

Taxonomic studies in the Disinae. V. A revision of the genus *Monadenia*

H. P. LINDER\*

ABSTRACT

The genus *Monadenia* (Disinae, Orchidaceae) is revised. Sixteen species arranged in four sections are recognized. The distribution of each species is plotted, and 12 species are illustrated. A hypothesis on the phylogenetic relationships of the species is presented.

RÉSUMÉ

ÉTUDES TAXONOMIQUES DES DISINAE. V. UNE RÉVISION DU GENRE MONADENIA

Le genre *Monadenia* (Disinae, Orchidaceae) est révisé. Seize espèces arrangées en quatre sections sont reconnues. La distribution de chaque espèce est située, et 12 espèces sont illustrées. Une hypothèse sur les relations phylogénétiques des espèces est présentée.

INTRODUCTION

*Monadenia* Lindl. is a small genus of 16 species, which is closely related to *Disa* Berg. (Orchidoideae, Orchidaceae). Fifteen of the 16 species are restricted to the Cape Flora Floral Region (Goldblatt, 1979), whereas the remaining species is rather widespread in the montane grasslands (White, 1978) of southern Africa (Fig. 1). The plants are generally less than 300 mm tall, and have rather inconspicuous green to brownish flowers.

The first species of *Monadenia* were described by Thunberg in 1794 as *Satyrium*, and were transferred to *Disa* by Swartz (1800). The genus *Monadenia* was erected by Lindley in 1838. He included eight species in this genus, of which five were new species. However, he sowed the seeds for later nomenclatural confusion by misapplying *M. rufescens* (Thunb.) Lindl. to another taxon, later to be named *M. comosa* by Reichb. f. (1847). The true *M. rufescens* he named *M. macrocera*. He also gave the new names *M. micrantha* and *M. prasinata* to what should have been *M. bracteata* and *M. cernua*, respectively. Sonder (1847) and Reichenbach (1847) added four new names and one new species to the genus. Our knowledge of the genus was greatly extended by Harry Bolus and Rudolf Schlechter, who described four new and rather rare species in the genus. The last species was added to the genus in 1948 (Lewis, 1948).

To date there have been four taxonomic revisions of the group: Lindley (1838), Kraenzlin (1900), Schlechter (1901) and Rolfe (1913). Lindley only had material of half the presently known species before him. By 1900 the majority of species were known, or at least available in the European herbaria. However, Kraenzlin missed several species, and his work shows that he did not have access to sufficient material. Schlechter's and Rolfe's work differ in approach. Whereas Schlechter employed a broad species concept (combining *M. physodes* with *M. cernua* and *M. reticulata* with *M. macrostachya*), Rolfe raised almost every possible taxon to specific rank. Two species, *M. basutorum* (Schltr.) Rolfe and *M. leydenburgensis* Kraenzl., are here transferred to *Disa*, and have not been discussed above, and are excluded from Table 1.

The rank of the group has been controversial. Lindley (1838) recognized the group as a distinct genus, allied to *Disa*. This treatment was followed by Reichenbach (1847) and Sonder (1847), Bolus (1888, 1889, 1893, 1911, 1913) and Schlechter (1898, 1901) recognized *Monadenia* as a section of *Disa*. However, Rolfe (1913) maintained *Monadenia* as a distinct genus, as did Phillips (1926), Schelpe (1966) and Dyer (1976). The reasons for treating *Monadenia* as a distinct genus in this study will be dealt with in detail in another publication.

MORPHOLOGY

All the species in *Monadenia* may be shown to be rather minor variations on a simple pattern: erect herbs with linear to ovate cauline leaves, inflorescence a spike, dorsal sepal erect or curved forwards and shallowly galeate, oblong to obovate, spur straight, cylindrical, pendent from the base of the galea, lateral sepals somewhat smaller than the dorsal sepal, patent or reflexed, petals erect, obliquely ovate-oblong, retuse or truncate, lip linear to elliptic, pendent, lip and petals fleshy, rostellum simple with a deep central notch for the single large viscidium.

As in the rest of the subtribe Disinae, there are two

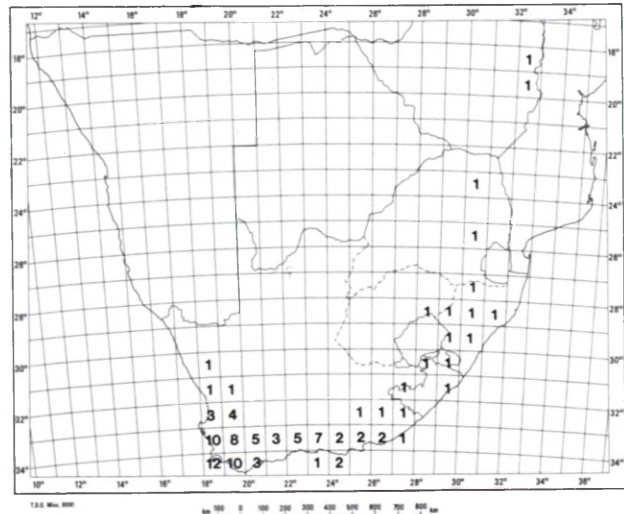


FIG. 1.—Distribution of the genus *Monadenia*. The number of species occurring in each grid square is indicated. The collection from Madagascar is not included.

\*Bolus Herbarium, University of Cape Town, Rondebosch, 7700.

TABLE 1.—Summary of the history of *Monadenia*

	Thunberg	Swartz	Ker	Lindley	Sonder	Reichb. f.	N.E.Br.	Bolus	Kraenzl.	Schltr.	Rolfe	Lewis
<i>M. ecalcarata</i>												x
<i>M. conferta</i>								x	x	x	x	
<i>M. pygmaea</i>								x	x	x	x	
<i>M. sabulosa</i>								x	x	x	x	
<i>M. bracteata</i>		x							x			
<i>M. densiflora</i>				micrantha x					micrantha x	micrantha x	micrantha x	
					multiflora				multiflora	multiflora	multiflora	
								auriculata	auriculata	auriculata	auriculata	
<i>M. macros-</i> <i>tachya</i>				x						x	x	
<i>M. reticulata</i>								x	x		x	
<i>M. comosa</i>				rufescens		x	affinis		x	x	x	
<i>M. bolusiana</i>										x	x	
<i>M. atro-</i> <i>rubens</i>											x	
<i>M. ophry-</i> <i>deae</i>				x					x	x	x	
<i>M. rufescens</i>	x	x		macrocera	lancifolia				x	x	macrocera	
<i>M. physodes</i>		x									x	
<i>M. cernua</i>	x	x	prasinata	prasinata	inflata				x	x	prasinata	
<i>M. brevis-</i> <i>cornis</i>				x					x	x	x	

Species excluded: *M. basutorum* (Schltr.) Rolfe = *Disa basutorum* Schltr.  
*M. leydenbergensis* Kraenzl. = *Disa stachyoides* Reichb. f.

testicular tubers. There may be some variation in the tuber shape, but this variation is difficult to quantify due to lack of material.

The variation in leaf shape may be used to some extent to subdivide the genus: in sect. *Densiflora* the leaves tend to be linear-lanceolate, as compared to the more lanceolate leaves of the other sections. *M. comosa*, the only species that often occurs in half-shaded conditions, has rather distinctive spreading ovate leaves, sharply differentiated from the upper sheathing cauline leaves.

Inflorescence shape also more or less follows the sectional classification. The small-flowered sect. *Densiflora* has compact cylindrical spikes, the large-flowered sect. *Monadenia* semi-dense cylindrical spikes, and in sect. *Tenuicornes* the inflorescence tends to be lax. *M. sabulosa* and to a lesser extent *M. pygmaea* have an obovate inflorescence. This variation may also be expressed in the angle between the stem and the ovaries: in sect. *Densiflorae* the ovaries spread away from the axis, whereas they are almost erect and adpressed to the axis in sect. *Tenuicornes*. Only in sect. *Tenuicornes* do the floral bracts show any sharp discontinuities: in *M. rufescens* the bracts are almost of a leathery texture, partially obscuring the flowers and imbricate, whereas in *M. reticulata*, *M. comosa* and *M. bolusiana* they are of a more membranous texture, with the venation clearly visible on dried specimens, and the bracts not imbricate.

There is little variation in the shape of the dorsal sepal. In the majority of taxa the galea is best described as oblong. In some, i.e. *M. sabulosa*, the galea is obovate. There is some variation in the angle at which the galea is held: from vertical to falcately curved forwards, but this is difficult to quantify.

The lateral sepals are almost invariably oblong. In some taxa the sepals are reduced in size relative to the dorsal sepal. This is often associated with being reflexed (e.g. *M. sabulosa*). Generally, the apical parts of the sepals are recurved (e.g. *M. bracteata*). This is considered to be the primitive state. Presumably derived from this state are the sharply

reflexed sepals of *M. sabulosa* and *M. atrorubens* or the spreading sepals of *M. ophrydea*.

The petal structure is remarkably uniform throughout the group, and the variation is often rather subtle. This is shown rather clearly by *M. rufescens*, in which the petal shape differs marginally from *M. reticulata*, but the angle and the juxtaposition to the galea is somewhat changed, with a markedly different effect. *M. sabulosa* and *M. pygmaea* are somewhat distinct by virtue of the bifid petals.

Lip shape varies from linear to elliptic in the genus, and the shape is constant for each species. In sect. *Tenuicornes* it may be used as a good differentiating character for the different species.

Rostellum structure is dominated by the small anther, often partially pendent, and the single large viscidium. The rostellum is comparatively simple with a deep notch in which the viscidium is held. The rostellum is often flanked by two erect flanges of tissue, which may also flank the anterior part of the anther. The size of these flanges varies among the species. The origin of these flanges is not known. They may be derived from the staminodes.

The viscidium is generally an almost square structure. However, in *M. rufescens* it is elongated to the back, and has a deep dorsal groove. The two pollen-masses may be as long as or shorter than the caudicles.

The stigma is variable in shape. In general, the two lateral lobes are larger than the posterior lobe. In some cases the stigma is sessile at the base of the rostellum, in others it may be on a tall, often curved, stipe as in sect. *Tenuicornes*.

The spur length and shape provides a very valuable character and has been used as the diagnostic character for the sectional delimitation. In sect. *Tenuicornes* the spur is slender, acute and longer than the dorsal sepal. In sect. *Monadenia* it is much inflated, shorter or longer than the galea, obtuse, rounded or acute. In sect. *Densiflorae* the spur is as long as or shorter than the galea, slender or subclavate, acute to retuse, occasionally constricted at the base.



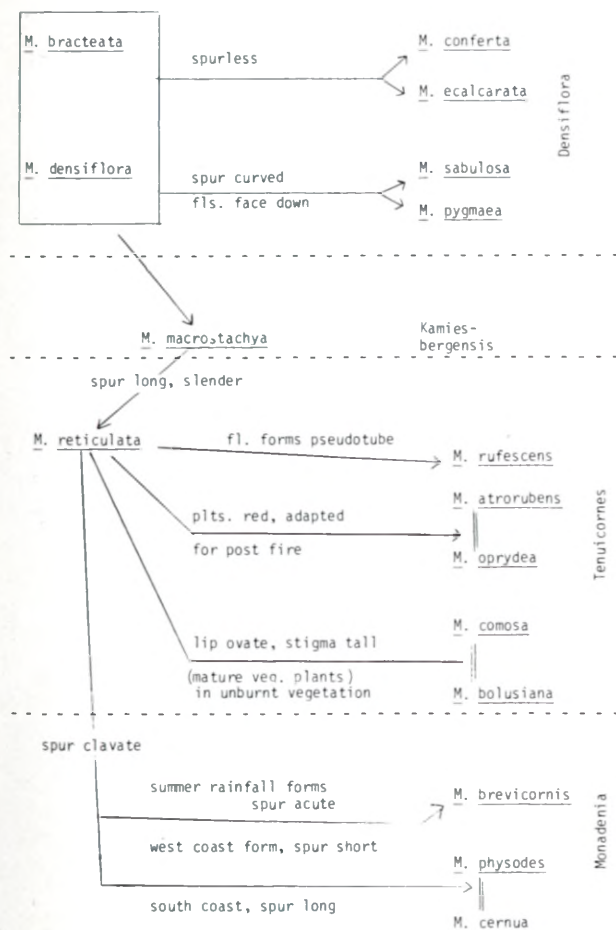


FIG. 2.—Postulated phylogenetic relationships among the species in *Monadenia*.

The morphological relationships in the genus are summarized in the cladogram in Fig. 2. The sectional classification is based on flower size, inflorescence shape and spur shape and length. The first two characters are related to each other, and also to overall plant size. Other characters that vary within the genus (sepal reflexion, stigma size, lip shape and leaf structure) have been found to vary between otherwise obviously closely related taxa (e.g. *M. atrorubens* and *M. ophrydea* for sepal reflexion, lip shape, stigma size, and *M. comosa* and *M. bolusiana* for leaf shape), and are therefore, unlikely to reflect evolutionary tendencies.

#### PHYLOGENY AND EVOLUTION

The postulated phylogeny of the genus is derived from the relationships among the taxa as indicated by the morphological data. However, to arrange the taxa into a sequence, ancestral and derived character states have to be suggested. The relative age of the extant taxa may be estimated from eco-geographical data.

Ancestral character states are probably those states found in other taxa in the *Disinae*, and also simpler states from which more complex states may be derived. In *Monadenia* the ancestral form was probably a slender herb with narrowly lanceolate, subimbricate cauline leaves, an inflorescence with numerous medium-sized flowers with the sepals about 6 mm long, spreading to slightly reflexed, subequal, the dorsal sepal shallowly galeate with a slender spur as

long as or slightly shorter than the sepal, subpendent, petals falcate, erect next to the rostellum, wider towards the base, lip lorate, obtuse, pendent, anther subpendent, rostellum low with a single viscidium, stigma sessile. Such a plant would be comparable to the suggested ancestral forms found in several sections of *Disa* (*Disa polygonoides* Lindl., *D. vaginata* Lindl. and *D. obtusa* Lindl.). In *Monadenia*, *M. bracteata* has the greatest similarity to this set of character states.

Relatively older species may be expected to be morphologically isolated, often with relic distributions in the form of widely scattered populations over large distribution areas, and possibly with wide ecological amplitudes. Morphologically isolated species are found in sect. *Densiflorae* (*M. sabulosa*, *M. pygmaea*, *M. ecalcarata* and *M. conferta*), whereas in the rest of the genus only *M. rufescens* is morphologically clearly isolated.

Several species in the genus show wide distribution ranges (*M. bracteata*, *M. densiflora*, *M. comosa* and *M. reticulata*), but only *M. densiflora* and *M. reticulata* have disjunct distributions. The majority of the species show a restricted distribution range, either on the west coast, or the south coast, or the area bounded by Caledon, Worcester and Cape Town. Two species are only known from very restricted localities: *M. ecalcarata* from a single specimen on the Cape Peninsula and *M. macrostachya* from a single locality in the Kamiesberg.

All the species in sect. *Densiflorae* have at least some morphologically or distributionally primitive features: *M. bracteata* and *M. densiflora* with widespread distributions and being morphologically ancestral, and the remainder of the species in the section being morphologically isolated.

The remaining species in the genus are grouped into interlinking species groups, in which the individual species are often difficult to separate rigorously. They present the aspect of a rapidly evolving group. Sect. *Tenuicornes* has diversified mainly in the mountains of the Cape, with one group adapted for the immediately post-fire temporal niche (*M. ophrydea* and *M. atrorubens*), with suitable cryptic coloration, and the other group adapted for unburnt vegetation, with one species found on rock ledges and the other at high altitudes in high-altitude low heathlands (Taylor, 1978) (*M. comosa* and *M. bolusiana*). One isolated species in the section appears to have become specialized for a particular pollination syndrome (*M. rufescens*). These five species therefore show a certain degree of specialization, and may all be derived from *M. reticulata*, the widespread and presumably simplest member of the section.

Sect. *Monadenia* has a rather specialized spur shape, and is a lowlands group, except in the summer rainfall area. The three species are geographically separated.

The single member of sect. *Kamiesbergenses* is best understood as the link between the older sect. *Densiflorae* and the derived remainder of the genus.

These postulated phylogenetic relationships are simplistically displayed in Fig. 2.

#### MONADENIA

*Monadenia* Lindl., Gen. Sp. Orch. 356 (1838); Benth. & Hook. f., Gen. Pl. 3: 630 (1883); Pfitzer in

Natürl. PflFam. 2, 6: 98 (1889); Kraenzl., Orch. Gen. Sp. 1: 808 (1900); Rolfe in Fl. Cap. 5, 3: 186 (1913); Senghas in Schltr., Die Orchideen 1: 274 (1972); R. A. Dyer, Gen. 2: 995 (1976). Type species: *Monadenia brevicornis* Lindl., Gen. Sp. Orch. 357 (1838) (lectotype).

*Disa* Berg. sect. *Monadenia* (Lindl.) H. Bol. in Trans. S. Afr. phil. Soc. 5: 137 (1888); Schltr. in Bot. Jb. 31: 202 (1901).

*Monadenia brevicornis* is here selected as the lectotype, since it is the only correct name Lindley placed in the genus in 1838.

The generic name refers to the single viscidium and is derived from the greek 'monos' = one and 'adenos' = gland.

Leaves all cauline; dorsal sepal shallowly galeate, spur pendent from the base of the galea; petals obliquely ovate-oblong, subcarinate, partially exserted from the galea; lip linear to elliptic, subcarinate; anther usually semi-pendent, with a single large viscidium.

Plants terrestrial, herbaceous, usually erect, 40-600 mm tall; tubers 2, testicular or cylindrical; basal sheaths hyaline, obtuse; leaves all cauline, usually imbricate, the leaf bases sheathing, the blades elliptic to linear-lanceolate, usually erect, the lowermost the largest, the upper grading into the floral bracts; inflorescence cylindrical to secund, dense to lax; ovaries usually twisted, 5-25 mm long; bracts ovate to lanceolate, acute to acuminate, slightly shorter than the ovaries to longer than the flower. *Flowers*

resupinate (except *M. ecalcarata* Lewis), purplish, brown or green; dorsal sepal shallowly galeate, usually oblong, obtuse, 2.5-15 mm long; spur pendent from the base of the galea, slender or clavate, obsolete or longer than the galea; lateral sepals patent or reflexed, usually oblong, often shorter than the galea; petals generally obliquely narrowly ovate-oblong, acute to bifid, the broad base enclosing the anther and the apex erect in the galea, partially exserted from the galea; lip patent to pendent, linear to elliptic, subfleshy; anther horizontal to semipendent with a single large concrete viscidium and two cells; rostellum simple with a deep notch containing the viscidium and with two often well developed lateral flanges flanking the anterior part of the anther; stigma equally or unequally tripulvinate, shortly stipitate to as tall as the rostellum.

Sect. *Densiflora* Linder, sect. nov., calcar sepal dorsalo plerumque brevior, sepalis 2.5-5 (-7) mm longis, inflorescentia densa dignoscenda.

Spur usually shorter than the dorsal sepal, rarely as long as the dorsal sepal; flowers small, sepal 2.5-5 (-7) mm long; inflorescence dense, cylindrical.

Type species: *Monadenia bracteata* (Swartz) Dur. & Schinz.

