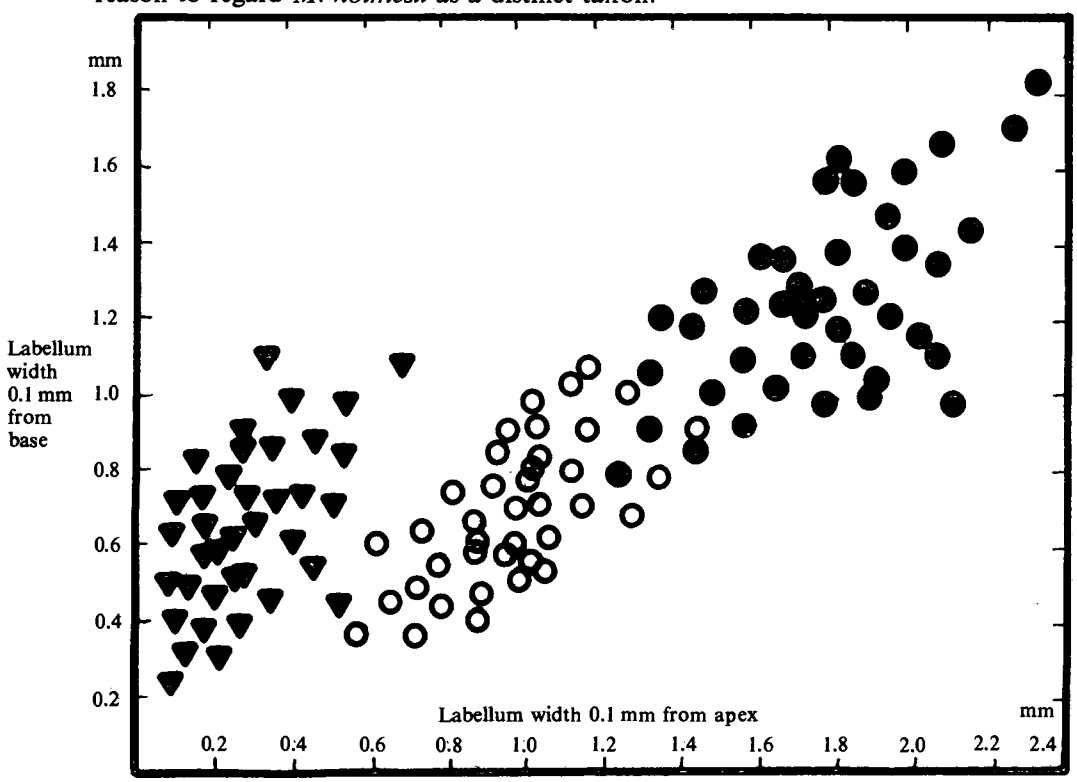


Fig. 4. Scatter diagram portraying the variation of the width of the labellum as measured at the base and at the apex in *M. parviflora* and *M. unifolia*. *M. parviflora* ▼; *M. unifolia* of Australian and New Zealand populations ●; of Asian and Polynesian populations ○.

Selected specimens (from 320 collections examined)

QUEENSLAND: *W. Abell s.n.*, 7.ix.1965, near Maryborough (NSW 123844); *F.M. Bailey s.n.*, 1888, no locality (AUK 96162); *R. Fitzgerald s.n.*, 1876, McLeay River (MEL 99107); *E.H. Ising s.n.*, 16.viii.1969, Caloundra (AD 97013191): *F.H. Kenny s.n.*, ix.1908, Gympie (AD 97734717); *F. von Mueller s.n.*, date unknown, Moreton Bay (MEL 99093); *J.H. Simmonds s.n.*, 2.ix.1938, Tambourine Mtn. (CHR 14365).

NEW SOUTH WALES: *B. Briggs 3063*, 17.x.1974, Central West Slopes (NSW); *J.B. Cleland s.n.*, 6.x.1911, Narrabri (AD 97735054); *R. Coveny 4500*, 7.x.1976, Jenolan Caves (NSW); *M. Fagg 309*, 28.xii.1966, 90 km east of Albury (AD); *M. Fawcett 8*, 7.xi.1970, Bullahdelah (MEL 99102); *J.H. Maiden s.n.*, 17.x.1880, Port Jackson (NSW 88270); *T.B. Muir 1708*, 10.xi.1974, Mitta Mitta (MEL); *H.M.R. Rupp s.n.*, x.1927, Paterson (NSW); *F.A. Rodway s.n.*, 20.x.1929, Jervis Bay (OA 41707, K).

VICTORIA: *A.C. Beauglehole 30105*, 17.xii.1976, Marlo (MEL, AD); *A.B. Braine s.n.*, 23.x.1921, Athlone (AD 30368); *K. Czornij 477*, 9.xii.1971, Genoa (AD); *F. Mueller s.n.*, 16.xi.1880, Horsham (MEL 99119); *F. Mueller 65*, Coll. G.A. Toepffer, 3.xii.1886 (MEL); *R. Nash 474*, 8.i.1956, Somers (AD); *W. Perry s.n.*, 7.xi.1907, Bendigo (MEL 538337); *E.E. Pescott s.n.*, 16.xi.1917, Fern Tree Gully (AD 97730372); *J.H. Willis s.n.*, 6.i.1966, Mt. Donna Buang (MEL 584371).

TASMANIA: *E.W. Ashby s.n.*, i.1913, Sandford Bay (AD 97263015); *J.S. Whinray 242*, 29.xii.1968, Deal Island near Lighthouse (HO); *S.A. White s.n.*, xi.1906, Mt. Wellington (AD 97632450).

SOUTH AUSTRALIA: *R. Bates 137*, 25.ix.1968, 3 km west of Alligator Gorge (AD); *R. Bates 2127*, 25.xi.1981, Peter Creek swamps, Kuitpo (AD); *H. Goldsack 477*, 9.x.1932, Cherry Gardens (AD, NSW); *D. Hunt 1448*, 9.xii.1962, Naracoorte (AD); *R.H. Kuchel 1478*, 30.xi.1963, Mt Compass (AD); *R.S. Rogers 2228* 15.xii.1920, Mt Compass. (This is labelled 'M. parviflora var. densiflora' by Rogers) (AD); *A. Spooner 6250*, 7.xii.1974, Tanunda (AD).

NEW ZEALAND: *H. Carse 556*, 24.xii.1911, Manganui (CHR); *A.P. Druce s.n.*, xi.1975, Nelson (CHR 285796); *R. Mason and N. Moar 7016*, 7.xii.1972, Waikato (CHR); *H.B. Matthews 3451*, i.1920, Rotorua (AD); *O. Oswald s.n.*, 17.xii.1924, Wangaramino (CHR 83946); *W.R. Sykes 76*, 24.xi.1970, Macauley Isl. (AUK).

6. **Microtis unifolia** (Forster f.) Reichb. F., Beitr. Syst. Pfl. 62 (1871); Fitzg., Aust. Orch. 2 (1) t. col. (1884); Kraenzl., Bot. Jahrb. Syst. 6: 55 (1885); J.J. Smith, Orch. Java 6: 47 (1905) and Java. Fig. Atlas t. 26 (1908); Ames, Orch. Fasc. 1: 65 (1905) and ibid. 2: 41 (1908); Merrill, Phil. Fl. Pl. 1: 261 (1924); Dickins, Vict. Orch. t. 42 (1929); Black, Fl. S. Aust. edn 2 (1): 217 (1944); Nicholls, Vict. Nat. 66: 93, fig. M. (1949); Erickson, Orch. West 47 (1951); Willis Handb. Pl. Vict. 1: 363 (1963); Firth, Nat. Orch. Tasm. 54 (1965); Jisaburo, Fl. Jap. 340 (1965); Cady, Aust. Pl. 4: 163, fig. B (1967); Backer & Bakhuizen, Fl. Java 3: 254 (1968); Dockr. Aust. Indig. Orch. 1: t. opp. p. 90 (1969); Nicholls, Orch. Aust. 23, t. 96, col. (1969); Moore & Edgar, Fl. N. Zeal. 2: 153 (1970); Burbidge & Gray, Fl. A.C.T. 116 (1970); Gray, Vict. Nat. Orch. t. 2, col. (1972); Pocock, Ground Orch. Aust. col. photos 86, 88 and 89 (1972); Garay & Sweet, Orch. S. Ryuku Is. 42 (1974); Lothian, Rosa Fiveash Aust. Orch. 7, t. 87, col. (1974); Halle, Fl. Nouv. Caled. 8: 469 (1977); Shun Ying, Indig. Orch. Taiwan 1: 482 (1977); Lin, Fl. Taiwan 1062 (1978); Weber & Bates in J.P. Jessop ed. Black, Fl. S. Aust. edn. 3 (1): 423, t. 404 (1978); W.M. Curtis, Stud. Fl. Tasm. 4a: 56 (1980); Cooper, N. Zeal. Nat. Orch. fig. 33 (1981); Cunningham et al., Plants of Western N.S. Wales 200, col. photo (1982).

Type: *Forster 167*, New Zealand, no date (GOET, lecto, photo!, P, iso., photo!). (There is a Forster painting of this species at BM labelled "Charlotte Sound"). The lectotype was selected by A.S. George 1971 as holotype. It is the better of the two type specimens located.

Ophrys unifolia Forster f., Prod. 59 (1786); R. Br., Prod. 320 (1810).

Epipactis porrifolia Sw., Vetensk. Akad. Handl. 21: 233 (1800); Willd., Spec. Pl. 4: 89 (1805); Pers., Synops. Pl. 2: 513 (1807); R. Br., Prod. 320 (1810). Superfluous name based on the type of *Ophrys unifolia*. There is a sheet in the Swartz Herbarium at S without locality, date or collector which may be a type.

Serapias porrifolia (Sw.) Steudel, Nom. bot. 1 (1): 767 (1824); Steudel, Nom. bot. 2 (2): 567 (1841); Heynhold, Nom. bot. Hort. 2 (2): 408 (1846) attributed to Willd.

Microtis porrifolia (Sw.) R. Br. ex Sprengel, Syst. Veg. 3: 713 (1826); Lindley, Gen. sp. orch. pl. 54 (1840); Hook. f., Fl. N. Zel. 67 (1853); F. Muell., Veget. Chatham Is. 43 (1864); Hook. f., Handb. Fl. N. Zel. 266 (1864); Tepper, Garden & Field 5: 100 (1880); F. Muell., Syst. Census Aust. Pl. 112 p.p. (1882); F.M. Bail., Synops. Qld. Fl. 177 (1883); Fitzg., Aust. Orch. 2, t. col. (1884); Rodway, Tasm. Fl. 166 (1903); J.J. Smith, Fl. Buitenz. 6: 47 (1905); Cheeseman, Man. N. Zeal. Fl. 673 p.p. (1906); Laing & Blackwell, Pl. N. Zeal., t. opp. p. 114 (1906); R. Rogers, Trans. & Proc. Roy. Soc. S. Aust. 44: 326 (1920); R. Rogers, in Black Fl. S. Aust. edn. 1 (1): 123, t. 88 (1922); Pescott, Orch. Vict. 47 (1928); Pelloe, W. Aust. Orch. 18 (1930); Rupp, Orch. N.S. Wales 21 (1931); Ewart, Fl. Vict. 245 (1931); Goldsack, S. Aust. Naturalist. 22: 94 (1944).

Microtis media R. Br., Prod. 321 (1810); Sprengel, Syst. Veg. 3: 713 (1826); Lindley, Gen. sp. orchid pl. 396 (1840); F. Muell., Sec. Syst. Census Aust. Pl. 190 (1889); Constantin, Atlas Orch. Cult. t. 28, fig. 1 (1913); R. Rogers, Trans. & Proc. R. Soc. S. Aust. 44: 326 (1920); Pelloe, W. Aust. Orch. 19 (1930); Erickson, Orch. West 48 (1951); Cady, Aust. Pl. 4: 165 (1967); A.S. George, Nuytsia 1 (2): 184 (1971).

Type: *R. Brown s.n.*, King George Sound (Western Australia) Dec. 1801 (BM, lecto., iso.!). The lectotype was selected by A.S. George (1971) as holotype.

M. parviflora auctt. non R. Br. (1810); Ames, Orch. Fasc. 2: 41, quoad syn. (1908); Pelloe, W. Aust. Orch. 19 (1930); Erickson, Orch. West 48 (1961); van Steenis, Mount. Fl. Java 176 (1972); These are references to Western Australian and Asian plants.

M. pulchella auctt. non R. Br. (1810); Lindl. Gen. sp. orch. pl. 396 pp. (1840); Archer & Fitch in Hook. f., Fl. Tasm. 2: t. 118 (1860); Reichb. f., Beitr. Syst. pfl. 62 as "M. pulchella Hook. f." quoad syn. (1871).

M. rara auct. non R. Br. (1810); Benth., Fl. Aust. 6: 347 quoad syn. *M. porrifolia* (1873).

M. banksii Hook., Curtis' Bot. Mag., sub t. 3377 (1835); Hook. f., Fl. N. Zel. 1: 245 (1853); Hook. f., Handb., Fl. N. Zel. 2: 266 (1864); Cheeseman Man. N. Zeal. Fl. 673 as "*M. banksii* A. Cunn." quoad. syn. *M. porrifolia* (1906).

Type: *A. Cunningham 311*, New Zealand "on the slopes of hills among ferns", 1834. (K, holo!, BM, iso!, drawings).

M. pulchella var. *vivax* Lindley, Gen. p. orch. pl. 395 (1840); Reichb. f., Beitr. Syst. Pfl. 62 as "M. vivax R. Gunn" quoad syn. *M. unifolia* (1871).

Type: *R. Gunn 918*, Circular Head (Tasmania), xi.1837 (K-L, syn., photo!); *R. Gunn 915*, Insula van Diemen xi.1837 (BM, syn.!). This sheet bears the label 'M. vivax R. Gunn'.

M. arenaria Lindley, Gen. sp. orch. pl. 396 (1840); Archer & Fitch in Hook. f., Fl. Tasm. 2, t. 118 (1860).

Type: *Gunn 916*, Circular Head (Tasmania) "in sandhills near the sea" 25.ii.1837 (K-L, holo.; AD!, HO!, K!, NSW iso.!).

M. frutetorum Schltdl., Linnaea 20: 568 (1847); Reichb. f., Walp. Ann. bot. 1: 807 (1849): French, Vict. Nat. 2: 130 as "M. frutelorum" quoad syn. M. porrifolia (1886).

Type: *H. Behr s.n.*, pine forest by Gawler Town (South Australia), x. 1846 (HAL, holo.!; K-L, MEL, iso.!).

M. javanica Reichb. f., Bonpl. 5: 36 (1857); J.J. Smith, Bull. Jard. Bot. ser. 3, (10): 4 (1928).

Type: *Reichenbach 859*, Tennger, Java "In graminosis montis Jdjn 6000 feet, 28.iv.1845 (W, holo. photo!).

M. viridis F. Muell., Fragm. Phyt. Aust. 5: 97, nom. illeg. p.p. (1866); Woolls. Contrib. Fl. Aust. 15 (1867).

Type: not known.

M. parviflora var. *densiflora* Benth., Fl. Aust. 6: 348 (1873).

Type: *Drummond 117*, S.W. Australia, 1849 (K, holo.!, MEL, iso.!).

M. longifolia Colenso, Trans. N. Zeal. Inst. 17: 247 (1885).

Type: *W. Colenso*, Norsewood, Hawkes Bay, North Island (New Zealand) 1883-4 (WELT 24277 holo.!, AK 3452 iso.!).

M. papillosa Colenso, Trans. N. Zeal. Inst. 18: 268 (1886).

Type: *C.P. Winkelmann*, Kaipara Heads, North Island (New Zealand) x.1884 (not loc.).

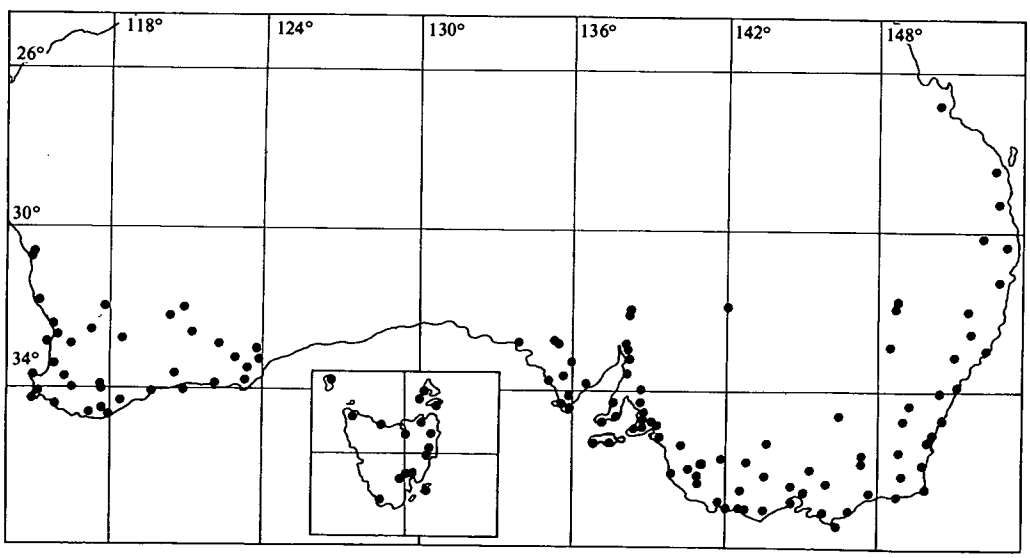
M. aemula Schltr., Bot. Jahrb. Syst. 39: 37 (1906); Rendle, J. Linn. Soc. Bot. 45: 172 (1914); Guillaumin, Bull. Soc. Bot. Fr. 5: 399 (1929); Guillaumin, Fl. Nouv. Caled. 71 (1948).

Type: *R. Schlechter 14724*, "Auf den Hugeln bei Yaouhe" New Caledonia, ix.1902 (P, lecto.; AD!, AK!, BRIS!, K!, NSW!, Z, iso.). Lectotypified by Halle (1977).

M. biloba Nicholls, Vict. Nat. 66: 94, figs. j, 1 (1949); Firth, Nat. Orch. Tasm. 54 (1965); Cady, Aust. Pl. 4: 274 (1967); Nicholls, Orch. Aust. 24, t. 97 col. (1969); Gray, Vict. Nat. Orch. photo. 3 (1972); W.M. Curtis, Stud. Fl. Tasm. 4a: 56 (1980).

Type: *N. Holmes s.n.*, Moe (Victoria) 1946 (MEL 70476, holo!).

Plant slender to robust, 5-60 (-90) cm high. *Tuberoid* globose, 0.5-1.5 cm diam.; epidermis drying brown and not separating. Leaf 8-60 (-80) cm long, 2-12 mm diam.; apex acuminate, hollow, erect or drooping, usually damaged; fissure developing 2-20 cm from leaf base. *Flowers* 6-100 (-150), often lightly scented, green or yellow-green, sub-erect, spirally arranged (rarely in whorls) in moderate to densely packed raceme, 2-20 cm long, to 3 cm diam.; scape from fissure to lowest flower 2-20 cm long, 1-3 mm diam. *Pedicel* 1-1.5 x 0.2-1 mm. *Floral bract* lanceolate to ovate-lanceolate, acuminate, 2-4 x 1-1.5 mm. *Dorsal sepal* ovate to orbicular, 2-4 x 1-2 mm, markedly concave below, apex broad and obtuse to acute, often with short, straight or recurved apiculus. *Lateral sepals* linear-oblong to ovate-lanceolate, 1.5-2.5 x 0.8-1.2 mm, recurved or rolled, sub-acute. *Petals* falcate-lanceolate to ovate-lanceolate, 1.4-1.8 x 0.4-0.8 mm, spreading but partly within dorsal hood, sub-acute. *Labellum* oblong, 1.2-2.5 x 0.4-2 mm, pendulous or recurved against ovary; margins undulate, crenulate to rugulose, apex obtuse, truncate or usually emarginate; basal calli saddle-shaped, 0.2-0.8 x 0.2-0.4 mm, smooth, rounded or square; nectary a 'W' shaped transverse groove at base; apical callus irregular, 0.2-0.4 mm diam., verrucose or papillose, remainder of lamina minutely tuberculate. *Column* 1.2-1.5 x 0.6-0.8 mm, erect or decurved with ovate auricles 0.2 x 0.2 mm. *Stigma* prominent, semi-lunate, 0.2 x 0.3 mm, at first concave, becoming convex, tuberculate and with indistinct margins; rostellum triangular, c. 0.2 x 0.1 mm, erect, bifid. *Anther* 0.2 x 0.25 mm, cucullate, erect at first, becoming decurved, retuse with minute mucro at anthesis. *Pollinia* coherent at first, enclosed in anther cells becoming granular and separating, caudicle c. 0.1 mm long. *Ovary* ovoid, 2-10 x 1.2-3 mm, erect, standing out from scape. (Figs 4, 5, 7B, 9A, B).