This section is linked to the rest of the genus by *M. densiflora*. In the *M. densiflora*/*M. bracteata* group the spur is straight or slightly curved, and about as long as the dorsal sepal. From this group two lines of development may be postulated: a line in which the spur is highly reduced, and flower size is decreased

#### KEY TO SPECIES

- 1a Spur as long as or shorter than the dorsal sepal:
  - 2a Spur saccate or obsolete:
    - 3a Inflorescence slender, 10 mm in diameter; lateral sepals 2.5 mm long ..... 2. *M. conferta*
    - 3b Inflorescence stout, 15 mm in diameter; lateral sepals 4 mm long ..... 1. *M. ecalcarata*
  - 2b Spur well developed, more than 1 mm long:
    - 4a Spur clavate, rounded ..... 14. *M. physodes*
    - 4b Spur slender:
      - 5a Spur about as long as the dorsal sepal:
        - 6a Spur with a sharp bend; petals deeply bilobed ..... 3. *M. sabulosa*
        - 6b Spur straight or gently curved; petals rounded to obtuse:
          - 7a Lateral sepals c. 7 mm long. .... 7. *M. macrostachya*
          - 7b Lateral sepals less than 4 mm long ..... 5. *M. bracteata*
      - 5b Spur about 1/2 as long as the dorsal sepal:
        - 8a Spur constricted at the base and triangular in cross-section ..... 6. *M. densiflora*
        - 8b Spur cylindrical; not constricted at the base ..... 4. *M. pygmaea*
  - 1b Spur longer than the dorsal sepal:
    - 9a Spur clavate:
      - 10a Spur rounded ..... 15. *M. cernua*
      - 10b Spur acute ..... 16. *M. brevicornis*
    - 9b Spur slender:
      - 11a Plants suffused beetroot-red when fresh, reddish brown when dry:
        - 12a Lip 8-10 mm long, narrowly elliptic to lorate; lateral sepals spreading ..... 12. *M. ophrydea*
        - 12b Lip 5-7 (-8) mm long, oblong to narrowly oblong; lateral sepals reflexed ..... 11. *M. atrorubens*
      - 11b Plants green when fresh, pale to dark brown when dry:
        - 13a Bracts leathery, venation not visible; petals purple ..... 13. *M. rufescens*
        - 13b Bracts membranous to thin-tissued, venation visible; petals lime-green:
          - 14a Lip lorate; leaves linear-lanceolate ..... 8. *M. reticulata*
          - 14b Lip elliptic; leaves elliptic to lanceolate:
            - 15a Lowest 2 (-3) leaves elliptic, spreading, sharply differentiated from the remaining leaves, flowering mostly in October ..... 10. *M. comosa*
            - 15b Leaves gradually smaller from the base to the apex of the stem; flowering mostly in December and January ..... 10. *M. bolusiana*



(*M. ecalcarata*, *M. conferta*), and a line in which the spur becomes sharply curved, the inflorescence becomes relatively massive, and the flowers face downwards (*M. pygmaea*, *M. sabulosa*).

The *M. bracteata*/*M. densiflora* group is here considered as being ancestral. These two species are closely related, and may be separated by the shape of the spur and the galea. Both taxa are ecologically diverse and widespread in the Cape Flora. *M. bracteata* is ubiquitous in the area, and *M. densiflora* shows quite a remarkable degree of variation in the floral morphology (see below).

Both *Monadenia ecalcarata* and *M. conferta* are rare. *M. ecalcarata* is known from a single specimen, whereas the latter taxon is more widespread, but populations are very sparse. As both taxa show specializations not found in the other (the non-resupinate flowers in *M. ecalcarata* and the beetroot-red colouring in *M. conferta*), they cannot be placed in an ancestor-descendant relationship.

*Monadenia sabulosa* and *M. pygmaea* are restricted to the Cape Peninsula and the Caledon District, showing the False Bay disjunction in their distributions as recorded by Rourke (1972) for *Leucospermum hypophyllocarpodendron* subsp. *hypophyllocarpodendron* and Linder (1981b) for *Herschelia purpurascens*. However, as orchids are rather easily distributed by seed, it is suggested that this distribution pattern is the result of the distribution of available habitats, rather than of geological history, as suggested by Rourke (1972) for *Leucospermum hypophyllocarpodendron*. Although the group is quite distinctive, the species are clearly distinct. Although there is some overlap in the habitats of the species, *M. pygmaea* generally occurs on more rocky and more mountainous localities, whereas *M. sabulosa* is restricted to lowland sand-flats. Both taxa are generally recorded as flowering after fire.

**1. *Monadenia ecalcarata* Lewis** in J1 S. Afr. Bot. 14: 31 (1948). Type: Cape Province, Cape Peninsula, on damp rocky northern slopes of Constantiaberg, Lewis 1487 (SAM, holo.).

Icon: J1 S. Afr. Bot. 14: 32, Fig. 2 (1948).

Plant 130 mm tall; tubers testicular, 10 mm in diameter; basal sheaths 2, hyaline, obtuse, up to 20 mm long; leaves linear-lanceolate, acute, erect and curved towards the stem, conduplicate, the longest at the base of the stem, 70 mm long, the upper grading rapidly into the floral bracts, densely imbricate; inflorescence a dense cylinder, 60 mm long and 15 mm in diameter with numerous imbricate flowers; ovaries slender, c. 10 mm long; bracts as tall as the flowers, lanceolate, acuminate. Flowers not resupinate, lime-green; dorsal sepal shallowly galeate at the base, narrowly oblong, obtuse, 4 mm long; petals obliquely narrowly oblong, obtuse, fleshy, 3 mm long; lip pendent, lobate, obtuse, 3–4 mm long; anther about 1 mm long; rostellum small, erect; style a nearly square, pulvinate.

**Diagnostic features.** Flowers with lateral sepals 4 mm long, spur obsolete, flowers not resupinate.

Flowering time: October.

This species is known from a single collection. It differs in too many characters from its nearest relations, *M. conferta* and *M. micrantha*, to be considered as an aberrant form. It is puzzling that an orchid should be so rare (Fig. 3).

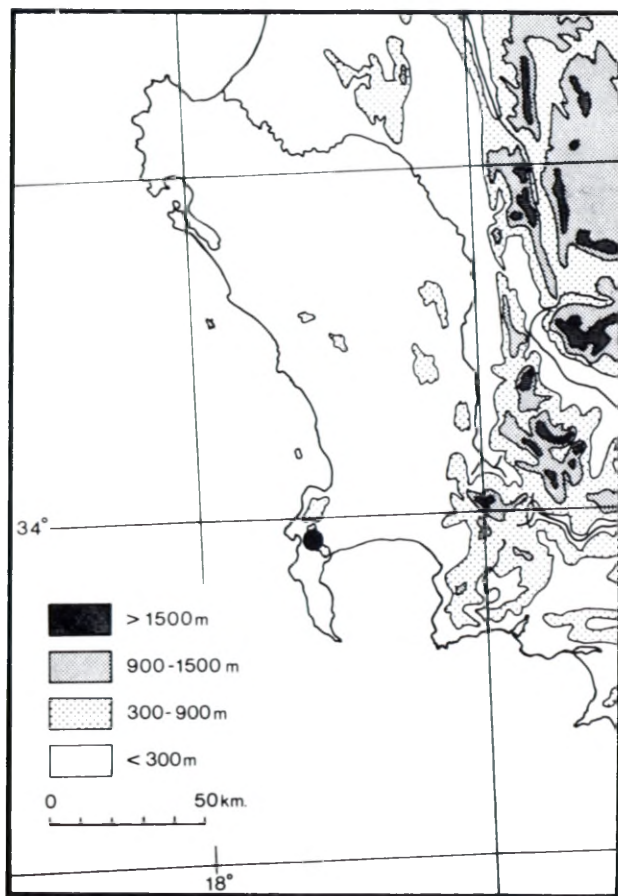


FIG. 3.—Distribution of *Monadenia ecalcarata*.

**2. *Monadenia conferta* (H. Bol.) Kraenzl.**, Orch. Gen. Sp. 1: 810 (1900); Rolfe in Fl. Cap. 5,3: 187 (1913). Type: Cape Province, Cape Peninsula, Raapenburg, Guthrie 725 (= Bolus 7097) (BOL, lecto.; K!).

*Disa conferta* H. Bol., Icones Orch. Austro-Afr. 1: t. 28 (1893); Schltr. in Bot. Jb. 31: 212 (1901).

Icon: H. Bol., Icones Orch. Austro-Afr. 1: t. 28 (1893).

Plant slender, suffused with beetroot-red, 80–220 mm tall; tubers c. 10 mm long; leaves linear, acute, numerous, densely imbricate, the largest generally near the base of the stem, up to 70 mm long, erect, conduplicate, grading apically into the floral bracts; inflorescence dense, cylindrical, slender 30–130 mm long and 10 mm in diameter; ovaries 5–10 mm long; bracts as tall as or taller than the flowers, lanceolate, subacuminate, longer towards the base of the inflorescence. Flowers lime-green at anthesis, sepals soon turning beetroot-red; dorsal sepal shallowly galeate, rounded to obtuse, oblong, 2.5 mm long; spur saccate, 0.1–0.2 mm long; lateral sepals reflexed, oblong to narrowly oblong, rounded to obtuse, 2 mm long, shallowly concave, erect next to the rostellum; lip pendent, narrowly oblong, obtuse 2–2.5 mm long; another horizontal, 0.5–7 mm long, connective longer than the pollen masses, viscidium minute; rostellum 1 mm tall with large lateral lobes flanking the anther; stigma fused to the base of the rostellum. Fig. 4.

**Diagnostic features.** Flowers minute, lateral sepal 2.5 mm long; inflorescence dense, slender, cylindrical; spur obsolete.

Flowering time: (September–) October (–December).

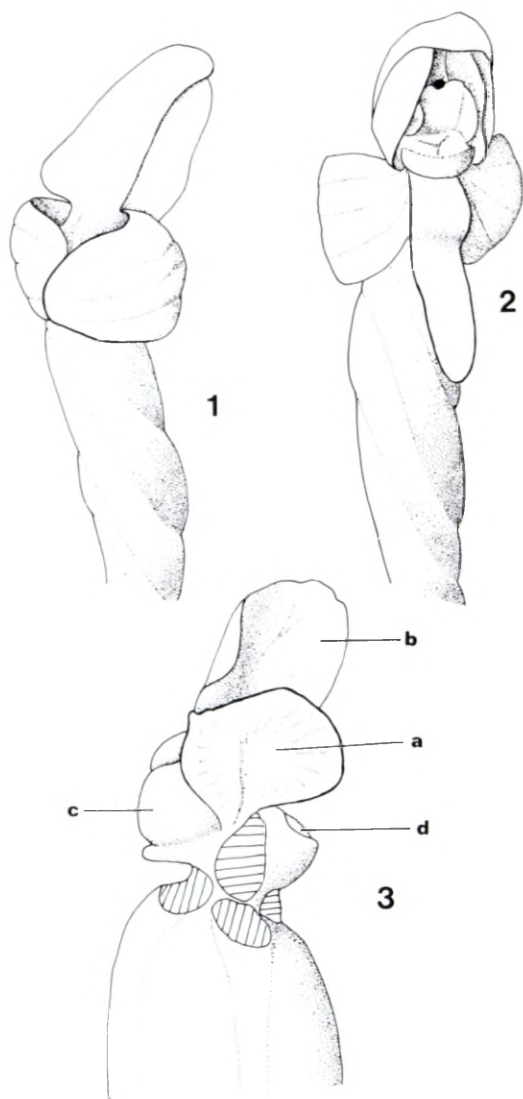


FIG. 4.—*Monadenia conferta*. 1, flower seen from behind,  $\times 10$ . 2, flower in front view,  $\times 10$ . 3, dissected flower: a, rostellum; b, petal; c, anther; d, stigma,  $\times 20$ . All drawn from Williams s.n. (BOL).

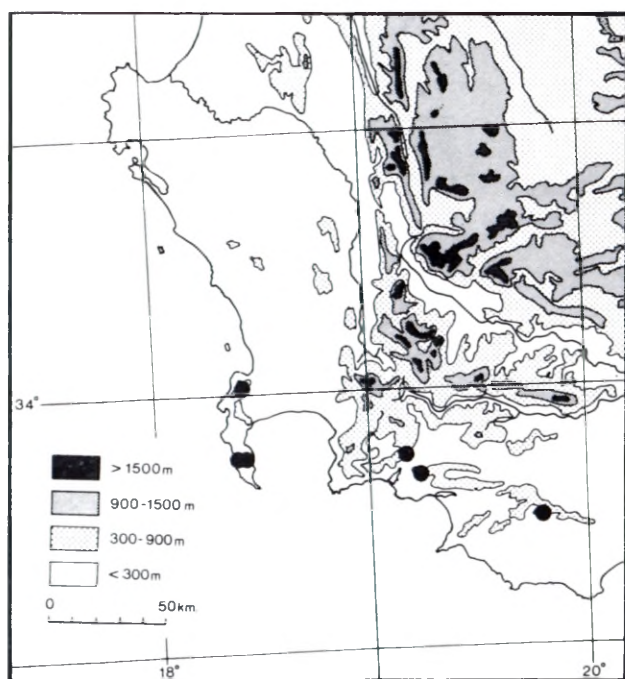


FIG. 5.—Distribution of *Monadenia conferta*.

Locally rare to common in the western Cape Province, occurring on seasonally damp to dry sand, rarely on rocky or gravelly slopes (Fig. 5).

CAPE.—3419 (Caledon): Koue Rivier Berge near Elim (–AD), Dec. 1896, *Schlechter* 9618 (BM; BOL; G; K; P; PRE). 3418 (Simonstown): Buffels River Valley at Hangklip, on a rocky hillside, (–BD), Nov. 1945, *Barker* 3925 (NBG); Cape Point Nature Reserve, Olifantsbos (–AD), Oct. 1955, *Lewis* 4455 (SAM).

This species may readily be identified by the slender beetroot-red plant with minute spurless flowers.

Only one population has been studied in the field (*Linder* 1528, Caledon District, Babylon's Tower). Occasional to rare individuals occurred on dry scree slopes, flowering one year after a fire. Several collectors noted that the species flowered after fire. The altitude range of the species is from sea level to about 600 m.

Bolus (1893) described *Disa conferta* from two living specimens from different localities. These he cites as *Bodkin* in BOL 6231 from near Houw Hoek and *Guthrie* in BOL 7097 from Raapenburg on the Cape Peninsula. The latter collection is also in BOL under the number *Guthrie* 725. The Guthrie collection is also duplicated in Kew and is here selected as the lectotype.

3. *Monadenia sabulosa* (H. Bol.) Kraenzl., Orch. Gen. Sp. 1: 814 (1900); Rolfe in Fl. Cap. 5,3: 195 (1913). Type: Cape Province, Cape Peninsula, Kenilworth, *Bolus* 1374 (= 7104) (BOL, holo.!; BM!; G!; K!; P!; SAM!; UPS!; W!; ZT!).

*Disa sabulosa* H. Bol. in Icones Orch. Austro-Afr. 1 t. 27 (1893); Schltr. in Bot. Jb. 31: 207 (1901).

Icon: H. Bol., Icones Orch. Austro-Afr. 1: t. 27 (1893).

Plants 80–200 mm tall; leaves lanceolate, acute, sheathing at the base, semi-erect, the margins undulate, imbricate, the largest leaves near the base of the stem, up to 50 mm long, the apical leaves grading into the inflorescence; inflorescence dense, obovate, 30–70 mm long and up to 40 mm in diameter; ovaries c. 15 mm long; bracts as tall as the flowers, lanceolate, acute, green. *Flowers* with lime-green sepals and yellow petals and with a faint scent; dorsal sepal subspathulate to broadly obovate, falcate in sideview, the upper half shallowly galeate, obtuse, 10–15 mm long; spur pendent, flexuose near the base, slender, acute to retuse, 10–15 mm long; lateral sepals reflexed, oblong, rounded, 7–9 mm long, veins prominent; petals subobliquely oblong, the apex deeply and equally bifid, the lobes 2 mm long, petal 7–8 mm long, erect, twisted to face forwards; lip oblanceolate, obtuse, pendent, subfleshy, c. 6 mm long; anther pendent, 2 mm long, viscidium large, square, caudicles 1.5–2 mm long; rostellum lateral lobes partially flanking the anther, c. 2 mm tall; stigma flat, horizontal, 1 mm tall. Fig. 6.

*Diagnostic features.* Dorsal sepal subspathulate, facing downwards; spur geniculate; petals deeply bifid. Flowering time: October (–November).

A rare, stout, greenish orchid, occurring on damp to dry sand, usually flowering after fires, in the western Cape Province (Fig. 7).

\*In the treatment of each taxon only representative specimens have been cited. A full list of all specimens studied is given in the Appendix, pp. 361–363.



from areas now heavily disturbed or built over. However, the status in the Betty's Bay area appears to be satisfactory. It must be noted that the species is restricted to the lower slopes of the mountains and the coastal flats, which are prone to invasion by various introduced *Acacia* species. In the long term, these localities will require active conservation.

**4. *Monadenia pygmaea* (H. Bol.) Dur. & Schinz,** Consp. Fl. Afr. 5: 111 (1894); Kraenzl. in Orch. Gen. SP. 1: 813 (1900); Rolfe in Fl. Cap. 5,3: 190 (1913). Type: Cape Province, Cape Peninsula, Muizenberg Mountain, *Bodkin* in BOL 4970 (BOL, holo.!: G!; K!; SAM!).

*Disa pygmaea* H. Bol. in J. Linn. Soc., Bot. 20: 72 (1885); Schltr. in Bot. Jb. 31: 213 (1901).

Icon: H. Bol., Icones Orch. Austro-Afr. 3: t 37 (1913).

Plants 45–150 mm tall; leaves narrowly ovate, acute, imbricate, semi-erect, all equal in size, 15–20 mm long; inflorescence cylindrical, dense, 15–100 mm long, longer than the leafy part of the stem; ovaries c. 5 mm long; bracts taller than the flowers, lanceolate, acute, green. *Flowers* with lime-green lip and petals, green lateral sepals and rusty brown dorsal sepal and spur; dorsal sepal shallowly galeate, oblong, obtuse, 5–6 mm long and up to 2 mm deep; spur c. 2.5 mm long, cylindrical, retuse, falcately curved towards the ovary; lateral sepals patent with the apices reflexed, oblong, obtuse, 4 mm long; petals obliquely narrowly oblong with a small tooth to the rear, the apex shortly and acutely bifid, erect, twisted to face partially forwards, 4 mm long; lip subsupendent, the apex reflexed, lorate, 3–4 mm long; anther pendent, 1 mm long; viscidium elongated with a dorsal groove; rostellum with small side lobes, 1 mm tall; stigma 0.3 mm tall, somewhat angled forwards. Fig. 6

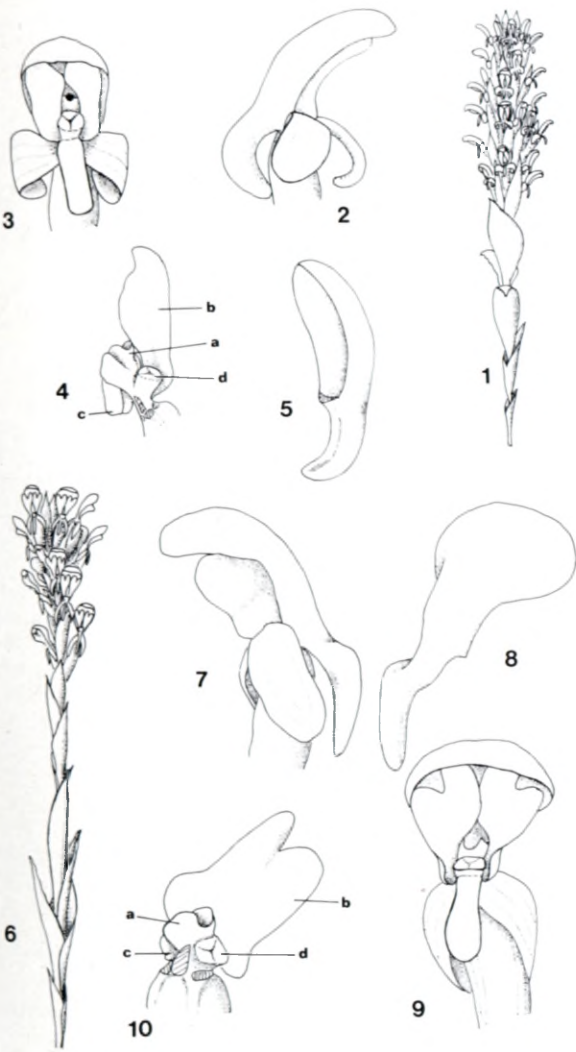


FIG. 6.—*Monadenia pygmaea* (1–5) and *M. sabulosa* (6–10). 1, plant of *M. pygmaea*,  $\times 1$ , from *Stokoe* s.n. (BOL). 2, flower in side view. 3, flower in front view. 4, dissection of flower. 5, dorsal sepal, (2–5 all drawn from *Linder* 1507,  $\times 6$ .) 6, plant of *M. sabulosa*,  $\times 0.5$ , from *Guthrie* 1080. 7, flower in side view. 8, dorsal sepal in rear view. 9, flower in front view. 10, dissection of flower: a, rostellum; b, petal; c, anther; d, stigma. (7–10 from *Linder* 1508; 7–9  $\times 3$  and 10  $\times 5$ .)