Map 7. Distribution of *M. unifolia* in Australia.

Distribution (Maps 7, 8 and 11)

Widely and commonly distributed from the south-west of Western Australia, through southern South Australia, Tasmania, Victoria, New South Wales, eastern Queensland into the tropics, to Lord Howe and Norfolk Islands, New Zealand and its outlying islands, New Caledonia, Indonesia, the Philippines, Taiwan and the Ryukyu Islands to Japan, making it the most widespread orchid of probable Australian origin. The species is unusual among Australian terrestrial orchids in occurring on numerous small off-shore islands.

Flowering

Spring and summer in temperate regions but may flower at any time in the tropics.

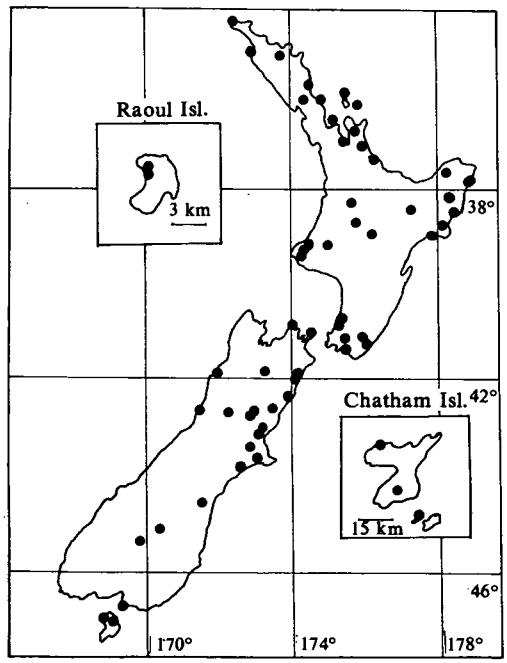
Ecology

Occurs in a wide variety of habitats from littoral to sub-alpine, from swamp and creek-bank to rock outcrops in semi-arid areas, from dense forest to open grassland. One of the few orchids tolerant of saline soils. Forms quite extensive colonies over wide areas. Commonly germinates in disturbed areas i.e. quarries, abandoned gardens, lawns (Garnet 1980, Bates 1981b).

Vernacular name: common onion orchid (Willis, 1963).

Affinities

M. unifolia is closely allied to *M. parviflora* and *M. rara*, in flower morphology, lying somewhat intermediate between the two. All three are inseparable using vegetative material alone, but each can be recognised on the basis of labellum structure and length. In Australia the flowers of *M. unifolia* are larger than those of *M. parviflora*, but the Asian



Map 8. Distribution of *M. unifolia* in New Zealand and outlying islands.

and Polynesian plants (Map 11) of *M. unifolia* can be seen as a connecting link (Fig. 4). *M. unifolia* and *M. rara* are pollinated by small wasps, and the larger more ornate labellum in those species acts as a landing platform for these flying insects. *M. parviflora* is ant pollinated and its smaller, less ornate labellum, is a possible result of such a pollination syndrome. For further differences see discussion under *M. parviflora* and *M. rara.*

Discussion of synonyms

M. aemula Schltr. from New Caledonia is a plant somewhat intermediate between *M. unifolia* and *M. parviflora* (see Fig. 4D), but I follow Halle (1977) in treating it as a synonym of the former.

M. parviflora var. *densiflora* Benth. is a littoral form of *M. unifolia*, with dense racemes, common in coastal dunes. The flower morphology is similar to that of *M. unifolia* and I agree with George (1971) in treating them as synonyms.

M. biloba Nicholls: the bilobed or emarginate labellum (Fig. 4A, B, C) by which Nicholls distinguished *M. biloba* is a feature of *M. unifolia* and I follow Jones (1976) in making the forms synonymous.

M. media R. Br. falls within the range of variation of *M. unifolia.* Brown's original description does not differ in any salient point from Forster's and examination of the types confirms that they should be regarded synonymous.

Brown (1810) in the protologue of *Microtis* remarked that *Epipactis porrifolia* Sw. based on *Ophrys unifolia* Forster f. belonged to this genus without making the transfer of names. Sprengel (1826) made the combination as "*Microtis porrifolia* R. Br.". The correct name and citation for the synonym should be *M. porrifolia* (Sw). R. Br. ex Sprengel. It was not until 1871 that Reichb. f. made the combination *M. unifolia.* He did not attribute the name to Brown: therefore the citation for the species is *M. unifolia* (Forster f.) Reichb. f., the citation most consistently used by recent authors.

Morphology

M. unifolia is very variable in its vegetative and floral characteristics, particularly in size of plants, density of flowers on the raceme and in morphology of the dorsal sepal and labellum (Fig. 4). This is thought to be partly due to the wide geographical distribution, diverse habitats and the influence of other species through hybridisation. Both variable and uniform populations occur and the various forms are not usually confined to a particular area but occur to different degrees in both remote and neighbouring populations. These 'races' interbreed wherever their geographical ranges overlap and their ecological niches are in close proximity, depending on the amount of outcrossing possible between the sympatric populations. Some forms are known to be clonal in nature due either to vegetative reproduction or to apomixy, while others appear to be ecotypic in character. One race from peaty bogs in the Mount Lofty Ranges, South Australia (*Bates 2381*, AD) has a consistently broad orbicular dorsal sepal with an obtuse apex and a fleshy labellum with oblong calli (Fig. 4E). The flowers are similar to *M. oligantha*, but 20-40 occur on each raceme. This form seldom intergrades with others in the same area. Another race occupying swamps in Western Australia (*Bates 2940* AD) has a very narrow acute dorsal sepal with a long apiculus, and a slender labellum with almost entire margins (Fig. 4F). This form has apparently been mistaken for *M. parviflora* in Western Australia. A littoral form common around the coasts of Southern Australia forms very large racemes with densely packed flowers: *Bates 2892*, (AD, PERTH) has racemes with 150 flowers set almost in whorls. The type collection of *M. parviflora* var. *densiflora* Benth. belongs to this form. Populations however are not constant enough to warrant varietal rank.

The most perplexing variation occurs in the eastern Pacific from New Caledonia through Indonesia and the Philippines to Japan. Most plants from these areas have flowers smaller than the average Australian and New Zealand material (Figs 4D, 5), and do not possess the emarginate apex to the labellum which is a common feature of these plants. In general the apical callus of the Asian and near Asian plants is much smaller than in Australian and New Zealand populations, yet in some collections (i.e. *Hoogland 7462*, from Borneo) those features of large flowers, emarginate labellum apex and large apical callus do occur either singly or in combination, without any geographical or ecological pattern.

Further variable features in *M. unifolia* include fragrance (present or absent), labellum callosities (smooth or rugulose), and lateral sepals recurved to rolled. Occasional specimens have forked inflorescences (*Wilson 679*, CHR) but this is probably due to virus infection. Moore (1970, p. 152) notes the presence of a strong sweet smell from the leaf and tuber of New Zealand plants.

Selected specimens (from c. 2,100 collections examined)

WESTERN AUSTRALIA: *C. Andrews s.n.*, 1903, York, bears label by A.S. George—"Very similar to type at BM of *Microtis media* R. Br. ..." (PERTH); *E.T. Bailey 966*, 13.xi.1924, Manjimup, bears label by A.S. George —"Similar to type at P of *Microtis unifolia* . . ." (PERTH); *R. Bates 2833*, 19.xii.1982, Denmark to Mt Barker (AD); *R. Bates 2892*, 24.xii.1982, Augusta (AD); *A.S. George 4188*, 16.x.1967, Queen Victoria Rocks (PERTH); *M.R. Pocock 73*, 17.xi.1969, Gnarlbine (AD); *R.S. Rogers 2203*, 26.x.1924, Coolgardie South (AD, MEL); *D.R. Voigt 34*, 17.xi.1976, NW of Cue (PERTH); *J.H. Willis s.n.*, 20.x.1962, Recherche Archipelago (MEL 99192).

QUEENSLAND: *E. Bowman s.n.*, 6.x.1966, Gympie (MEL 99117); *M.S. Clemens s.n.*, 14.x.1920, Moreton Bay (OA 42860); *M. Eaves s.n.*, 24.ix.1930, Mooloolah River (MEL 99235); *P. Hartman 174*, 16.ix.1970, Cardamine (MEL); *F. Mueller s.n.*, no date, Rockhampton (MEL 99120); *S.A. White s.n.*, 18.ix.1904, Enoggera (AD 97016516).

NEW SOUTH WALES: *J. Boorman s.n.*, 4.x.1926, Peak Hill (NSW 123815); *B. Briggs 6225*, 17.x.1968, Warrumbungles (NSW); *L. Cady 262*, 28.xii.1968, Kiama (AD); *G.M. Cunningham 3909*, 6.x.1968, Mt Wabalong (NSW); *R. Dickson 242*, 17.x.1980, Mootwingie Creek (AD); *M. Hammond s.n.*, 27.x.1956, Wagga Wagga (MEL 99269); *J. Robertson s.n.*, 26.ix.1862, Rosewater (NSW 123879).

VICTORIA: *A.C. Beauglehole 29637*, 19.xi.1968, Mt Arapiles (MEL); *A.C. Beauglehole 30017*, 11.xii.1968, Black Range, Grampians (MEL); *G. Lyell s.n.*, xii.1930, Gisborne (MEL 573852); *T.B. Muir 5370*, 27.x.1974, Whroo (MEL); *I.F. Norman s.n.*, 10.xii.1979, Rabbit Island (MEL 576459); *F.M. Reader s.n.*, 29.x.1892, Dimboola (MEL 99229); *J.H. Willis s.n.*, 22.xii.1951, swamps on Wilson's Promontory (MEL 99180); *J.H. Willis s.n.*, 20.x.1955, Anglesea, by highway (MEL 99250).

TASMANIA: *P. Barnett s.n.*, 17.xii.1970, King Island (MEL 584392); *R.C. Gunn 910*, 1837, McQuarie Harbour (OA 71208); *R.J. Milligan (Gunn 967)*, 21.xi.1845, Long Point, Flinders Island (HO); *L. Rodway 36*, xi.1930, Blackmans Bay (HO); *J.E.S. Townrow s.n.*, 17.xi.1979, west side of Bruny Island (HO); *J.S. Whinray 243*, 29.xii.1965, Summit of Deal Island (HO).