CAPE.—3318 (Cape Town): sandflats at Kenilworth near Wynberg (–CD), Oct. 1891, *MacOwan & Bolus* 1374 (BOL; SAM). 3418 (Simonstown): near Hangklip on road to Betty's Bay, on burnt ground (–BD), Oct. 1961, *Thomas* in NBG 56374 (NBG).

The type collection of this species was distributed under two different numbers — as *A. Bolus* in BOL 7104 (selected as lectotype) and as *A. Bolus* sub *MacOwan & Bolus* 1374.

*Monadenia sabulosa* may readily be distinguished from its allies by the deeply bifid petals, and from all the species in the genus by the sharp knee-bend in the spur and the subspathulate dorsal sepal.

A population studied at Betty's Bay (*Linder* 1508) occurred in sand among boulders on the lower slopes of the mountains, in a fire-break. Individuals occurred frequently, mostly in seasonally damp sand. Collectors' notes indicate that this species is most frequently collected after the climax vegetation has been removed (i.e. by fire or mechanical means) from sandy areas. The species ranges from near sea level to about 1 200 m altitude.

The conservation status of the species of the Cape Peninsula is not clear. The majority of collections are

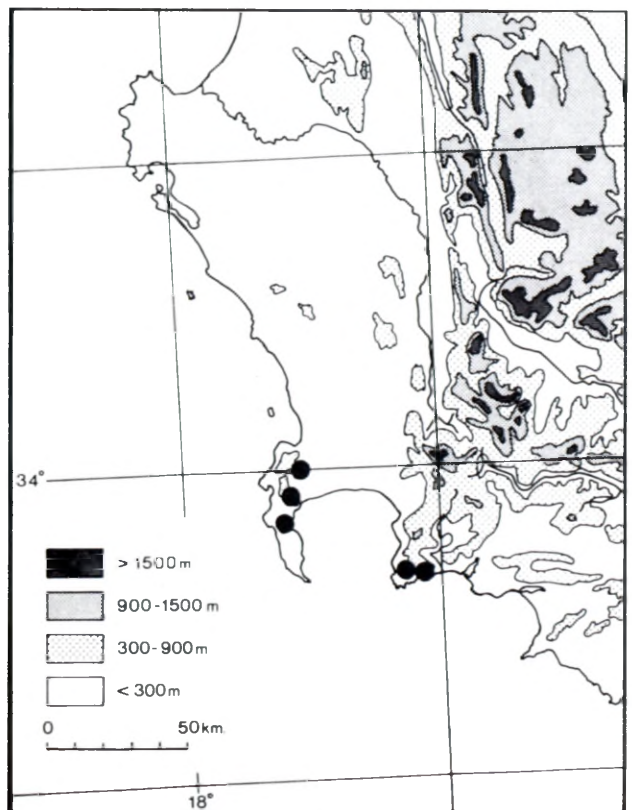


FIG. 7.—Distribution of *Monadenia sabulosa*.

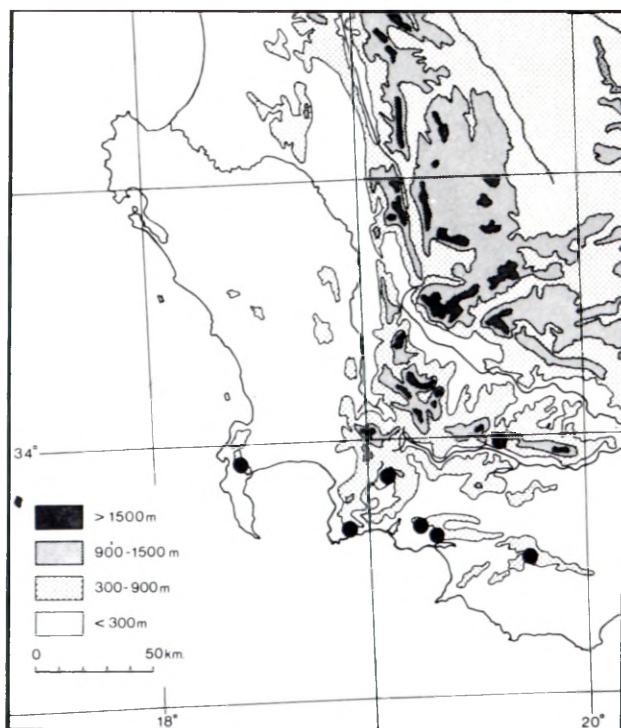


FIG. 8.—Distribution of *Monadenia pygmaea*.

**Diagnostic features.** Flowers small, lateral sepals 4 mm long; plants less than 150 mm tall, inflorescence longer than the leafy stem.

Flowering time: October and November.

*Monadenia pygmaea* occurs occasionally in small populations in sandy areas, often flowering after fire (Fig. 8).

CAPE.—3418 (Simonstown): Steenberg Plateau, burnt sandy slope near reservoir (—AB), Oct. 1945, *Lewis 1095* (SAM). 3419 (Caledon): Klein Riversbergen near Onrust (—AC), Nov. 1896, *Schlechter 9501* (BOL).

This species is allied to *M. sabulosa* by the bifid petals and the slight knee-bend in the spur, but may be distinguished from that species by the much smaller flowers and plants (sepals about 4 mm long). From the rest of the genus it may be separated on the inflorescence that is always longer than the leafy stem, the flowers that face downwards, and the short spur.

A population studied near Betty's Bay (*Linder 1507*) was found near *M. sabulosa* in sand in a recently cleared fire-break at the base of the mountain. Individuals occurred frequently in seasonally damp sandy areas. Other collectors also generally indicate a sandy substrate, except two collections from the Lebanon Forest Reserve, which are from dry rocky slopes, one with loose rocky sand. Several collections were made after fire. The altitude range of the species is from sea level to almost 1 000 m. The rainfall ranges from about 800 mm to over 1 500 mm in some localities, mostly restricted to the winter.

Although the majority of collections are from localities suffering from severe disturbance, the species has also been recorded from localities likely to have some long-term protection, such as the Lebanon Forest Reserve.

5. *Monadenia bracteata* (Swartz) Dur. & Schinz, *Consp. Fl. Afr.* 5: 111 (1894). Type: Cape of Good Hope, *Sparrman* s.n. (W, holo.).

*Disa bracteata* Swartz in *Vet. Acad. Handl.* 21: 211 (1800).

*Monadenia micrantha* Lindl., *Gen. Sp. Orch.* 357 (1838); Kraenzl., *Orch. Gen. Sp.* 1: 818 (1900); Rolfe in *Fl. Cap.* 5, 3: 190 (1913). *Disa micrantha* (Lindl.) H. Bol. in *Trans. S. Afr. phil. Soc.* 5: 142 (1888); Schltr. in *Bot. Jb.* 31: 213 (1901). Type: Knysna, Ruigtevallei *Drège 1261* (K, holo.; G!; P!; W!).

*Disa praetermissa* Schltr. in *Ann. Transv. Mus.* 10: 246 (1924). Type: Humansdorp, sandy grassland near Stormsriver, *Schlechter* s.n. (B, holo.).

*Monadenia australiensis* Rupp in *Austr. Orch. Rev.* 11: 70 (1946). Type: West Australia, Stirling Range, Youngs Siding, *Southerland* s.n. (PERTH, holo.).

Plants up to 300 (–500) mm tall; leaves linear-lanceolate, acute, imbricate, numerous, erect and usually curved inwards, the largest near the base, 40–120 mm long, grading apically into the floral bracts; basal sheaths hyaline, obtuse, 10–20 mm long; inflorescence cylindrical, imbricate, flowers numerous, 20–120 mm long; ovaries erect, 6–10 mm long; bracts shortly overtopping the flowers, rarely much taller than the flowers, narrowly ovate, acuminate. Flowers green with the sepals usually tinted maroon; dorsal sepal shallowly galeate, broadly oblong, obtuse to acute, 3–4 mm long and c. 1 mm deep, falcate in side view; spur shallowly triangular, pendent from the base of the galea, rounded to truncate, 3–4.5 mm long; lateral sepals patent with the apices usually reflexed, oblong, obliquely acute, 2.5–3.5 mm long; petals erect, partially included in the galea, broadly obtriangulate in outline, obliquely acute, 2–2.5 mm long, concave, venation strongly falcate; lip pendent narrowly oblong to lorate, often oblanceolate, 2–2.5 mm long; anther pendent, c. 1 mm long; rostellum with a large central notch, staminodes of variable size; stigma pulvinate. Fig. 10.

**Diagnostic features.** Flowers small, lateral sepals 2.5–3.5 mm long, spur pendent, 3–4.5 mm long, slender, rounded or truncate, inflorescence dense, cylindrical.

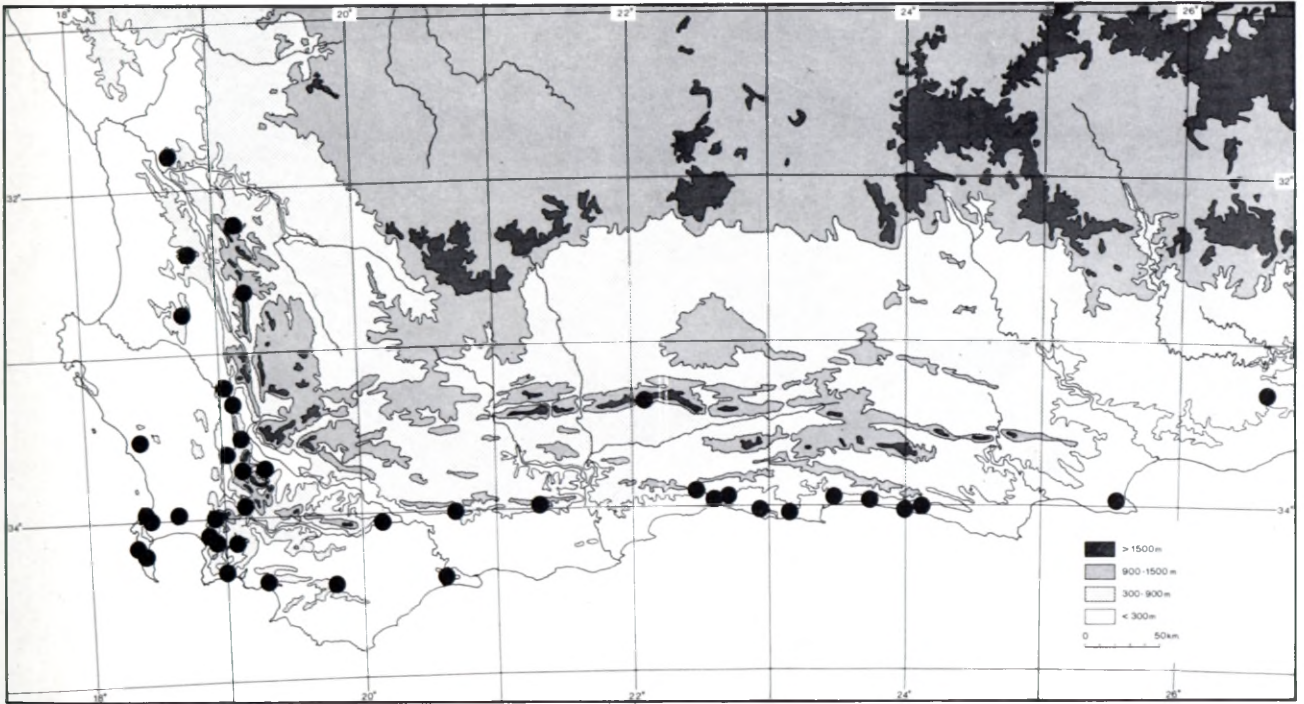
Flowering time: September–November.

*Monadenia bracteata* is a widespread and common little orchid (Fig. 9), that occurs frequently in wasteland areas, especially in areas of mild disturbance. In undisturbed vegetation it is widespread, but somewhat rarer. In Australia it has been recorded as a roadside weed.

CAPE.—3318 (Cape Town): Rondebosch, University of Cape Town football field (—CD), Sept. 1946, *Leighton 2079* (BOL). 3418 (Simonstown): Fish Hoek mountain, in shade under trees (—AB), Nov. 1944, *Lewis 823* (SAM). 3322 (Oudtshoorn): Saasveld, near George, in grassland at the forest edge (—DC), Oct. 1965, *Morze 2026* (BOL). 3323 (Willowmore): near Stormsriver mouth (—DD), Nov. 1894, *Schlechter 5965* (BM; G; K; W; Z).

The identity of *Disa bracteata* has led to much confusion. N. E. Brown applied the name to an illustration of what is clearly *Monadenia multiflora*. Lindley (1838) cited a plate of Brown (1818) as being *Disa bracteata*. Bolus (1888) discussed the problem of the identity of *D. bracteata*, indicating that it could not be confused with *Disa cylindrica* and that it is likely to be a *Monadenia*. He could not, however, trace a type specimen either in the Swartz or Thunberg herbarium. Rolfe (1913) was of the opinion that *D. bracteata* is *M. multiflora*, as 'It does not describe the cylindrical spur and linear lip of *M. micrantha* Lindl'. In Vienna I located a capsule containing several flowers and an inflorescence of *Monadenia micrantha*. The capsule was annotated '*Disa bracteata* Swartz scripsit'. The words 'Disa' and 'Swartz scripsit' were in a hand that I do not know, but 'bracteata' is written in a hand closely resembling



FIG. 9.—Distribution of *Monadenia bracteata*.

that of Olof Swartz (*vide* Burdet, 1978). As there are several sheets of Swartz types at Vienna (Linder, 1981a), this is not exceptional, and might well be the type of *Disa bracteata*.

The type of *Disa praetermissa* has unfortunately been lost. However, from the protologue this name has to be included in the synonymy here, as the distinguishing characters mentioned by Schlechter (1924) (Spur length and leaf shape) are quite variable in *M. bracteata*.

*Monadenia bracteata* is closely allied to *M. densiflora*, but may be distinguished from this species by the terete spur, which is generally as long as the dorsal sepal. In *M. densiflora*, the galea is often obovate, a state that never occurs in *M. bracteata*. From the rest of the genus these two species are separated by the small flowers (sepals less than 8 mm long) and spur as long as or shorter than the dorsal sepal.

This is by far the most common species of *Monadenia*, and occurs in a wide range of habitats, from dry sandy areas to gravelly mountain slopes, on damp clayey soils and in black turf sand. The altitude range of the species is from sea level to 1 500 m, and specimens have been collected in full sunlight and in shade. The rainfall regime over the distribution range varies from less than 800 mm p.a. to well over 1 600 mm, and from an all-year rainfall in the Knysna-Humansdorp area to several months of summer drought in the Clanwilliam area.

In undisturbed vegetation populations have a low density and individuals occur scattered over a large area. In disturbed conditions (road-cuttings) and fills, old fields, gravel pits, sport fields, etc.) large populations may be found. Over its whole distribution range, this species is well established as a pioneer.

*M. bracteata* has also been recorded from Australia, initially under the name *M. australiensis*, as it was thought to be indigenous to Australia (Rupp, 1946). Erickson (1965) noted that 'It was found to be most common on the roadsides, the usual lodging

place for immigrant plants ...' Pocock (1972) recorded this species only from the south-west of Australia, flowering in November. It was probably introduced accidentally to that continent.

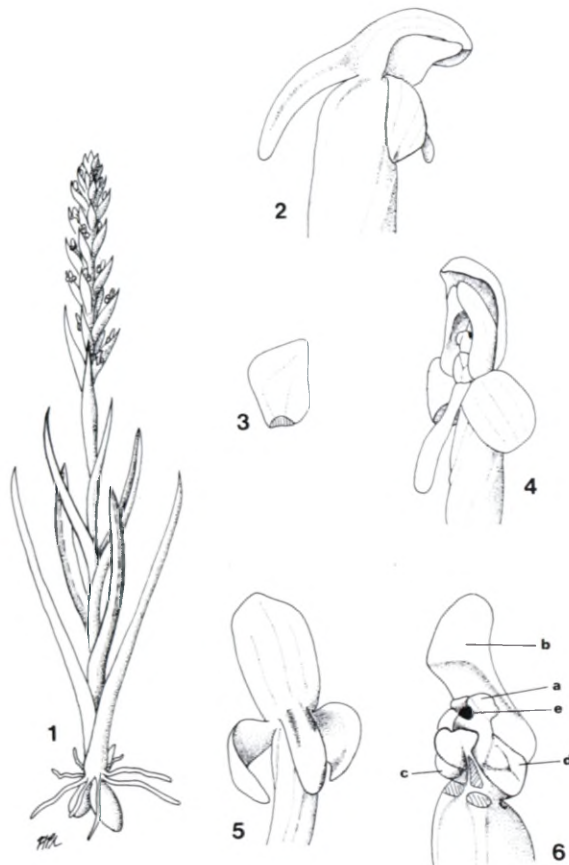


FIG. 10.—*Monadenia bracteata* (1–3) and *M. densiflora* (4–6). 1, plant of *M. bracteata*,  $\times 0.5$ , from Esterhuysen 12074. 2, flower in side view. 3, petal. (2–3 from Walters 508,  $\times 5$ .) 4, flower of *M. densiflora* in front view. 5, flower in rear view, showing the spur. 6, dissection of flower: a, rostellum; b, petal; c, anther; d, stigma. (4–6 from Linder 1513,  $\times 5$ .)

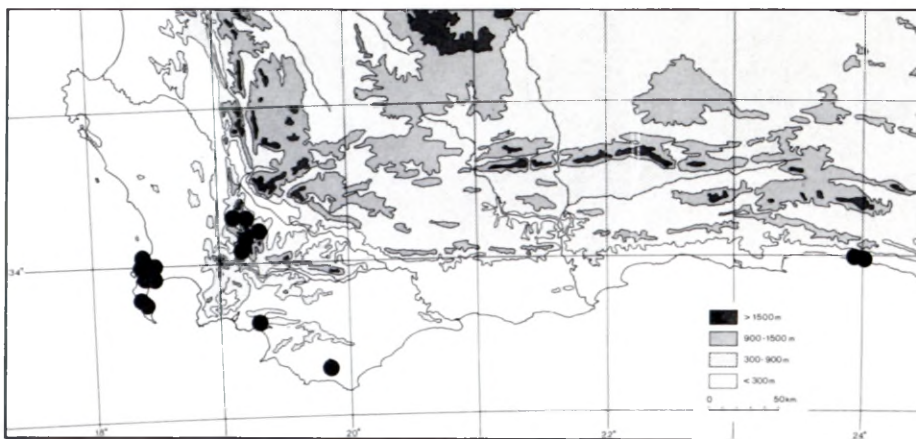


FIG. 11.—Distribution of *Monadenia densiflora*.

6. *Monadenia densiflora* Lindl., Gen. Sp. Orch. 357 (1838); Kraenzl., Orch. Gen. Sp. 1: 814 (1900). Lectotype: Cape of Good Hope, *Thom* s.n. (K, lecto!).

*Disa densiflora* (Lindl.) H. Bol. in J. Linn. Soc., Bot 25: 197 (1889).

*Monadenia multiflora* Sond. in Linnaea 19: 101 (1847); Kraenzl., Orch. Gen. Sp. 1: 811 (1900); Rolfe in Fl. Cap. 5, 3: 188 (1913). *Disa multiflora* (Sond.) H. Bol. in Trans. S. Afr. phil. Soc. 5: 140 (1888); Schltr. in Bot. Jb. 31: 215 (1901). Type: Cape Province, Cape Peninsula, Doornhoogte, *Ecklon & Zeyher* s.n. (S, holo.; K!; P!; W!).

*Disa auriculata* H. Bol., Icones Orch. Austro-Afr. 1: t. 77 (1896); Schltr. in Bot. Jb. 31: 214 (1901). *Monadenia auriculata* (H. Bol.) Rolfe in Fl. Cap. 5, 3: 189 (1913). Syntypes: Cape Province, Cape Peninsula, *Guthrie* s.n. (BOL!); Humansdorp, near Storms River, *Schlechter* 5958 (BOL!; BM!; G!; W!; Z!).

Icones: H. Bol., Icones Orch. Austro-Afr. 1: t. 77 (1896), as *Disa auriculata*: 3: t. 39 (1913), as *D. multiflora*.

Plants slender to robust, 75–195–350 mm tall; tubers up to 20 mm long; basal sheaths hyaline, obtuse to apiculate, 2–3, up to 40 mm long; leaves linear-lanceolate, acute, conduplicate, numerous, imbricate, 50–90–140 (–220) mm long, generally reaching to the base of the inflorescence and grading apically into the floral bracts; inflorescence slender cylindrical, 25–95–180 mm long, usually longer than the leafy shoot, flowers numerous, imbricate; ovaries 5–10 mm long, twisted; bracts as tall as or overtopping the flowers, generally longer towards the base of the inflorescence, narrowly ovate, acuminate. Flowers with dull green petals and lip, and rusty red to green sepals; dorsal sepal shallowly galeate, oblong, obtuse, erect or falcately curved forwards, 3–5 (–7) mm long and 0.5–1 mm deep; spur pendent from the base of the galea, triangular in cross-section, constricted at the base, apex obtuse to retuse, (1–) 2–3 (–4) mm long, shorter than the galea; lateral sepals oblong-ovate, sub-obtuse to rounded, spreading, apices reflexed, 3–5 (–7) mm long; petals erect, narrowly oblong, subfalcate, 2.5–5 (–7) mm long, rounded to rarely acute, the apical 1/3 fleshy; lip pendent, narrowly oblong to oblanceolate, rounded, 2.5–5 (–7) mm long, apex fleshy; anther pendent, c. 0.8 mm long; rostellum with a deep notch for the single viscidium, viscidium flanked by two flat projections; stigma horizontal, unequally three-lobed. Fig. 10.

**Diagnostic features.** Flowers small, lateral sepals 3–5 (–7) mm long, spur shorter than the galea, 2–4 mm long, triangular in cross-section, somewhat constricted at the base; plants 75–350 mm tall.

Flowering time: (September–) October (–December).

*Monadenia densiflora* is a widespread, but usually not common, species, occurring usually in sandy places, but also in a wide range of other habitats (Fig. 11).

CAPE.—3318 (Cape Town): Table Mountain, Groene Kloof, 600 m (–CD), Nov. 1897, *Galpin* 4612 (PRE), 3418 (Simonstown): Constantiaberg, slopes above Baviaans Kloof (–AB), Oct. 1947, *Lewis* 1833 (SAM); Krom River (–AB), Oct. 1945, *Compton* 17486 (NBG). 3319 (Worcester): Wemmershoek Peak, 1 650 m (–CC), Dec. 1944, *Lewis* 850 (SAM). 3323 (Willowmore): at Stormsriver Mouth (–DD), Nov. 1978, *Linder* 1903 (BOL).

*Monadenia densiflora* Lindl. was based on two syntypes at Kew, namely *Thom* s.n. and *Drège* 8288. According to Article 9.2 of the I.C.B.N. (1978), the element most closely resembling the protologue has to be selected as the lectotype. *Thom* s.n. most closely resembles the protologue. ‘Calcere pendulo filiforme antice alato’ and ‘labello lineari-spathulato carnosio’ can only refer to this element, whereas ‘petalis . . . . . galea duplo brevioribus’ refers to *Drège* 8288. N. E. Brown in a note on *Thom* s.n. wrote that the description of *M. densiflora* was based on this specimen, but Rolfe (1913) effectively lectotyped the name *M. densiflora* by attaching the *Thom* specimen (*Thom* 732) to that species and referring *Drège* 8288 to *M. physodes*. This lectotypification should be followed.

This highly variable species has small flowers (sepals 3–5 (–7) mm long) with a spur shorter than the galea. It may be separated from the closely related *M. bracteata* by the relatively short spur which is triangular and constricted at the base.

This species has a peculiarly disjunct distribution, with the vast bulk of the collections known from the western Cape Province, and a few rare collections from the Tsitsikamma coastline between Humansdorp and Knysna. As discussed above, there is some morphological differentiation between these two centres.

In the western Cape, this species occupies a wide range of habitats. It has been recorded from sand near sea level, at Olifantsbos in the Cape Point Nature Reserve, from the summit of Table Mountain, and from rock ledges in the Wemmershoek Mountains. The altitude range of the species is from sea level to over 1 600 m. In general, it appears to be restricted to slightly damp areas, and has often been collected after fires. It does not appear to be common in any of these habitats. The macro-climatic conditions vary from all year rainfall in the Knysna area, to summer drought conditions on the Cape Flats. In



the mountains of the western Cape, it often occurs in the south-eastern cloud zone.

*Monadenia multiflora* has generally been recognized as a distinct species. Sonder (1847) clearly distinguished it from *M. bracteata* by the larger flowers and shorter spur. However, *M. auriculata* has never been satisfactorily separated from *M. multiflora*. Bolus (1896) stated 'It comes near to *D. multiflora*, *mihi*, in its flowers, but the spike is always slenderer, and the inflorescence usually less dense'. Schlechter (1901) claimed that *D. auriculata* may easily be recognized by 'the more slender habit, smaller flowers, more helm-shaped dorsal sepal and the rostellum'. Rolfe (1913) used the relative lengths of the spike and the leafy shoot to separate the two putative taxa. Lewis (1950) separated the taxa on the width of the spike and the shape of the spur. A careful analysis of all the available material, as well as field studies in the various localities where the types were collected, showed that the two taxa could not be maintained as distinct from each other and *M. densiflora*.

*Monadenia densiflora* is rather variable with respect to flower size, and the shapes of the petals and the spur. Although the inflorescence is generally longer than the leafy shoot, the ratio is often reversed. Spur length varies from 1 mm (Barker 3893) to 4 mm (Page in BOL 16232) and spur shape from a rounded apex to an emarginate apex. There is some geographical pattern to flower size. Collections from the Tsitsikamma coastal flats have the smallest flowers (lateral sepal c. 3 mm long, Linder 1903), whereas collections from the summit of Table Mountain on the Cape Peninsula show the largest flowers (Lewis 1107). One of the syntypes of *D. auriculata* (Schlechter 5958) is representative of the small-flowered Tsitsikamma form, whereas the lectotype of *M. densiflora* is typical of the large-flowered form from Table Mountain. The type of *M. multiflora*, Ecklon & Zeyher s.n., is from the more common intermediate size range (lateral sepals c. 3,4 mm long).

Sect. **Kamiesbergenses** Linder, sect. nov., calcar sepalo dorsalo aequanti, sepalis c. 7 mm longis, inflorescentia laxa dignoscenda.

Spur about as long as the dorsal sepal; flowers medium sized, sepals about 7 mm long; inflorescence lax.

Type species: *Monadenia macrostachya* Lindl.

The sole species in this section, *M. macrostachya*, could be placed into any of the other three sections, as it is closely related to *M. densiflora*, *M. reticulata* and *M. brevicornis*. However, in the cladistic analysis followed here, it would appear to be best placed in a position linking the other groups, and possibly ancestral to them. If the other three groups were to be recognized as being distinct sections, this species would also have to be placed into a section by itself.

This analysis would imply that the present distribution of *M. macrostachya* is only a relic of a more extensive older distribution. If this is correct, it is certainly interesting that the relic should be in an outlier of the Cape Flora, where the species richness is relatively low.

7. ***Monadenia macrostachya* Lindl., Gen. Sp. Orch. 357 (1838); Kraenzl., Orch. Gen. Sp. 1: 812 (1900), excl. syn.; Rolfe in Fl. Cap. 5, 3: 189 (1913).** Type: Cape Province, Namaqualand, Rooiberg. Drège 8289 (K, holo.!: G!; K!).

*Disa macrostachya* (Lindl.) H. Bol. in J. Linn. Soc., Bot 25: 197 (1889); Schltr. in Bot. Jb. 31: 209 (1901), excl. syn.

Plant slender, 300 mm tall; leaves imbricate, the lower 4–8 lorate, acute, erect, conduplicate, up to 130 mm long and 20 mm wide, remaining leaves mostly sheathing, grading into the floral bracts; inflorescence lax with several flowers, up to 200 mm long; ovaries c. 10 mm long; bracts as tall as the flowers, ovate, acuminate, probably dry. *Dorsal sepal* erect, narrowly oblong, acute, 8 mm tall and galea 1,5 mm deep; spur pendent from the base of the galea, somewhat inflated, obtuse to retuse, 6–8 mm long and about 2 mm in diameter, straight; lateral sepals reflexed, oblong, obtuse, c. 7 mm long; petals obliquely narrowly ovate, very acute, 6 mm long, erect; lip pendent, lorate, obtuse, 6 mm long; anther semipendent, 1,5 mm long; rostellum erect, tall; stigma on a 2 mm tall pedicel.

**Diagnostic features.** Dorsal sepal 8 mm long, spur subclavate, retuse, as long as the dorsal sepal, bracts dry, basal leaves lorate, erect, acute, cauline leaves mostly sheathing.

Flowering time: ? September.

This species is only known from two collections: the type collection probably made in about 1835 by Drège; and from a plant past flowering, collected by me in 1977 (Fig. 12). The above description was prepared from the meagre material available, and upon receipt of further material may well be found to be wanting.

Although *M. macrostachya* is clearly distinct, it is related to several of the major groups in *Monadenia*, and may be regarded phylogenetically as a relic that links these three groups together (Fig. 2).

Following Bolus (1911) and Schlechter (1901) in most herbaria *Monadenia macrostachya* and *M. reticulata* are regarded as synonymous. In this treatment *M. reticulata* is regarded as a distinct species.

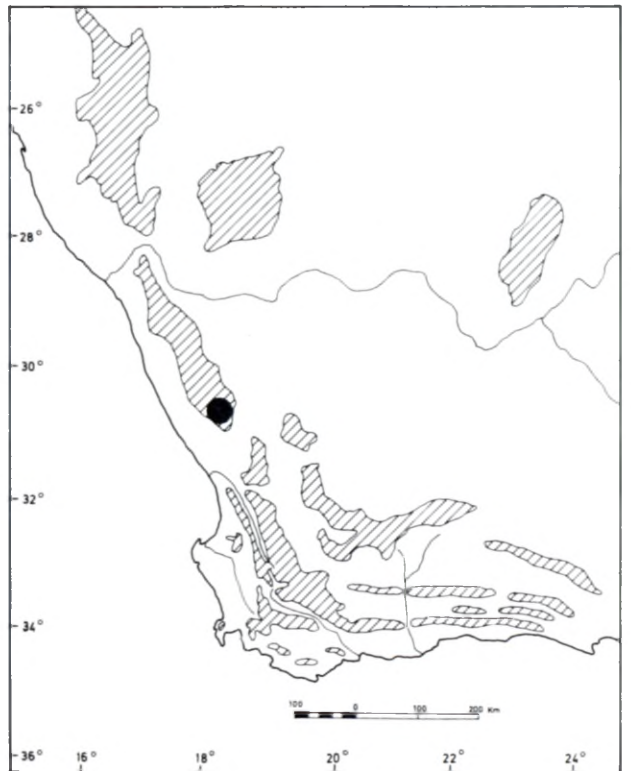


FIG. 12.—Distribution of *Monadenia macrostachya*.

A single small population of this species was located by the author in the Kamiesberg on the Rooiberg. The plants occurred in dry stony soil near a stream, and had been heavily grazed by sheep. There might well be more populations, as the mountains have not been properly explored.

Sect. *Tenuicornes* Linder, sect. nov., calcar tenui, sepalis dorsalibus longiore, sepalis 6–10 mm longis, inflorescentia laxa dignoscenda.

Spur slender, longer than the dorsal sepal; flowers medium sized, sepal 6–10 mm long; inflorescence lax.

Type species: *Monadenia ophrydea* Lindl.

This rather distinct section includes six species: *M. reticulata*, which is closely related to *M. macrostachya*, in which it has been included by some botanists; *M. rufescens*, with a relatively short spur and an elongated viscidium; *M. bolusiana* and *M. comosa*, with green petals and the stigma on a tall stipe; and *M. ophrydea* and *M. atrorubens* in which the plants are suffused with beetroot-red. The section may be distinguished from sect. *Densiflorae* and sect. *Kamiesbergenses* by the spur always being longer than the dorsal sepal, and from sect. *Monadenia* by the slender spur.

Both the *M. comosa* and the *M. ophrydea* groups may be derived from *M. reticulata*. Consequently, this species is treated as being ancestral in the section. Other evidence in favour of the ancestral position of this species is its wide distribution and large range of habitats. It is also closely related to *M. macrostachya*.

*M. rufescens* is clearly related to *M. reticulata* by the slender spur and the shape of the petals, but may readily be distinguished by the three-dimensional shape of the flowers, the dense tissue of the bracts which do not show the venation, and the elongated viscidium. It appears as if this species may have evolved a peculiar pollination syndrome. Although *M. rufescens* is essentially restricted to the western Cape Province, it has been collected from a wide range of habitats.

Within the *M. comosa* complex three groups might conveniently be recognized. The differences between these groups are given in Table 2. The characters listed in the table are approximations, as several are rather difficult to quantify e.g. variation in leaf shape and the habitats. No difference in the floral structures among the groups has been detected.

The three groups behave like ecotypes. Group one occurs almost invariably in rock crevices, usually in

shady places. Group three generally grows in full sunlight, usually on the upper ridges of mountains. Various populations occur in a wide range of habitats: deep sand (*Ebersohn* 151), footpaths (*Linder* 1672) and in rock crevices and ledges (*Linder* 1748). These two groups occur in the Langeberg and in the mountains between Caledon and Clanwilliam. Group two occurs on the summit of the Swartberg near Oudtshoorn, at a high altitude, in a zone receiving the bulk of the rain in the summer months. It grows in a habitat similar to that of Group three.

Groups one and three behave like distinct species. The ranges of these two groups are sympatric but, although populations of the two groups occur on the same mountain, the plants occupy different habitats, and interbreeding is prevented by allochronic flowering. Morphologically, individuals can be placed into these two groups on the basis of the leaf structure and the colour of the vegetative parts of the plants, both in the fresh and dried state.

Group two does not occur sympatrically with groups two and three, and its biological role can therefore not be determined on the basis of its interaction with closely related populations. Morphologically, the populations are quite variable, with the majority of individuals rather similar to group one, but with the variation ranging almost to that typical of group three.

Taxonomically the *M. comosa* complex may be treated in several ways:

- 1. As a variable species with three infraspecific taxa. However, groups one and three behave as distinct species.
- 2. As two distinct species, with group two recognized at infraspecific level in either of the two species. However, group two is intermediate between the two species, and such a treatment implies that either group two arose by secondary convergent evolution, or that group one arose by secondary divergence from group two.
- 3. As two distinct species, with group two recognized as an ancient hybrid complex between the two species. This would account for the extraordinary range of variation in the populations assigned to group two. Hybridization on the Swartberg could be accounted for by the delay of flowering of group one, leading to synchronous flowering. This would lead to the present situation, where parents, hybrids and the results of introgression can no longer be separated. This interpretation of group two would also strengthen the notion that groups one and three represent biological species.

TABLE 2.—Groups recognized within *M. comosa* s.l.

Character	Group one	Group two	Group three
Leaves	Basal two leaves spreading, distinct from rest	Leaves variable, basal leaves generally larger	Basal leaves grading gradually into upper leaves
Flowering (months)	(9–) 10 (–11)	12	(10–) 12–1
Habitat	Shady ledges	Full sun in rocks	Full sun on mountain summits



The third treatment is followed in this study.

Although the *M. comosa* complex is closely related to *M. reticulata*, it may be separated from this species by the higher stigma and somewhat longer spur. Both species of the group are best regarded as specialized derivatives from *M. reticulata*.

*Monadenia ophrydea* and *M. atrorubens* are also very closely allied and have frequently been confused. There are numerous small differences between the species, most of which are rather difficult to observe on dried material and have at least some exceptions. Only the rostellum height/stigma height ratio appears to be a constant differential character. The differences between the two species are listed in Table 3.

TABLE 3.—Morphological differences between *M. atrorubens* and *M. ophrydea* (note that few collections have all these characters)

<i>M. atrorubens</i>	<i>M. ophrydea</i>
Rostellum as tall as stigma	Rostellum twice as tall as stigma
Lateral sepals completely reflexed	Lateral sepals not or barely reflexed
Dorsal sepal narrowly oblong	Dorsal sepal oblong-obovate
Lateral sepals deep purple	Lateral sepals almost white
Caudicles shorter than the pollinarium	Caudicles longer than the pollinarium
Lip oblong to narrowly oblong	Lip narrowly elliptical to lorate
Lip 5–7 (–8) mm long	Lip 8–10 mm long

The morphological differences between the species are correlated with ecogeographical differences. *M. atrorubens* occurs on the west coast of the western Cape Province, and extends southwards to Houw Hoek in the Caledon District, whereas *M. ophrydea* extends from Table Mountain on the Cape Peninsula eastwards to Humansdorp. *M. atrorubens* grows mainly on deep sand, in areas in which there is almost no precipitation in the summer months, whereas *M. ophrydea* is generally found on mountain slopes in shallower stony sand, in areas where there is at least some rainfall in the summer months. Flowering in *M. atrorubens* peaks in September, while in *M. ophrydea* it peaks in October.

This group appears to be derived from *M. reticulata*, and is morphologically very similar to it. The beetroot-red colour of the plants appear to be a single-gene factor, as several individuals have been collected in which the red coloration is absent. Such individuals are difficult to distinguish from *M. reticulata* when they are dried.

8. *Monadenia reticulata* (H. Bol.) Dur. & Schinz, Consp. Fl. Afr. 5, 3: 111 (1894); Kraenzl., Orch. Gen. Sp. 1: 816 (1900); Rolfe in Fl. Cap 5, 3: 193 (1913). Type: Cape Province, Cape Peninsula, Constantiaberg, Bodkin in BOL 4988 (BOL, holo.!). K!).

*Disa reticulata* H. Bol. in J. Linn. Soc., Bot. 22: 75 (1885); Schltr. in Bot. Jb. 31: 209 (1901), excl. syn.

Icones: H. Bol., Icones Orch. Austro-Afr. 2: t. 88 (1911); 3: t. 41 (1913), as *Disa macrostachya*.

Plants 80–400 mm tall; leaves generally linear-lanceolate, rarely narrowly oblong, acute, imbricate,

erect, the lower the longest, up to 150 mm long, gradually grading into the upper leaves that are almost completely sheathing, grading into the floral bracts; inflorescence cylindrical, generally dense with numerous flowers, 30–150 mm long; ovaries c. 10 mm long; bracts reaching to the top of the flowers, narrowly ovate, acuminate, the reticulate venation clearly visible on dried material. Flowers lime-green, occasionally with some maroon tinting or mottling on the petals or sepals, scent strong, soapy; dorsal sepal shallowly galeate, oblong, obtuse, somewhat curved forwards, 7–8 mm long; spur pendent from the base of the galea, slender, acute, longer than the galea, 10–20 mm long and c. 1 mm in diameter; lateral sepals oblong, rounded, 6–7 mm long; petals obliquely narrowly ovate to rarely narrowly oblong, apically obliquely retuse to rounded, the broad base of the petals enclosing the anther, the apex twisted to face forwards, 5–6 mm long; lip pendent, lorate to rarely narrowly oblanceolate, acute to rarely rounded, 4–6.5 mm long; anther semipendent, 1.5 mm long; rostellum simple, 1 mm tall; stigma simple, not as tall as the rostellum.