SOUTH AUSTRALIA: *C.R. Alcock 3308*, 20.x.1976, near Streaky Bay (AD); *R. Bates 742*, 6.x.1976, Yardea, Gawler Ranges; *R. Bates 2101*, 3.xi.1981, Peter Creek (AD); *R. Bates 2381*, 27.xi.1981, Mt Compass (AD); *V. Jaegerman s.n.*, 1974, Aroona Valley, Flinders Ranges (AD 9734739); *B. Copley 3138*, 16.x.1972, Corny Point (AD); *D. Hunt 3382*, 24.xi.1962, Naracoorte (AD); *J.G.O. Tepper 20*, 16.x.1876, Nuriootpa (AD).

NEW ZEALAND: *J.K. Bartlett s.n.*, 17.xii.1970, Great Barrier Island (CHR 321397); *J. Clarke s.n.*, 24.xi.1964, Mangere Island, Chathams (CHR 189037); *T.F. Colenso s.n.*, x.1883, Curier Island (CHR 3447); *N. Lothian s.n.*, xii.1936, Waram Marble Deposits (AD 96232191); *R. Major 10*, 1947, Stewart Island (OA); *H.B. Matthews s.n.*, x.1924, Kaitaia (AD); *I.M. Ritchie s.n.*, 16.xi.1960, Codfish Island (AUK 150288); *H.D. Wilson 679*, 4.i.1948, Mt Cook area (CHR); *A.E. Wright 1924*, 17.xii.1978, near Auckland (AUK).

POLYNESIA: *A.C. Beauglehole 5503*, 18.xi.1962, Lord Howe Island (NSW); *J.P. Blanchon 969*, 15.ix.1964, Col. des Roussettes, New Caledonia (OA); *P.S. Green 1556*, 11.xi.1963, grassy rock ledges, south-east slopes of Malabar (OA); *R.D. Hoogland 6629*, 11.xii.1959, Transit Hill, Norfolk Island; *H.S. McKee 20633*, 28.xiii.1969, Canala, New Caledonia (NOUMEA).

INDONESIA: *M.J. Elbert s.n.*, no date, Lombok Island at 2,400 m. (AD 97263041); *R. Hoogland 7462*, 17.vii.1962, Borneo (AD); *J. van Steenis 10788*, 12.vii.1938, Jang Plateau West at 1900 m, Java (OA).

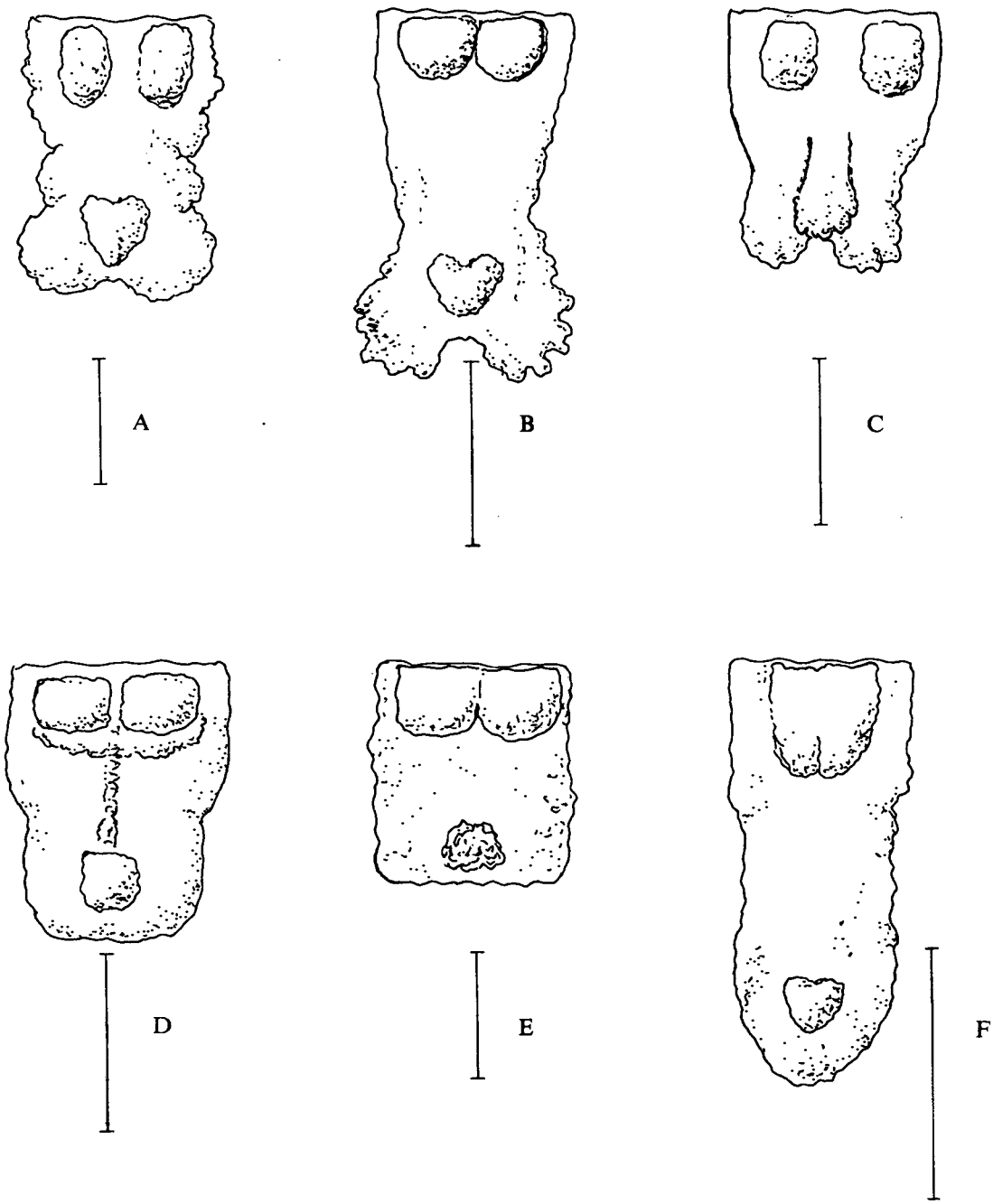


Fig. 5. Variation in the labellum morphology of *M. unifolia*. A, type and most common from (*E.T. Bailey 966*); B, coastal form (*R. Bates 2892*); C, small swamp form (*R. Bates 2101*); D, isotype of *M. aemula (R. Schlechter 14752*); E, large swamp form (*R. Bates 2381*); F, unusual swamp form from Western Australia (*R. Bates 2940*). Scale = 1 mm. Illustration by G.R.M. Dashorst.

EAST ASIAN ISLANDS: *M. Hoff 1510*, 16.ii.1979, Mt Nakada at 600 m, Honshu (TO); *M. Jacobs 7414*, 16.iii.1968, Bontoc, Philippines (MANILA); *E. Merrill 4345*, 24.xi.1905, grassy slopes in pine forest, Bagnio, Luzon (OA); *F.P. Metcalf and T.C. Chang 938*, 1925, Awoy, Fuchien, Formosa (OA); *R. Tanaka 13546*, 13.vi.1933, Tomita-cho Kyushu (OA); *C. Wright 340*, 30.iv.1855, Loo Choo Islands (OA).

7. **M. oligantha** L.B. Moore, N. Zeal. J. Bot. 6: 473 t.i. (1968); Moore & Edgar, Fl. N. Zeal. 2: 154, t. 31 (1970); Cooper, Orch. N. Zeal. (1982); Johns & Molloy, Nat. Orch. N. Zeal., photos 83, 84 col. (1983).

Type: *J. Clarke s.n.*, Lake Roundabout, Ashburton Valley (South Island, New Zealand), 3.ii.1966 (CHR 150775, holo.!).

M. magnadenia non R. Rogers, sensu Hatch., Trans. Roy. Soc. N. Zeal. bot. 2: 187 (1963).

Plant slender, 2-15 (-25) cm high. *Tuberoid* globose 0.4-0.8 cm diam.; epidermis brown and not separating when mature. *Leaf* slender, 6-15 cm long, 0.3-0.6 mm diam.; apex erect or drooping; the fissure forming 1-5 cm from the leaf base. *Flowers* 1-10, green, not scented; the raceme rarely >4 cm long, moderately loose; the free scape 2-10 cm long, 1-1.5 mm diam. *Pedicel* 0.8 x 0.5 mm. *Floral bract* ovate, 1.0 x0.8 mm. *Dorsal sepal* ovate, 2.5 x 2.0 mm, only slightly concave; apex short, straight, obtuse. *Lateral sepals* ovate-lanceolate, 1.2 x 0.6 mm, depressed and spreading on either side of labellum, not recurved or revolute, almost flat; apex straight, sub-acute. *Petals* ovate-lanceolate, 1.0 x 0.6 mm, partly hidden below the dorsal sepal, sub-acute. *Labellum* oblong, 1.2-1.4 x 0.8-1.0 mm, sometimes constricted about the middle; apex truncate or emarginate, not apiculate; margins shallowly crenulate, or minutely papillose, sometimes thickened; apical callus variously developed, verrucose; basal calli squarish, 0.3 mm wide, separate or conjoined; nectary a short transverse furrow. *Column* c. 1.0 x 0.8 mm; the auricles square, 0.2 mm long. *Stigma* oval at anthesis but soon becoming irregular, 0.3 x 0.2 mm, prominent; rostellum indistinct. *Anther* hemispherical, 0.4 mm wide, retuse. *Pollinia* crumbly; caudicle absent; viscidium only visible at anthesis, minute. *Ovary* tumescent, much larger than flower, 4-8 mm long when mature, sub-cylindrical but flattened above and below. (Figs. 7C; 9C,D).

Distribution (Map 9)

Endemic in New Zealand where it is widespread in the South Island and also occurring in the highlands of the North Island and coastal Stewart Island.

Flowering

December to March, usually opening a little later than *M. unifolia* in the same area.

Ecology

Almost confined to short tussock grassland particularly around bogs, rarely associated with *M. unifolia*. In its natural tussock grassland *M. oligantha* is a dwarf plant usually less than 12 cm tall, but in well-shaded locations the plants become attenuated and may reach 25 cm. They do however retain the few flowered inflorescence and flower characters.