**Diagnostic features.** Flowers with the lateral sepals 6–7 mm long; spur 10–20 mm long, slender, acute; lip lorate; bracts with an obvious reticulate venation; leaves generally linear-lanceolate, erect, about 8.

Flowering time: November and December.

*Monadenia reticulata* occurs occasionally in seasonally damp places in the western Cape Province, often after fire, between sea level and 1 700 m. It also extends eastwards along the mountains to George (Fig. 13).

CAPE.—3318 (Cape Town): Table Mountain, 700 m (–CD), Dec. 1879, Bolus 4542 (BOL). 3320 (Montagu): Grootvadersbosch, Heidelberg (–DD), Dec. 1958, Barker 8838 (NBG). 3322 (Oudtshoorn): Montagu Pass, 600 m (–CD), Nov. 1894, Schlechter 5791 (BOL; Z).

This species has for some time been confused with *M. macrostachya* (Schlechter, 1901; Bolus, 1913), but it may be separated by the spur which is longer than the dorsal sepal, the laxer inflorescence and the narrower leaves. From the rest of the *Monadenia* species with slender spurs it is distinct by the papery bracts, which clearly display the venation in the dried state, the greenish flowers and the erect linear-lanceolate leaves.

The collections all appear to be from sandy soil derived from Table Mountain Sandstone. Most of the collections are from areas where at least some precipitation occurs in the summer months, even if only from cloud derived from south-east winds.

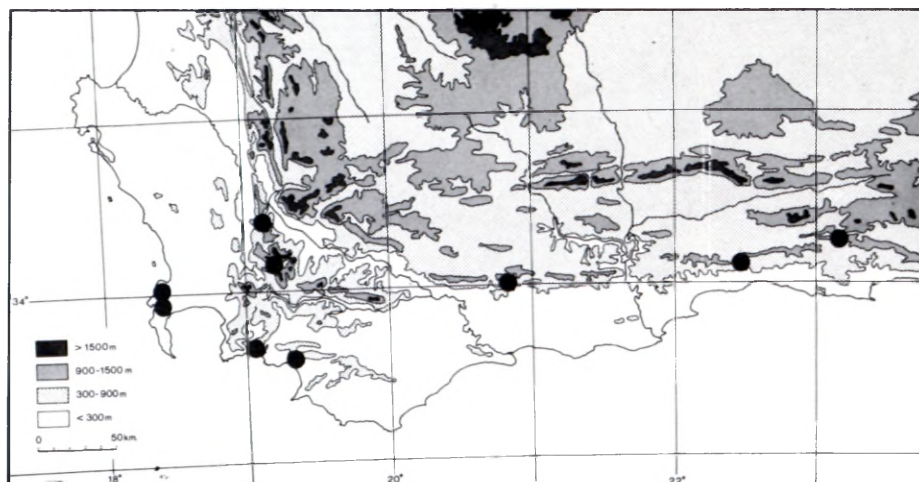
9. *Monadenia comosa* Reichb. f. in Linnaea 20: 687 (1847); Kraenzl., Orch. Gen. Sp. 1: 813 (1900); Rolfe in Fl. Cap. 5, 3: 194 (1913). Type: Cape of Good Hope, Gueinzus s.n. (W, holo.!).

*Disa comosa* (Reichb. f.) Schltr. in Bot. Jb. 31: 206 (1901); H. Bol., Icones Orch. Austro-Afr. 3: t. 43 (1913).

*Monadenia rufescens* Lindl., Gen. Sp. Orch. 356 (1838), non Thunb. *Disa affinis* N. E. Br. in Gdnrs' Chron. 24: 402 (1835), nom. nov. Lectotype: Cape Province, near Genadendal, Drège 1252 (K, holo.!).

Icon: H. Bol., Icones Orch. Austro-Afr. 3: t. 43 (1913), as *Disa comosa*.

Plants erect or subflexuose, 80–300 (–600 mm tall; tubers slender cylindrical, up to 50 mm long, basal sheaths hyaline, obtuse, 1–2; leaves variable the basal 2 (–3) elliptic to rarely narrowly elliptic, ob-

FIG. 13.—Distribution of *Monadenia reticulata*.

tuse, semi-erect, 30–70–120 (–170) mm long, the remaining leaves closely sheathing the stem, acute, lax to imbricate, similar to the floral bracts; inflorescence slender, usually lax, 40–150 mm long, with 1–20 flowers; ovaries erect, 15–20 mm long; bracts slightly shorter than the ovaries, narrowly ovate to rarely ovate, acute to acuminate, venation reticulate and visible. *Flowers* lime-green, occasionally tinted red; dorsal sepal erect to somewhat curved forwards, shallowly galeate, oblong, obtuse to rounded, 9–11 mm tall and c. 1 mm deep; spur pendent from the base of the galea, slender cylindrical, acute, addressed to the ovary, 17–24 mm long and c. 1.5 mm in diameter; lateral sepals patent to reflexed, obliquely oblong-ovate, obtuse, 6–7 mm long; petals obliquely ovate-narrowly oblong, obliquely retuse to emarginate, 6–8 mm long, the broad basal part enclosing the anther and the narrower apical part curved forwards; lip elliptic, decurved, obtuse to acute, subfleshy, 6–8 mm long; anther semipendent, 2 mm long; rostellum simple, 2 mm tall; stigma as tall as the rostellum. Fig. 14.

*Diagnostic features.* Spur slender, acute, 17–24 mm long; bracts with the venation visible; stigma as tall as the rostellum; petals lime-green; basal two leaves spreading, the remaining leaves closely sheathing the stem.

Flowering time: (September–) October (–November).

A widespread and often common green flowered orchid in rock crevices and on ledges (Fig. 15).

CAPE.—3319 (Worcester): Slab Peak, Michell's Pass (–BA), Oct. 1941, *Compton 11955* (NBG). 3318 (Cape Town): rock crevices on Table Mountain (–CD), Oct 1883, *MacOwan & Bolus 170* (BM: BOL; G; K; P; W; ZT). 3419 (Caledon): Kanonkop, above Greyton, 1500 m (–BA), Jan. 1964, *Oliver s.n.* (BOL). 3322 (Oudtshoorn): summit of Swartbergpas (–AC), Dec. 1977, *Linder 1740* (BOL).

Reichenbach described *M. comosa* from a Gueinzus collection. In the Reichenbach collection at Vienna there is a single specimen of *M. comosa* collected by Gueinzus, but it is labelled '*Monadenia rufescens*'. However, this annotation is not in Reichenbach's hand, and *M. rufescens* is the name that Lindley (1838) applied to this taxon. This sheet is likely to be the holotype.

Lindley mistook the identity of Thunberg's *Satyrion rufescens*, and described it as being: 'foliis radicalibus binis oblongis, caule vaginato', a character unique to *M. comosa*. Of the two collections cited by Lindley, one, *Drège 1252*, fits his description, and the other is referable to *Monadenia rufescens* (Thunb.) Lindl. in the correct sense.

Reichenbach proposed the name *M. comosa* for the species, but he did not refer to Lindley's work. The name is therefore not a *nomen novum*, and the type is the Gueinzus collection. In 1885 N. E. Brown proposed *Disa affinis* as a *nomen novum* for *M. rufescens* Lindl. non Thunb., apparently unaware of the identity of *M. comosa* Reichb. f. This confusion was resolved by Durand & Schinz (1894).

*Monadenia comosa* belongs to the group of species in *Monadenia* with long slender spurs. It may be separated from the other species in this group by the two or three large spreading narrowly ovate basal leaves, the dry papery floral bracts and the pale green flowers.

FIG. 14.—*Monadenia comosa*, from Esterhuysen 16200,  $\times 0.5$ .



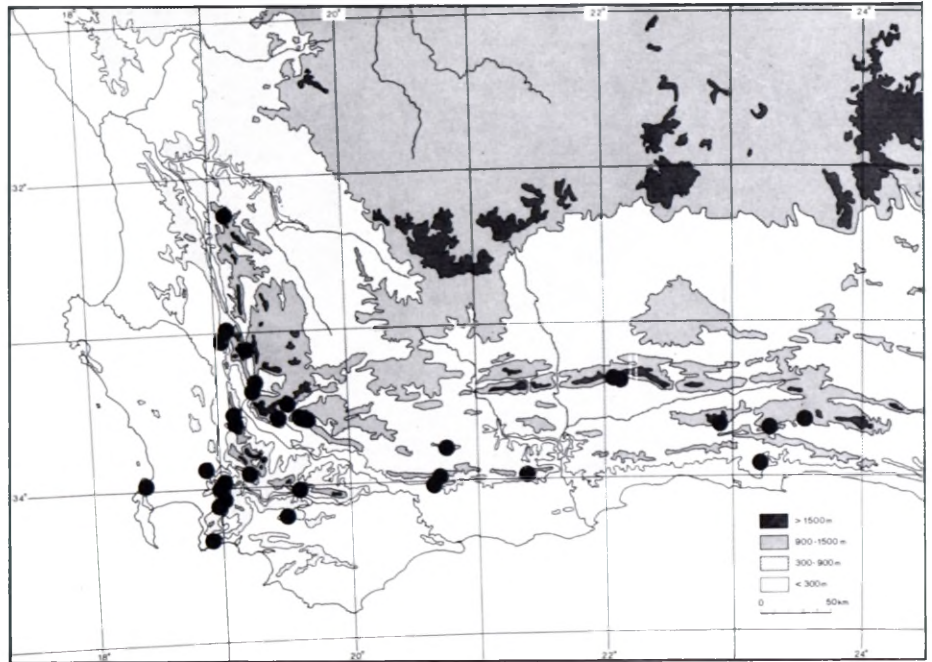


FIG. 15.—Distribution of *Monadenia comosa*

This species is widespread in the mountains of the western and southern Cape Province, where it occurs almost exclusively in crevices and on ledges on rocks and cliffs, often in half-shade. A few collections are from talus slopes e.g. *Linder* 1601. In general, populations consist of numerous individuals, often forming almost monospecific associations on rock ledges. On the summit of the Swartberg at Oudtshoorn, plants occur in gravelly soil (*Linder* 1740).

The altitude range of the species is from near sea level to 1 600 m, although the majority of the collections are from below 1 000 m. Rainfall over the distribution range varies considerably from an all-the-year rainfall in the Knysna area, to summer drought conditions in the western Cape area.

10. *Monadenia bolusiana* (*Schltr.*) *Rolfe* in Fl. Cap. 5,3: 194 (1913). Type: Cape Province, Cape Peninsula, Table Mountain, *Bodkin* in BOL 4903 (BOL, lecto.!: K!).

*Disa bolusiana* *Schltr.* in Bot. Jb. 24: 426 (1898); *Schltr.* in Bot. Jb. 31: 207 (1901).

Icon: H. Bol., *Icones Orch. Austro-Afr.* 2: t. 90 (1911).

Plants erect, (100–) 200–300 mm tall; basal sheaths hyaline, obtuse; leaves imbricate, the lower 2–5 narrowly oblong, acute, semi-erect, flat, the largest 50 (–70) mm long, grading gradually into the sheathing, narrowly ovate, acute upper leaves; inflorescence subimbricate, occasionally secund, 30–130 mm long and with 2–25 flowers; ovaries 15–20 mm long, erect; bracts about as long as the ovaries, narrowly ovate, acute, the reticulate venation usually visible. Flowers lime-green, occasionally tinted red; dorsal sepal erect, curved forwards, shallowly galeate, oblong, obtuse to rounded, 8–11 mm long and c. 1 mm deep; spur pendent from the base of the galea, slender, acute, 16–22 mm long and about 1 mm in diameter; lateral sepals reflexed, oblong, rounded, 6–8 mm long; petals obliquely ovate-narrowly oblong, obliquely emarginate, 6–8 mm long, the broad basal part enclosing the anther, the narrower apical part erect; lip patent or recurved,

elliptic, obtuse to acute, subfleshy, 5–7 mm long; anther semipendent, 1.5–2 mm long; rostellum erect, 1.5 mm tall; stigma as tall as rostellum. Fig. 16.

*Diagnostic features.* Spur slender, acute, 16–22 mm long; petals lime-green, stigma as tall as the rostellum; lower cauline leaves larger than the upper, but gradually grading into them; plants flowering in December and January.

Flowering time: (October–) December–January.

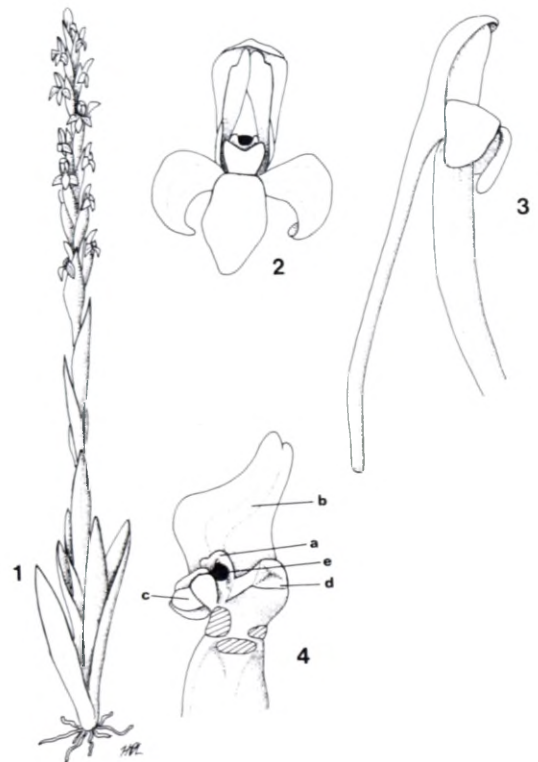


FIG. 16.—*Monadenia bolusiana*. 1, whole plant, from *Esterhuysen* 9780,  $\times 0.5$ . 2, flower in front view,  $\times 3$ . 3, flower in side view,  $\times 2$ . 4, dissection of flower; a, rostellum; b, petal; c, anther; d, stigma; e, viscidium,  $\times 5$ . 2–4 from *Linder* 1748.

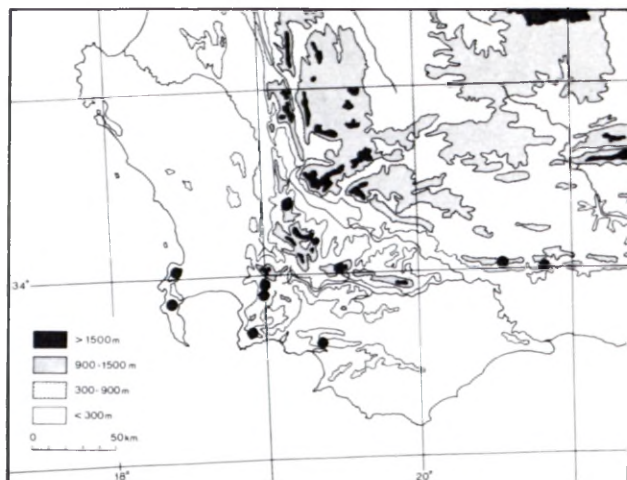


FIG. 17.—Distribution of *Monadenia bolusiana*.

*Monadenia bolusiana* is a small dark green to even purplish herb that occurs occasionally to frequently in exposed gravelly soil on the summit of the mountains in the western Cape Province (Fig. 17).

CAPE. — 3419 (Caledon). Betty's Bay, Harold Porter Nature Reserve, east slope of Voorberg, 200 m (—BD), Nov. 1970, *Eber-sonn* 151 (NBG). 3320 (Montague): Strawberry Hill (—DD), Dec. 1957, *Stokoe* in *CH* 9904 (NBG).

Schlechter (1898) cites three collections after his description of *Disa bolusiana*: *Zeyher* 1570 and *Bolus* 4903 from Maclear's Beacon on Table Mountain and *Schlechter* s.n. from the Langeberg above Zuurbraak near Swellendam. It is likely that these collections were in Schlechter's herbarium in Berlin that was destroyed in World War II. In BOL there is an excellent duplicate of *Bolus* 4903, and that is selected here as the lectotype. However, there are two collections under that number. The first one is a *Bodkin* collection, made in January 1883, while the second is a *Scully* collection, made in January 1884. The illustration for the *Icones* was made from the second collection, while Schlechter specified the first collection as the type ('*Bolus* n. 4903, bluehend im Januar 1883').

This species is closely allied to *Monadenia comosa* by virtue of the long slender spur, green flowers and papery bracts. It may be separated from this species by the numerous cauline leaves, the purplish colour of the plants and the flowering season (November to January).

*Monadenia bolusiana* occurs mostly in the full sunlight on the summit ridges of mountains, in shallow gravelly soils, often in footpaths and other disturbed areas. At present there are rather few herbarium records of this species, but this might be due to undercollecting in these more or less inaccessible localities. Fieldwork has revealed it to occur at least occasionally, and possibly even frequently and widespread, in the summit zones of the ridges. The altitudinal range of the species is from 200 m in the Betty's Bay area to over 1 200 m in the Langeberg and Hottentots Holland Mountains. Over the whole range there is a certain amount of moisture available in the summer months from condensation from the 'south-easter' clouds.

11. *Monadenia atrorubens* (Schltr.) Rolfe in Fl. Cap. 5, 3: 196 (1913). Type: Cape Province, Clanwilliam, Zwartboschkraal, *Schlechter* 5167 (B, holo. †; BOL!; Z!).

*Disa atrorubens* Schltr. in Bot. Jb. 24: 427 (1898); Schltr. in Bot. Jb. 31: 205 (1901).

*Monadenia ophrydea* Lindl. sensu Kraenzl., Orch. Gen. Sp. 1: 817 (1900), pro parte.

Plants 100–400 mm tall, suffused with beetroot-red; tubers 15–20 mm long, acute; basal sheaths hyaline, acute or obtuse, about 20 mm long, occasionally much longer; cauline leaves green, narrowly lanceolate to lanceolate, acute, the longest at the base, up to 90 mm long, semi-erect and sheathing at the base, upper leaves grading into the floral bracts, imbricate to subimbricate, acute; inflorescence slender, lax, (40–) 80–150 (–250) mm long and with (3–) 10–180 (–250) flowers; bracts green, lanceolate to narrowly ovate, acute, reaching the flowers or overtopping them; ovary slender, 15–20 mm long. Flowers horizontal, sepals and spur beetroot-red, lip and petals almost black; dorsal sepal narrowly oblong, obtuse, shallowly concave, 7–10 mm long, 3–4 mm wide and c. 1.5 mm deep; spur pendent from the base of the sepal, cylindrical, tapering to an acute apex, parallel to the ovary, 15–30 mm long; lateral sepals reflexed at anthesis, narrowly oblong, obtuse, 6–8 mm long; petals erect inside the galea, obliquely ovate, subacute, often shallow bidentate, fleshy apically and along the margins with papillae on the inside margin surface, 5–7 mm long and 3–5 mm wide; lip oblong to narrowly oblong, rounded, fleshy, horizontal basally but soon decurved, 5–7 (–8) mm long and 2–4 mm wide; rostellum erect, c. 1.5 mm tall with short lateral lobes flanking the caudicles; anther semipendent, 1–1.5 mm long, the single viscidium a large disc; stigma c. 2 mm in diameter, on a pedicel as tall as the rostellum and angled forwards. Fig. 18

**Diagnostic features.** Plants suffused with beetroot-red in fresh state, reddish brown when dry, spur slender, up to 30 mm long, lip oblong to narrowly oblong, lateral sepals purple to beetroot-red, reflexed.

Flowering time: August–October.

The plants, suffused with beetroot-red, form small populations in sandy areas, where they may be seen in flower the first year after a fire. (Fig. 19).

CAPE.—3119 (Calvinia): between Oorlogs Kloof and Papkuilsfontein. (—AC), Sept. 1939, *Leipoldt* 3236 (BOL). 3318 (Cape Town): Pella Mission, common on sandflats after fire (—DA), Sept. 1977, *Linder* 1140 (BOL).

This species appears to be restricted to sandy areas in the western Cape Province between Houw Hoek and Calvinia, from near sea level to about 1 000 m in the northern end of the distribution area. Two populations were studied in the field (*Linder* 1140 & 1129). Both flowered the first year after the fire, and occurred on slightly seasonally damp deep sand. The populations were clearly defined, and within the area the species occurred frequently. Among the burnt twigs and branches the purplish red plants were scarcely visible. Despite extensive field work in the western Cape, no plants were found in unburnt vegetation.

Over the whole distribution range the summers are dry, and in the winter 500–800 mm rain falls.

The differences between this species and *M. ophrydea* are discussed above.

12. *Monadenia ophrydea* Lindl., Gen. Sp. Orch. 358 (1838); Kraenzl. Orch. Gen. Sp. 1: 817 (1900); Rolfe in Fl. Cap. 5, 3: 195 (1913). Type: Cape Province, Paarl, Drakenstein Mountains, *Drège* 8290 (K, holo.!).



*Disa ophrydea* (Lindl.) H. Bol. in Trans. S. Afr. phil. Soc. 5: 142 (1888); Schltr. in Bot. Jb. 31: 204 (1901).

*Brownleea pentheriana* Kraenzl. ex Zahlbr. in Ann. Nat. Hofmus. Wien 20: 6 (1905). Type: Cape Province, Montagu Pass, *Penther* 189 (W, holo.).

Plants slender, up to 400 mm tall, suffused with beetroot-red tubers 10–20 mm long; basal sheaths 1–2, hyaline, obtuse or acute, 1 (–3) mm long; leaves green, narrowly lanceolate, acute, rarely obtuse, the largest near the base of the stem, up to 100 mm long and 20 mm wide, usually imbricate; inflorescence lax, up to 300 mm long with (1–) 5–15 (–30) flowers; bracts purplish-green, ovate to shortly acuminate, 20–40 mm long and 15–25 mm wide, generally as tall as the flowers; ovaries 20–25 mm long. *Flowers* horizontal, purple-red, the lateral sepals paler and often white; dorsal sepal oblong-obovate, shallowly galeate, rounded, 9–11 mm long, 5–7 mm wide and 1–2 mm deep; spur pendent from the base of the dorsal sepal, slender, tapering to an acute apex, slightly curved towards the ovary, 20–24 mm long; lateral sepals spreading, narrowly ovate, acute, rarely somewhat reflexed, much paler than the rest of the flower, 8–10 mm long; petals erect inside the galea, very obliquely ovate, acute with a shallowly emarginate apex, falcate in side view, somewhat curved around the rear of the anther, the apex and anterior margins fleshy; lip narrowly elliptical to almost lorate, subacute to acute, fleshy, pendent, 8–10 mm long; rostellum simple, flanking the caudicles, c. 3 mm tall; anther semipendent, c. 4 mm long, pollen-masses almost globular, viscidium almost globular, 0.8 mm in diameter; stigma equally tripulvinate, c. 1.5 mm in diameter, about  $\frac{1}{2}$  as tall as the rostellum. Fig. 18.

*Diagnostic features.* Plant suffused with a beetroot-red when fresh, reddish brown when dry, spur slender, up to 24 mm long, lateral sepals reddish and white, spreading, lip narrowly elliptical to lorate.

Flowering time: October and November.

A slender herb, suffused with beetroot-red, occurring usually in extensive populations in recently burnt veld on mountain sides, in damp conditions, in the western and southern Cape Province (Fig. 19).

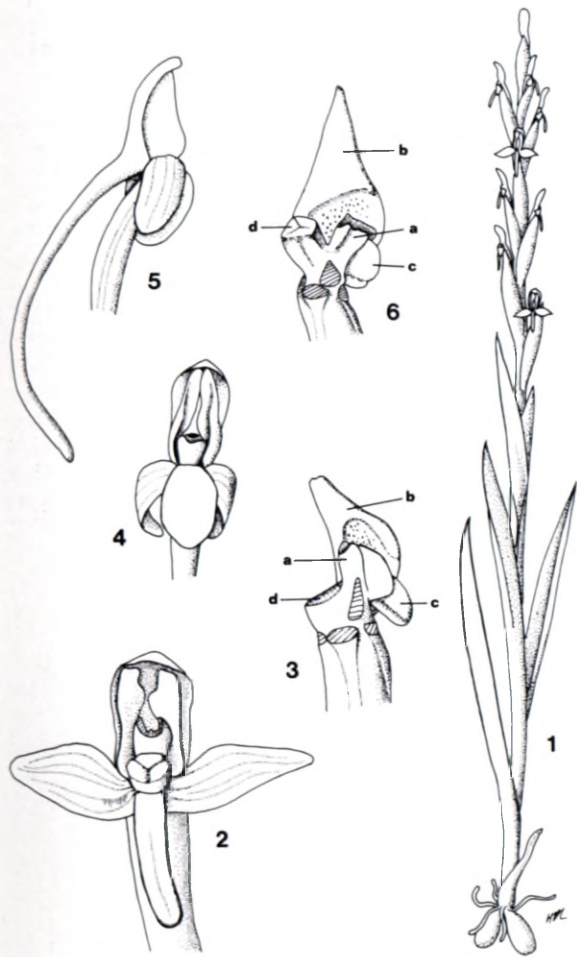


FIG. 18.—*Monadenia ophrydea* (1–3) and *M. atrorubens* (4–6). 1, plant of *M. ophrydea*, from Esterhuysen 10573,  $\times 0.5$ . 2, front view of flower,  $\times 3$ . 3, dissection of flower,  $\times 5$ . (2–3 from Linder 1596.) 4, front view of flower of *M. atrorubens*,  $\times 3$ . 5, side view of flower,  $\times 3$ . 6, dissection of flower,  $\times 5$ : a, rostellum; b, petal; c, anther; d, stigma. (4–6 from Linder 1129.)

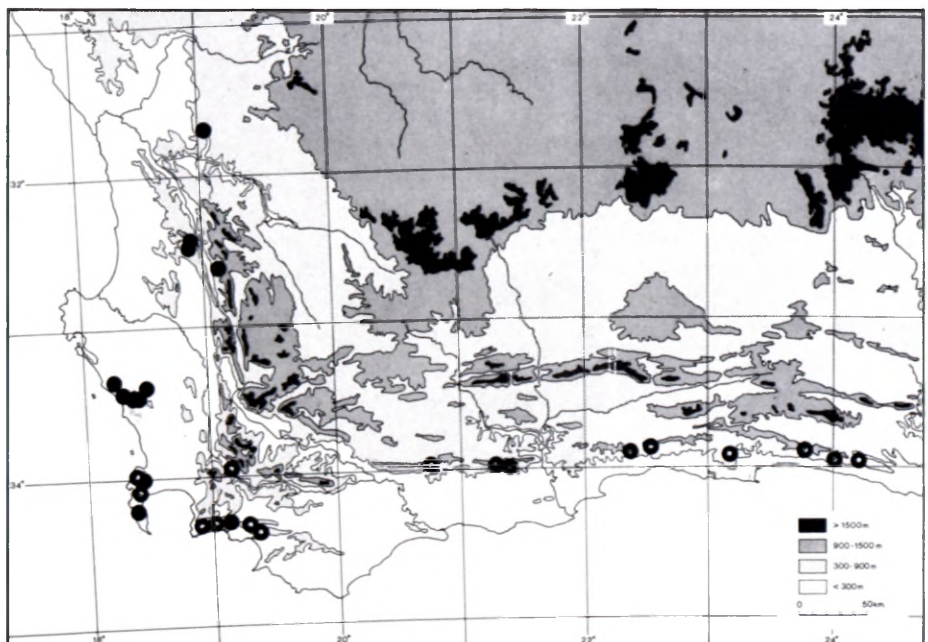


FIG. 19.—Distribution of *Monadenia atrorubens* (solid circles) and *Monadenia ophrydea* (open circles).

CAPE.—3318 (Cape Town): damp grassland on Table Mountain, 700 m (—CD), Oct. 1879, *Bolus 4538* (BOL). 3323 (Willowmore): Outeniqua Mountains near Joubertina (—DD), Dec. 1946, *Esterhuysen in BOL 23635* (BOL).

Several populations of this distinct species have been studied over the length of the distribution range. Generally the populations are extensive with numerous individuals, occurring on damp peaty mountain slopes facing the coast and consequently the rain-bearing winds. This species, as in *M. atrorubens*, appears to flower only after fire, when the beetroot-red plant colour is cryptic in the burnt-out vegetation. The altitude range is from near sea level in the Betty's Bay (Caledon) area to more commonly 300–1 000 m in the Langeberg and eastwards to Humansdorp. Over the whole distribution range, the species receives some precipitation throughout the year: in the east from the all-the-year rains and in the west from condensation or occasionally rain from the 'south-easter' clouds.

For the differences from *M. atrorubens*, see above.

**13. *Monadenia rufescens* (Thunb.) Lindl., Gen. Sp. Orch. 356 (1838); Kraenzl., Orch. Gen. Sp. 1: 818 (1900).** Type: Cape of Good Hope, *Thunberg* in herb. Thunberg 21456 (UPS; holo.!; W!).

*Satyrium rufescens* Thunb., Prod. 5 (1794). *Disa rufescens* (Thunb.) Swartz in Vet. Acad. Handl. 21: 210 (1800); Schltr. in Bot. Jb. 31: 209 (1901). *Monadenia lancifolia* Sond. in Linnaea 19: 100 (1847), nom. nov.

*Monadenia macrocera* Lindl., Gen. Sp. Orch. 358 (1838); Rolfe in Fl. Cap. 5, 3: 193 (1913). Type: Cape of Good Hope, *Thom s.n.* (K, holo.!).

*Monadenia leptostachya* Sond. in Linnaea 19: 101 (1847). Type: Cape Province, Cape Peninsula near Wynberg, *Ecklon & Zeyher s.n.* (S, holo.!; P!; W!).

Icon: H. Bol., Icones Orch. Austro-Afr. 2: t. 89 (1911).

Plants erect, 140–235–400 mm tall; tubers testicular, 20 mm in diameter; base of the stem often with the remnants of old leaf fibres; basal sheaths hyaline, grading into the leaves; leaves imbricate, the largest leaves near the base of the stem, narrowly lanceolate, to linear, acute, 50–70 mm long, conduplicate, gradually smaller and more sheathing towards the apex of the stem, grading into the floral bracts; inflorescence a slender spike, 30–150 mm long and 15 mm in diameter, with 2–25 flowers; ovaries 10–15 mm long; bracts usually slightly longer than the ovaries, narrowly ovate, acuminate, dark green, imbricate and partially obscuring the flowers. *Flowers* lime-green with dark purple petals and lip; dorsal sepal angled forwards, shallowly galeate, oblong, obtuse to rounded, 9–11 mm long and c. 1 mm deep; spur pendent from the base of the galea, slender cylindrical, acute, 10–16 mm long; lateral sepals erect or patent, oblong, obtuse, 6–8 mm long; petals obliquely narrowly oblong, obliquely truncate, wider at the base, subfleshy, concave, 6–7 mm long, the broad basal part enclosing the anther, the narrowly oblong apical part forming a tube with the dorsal sepal; lip decurved, narrowly oblong, obtuse, 6–7 mm long; anther semipendent, 1.5 mm long, viscidium elongated backwards with a longitudinal dorsal groove; rostellum c. 1 mm tall; stigma pedicellate, not as tall as the rostellum. Fig. 20.

**Diagnostic features.** Flowers with the lateral sepals 6–8 mm long, spur slender acute, 10–16 mm long; floral bracts prominent, green; leaves gradually grading from large at the base to sheathing at the apex; stigma lower than the rostellum.

Flowering time: (September–) October (–November).

*Monadenia rufescens* is a slender herb that occurs occasionally in seasonally damp localities in the western Cape Province, between sea level and 1 000 m (Fig. 21).

CAPE.—3318 (Cape Town): Lower Plateau of Table Mountain, 750 mm (—CD), Oct. 1884, *Bolus 4969* (BOL). 3418 (Simonstown): Vlakkenberg vlei, 600 m (—AB), Oct. 1947, *Compton 20180* (NBG). 3419 (Caledon): flats east of Viljoenspass (—AA), Sept. 1949, *Stokoe in SAM 61250* (SAM).

The nomenclatural history of this species is complex. The type of *Satyrium rufescens*, although not in a good condition, is clearly recognizable. However, Lindley (1838) misidentified *Satyrium rufescens* Thunb. ('I know no plant to which the definitions of Swartz and Thunberg exactly apply'). His description of *Monadenia rufescens* (Thunb.) Lindl. applies to *Drège 1252*, and must be referred to *M. comosa* Reichb. f. However, the combination *Monadenia rufescens* (Thunb.) Lindl. is valid, and has to be used for *M. rufescens* sensu Thunb. Ironically, the other

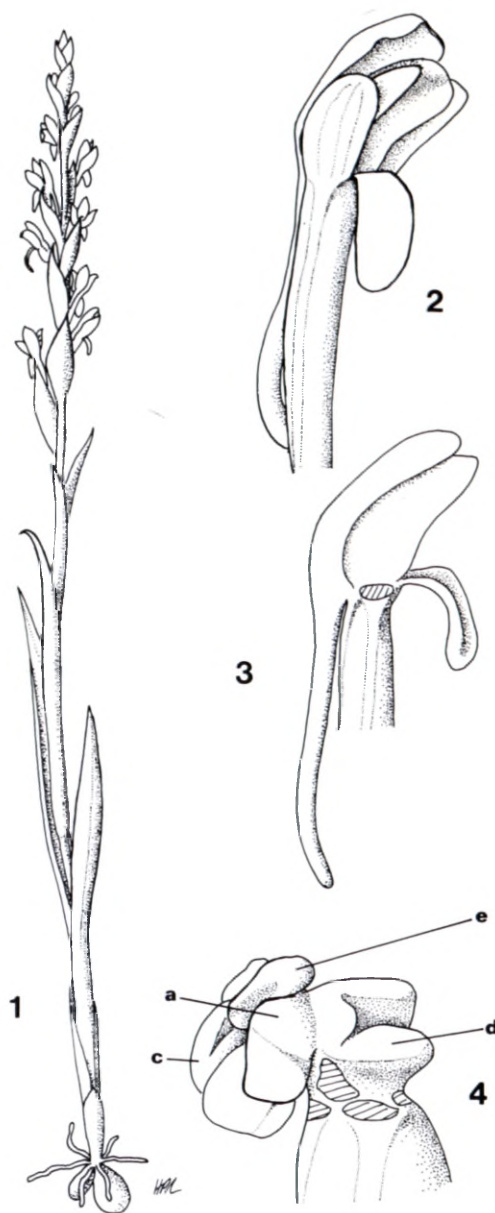
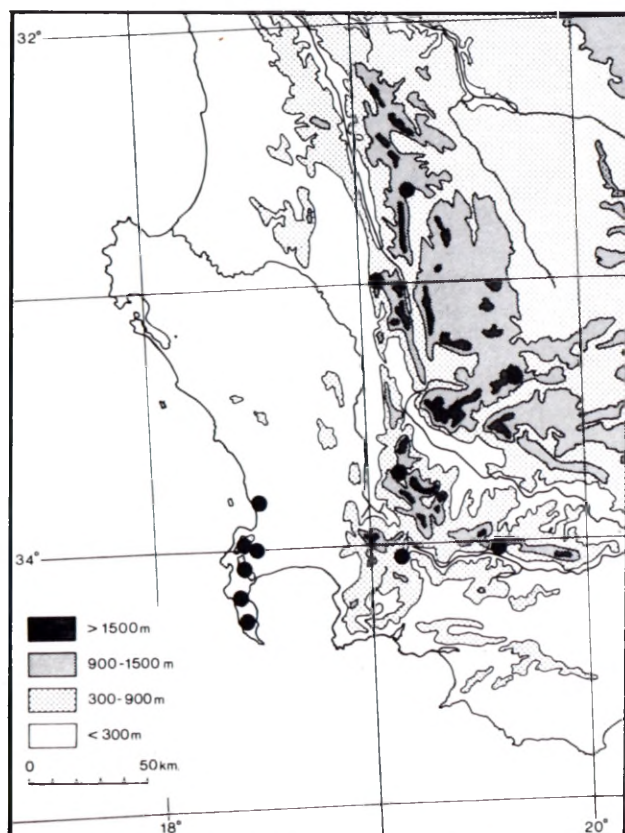


FIG. 20.—*Monadenia rufescens*. 1, whole plant, from *Salter 8479*,  $\times 0.5$ . 2, flower in angled front view,  $\times 3$ . 3, flower in side view with the lateral sepal removed,  $\times 3$ . 4, column,  $\times 10$ : a, rostellum; c, anther; d, stigma; e, viscidium. (2–4 from *Linder 1610*.)



FIG. 21.—Distribution of *Monadenia rufescens*.

collection cited by Lindley is clearly *Satyrium rufescens* Thunb. Sonder (1847) noted that *Monadenia rufescens* Lindl. is not the same as *Disa rufescens* (Thunb.) Swartz. He upheld the former, and proposed *Monadenia lancifolia* as a *nomen novum* for the latter. Lindley (1838) had also received a specimen of the true *Satyrium rufescens* Thunb., and named it *Monadenia macrocera* (1838). This name was used by Rolfe (1913), who followed the 'Kew Rule'. Sonder (1847) also proposed another name, *Monadenia leptostachya* for the species which he separated from *M. lancifolia* on several characters. Examination of the types indicated that these names all apply to the same taxon.

*Monadenia rufescens* is systematically relatively isolated within the group of slender long-spurred species of *Monadenia*. The dorsal sepal and petals are angled forwards and are applied to each other to form a tube leading over the rostellum into the spur. The rostellum is higher than the stigma and the single large viscidium is elongated backwards. Consequently it has a large surface exposed to the proboscis of an insect probing into the spur. The viscidium also has a longitudinal dorsal groove, which may also be related to this pollination syndrome. Further the species may be distinguished by the leathery bracts and the purple petals and lip.

Although *M. rufescens* is relatively widespread in the western Cape Province, it does not appear to be common at any locality and plants frequently appear to occur singly. The majority of collections are from slightly damp localities in a variety of habitats, ranging from dunes to rocky mountain sides at about 1 000 m. Although the distribution range covers an area of summer drought, many of the sampled localities must receive at least some moisture condensed from the 'south-easter' clouds.

This species is not well known, and more field data could cast some light on its ecological requirements.

### Sect. *Monadenia*

Spur longer or shorter than the dorsal sepal, clavate; flowers relatively large, sepals 7–14 mm long; inflorescence generally dense.

Type species: *Monadenia brevicornis* Lindl.

This section of three species is clearly defined by the swollen or clavate spurs, the larger flowers and the more robust plants. Only *M. brevicornis* approaches *M. reticulata* in some populations.

The three species replace each other geographically, with narrow overlap zones. *M. physodes* occurs between the Kamiesberg in Namaqualand and the Cape Peninsula. *M. cernua* extends from the Cape Peninsula to Humansdorp, whereas *M. brevicornis* is widespread in montane grasslands in southern Africa, reaching as far south-west as Knysna. Although the vast majority of the collections are readily distinguished on morphological features, there are some intermediate collections between *M. physodes* and *M. cernua* and between *M. brevicornis* and *M. reticulata*.

*M. physodes* and *M. cernua* are readily distinguished by the relative spur length (Fig. 22). However, some of the collections from the overlap zone on the Cape Peninsula are rather difficult to assign to one of the two species, whereas others do not present any difficulty (i.e. *Le Sueur* in BOL 4973). One of the intermediate collections is the type collection of *M. inflata* Sond. An analysis of several flowers from this collections indicated that it is best placed under *M. cernua*.