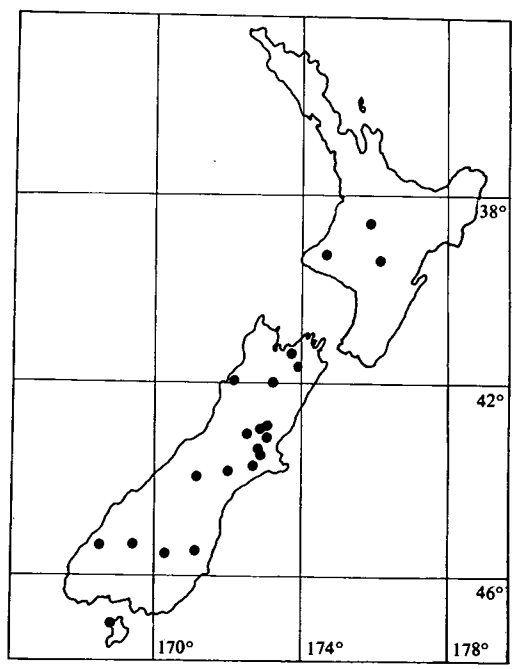
Affinities

Intermediate forms between *M. oligantha* and *M. unifolia* do occur in New Zealand (*Lothian s.n.* AD 97730402) but Molloy (1983, pers. comm. 1982) notes that where the two occur together around Christchurch they remain distinct and no hybrids have been detected. Some Tasmanian collections also contain plants closely approaching *M. oligantha* (*Simmonds 372* AD). Plants of *M. oligantha* and *M. unifolia* from New Zealand

flowered together under the same conditions at Adelaide Botanic Gardens in November 1982. The plants of *M. oligantha* were unusual in producing taller racemes than the *M. unifolia* but typical in having only 2-4 flowers. Attenuation of *M. oligantha* in cultivation was reported by Moore (1968). Preliminary work by Molloy (pers. comm. 1983) gives a chromosome count of 2n = 44 for *M. oligantha* and 2n = 88 for *M. unifolia* in New Zealand. Recent observation of cultivated plants by the author suggests that apomixy may occur in *M. oligantha*.

Although *M. oligantha* was not described until 1968, its distinctiveness was recognised about 1890 by T. Kirk who used the ms. name "*M. porrifolia* var. *alpina*" on his collections. Hatch (1963) also recognised them as different but he determined the plants as *M. magnadenia* R. Rogers. Most collections of *M. oligantha* seen were made after 1968, reflecting the interest shown by collectors after its publication as a species.

M. oligantha is a fairly constant taxon. Of more than 60 collections examined only six were difficult to place due to the fact that they contained a range of plants, some having up to twenty flowers indicating that they were either mixed collections or intergrades. Most collections are recognisable at a glance as the short slender plants generally have only 2-8 flowers. Moore (1970) distinguished *M. oligantha* as having "dorsal sepal obtuse, labellum almost quadrate, margins crenate rarely undulate and large basal calli squarish, not prominent"; although these features occur separately in populations of *M. unifolia* they do not occur all together.



Map 9. Distribution of *M. oligantha*.

Selected specimens (from 60 collections examined)

NEW ZEALAND: *A.M. Buchanan s.n.*, 4.iv.1969, Hoophorn spur, Mt Cook (CHR 245676); *D.J. Court s.n.*, 7.i.1968, Cavalli Island (AUK 150301); *A.P. Druce 210267*, 16.i.1966, Mt Egmont (CHR); *A.J. Healy s.n.*, 17.i.1968, Canterbury (CHR 182120); *P. Hynes s.n.*, 6.i.1940, Manora Hills, (bears the E.D. Hatch label 'M. magnadenia') (AUK 104839); *T. Kirk s.n.*, 1885, South Island, (bears label 'M. porrifolia Spreng. var. alpina') (AUK 30693); *R. Mason and N.T. Moor s.n.*, 12.xii.1958, Whangaramir (AD 9734732); *H.B. Matthews (Herb Cheeseman 3451)*, 17.i.1920, Rotorua (AUK); *B. Molloy s.n.*, sub *R. Bates 2122*, 4.i.1982, Cass (AD), and same cultivated Adelaide and flowers removed 2.xi.1982 (AD 98316721); *I. Robins s.n.*, 8.i.1968, Lake Tekapo (CHR 189066).

8. **Microtis rara** R. Br., Prod. 321 (1810); Sprengel, Syst. Veg. 3: 713 (1826); Lindley, Gen. sp. orch. pl. 396 (1840); W.M. Curtis, Stud. Fl. Tasm. 4a: 56 (1980).

Type: *R. Brown s.n.*, Port Jackson, New South Wales, 1804 (BM lecto., K!, ? AD iso!). The lectotype chosen here is the largest plant on the BM sheet. It is the specimen most closely matching Brown's original description.

M. unifolia (Forster f.) Reichb. f. var. *rara* (R. Br.) Reichb. f., Beitr. Syst. Pfl. 62 (1871). Based on *M. rara* R. Br.

M. media sensu Benth., Fl. Aust. 6: 348 (1873), non R. Br. (1810).
M. parviflora sensu Fitzg., Aust. Orch. 2 (1) t. col. (1884), non R. Br. (1810).

M. viridis F. Muell., Fragm. Phyt. Aust. 5: 97 (1866) pro. parte; Woolls, Contrib. Fl. Aust. 15 (1867).

M. brownii Reichb. f., Beitr. Syst. pfl. 24 (1871); George, Nuytsia 1 (2): 185 (1971).

Type: *R. Brown s.n.*, King George Sound, Western Australia, xii.1801, (K, lecto.!, E. iso.). George (1971) selected the lectotype. His 6.ix.1968 label on the type sheet reads: "This specimen matches an illustration by Reichb. f. at W. and also fits his description of *M. brownii* better than the other specimen". On this sheet are also two specimens labelled "*M. rara*, Swan River, Drummond 1839" in Lindley's hand.

Microtis truncata R. Rogers, Trans. & Proc. R. Soc. S. Aust. 44: 326 (1920) and l.c. 47: 340 (1923) for Latin diagnosis; Pelloe, W. Aust. Orch. 19 (1930); Erickson, Orch. West 47 (1951); Cady, Aust. Pl. 4: 163 (1967).

Type: *Miss I. Knox-Peden s.n.* sub *R.S. Rogers 2286*, Diamond Tree School near Jarnadup (Western Australia), xii.1918 (AD, lecto.!); *R. Pulleine s.n.* sub *R.S. Rogers 2285*, Greenbushes (Western Australia) 8.xii.1917 (AD, syn.!); *A. Syme-Johnson*, Albany, 4.xii.1919 (not located, syn.). The lectotype was chosen by George (1971). He did not see the Greenbushes specimen which was annotated as the type by Rogers but this was not published.

M. oblonga R. Rogers, Trans. & Proc. R. Soc. S. Aust. 47: 339 (1927); Pescott, Orch. Vict. 36 (1928); Ewart, Fl. Vict. 334 (1931); Black, Fl. S. Aust. edn 2 (1): 218 (1943); Rupp, Orch. N.S.W. 21 (1943); Nicholls, Vict. Nat. 66: 91, fig. P (1949); Willis, Handb. Pl. Vict. 1: 363 (1963); Firth, Nat. Orch. Tasm. 54 (1965); Cady, Aust. Pl. 4: 166 (1967); Nicholls, Orch. Aust. 24, t. 98 col. (1969); Gray, Vict. Nat. Orch. 2: 4 col. photo (1971); Cady & Rotherham, Aust. Nat. Orch. 22 (1972); Weber & Bates in J.P. Jessop ed., Black, Fl. S. Aust. edn 3 (1): 422, t. 401 (1978); Beadle et al., Fl. Sydney Reg. edn 3: 568 (1982).

Types: *A.B. Braine s.n.* sub. *R.S. Rogers 2205*, Ringwood, Vict., 19.ix.1920 (AD, lecto.!, AD, iso.!); *A.B. Braine s.n.* sub *R.S. Rogers 2206e*, Cravensville, Vict., 25.xii.1919 (AD, syn.!). (This sheet contains a mixed collection, some plants are *M. rara*, others *M. unifolia*); *E. Coleman s.n.* sub *R.S. Rogers 2206d*, Healesville, Vict., 1.i.1922 (AD, syn.!); *C.W. D'Alton s.n.* sub *R.S. Rogers 2206c*, Halls Gap, Grampians, Vict., ?.xii.1920 (AD, MEL, syn.!). The lectotype is a specimen from the Braine collection at AD which was annotated as type by Rogers.

M. magnadenia R. Rogers, Trans. & Proc. R. Soc. S. Aust. 54: 44 (1930); Rupp, Orch. N.S.W. 21 (1943); Cady, Aust. Pl. 4: 264 (1945), Beadle et al., Fl. Sydney Reg. edn 3: 568 (1982).

Type: *A.S. Dwyer s.n.* sub *R. Rogers*, Lake Wonboyne (New South Wales), "near the Prince's Highway", 28.xi.1929 (AD 96747077, holo.!).

Plant very slender, 15-45 (-60) cm high. *Tuberoid* globose, 0.5-1 cm diam.; epidermis drying brown and not separating. *Leaf* 20-50 (-65) cm long, 2-4 mm wide, tapering gradually to long, slender apex; fissure 1-2 cm long, forming 3-10 cm from leaf base. *Flowers* (5-) 10-30 (-50), fragrant, green, erect, spirally or alternately arranged in loose raceme, 5-25 cm long, free scape 5-20 cm long, c. 1 mm diam. *Pedicel* slender, 1-2 mm

long. *Floral bract* lanceolate, 3-4 x 1-2 mm, acuminate. *Dorsal sepal* ovate, (2-) 3-4 x 1.5-2 mm, shallowly concave below, margins paler coloured; apex with narrow, decurved, straight or recurved apiculus. *Lateral sepals* linear-oblong, 2-3 x 0.8 mm, spreading, recurved or revolute, sub-acute. *Petals* falcate-lanceolate, 2-2.5 x 0.8 mm, with pale margins, widely spreading below dorsal sepal, acute. *Labellum* ± oblong, 3-4 (-5) x 1-1.5 mm, usually constricted about middle, deflexed against ovary reaching more or less to base, margins crenulate, rugulose, often thickened (and drying darker coloured); apex truncate or emarginate; basal calli saddle-shaped, rounded or square, smooth, variable in size, 1-2 x 1-1.5 mm; nectary a 'W'-shaped transverse furrow at its base; apical callus rounded, oblong or irregular, 0.5-1.2 mm diam., tuberculate, rugulose or papillose, very variable. *Column* 1.2 x 0.8 mm, incurved with prominent, oblong to spathulate auricles, 0.3 x 0.2 mm. *Stigma* semi-lunate, 0.4 x 0.2 mm, concave; rostellum broadly triangular, 0.3 x 0.1 mm; apex asymetrically bifid. *Anther* hemispherical, 0.4 x 0.3 mm, cucullate, retuse, often with minute mucro. *Pollinia* coherent; caudicle c. 0.2 mm long; viscidium orbicular, c. 0.1 mm diam. *Ovary* ellipsoid, elongate, narrow at base, broader toward decurved apex, standing out from scape. (Figs 7D; 9E, F).