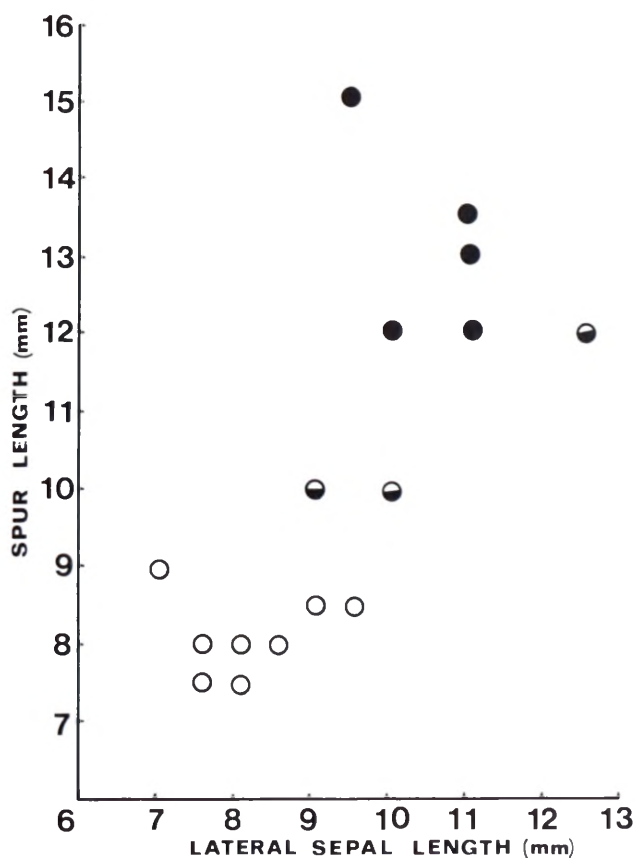


FIG. 22.—Variation in the relative spur length in *Monadenia physodes* and *M. cernua*. The solid circles represent *M. cernua* and the open circles *M. physodes*. The half-solid circles represent two collections from the Cape Peninsula that are intermediate between the two taxa, one of which is the type collection of *Monadenia inflata*.

There are no intermediate forms in the overlap zone between *M. cernua* and *M. brevicornis* — as though the morphological differences between the two taxa are accentuated in this area, with collections of *M. cernua* with longer spurs than is usually found in this species.

However, the southernmost populations of *M. brevicornis* approach *M. reticulata*. Generally these two taxa are separated by the wider and more robust cauline leaves and more inflated spurs of *M. brevicornis*. In collections from the Uniondale area (*Esterhuysen* 10692) the leaves are narrower, more clustered towards the base of the stem, and the spurs are more slender. A possible explanation is hybridization between these two taxa, with introgression into *M. brevicornis*.

**14. *Monadenia physodes* (Swartz) Reichb. f.** in *Flora* 66: 461 (1883); Rolfe in *Fl. Cap.* 5, 3: 191 (1913). Type: Cape of Good Hope, *Thunberg* in herb Thunberg 21455 (UPS, holo.).

*Disa physodes* Swartz in *Vet. Acad. Handl.* 21: 211 (1800); Thunb., *Fl. Cap.* 12 (1823); Lindl., *Gen. Sp. Orch.* 356 (1838); Kraenzl., *Orch. Gen. Sp.* 1: 788 (1900).

*D. cernua* (Thunb.) Swartz, *Schltr. in Bot. Jb.* 31: 210 (1901), pro parte.

Plants robust, 250–600 mm tall; tubers up to 40 mm long; basal sheaths hyaline, obtuse, 1–2; leaves linear-lanceolate, acute, conduplicate, falcately erect, the longest at the base, 140–200 mm long and c. 20 mm wide, grading apically into the foral bracts; inflorescence cylindrical, 50–300 mm long and 30–40 mm in diameter, flowers subimbricate; ovaries c. 15 mm long; bracts as long as the flowers, narrowly ovate, acuminate. *Flowers* with lime-green sepals, often mottled or suffused maroon, petals lime-green; dorsal sepal shallowly galeate, oblong, obtuse erect, 9–11 mm tall and c. 1 mm deep; spur pendent from the base of the galea, clavate, rounded, 7–9 mm long and 3–6 mm wide, adpressed to the ovary; lateral sepals reflexed, oblong, obtuse to rarely acute, 7–10 mm long; petals obliquely narrowly ovate-oblong, bluntly acuminate or obliquely retuse, 7–9 mm long, the broad basal part enclosing the anther and the narrower apical part twisted to face out of the galea; lip pendent, lorate to narrowly oblanceolate, rounded,

7–10 mm long; anther semipendent, 2 mm long; rostellum lateral lobes large, flanking the anther, 2 mm tall, stigma on a 1 mm tall pedicel, horizontal, lateral lobes much larger than the central lobe.

**Diagnostic features.** Flowers with the lateral sepals 7–10 mm long; spur clavate, rounded, 7–9 mm long, rostellum up to 2 mm tall.

Flowering time: September–October.

This robust herb occurs in the western Cape Province, mostly in swampy localities, but at least one record is from a dry slope after a fire (Fig. 23).

CAPE.—3018 (Kamiesberg): Leliefontein, Little Namaqualand (–AB), Oct. 1940, *Leipoldt* 3809 (BOL). 3318 (Cape Town): about 6 km north of Malmesbury (–BC), Oct. 1964, *Rabinowitz* in NBG 77143 (NBG); lower slopes of Lions Head near Sea Point, 80 m (–CD), Sept. 1884, *Le Sueur* in BOL 4973 (BOL).

Thunberg (1794) regarded this species as synonymous with *M. cernua*, as he cites both in his protologue. *M. physodes* was only separated by Swartz in 1800. In general, the distinction between the two taxa has been recognized, except for Schlechter (1901), who regarded *M. physodes* merely as a smaller form of *M. cernua*.

This species is unique because of its strongly clavate spur which is shorter than the dorsal sepal. It is clearly allied to *M. cernua*, but may readily be distinguished by the relatively short spur and the peculiar rostellum with massive lateral lobes flanking the anther.

I have not seen any populations of this peculiar species in the wild, and collectors notes do not indicate the habitat. Oliver (*Oliver* 4761) reports that near Ceres the species flowered in sandy stony flats after a fire.

The altitude range of the species is from near sea level at Sea Point, to over 1 000 m in some inland localities. Many of the localities of herbarium collections are now disturbed, and the number of populations of the species must be much reduced from that of a century ago. The distribution range of the species falls in an area of summer drought and total rainfall values of 500–800 mm p.a.

There are two records of an unpleasant mouse-like scent.

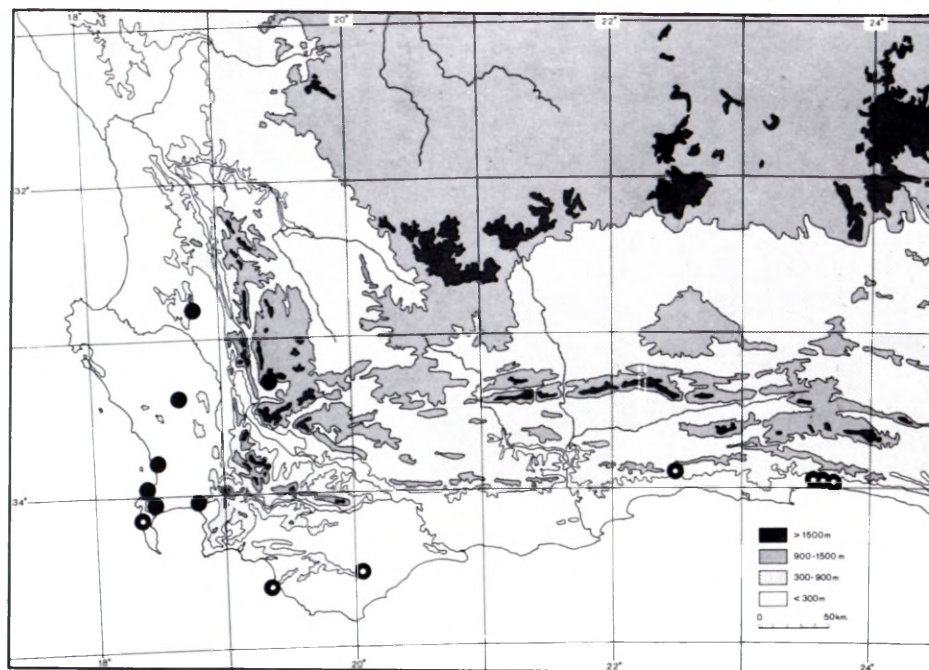


FIG. 23.—Distribution of *Monadenia physodes* (solid circles) *Monadenia cernua* (open circles).



15. *Monadenia cernua* (Thunb.) Dur & Schinz, Consp. Fl. Afr. 5: 111 (1894); Kraenzl., Orch. Gen. Sp. 1: 815 (1900); Rolfe in Fl. Cap. 5, 3: 192 (1913). Type: Cape of Good Hope, *Thunberg* in herb. Thunberg 21431, 21432 (lecto.), 21433 (all UPS!).

*Satyrium cernuum* Thunb., Prodr. Pl. Cap. 5 (1794). *Disa cernua* (Thunb.) Swartz in Vet. Acad. Handl. 21: 211 (1800); Thunb., Fl. Cap. 12 (1823); Lindl., Gen. Sp. Orch. 356 (1838); Schltr. in Bot Jb. 31: 210 (1901), excl. *M. physodes*.

*Disa prasinata* Ker-Gawl. in Edwards's bot. Reg. t. 210 (1817). *Monadenia prasinata* (Ker-Gawl.) Lindl., Gen. Sp. Orch. 358 (1838). Type: Edwards's bot. Reg. t. 210 (1817), iconotype.

*Monadenia inflata* Sond. in Linnaea 19: 102 (1847). Type: Cape Province, Cape Peninsula near Wynberg, *Ecklon & Zeyher* s.n. (S, holo.; BOL.; K!; P!; SAM!; W!; Z!).

Icones: Edwards's bot. Reg. t. 210 (1817); H. Bol., Icones Orch. Austro-Afr. 2: t. 91 (1911), as *Disa cernua*.

Plants robust, 200–600 mm tall; basal sheaths hyaline, obtuse, 1–2; leaves linear-lanceolate, acute, conduplicate, imbricate, the largest at the base, (100–) 140–200 mm long and 15–20 mm wide, grading apically into the floral bracts; inflorescence 100–250 mm long and 30–40 mm in diameter, flowers subimbricate; ovaries c. 15 mm long; bracts as tall as the flowers, narrowly ovate, subacuminate. Flowers with cream-green sepals, mottled maroon, and lime-green petals and lip; dorsal sepal shallowly galeate, slightly angled forwards, oblong, obtuse, 10–14 mm long and c. 1 mm deep; spur pendent from the base of the galea, clavate, rounded, 11–17 mm long and 3–5 mm wide, adpressed to the ovary; lateral sepals reflexed, narrowly oblong to oblong, acute to obtuse, 9–13 mm long; petals subobliquely narrowly ovate-oblong, bluntly acuminate to obliquely retuse, 7–10 mm long, the broad basal part flanking the anther and the narrow apical part twisted to face out of the galea; lip pendent lorate, rounded, subfleshy, 8–12 mm long; anther subhorizontal, 3 mm long; rostellum with 2–3 mm tall lateral lobes flanking the anterior part of the anther; stigma on a 1 mm tall pedicel, slightly angled forwards, flat, lateral lobes larger than the posterior lobe. Fig. 24.

**Diagnostic features.** Flowers with the lateral sepals 9–13 mm long; spur clavate, rounded, 11–17 mm long; rostellum with 2–3 mm tall side lobes.

Flowering time: (September–) October (–November).

*Monadenia cernua* is a tall robust herb that occurs in damp to swampy habitats in the western and southern Cape Province, (Fig. 23) on the flats between the mountains and the sea, from the Cape Peninsula to Humansdorp.

CAPE.—3318 (Cape Town): Rietvalley (–DC), Oct. *Zeyher* 1569 (SAM). 3322 (Oudtshoorn): Montagu Pass, George, 400 m (–CD), Oct. 1880, *Young* in BOL 5534 (BOL). 3323 (Willowmore): between Keurbooms River and Storms River (–CD), Oct. 1938, *Gillet* 4565 (BOL).

*Satyrium cernuum* Thunb. was based on a mixed type; The discordant element was removed by Swartz and described as *Disa physodes* (1800).

In 1817 Ker-Gawler described *Disa prasinata* from a plant imported from South Africa by a Mr Griffin, who successfully flowered it. The plate in Edwards's Botanical Register has to serve as an iconotype, as no other type material is available. From the illustration it is difficult to decide whether the plant belongs to *M. physodes* or *M. cernua*, but the spur appears to be slightly longer than the dorsal sepal, a character also found in a *Ecklon & Zeyher* collection from Rietvlei

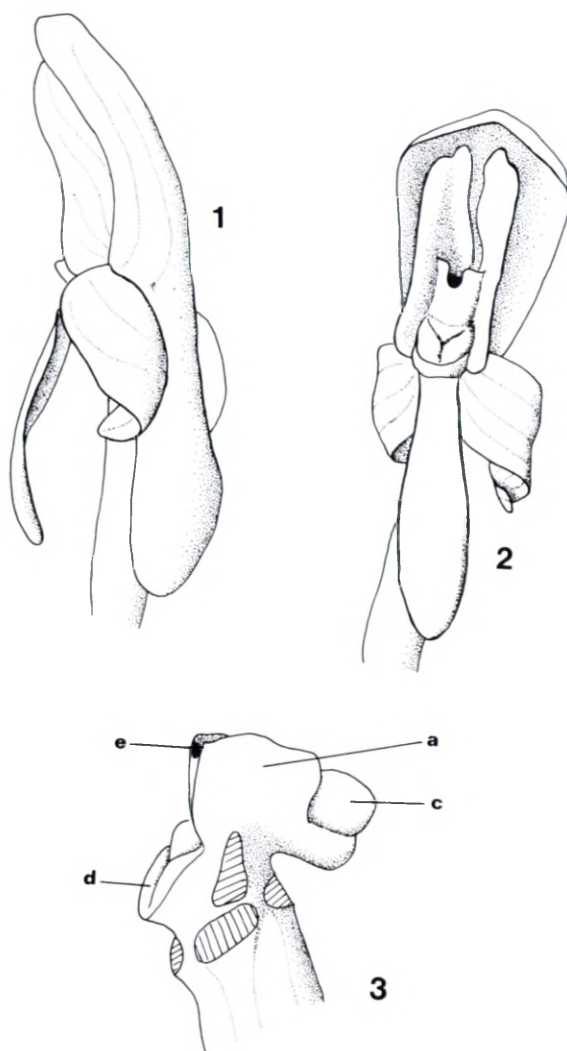


FIG. 24.—*Monadenia cernua*. 1, flower in side view,  $\times 3$ . 2, flower in front view,  $\times 3$ . 3, column in side view,  $\times 6$ : a, rostellum; c, anther; d, stigma; e, viscidium. All from *Walters* 536.

near Cape Town. This collection is grouped with *M. cernua*. *Disa prasinata* is therefore regarded as a synonym of *M. cernua*. The type of *Monadenia inflata* Sond. agrees in all characters with *M. cernua*.

This species is closely related to both *M. brevicornis* and *M. physodes*, and to some extent present a morphocline between these two taxa. It may be distinguished from the former by the rounded to obtuse spur, which is straight and not curved towards the ovary, and from the latter by the spur which is longer than the lateral sepal (Fig. 22).

The single population of this species which I studied in the field occurred on the Tsitsikamma coast, in a marshy area along the National Road. In this part of the country there are very few natural habitats still extant. Collectors' notes from the Bredasdorp area indicate that *M. cernua* occurs in damp sandy habitats. No further habitat data are available. One collection from Tsitsikamma (*Bower* 600) was found after fire.

The altitude range of the species is from near sea level at Cape Town, to more commonly between 100 and 300 m above sea level on the coastal flats. The majority of the populations must have been destroyed, as most of the area is under fairly intense cultivation, and in the Knysna area, afforested. Over the whole distribution range at least some summer rainfall occurs. The total rainfall varies from about 600 mm to over 1 000 mm p.a.

16. *Monadenia brevicornis* Lindl., Gen. Sp. Orch. 357 (1838); Kraenzl., Orch. Gen. Sp. 1: 816 (1900); Rolfe in Fl. Cap 5, 3: 192 (1913). Type: Cape of Good Hope, *Mund* s.n. (K, holo.).

*Disa brevicornis* (Lindl.) H. Bol. in J. Linn. Soc., Bot. 25: 196 (1889); Schltr. in Bot. Jb. 31: 211 (1901).

Icon: H. Bol., Icones Orch. Austro-Afr. 3: t. 40b (1911).

Plants 200–500 mm tall; tubers up to 50 mm long; leaves narrowly lanceolate to rarely narrowly ovate, acute, numerous, imbricate, the largest near the base, up to 150 mm long and grading apically into the floral bracts; inflorescence a lax or cylindrical spike, 40–300 mm tall; ovaries 10–15 mm long, more or less erect; bracts as tall as or overtopping the flowers, narrowly ovate to ovate, acuminate. *Flowers* with lime-green petals and lip, lip with a maroon base, lateral sepals green, dorsal sepal rust-coloured to maroon; dorsal sepal erect, shallowly galeate, obtuse to rounded, apiculate, narrowly obovate to oblong, 7–10 mm tall and c. 1 mm deep; spur pendent with the apex curved towards the ovary, cylindrical, 2–3 mm in diameter and 7–11 mm long; lateral sepals reflexed, oblong, obtuse, apiculate, 5–9 mm long; petals obliquely narrowly ovate to oblong, obliquely retuse, erect and twisted to face forwards, 5–9 mm tall; lip pendent, narrowly oblong, obtuse, 6–8 mm long; anther semipendent, 1.5–2 mm long; rostellum partially flanking the anther with a deep notch to the front containing the viscidium, 1–2 mm tall; stigma with the rear lobe smaller than the lateral lobes shortly pedicellate, horizontal. Fig. 25.

*Diagnostic features.* Flowers large, lateral sepals 5–9 mm long; spur cylindrical, acute, the apex curved towards the ovary, 7–11 mm long and 2–3 mm in diameter.

Flowering time: November–February.

*Monadenia brevicornis* is a slender herbaceous orchid, that occurs frequently in montane grassland from the southern Cape Province to southern Malawi and Madagascar (Fig. 26).

CAPE.—3423 (Kynsna): The Crag, Knysna (–AA), Nov. 1949, *Compton* 21729 (NBG).

TRANSKEI.—3129 (Port St Johns): Port St Johns (–DA), Oct. 1939, *McLoughlin* 403 (BOL).

NATAL.—2930 (Pietermaritzburg): escarpment above the Byrnes valley (–CC), Nov. 1975, *Hilliard* 5583 (NU).

ZIMBABWE.—Inyanga, Bidford Estate, 1 800 m, March 1958, *Beasley* 64 (K; SRGH).

This species is closely allied to *M. cernua*, from which it may be distinguished by the acute spur. From the rest of the genus, the species is distinct, because of its inflated spur, longer than the dorsal sepal, and its distribution in the summer rainfall/winter drought region.

*M. brevicornis* occurs very widespread in the montane grassland regions of southern Africa. Generally plants are found in slightly damp areas in the grassland. The altitudinal range varies from near the coast in the southern Cape Province (where some populations occur in Cape 'Fynbos' in the Humansdorp, Grahamstown and King William's Town areas), to between 1 300 and 2 700 m in Natal and northwards to Malawi. In this region the rainfall of about 800–1 200 mm p.a. occurs almost totally in the summer months, whereas the higher altitudes receive snow in the winter months (White, 1978). Populations tend to be extensive and sparse.

Although the species appears to be relatively common in South Africa and Zimbabwe, there is only a single collection known from Malawi (Mt Mlanje) and from Madagascar.

As at least Mt Mlanje in Malawi has been floristically well investigated by various botanists, the species has to be accepted as being rare in that country.

A sweet scent has occasionally been recorded.

#### PUTATIVE HYBRIDS

##### *Monadenia atrorubens* × *sabulosa*

*Linder* 1510 consists of a single plant found at Betty's Bay in the western Cape, growing between populations of both putative parents. The specimen is intermediate for all characters between the two parents.