Distribution (Map 10)

Mainly coastal, occurring in the south-west of Western Australia and from near Rockhampton in Queensland, through New South Wales to Victoria, Tasmania and South Australia east of Adelaide.

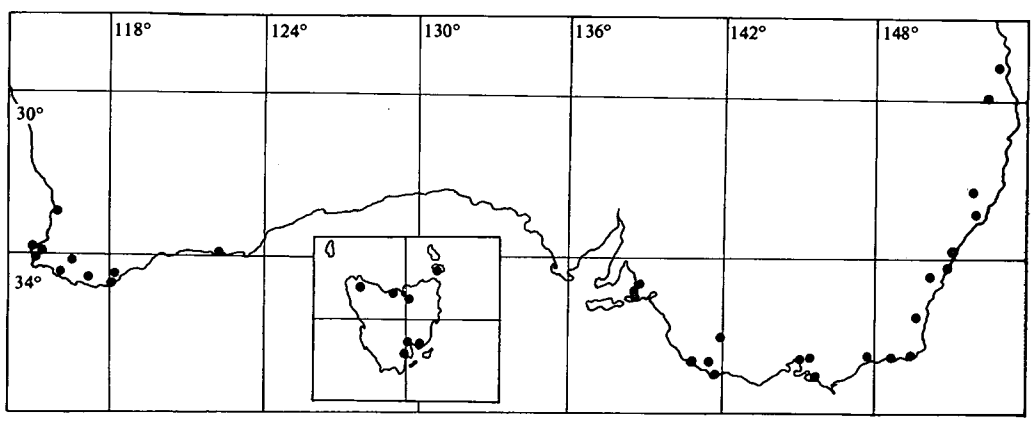
Flowering

October through to January, being later in the south or at higher altitudes.

Vernacular name: scented onion orchid, sweet onion orchid. (Willis 1962).

Ecology

Generally occurring in swamps or high rainfall areas, often in more densely shaded areas than other *Microtis* species. Growing singly or in small colonies. Flowering more freely after bushfires.



Map 10. Distribution of *M. rara*.

Affinities

M. rara is closely allied to both *M. alba* and *M. unifolia*. The three are indistinguishable on a basis of vegetative material alone. All have ovate dorsal sepals and generally revolute lateral sepals. *M. rara* differs from *M. unifolia* in being a more slender plant in bloom with flowers more distant on the spike; with narrower ovary, longer more slender pedicels, a broader, more shallowly concave dorsal sepal and a longer narrower labellum usually with thickened margins. The petals of *M. rara* are free while those of *M. unifolia* are generally partly hidden below the dorsal sepal. (Figs 9A, 9E). The differences between *M. rara* and *M. alba* are discussed under the latter species.

The identity of *M. brownii*, *M. truncata*, *M. oblonga* and *M. magnadenia* is as follows. When Brown was at King George Sound (Western Australia) in December 1801, among the four species of *Microtis* he gathered was a collection of *M. rara*, but he did not cite this collection in his "Prodromus" when describing *M. rara* from Port Jackson (New South Wales) material, nor did he apparently place any determination on it. This possibly influenced Reichenbach sixty years later to create a new name, *M. brownii* for the collection.

The types of *M. rara* and *M. brownii* differ only in size of flowers. George (1968) made a note to this effect on the *M. brownii* type sheet, but he did not cite the epithet among synonyms in his (1971) checklist. As both large and small flowered specimens have been collected throughout the range of *M. rara* and as there are no other distinguishing features, *M. brownii* is considered synonymous with *M. rara*. It is of interest that Reichenbach (1871) compared his *M. brownii* with *M. pulchella*, but did not mention *M. rara*.

When Rogers described *M. truncata* in 1920 from the south-west of Western Australia he had apparently not seen the type of *M. rara*. He had previously (1913) followed Bentham (1873) in treating *M. rara* as a synonym of *M. porrifolia* and was possibly unaware of the name *M. brownii*. George (1971) treated *M. truncata* as a synonym of *M. brownii* and I can find no reason to disagree with this as the types are very similar plants, and Rogers' description of *M. truncata*, although more elaborate than that of *M. brownii*, does not differ from it significantly.

Rogers (1923) when describing *M. oblonga* from Victoria, distinguished this species from his *M. truncata* on the basis of shape of labellum callosities, but as plants with either smooth or irregular callosities may be found even within a single population, this character is of little taxonomic value. The collections cited by Rogers as types of *M. oblonga* show a wide range of variation and although one sheet (*Rogers 2206e*) contains plants of *M. unifolia*, the rest, including the lectotype, are well within the range of *M. rara* and I follow Curtis (1981) in treating *M. oblonga* as a synonym of that species.

M. magnadenia was described from a single plant collected in New South Wales. Rogers (1930) distinguished the plant by its lateral sepals "not recurved", yet the lowest flowers have distinctly recurved lateral sepals! The only other difference indicated by Rogers lay in the "conspicuously raised" calli. These are clearly shown on a photograph accompanying the type and they are rather large. However, the calli of *M. rara* are very variable and I regard *M. magnadenia* to be no more than an unusually well developed specimen of *M. rara*.

Selected specimens (from c. 200 collections examined)

WESTERN AUSTRALIA: *R. Bates 2914*, 22.xii.1982, Pemberton (AD); *R. Coveny 4622*, 6.xi.1968, Busselton (NSW); *A.S. George 454*, 11.xii.1962, burnt swamps near Jandakot (NSW); *A.S. George and V. Mann 95*, 12.xi.1969, Nornalup Inlet in Jarrah forest (PERTH); *I. Knox-Peden s.n.*, 7.xii.1921, near Jarnadup (PERTH); *O.H. Sargent s.n.*, 7.xi.1918, York Hill Cutting (AD 97734720); *D. Voigt s.n.*, 16.xi.1979, Esperance area (PERTH).

QUEENSLAND: *F.M. Bailey s.n.*, x.1874, Maroochie (AD 97730568); *C. James 62*, 13.x.1938, Toowoomba (AD, NSW).

NEW SOUTH WALES: *L. Boormann s.n.*, 1902, Port Jackson (OA 25589); *L. Cady 462*, 21.ix.1958, Coffs Harbour (AD); *R. Filson 1421*, 1962, Barrington Tops (MEL); *R.C. Nash 934*, 12.xi.1966, Wedderton (AD); *W.H. Nicholls s.n.*, x.1937, Mt Sugarloaf (MEL 582286); *H.M.R. Rupp s.n.*, x.1923, Alum Mt., Bullahdelah (AD 97730570); *W. Schmidt s.n.*, 24.xi.1972, Maitland (NSW 102636).

VICTORIA: *A.C. Beauglehole 5125*, xii.1945, Portland swamps (MEL); *A.C. Beauglehole 30111*, 18.xii.1968, Golton Gorge, Grampians (MEL); *A.C. Beauglehole 32337*, 12.xii.1969, Mallacoota Inlet (MEL); *J. Brown s.n.*, 16.xii.1978, Springhurst (MEL 38374); *W. Hunter s.n.*, 6.xii.1937, Marlo (MEL 582248); *T.B. Muir 4815*, 25.i.1970, Mt Cobboras at 1500 m (MEL); *H.B. Williamson s.n.*, xii.1923, Emerald (MEL 99056).

TASMANIA: *T.E Burns s.n.*, Piper Heads Road (HO 37483); *W.M. Curtis s.n.*, 15.xii.1953, Piper Heads (HO 37517): *R. Gunn 673*, 2.i.1838, Black Lagoon (HO, MEL); *W.H. Nicholls s.n.*, i.1940, Mt Wellington (MEL 58225); *J.S. Whinray 363*, 20.xi.1969, Cape Barren Island (MEL, AD).

SOUTH AUSTRALIA: *R. Bates 576*, 17.xii.1979, 4 km west of Nelson (AD); *R. Bates 2532*, 4.xii.1981, Peter Creek Swamps, Kuitpo (AD); *E.H. Ising s.n.*, 25.xii.1934, Longwood (AD 97735056); *R.S. Rogers 2234*, Mt Compass (AD).

9. **Microtis alba** R. Br., Prod. 321 (1810); Sprengel, Syst. Veg. 3: 713 (1826); Lindley, Gen. sp. orch. pl. 396 (1840); F. Muell., Fragm. Phyt. Aust. 5: 97 (1866); Reichb. f., Beitr. Syst. Pfl. 62 (1871); Benth., Fl. Aust. 6: 348 (1873); Fitzg., Aust. Orch. unpub. t. 56; R. Rogers, Trans. & Proc. R. Soc. S. Aust. 44: 328 (1920); Pelloe, W. Aust. Orch. 19 (1930); Erickson, Orch. West, t. opp. p. 44 (1951); A.S. George, W. Aust. Nat. 8 (2): 40 (1961); Cady, Aust. Pl. 4: 165 (1967), Nicholls, Orch. Aust. 25. t. 99, col. (1969); Clyne, Aust. Ground Orch. photo opp. p. 68, col. (1970); A.S. George, Nuytsia 1 (2): 184 (1971); Pocock, Ground Orch. Aust. photo 84, col. (1972); Lothian, Rosa Fiveash Aust. Orch. t. 86 col. (1974) (A copy of Bauer's (1835) illust.?).

Type: *R. Brown s.n.*, King George Sound (Western Australia), xii.1801 (BM, lecto.!, K, iso.!). The lectotype was selected by A.S. George (1971) as holotype.

M. media sensu Hook., Curtis' Bot. mag., t. 3378 (1835), non R. Br. (1810).

Goadbyella gracilis R. Rogers, Trans. & Proc. Roy. Soc. S. Aust. 51: 294 (1927); Pelloe, W. Aust. Orch. 21 (1930); Erickson, Orch. West. 49, to. 16 (1951); Blackall & Grieve, W. Aust. Wildfl. 90 (1954).

Type: *P. Barwise s.n.* sub *R. Rogers 2015*, Pindalup (Western Australia) xi.1926 (AD, holo.!; PERTH, iso.!).

Plant usually slender, 15-60 (-90) cm high. *Tuberoid* globose, 0.5-1.2 cm diam., pale brown; epidermis not separating when mature. *Leaf* 15-50 (-80) cm long, 4-9 mm diam.; apex acuminate, erect or drooping; fissure 1-2 x 0.3 cm, forming 5-10 cm from leaf base. *Flowers* 10-50, very fragrant, white or greenish-white, thin-textured, inclined forward in loose to moderately dense raceme 5-20 cm long; free scape 6-18 cm long, c. 3 mm diam. *Pedicel* slender, 1-3 mm long. *Floral bract* ovate-lanceolate 3-4 x 1.5-2 mm acuminate. *Dorsal sepal* ovate-lanceolate, 4-5 x 2-2.5 mm, shallow, often constricted near base, tapering into recurved apiculum. *Lateral sepals* linear-oblong, 3-4 x 1-1.5 mm, rolled, acute. *Petals* linear-oblong, 3-4 x 1-1.2 mm, flat, falcate, spreading below dorsal sepal; apex incurved, sub-acute. *Labellum* more or less cuneate with bilobed apex, 4-6 (-8) mm long, pendulous; basal portion 2-3 x 0.9-1.1 mm, margins entire; expanding distally to c. 2 mm wide before branching into two divergent, oblong, lobes, each 1-3 x 1-2 mm; their margins crenulate, papillose, granular, drying darker than rest of flower; basal callus oblong, 0.5-1 x 0.5-0.8 mm, much raised, smooth, longitudinally channelled at first, then tapering into shallow, tuberculate, hemispherical apron; apical callus irregular, c. 1.5 x 1 mm, rugulose or papillose, situated just below sinus of two lobes, sometimes extending onto them. *Column* c. 1.2 x 0.5 mm, with prominent, falcate-lanceolate auricles, c. 0.3 x 0.1 mm, spreading on either side of anther. *Stigma* ovate to semi-lunate, c. 0.2 mm diam., concave; rostellum triangular, erect, c. 0.2 x 0.1 mm, bifid. *Anther* c. 0.2 x 0.1 mm,

cucullate, retuse with minute, membranous, decurved mucro. *Pollinia* coherent; caudicle <0.1 mm long, viscidium orbicular. *Ovary* elongate, 3-5 x 1-2 mm, decurved apically. *Seeds* pale. (Figs 7E; 9G, H).

Distribution (Map 3)

Endemic to south-west Western Australia and widespread in an arc from near Esperance in the east to north of Perth.

Flowering: October to January.

Vernacular name: white mignonette orchid (Nicholls 1969).

Ecology

Occurring in heathland or forest and flowering more freely after fire. The flowers attract a wide variety of insects, and small hymenopterans were observed transferring pollinia. Hybridism with *M. rara* and *M. unifolia* is suspected (Brown 1982, Heberle pers. comm. 1982) and this would help to explain the wide range of intermediate forms.

Affinities

M. alba is most closely allied to *M. rara* and the species are often sympatric in the west (*M. rara* also occurs in eastern Australia). The author collected both growing and flowering together near Pemberton (*R. Bates 2909, 2914*) in December 1982. No intermediates were seen. The two species are not distinguishable from vegetative material alone. Although *M. alba* has larger flowers, both have similar ovate dorsal sepals, revolute lateral sepals and spreading petals. They differ markedly in labellum structure (Figs 9E, 9G). The labellum of *M. alba* is cuneate with two apical divaricate lobes, while that of *M. rara* is oblong and not produced into lobes. Minor differences include the flower colour, white in *M. alba* and green in *M. rara*, and shape of auricles.

Rogers (1927) described the genus *Goadbyella* with one species *G. gracilis*. The single collection was made from Pindalup, an area where *M. alba* is common. Rogers on his notes accompanying the type sheet wrote, "Sent to me by Mr. P. Barwise with a parcel of *M. alba*". No similar plants have been found. Rogers stated that the genus differed from *Microtis* ". . . in its reversed flowers, slender and somewhat elongated column, its narrow non-cucullate dorsal sepal and its wide truncate lateral sepals". The type is clearly teratological, and flowers are irregular and variable, without ovaries, some with duplicate labella and petals, the columns incomplete, and I agree with the conclusion of George (1961, 1971) that *G. gracilis* is an aberrant specimen of *M. alba*.

Selected specimens (from c. 150 collections examined)

WESTERN AUSTRALIA: *T. Alpin 264*, 6.xi.1958, Red Hill (PERTH); *R. Bates 2902*, 23.xii.1982, Pemberton (AD, PERTH); *J. Forrest s.n.*, xi.1881, Toolbrunup Peak (MEL 9899); *A.S. George 407*, 14.xi.1959, open burnt sandplain 32 km east of Cranbrook (PERTH); *A.S. George 9730*, 12.x.1909, Broke Inlet (PERTH); *B.T. Goadby s.n.*, xi.1900, King George Sound (AD 97730448); *R. Heberle s.n.*, 7.xii.1981, Albany (AD 98222345); *I. Knox-Peden s.n.*, 4.xii.1921, Yarowee (PERTH); *K. Newbey 1710*, 12.xi.1964, Frenchman Bay (PERTH); *E. Pritzel 922*, xi.1901, Darling Range (AD); *M.R. Pocock 114*, 14.x.1968, Emu Point near Albany (AD); *R.D. Royce 2511*, 5.xi.1947, Busselton (PERTH); *J. Steedman s.n.*, xi.1931, Frankland River (PERTH); *D. Voigt s.n.*, 6.xi.1979, Cape le Grande (PERTH); *S.E. White s.n.*, 28.x.1920, Mundaring Weir (AD 966120403).

Doubtful and insufficiently known names

"*Micropera banksii* Hook.", "*Micropera media* R. Br.", "*Micropera parviflora* R. Br." and "*Microtis pallida* Lindley", Heynold, Nom. bot. hort. 1 (2): 523 (1840) in obs. are probable errors in transcription. They are given in 'Index Kewensis' as *nomina dubia*

except for *Micropera parviflora* which is given (probably incorrectly) as a synonym of *Sarcochilus parviflorus* Lindley. They would seem to have resulted from accidental transposition of specific epithets from two totally unrelated genera and are probably based on *Microtis banksii* Hook., *Microtis media* R. Br., *Microtis parviflora* R. Br. and *Micropera pallida* Lindley.

"*Microtis parvifolia* is given by Steudel, Nom. bot. 1: 531 (1821) as a synonym of *Serapias parvifolia* Pers., but neither name appears in 'Index Kewensis'.

M. formosana Schltr., Bot. Jahrb. Syst. 29: 37 (1906) nom. nud.; Schltr. ibid 45: 382 (1911). Schlechter cites no collection and I have not seen any annotation to show on which specimen he based the name. He used the name for plants from 'Formosa' (Taiwan). All plants from Taiwan examined by me have been referred to *M. unifolia* but illustrations of Taiwanese material in several publications (Hayata, Icon. Pl. Formosa 4: 23 (1914) and Lin, Fl. Taiwan 1062 [1978]) appear to be of *M. parviflora*.

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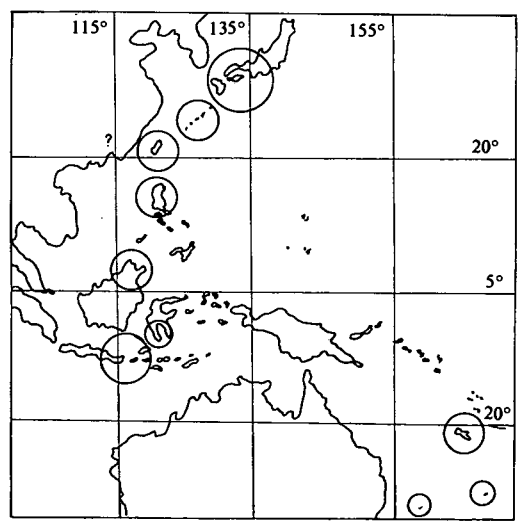

Map 11. Distribution of *Microtis* outside Australia and New Zealand.

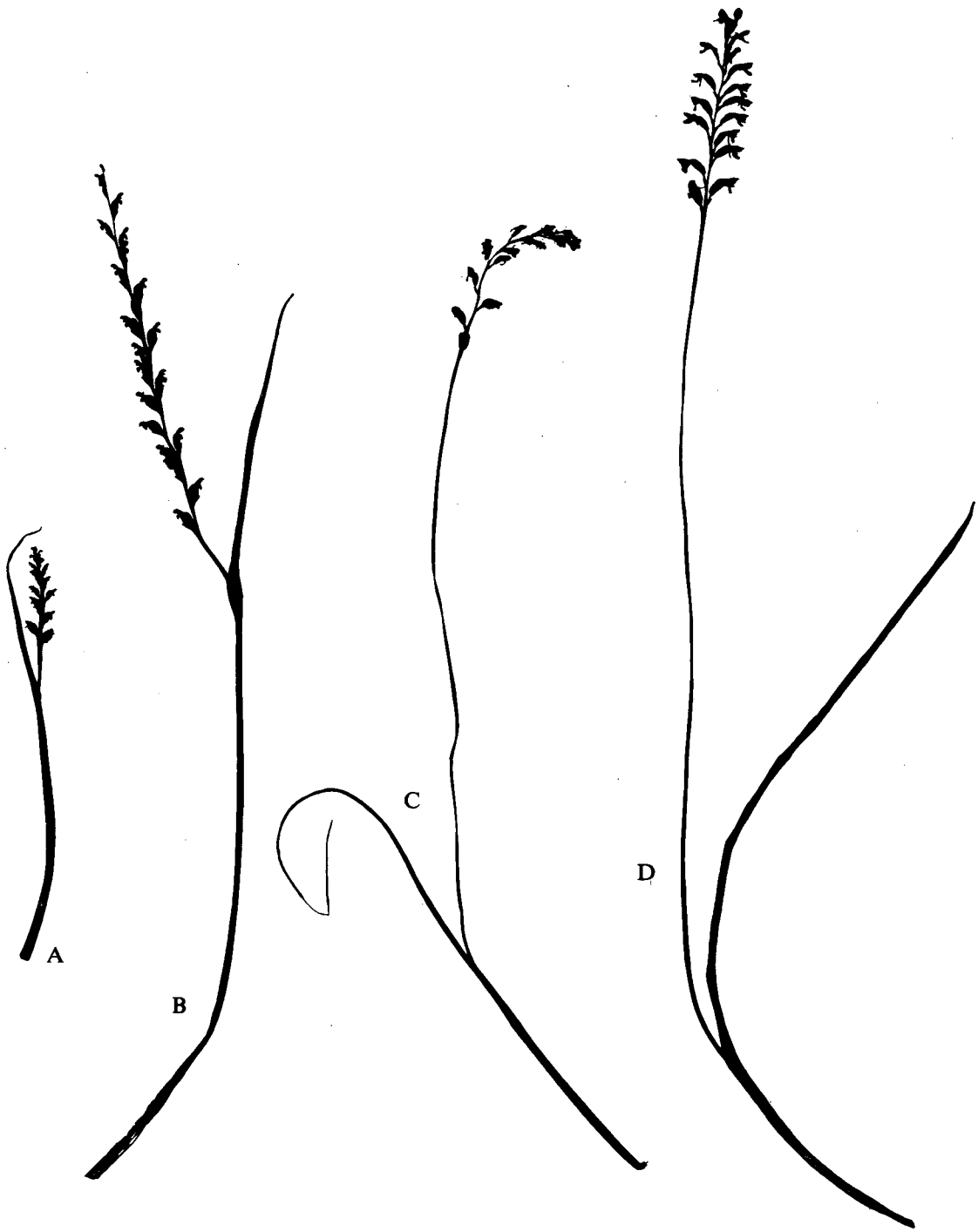

Fig. 6. Silhouettes of *Microtis* species as taken from herbarium specimens. A, *M. atrata* (*R.S. Rogers 2178*); B, *M. orbicularis* (*R. Bates 2094*); C, *M. globula* (*R. Bates 2923*); D, *M. pulchella* (*R. Bates 2916*).

Fig. 7. Silhouettes of *Microtis* species as taken from herbarium specimens. A, *M. parviflora* (*H. Goldsack 477*); B, *M. unifolia* (*R. Bates 742*); C, *M. oligantha* (*N. Weir 377*); D, *M. rara* (*R. Bates 2532*); E, *M. alba* (*R. Bates 2902*).

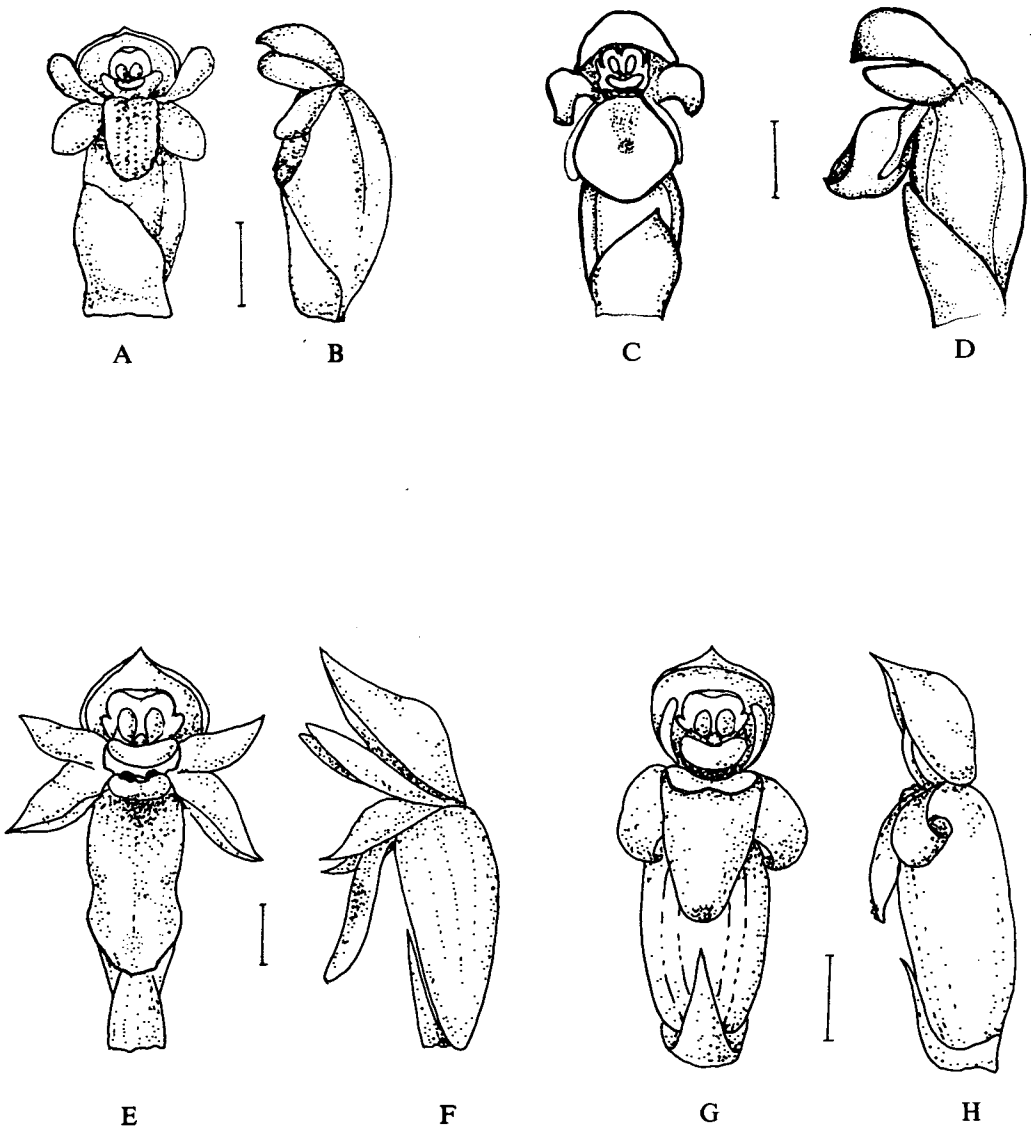

Fig. 8. Flowers in front and side view. A & B, *M. atrata* (*R. Bates 2093*, Kuitpo, S. Australia); C & D, *M. orbicularis*, (*R. Bates 2094*, Kuitpo, S. Australia); E & F, *M. pulchella* (*R. Heberle* sub R. Bates 2128, Albany, W. Australia); G & H, *M. parviflora* (*R. Bates 2127*, Kuitpo, S. Australia). Scale = 1 mm. Illustrations A, B, E-H by G.R.M. Dashorst; C & D by A. Prescott.

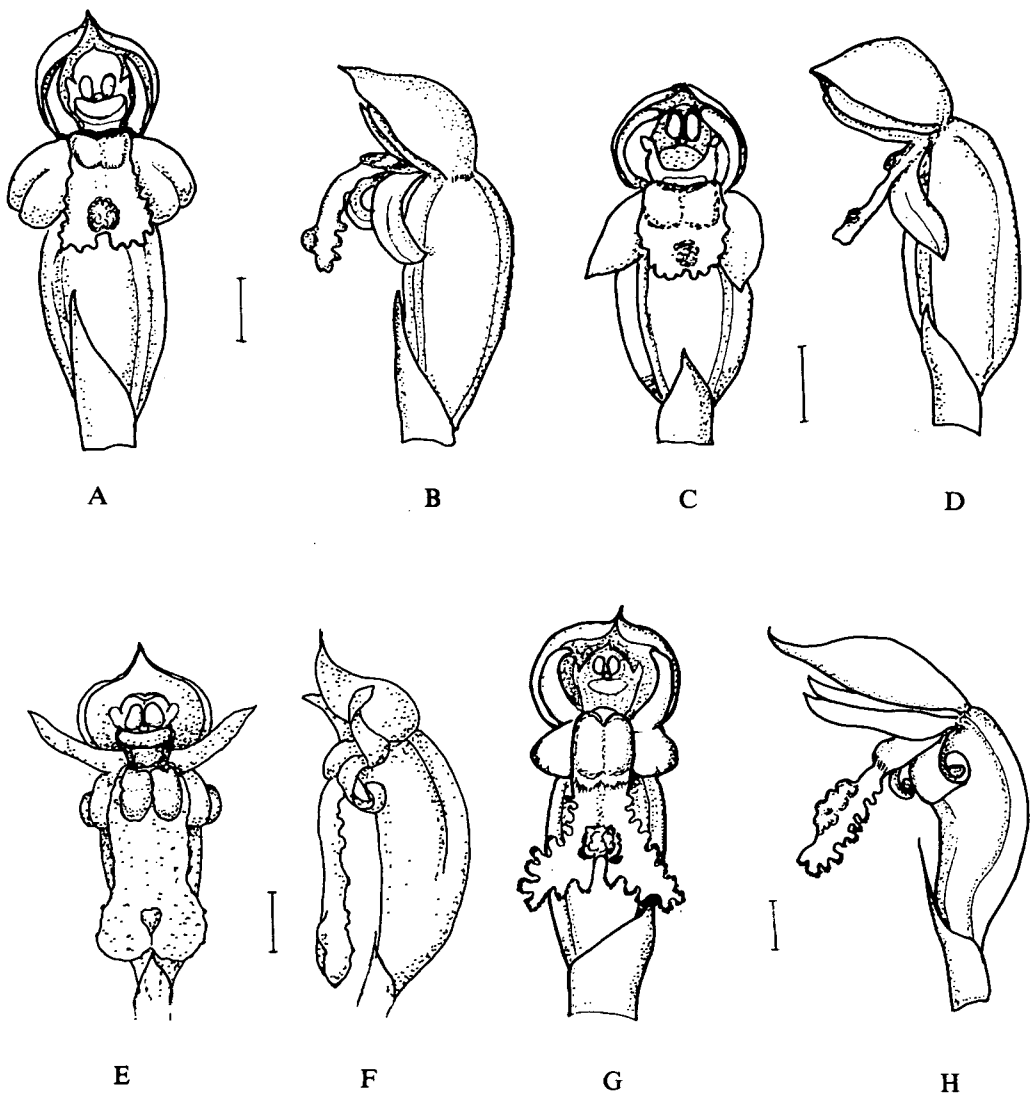

Fig. 9. Flowers in front and side view. A & B, *M. unifolia* (*R. Bates 2845*, Kuitpo, S. Australia); C & D, *M. oligantha* (*B. Molloy s.n.*, Arthurs Pass, N. Zealand); E & F, *M. rara* (*R. Bates 2368*, Mylor, S. Australia); G & H, *M. alba* (*R. Heberle s.n.*, Albany, W. Australia). Scale = 1 mm. Illustrations A & B by G.R.M. Dashorst, C-H by A. Prescott.

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Names

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