#### EXCLUDED SPECIES

*Monadenia leydenburgensis* Kraenzl., Orch. Gen. Sp. 1: 811 (1900); Rolfe in Fl. Cap. 5, 3: 189 (1913). Type: Transvaal, Lydenburg, along the Crocodile

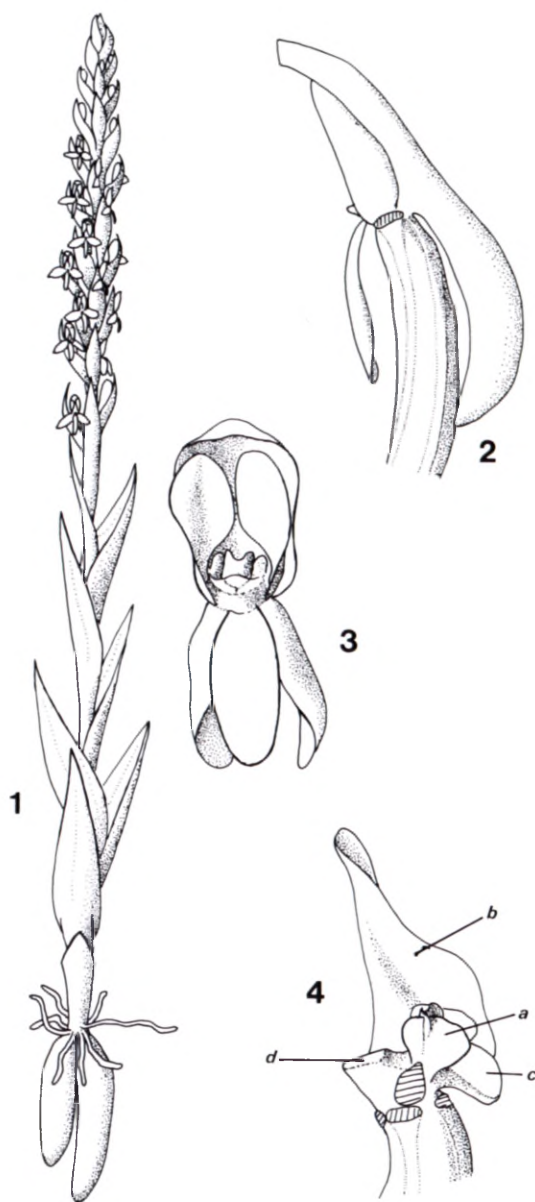
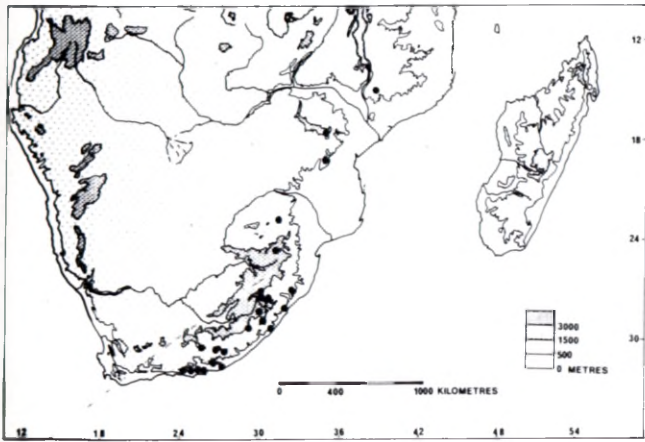


FIG. 25.—*Monadenia brevicornis*. 1, whole plant,  $\times 0.5$ . 2, flower in side view with one sepal removed,  $\times 3$ . 3, flower in front view,  $\times 3$ . 4, dissection of flower,  $\times 6$ : a, rostellum; b, petal; c, anther; d, stigma. All from *McLoughlin* 42.



FIG. 26.—Distribution of *Monadenia brevicornis*.

River, Wilms 1864 (Z, holo.!; BM!; K!) = *Disa stachyoides* Reichb. f. in *Flora* 64: 328 (1881).

*Monadenia basutorum* (Schltr.) Rolfe in *Fl.* Cap 5, 3: 196 (1913), based on *Disa basutorum* Schltr. in *Bot. Jb.* 20, 50: 17 (1895). Type: Natal, Drakensberg summit, Thode s.n. (K, iso.!) = *Disa basutorum* Schltr.

*Monadenia junodiana* Kraenzl. in *Vierteljahrschr. Nat. Ges. Zürich* 74: 108 (1929). Type: Transvaal, Mamotsuri, Junod 1208 (Z, holo.!) = *Disa fragrans* Schltr. in *Bot. Jb.* 20, 50: 40 (1895).

## ACKNOWLEDGEMENTS

I would like to thank the numerous people with whom I discussed this work, especially my supervisor, Prof. E. A. Schelpe. I am grateful to the directors and curators of the various herbaria where I was provided with working facilities, or who loaned material for study purposes. This research was done while holding a Smuts Fellowship and a CSIR post-graduate bursary.

## UITTREKSEL

Die genus *Monadenia* (*Disinae*, *Orchidaceae*) word hersien. Sestien spesies, in vier seksies verdeel, word erken. Die verspreiding van elke spesie word afgebaan en twee spesies word geïllustreer. 'n Hipotese oor die filogenetiese verwantskappe van die spesies word aangebied.

## REFERENCES

- BENTHAM, G. & HOOKER, J. D., 1883. *Genera Plantarum* III. London.
- BOLUS, H., 1888. The orchids of the Cape Peninsula. *Trans. S. Afr. phil. Soc.* 5: 1–201.
- BOLUS, H., 1889. Contributions to South African botany, part IV. *J. Linn. Soc., Bot.* 25: 156–209.
- BOLUS, H., 1893. *Icones Orchidearum Austro-Africanarum* I, part 1. London: Wesley.
- BOLUS, H., 1896. *Icones Orchidearum Austro-Africanarum* I, part 2. London: Wesley.
- BOLUS, H., 1911. *Icones Orchidearum Austro-Africanarum* II. London: Wesley.
- BOLUS, H., 1913. *Icones Orchidearum Austro-Africanarum* III. London: Wesley.
- BURDET, H. M., 1978. *Cartulae ad botanicorum graphicem* XIII. *Candollea* 33: 365–405.
- BROWN, N. E., 1815. Terrestrial orchids of South Africa. *Gdnrs' Chron.* 24: 402–404.
- BROWN, N. E., 1818. *Disa bracteata*. *Edwards's bot. Reg.* 4: t. 324.
- DURAND, T. & SCHINZ, H., 1894. *Conspectus Florae Africae* V. Bruxelles: Charles van de Weghe.
- DYER, R. A., 1976. *The genera of southern African flowering plants. II. Gymnosperms and monocotyledons*. Pretoria: Botanical Research Institute.
- ERIKSON, R., 1965. *Orchids of the West*.
- GOLDBLATT, P., 1978. An analysis of the flora of southern Africa: its characteristics, relationships, and origins. *Ann. Mo. bot. Gdn* 65: 369–436.
- HOLMGREN, P. K. & KEUKEN, W., 1974. *Index Herbariorum, part 1. The herbaria of the world*. Utrecht: Oosthoek, Scheltema & Holkema.
- KER, J. B., 1817. Of the three species of the natural order Orchideae. *Q. Jl Sci. Arts* 4: 199–206.
- KRAENZLIN, F., 1900. *Orchidacearum Genera et Species*. Vol. 1, part 13. Berlin: Mayer & Mueller.
- LEWIS, G. J., 1948. *Plantae novae africanae*. *Jl S. Afr. Bot.* 14: 31.
- LEWIS, G. J., 1950. Orchidaceae. In Adamson, R. S. & Salter, T. M. (eds) *Flora of the Cape Peninsula*. Cape Town: Juta.
- LINDER, H. P., 1981a. Taxonomic studies in the Disinae. IV. A revision of *Disa* Berg. sect. *Micranthae* Lindl. In preparation.
- LINDER, H. P., 1981b. Taxonomic studies in the Disinae. VI. A revision of *Herschelia* Lindl. *Bothalia* 13: 000–000.
- LINDLEY, J., 1838. *The genera and species of orchidaceous plants*. London: Ridgways.
- PHITZER, E., 1889. Orchidaceae. In Engler, A. & Prantl, K. (eds) *Die Natürlichen Pflanzenfamilien* 2.6 Leipzig: Engelmann.
- PHILLIPS, E. P., 1926. The genera of South African flowering plants. *Mem. bot. Surv. S. Afr.* 10.
- POCOCK, M. R., 1972. *Ground orchids of Australia*.
- REICHENBACH, H. G., 1847. *Orchidiographische Beiträge*. *Linnaea* 20: 673–696.
- REICHENBACH, H. G., 1883. Die Orchideen des Herbars Thunbergs. *Flora* 66: 459–463.
- ROLFE, R. A., 1913. Orchidaceae. In Thistelton-Dyer, W. T. (ed.) *Flora Capensis* 5, 3. London: Reeve.
- ROURKE, J. P., 1972. Taxonomic studies on *Leucospermum* R. Br. *Jl S. Afr. Bot. Suppl.* Vol. 8.
- RUPP, H. M. R., 1946. Two new orchids from western Australia. *Australian Orchid Review* 11: 70.
- SCHELPE, E. A., 1966. *An introduction to the South African orchids*. Cape Town: Purnell.
- SCHLECHTER, R., 1898. *Orchidaceae africanae novae vel minus cognitae*. *Bot. Jb.* 24: 418–433.
- SCHLECHTER, R., 1901. *Monographie der Discae*. *Bot. Jb.* 31: 134–313.
- SCHLECHTER, R., 1924. Contributions to South African Orchidology. *Ann. Transv. Mus.* 10: 233–252.
- SENGHAS, K., 1973. Orchidoideae. In R. Schlechter (ed.), *Die Orchideen*, ed. 3. Paul Parey.
- SONDER, G., 1847. Enumeratio Orchideatum, quas in Africa Australi Extra-tropicum collegerunt C. F. Ecklon, Dr, et C. Zeyher. *Linnaea* 19: 71–112.
- STAFLEU, F. A., et al., 1978. *International code of botanical nomenclature*. Utrecht: Bohn, Scheltema & Holkema.
- SWARTZ, O., 1800. *Orchidemes slagter och arter upstallde*. *Kongliga Vetenskaps Academi Handlinger, Stockholm* 31: 202–254.
- TAYLOR, H. C., 1978. Capensis. In Werger, M. J. A. (ed.) *Biogeography and ecology of southern Africa*. The Hague: Junk.
- THUNBERG, C. P., 1794. *Prodromus Plantarum Capensium*. Upsala.
- THUNBERG, C. P., 1823. *Flora Capensis*. ed. J. A. Schultes. Stuttgart: G. B. Schultes.
- WHITE, F., 1978. The afro-montane Region. In Werger, M. J. A. (ed.) *Biogeography and ecology of southern Africa*. The Hague: Junk.

## APPENDIX: SPECIMENS STUDIED

The specimens are listed alphabetically according to the name of the collector. The figures in brackets refer to the number of the taxon in the text. Herbaria from which each collection has been studied are indicated by the letter codes of Holmgren & Keuken (1974). Two taxon numbers connected by a dash, e.g. (3–4), indicates that the collection is a hybrid between the two species.

Acoks 1030 (5) S; 5318 (5) S; 19866 (5) PRE; 22797 (15) PRE; 23499 (5) PRE. Adamson 438 (16) K; in SAM 52937 (12) SAM. Alexander s.n. (5) K. Andreae 27 (6) PRE; sub Marloth 645 (9) PRE. Atherstone 25 (16) K.

Ball 550 (16) K; 568 (16) K. Barber 445 (16) K. Barker 328 (14) NBG; 1622 (5) NBG; 3398 (13) NBG; 3892 (5) NBG; 3893 (6) NBG; 3925 (2) NBG; 4172 (5) NBG; 8838 (8) NBG. Beasley 64 (16) K. Begley 8 (10) SAM. Boardman 49 (16) BOL; 262 (16) PRE. Bodkin in BOL 4903 (10) BOL; 4970 (4) BOL, G. PRE, SAM, Z; 4988 (8) BOL, K; 6231 (2) BOL. Bohnen 1066 (5) PRE. Bolus 3859 (5) BM, BOL, K, Z; 4336 (14) K; 4538 (12) BM, BOL, K, Z; 4542 (8) BOL; 4551 (13) BM, BOL, K, PRE, Z; 4555 (9) BM, BOL, K, SAM, Z; 4885 (6) BOL, K, PRE, Z; 4897 (8) BOL, K; 4969 (13)



BOL, K, Z; 4973 (14) PRE; 6862 (6) Z; 7104 (3) BOL, SAM; 7317 (16) BOL, G, Z; 9938 (11) BOL; 11646 (9) BOL; 13504 (4) BOL; 13505 (6) BOL; *sub Guthrie* 1080 (3) BOL; s.n. (5) BOL; s.n. (5) BOL; s.n. (8) BOL; s.n. (9) BOL; s.n. (11) BOL; s.n. (13) BOL. *Bond* 115 (9) NBG; 1206 (9) NBG. *Boucher* 699 (5) STE; 829 (12) STE; 1642 (12) STE; 1946 (9) STE; 2422 (5) PRE, STE. *Bower* 600 (15) PRE. *Boyle* 25 (16) K. *Buchanan* s.n. (16) K, W. *Burchell* 4015 (5) K; 6139 (5) K; 7321 (9) K.

*Calder* in SRGH 46276 (16) K. *Cassidy* 22 (5) NBG. *Cloete* in CH 66620 (13) NBG. *Codd* 2716 (16) K, PRE. *Coleman* 521 (16) PRE. *Compton* 4154 (9) BOL, NBG; 4507 (12) BOL, NBG; 4700 (13) BOL; 9756 (9) NBG; 9759 (9) NBG; 11928 (5) NBG; 11955 (9) NBG; 11993 (5) NBG; 16244 (9) NBG; 16446 (12) NBG; 17486 (6) NBG; 17496 (9) NBG; 18545 (9) NBG; 18609 (9) NBG; 18572 (5) NBG; 19411 (6) NBG; 20090 (5) NBG; 20180 (13) NBG; 20221 (5) NBG; 21729 (16) BOL, NBG; 23670 (5) NBG. *Cutting* s.n. (5) BOL.

*Davis & Stokoe* in SAM 49539 (9) PRE. *Daly* s.n. (5) PRE. *Dekenal* in CH 57315 (12) NBG. *Devenish* 813 (16) PRE; 1376 (16) PRE. *De Villiers* in NBG 1910/30 (12) BOL; s.n. (5) STE. *Doidge* 4802 (16) K. *Drège* 1252a (9) BM, G, K, P, S; 1252b (9) BM, K, P; 1261b (5) BM, G, K, P, W; 8290 (12) K; in SAM 21998 (13) SAM. *Drège* 94 (5) Z. *Dümmer* 547 (13) BM; 554a (6) BM; 934 (9) BM; s.n. (5) BM.

*Ebersohn* 151 (10) NBG; 152 (12) NBG. *Ecklon* 247 (5) M. *Emdon* 30 (12) STE. *Esterhuysen* 400 (5) NBG; 493 (5) NBG; 6175 (9) BOL, PRE; 6396 (9) BOL, PRE; 6543 (9) BOL; 6882 (16) BOL; 7086 (16) BOL; 8206 (9) BOL; 9025 (5) BOL; 9780 (10) BOL; 10573 (12) BOL; 10692 (16) BOL, PRE; 10712 (9) BOL; 10999 (9) BOL; 11194 (6) BOL; 11693 (5) NBG; 12074 (5) BOL; 12200 (9) BOL, PRE; 13313 (16) BOL; 16200 (9) BOL; 18979a (15) BOL; 21978 (5) BOL; 23635 (12) BOL; 31166 (9) BOL; in SAM 54324 (2) SAM.

*Fannin* 33 (16) K. *Farnham* s.n. (5) BOL. *Flanagan* 1687 (16) BOL, PRE; 1807 (16) BOL, PRE, SAM. *Fourcade* 519a (6) K; 1458 (15) K, STE; 1626 (9) BOL; 2840 (12) K, STE; 2848 (16) K; 3446 (5) K, STE. *Franklin* 40 (16) NU. *Frowien* in PRE 15649 (5) PRE. *Fry sub Galpin* 2719 (16) PRE.

*Galpin* 308 (16) PRE; 2719 (16) PRE; 4605 (9) GRA, K, PRE; 4606 (5) K, PRE; 4607 (5) K, PRE; 4608 (12) PRE; 4609 (9) BOL, K; 4610 (12) BOL, PRE; 4612 (6) PRE. *Garside* 210 (9) K; 1058 (5) K; 1696 (5) K. *Gillett* 982 (12) STE; 1352 (5) STE; 1783 (9) STE; 1842 (6) STE; 1856 (5) STE; 2091 (5) STE; 2094 (12) STE; 4565 (15) BOL; 4573 (5) BOL. *Glass* 617 (16) Z. *Goatcher* in BOL 6862 (6) Z. *Goldblatt* 324 (11) BOL. *Gordon* s.n. (16) PRE. *Gueinzus* 264 (16) P. *Guthrie* 725 (2) BOL; 1082 (9) NBG; 2729 (14) BOL; in BOL 7096 (6) BOL; in BOL 7097 (2) BOL, K.

*Häfstrom & Acocks* 2089 (9) PRE. *Hall* 419 (16) BOL; 736 (5) BOL; 737 (5) BOL; 1068 (5) BOL; 1073 (5) BOL; 1081 (5) BOL; 1104 (16) BOL; 1116 (16) BOL; 1122 (5) BOL; 1194 (9) BOL. *Hallack* in BOL 6093 (16) BOL, K. *Hanekom* 1264 (9) PRE; 2176 (13) PRE. *Harvey* 141 (5) K. *Haygarth* in PRE 22340 (16) K, PRE, Z. *Haynes Palmer* in CH 57305 (4) NBG. *Hilliard* 1695 (16) NU; 5583 (16) NU. *Hilliard & Burt* 8028 (16) NU. *Holland* 3739 (16) BOL. *Horrocks* 28 (5) NBG. *Humbert* 13642 (16) P. *Hutchinson* 575 (9) BM, K, PRE; 672 (6) K; 1225 (5) K; 1412a (15) K; 1432 (16) BOL, K.

*Jackson* in CH 85840 (12) NBG; in CH 86427 (3) NBG. *Jacobsen* 3720 (16) PRE; 3815 (16) K, PRE. *Jacobsz* 109a (16) PRE; 2/62 (16) PRE. *Jacot Guillarmod*, *Getliffe* and *Mzamani* 184 (16) K, PRE. *Jeppe* in PRE 33400 (6) PRE; 33401 (15) PRE; 33402 (16) PRE; 33403 (5) PRE; 33404 (12) PRE. *Jordaan* (5) STE.

*Kassner* 1374 (16) P; 1479 (5) P. *Keet* 1024 (12) PRE. *Kellerman* 26 (13) STE. *Kies* in CH 57316 (10) NBG. *Killick* 3858 (16) PRE; 3873 (16) PRE. *Killick & Vahrmeijer* 3631 (16) PRE. *Krige* in BOL 13491 (6) BOL. *Kruger* 29 (5) STE; 508 (4) STE; 556 (5) STE; 1001 (9) STE; 1072 (12) STE.

*Lamb* s.n. (13) BOL. *Laughton* 77 (5) BOL; 79 (5) BOL. *Lavranos* 9380 (16) PRE; 15232 (16) PRE. *Leighton* 840 (8) SAM; 1344 (9) BOL, PRE; 1441 (6) BOL; 1499 (5) BOL; 2079 (5) BOL; 2151 (9) BOL; 3146 (11) BOL. *Leipoldt* 3236 (11) BOL; 3237 (5) BOL; 3809 (14) BOL, K; s.n. (5) BOL. *Le Sueur* in BOL 4973 (14) BOL. *Lewis* 93 (5) SAM; 648 (5) SAM; 721 (13) SAM; 722 (12) SAM; 787 (5) SAM; 788 (13) SAM; 816 (5) SAM; 823 (5) SAM; 850 (6) SAM; 851 (8) SAM; 1094 (13) SAM; 1095 (4) SAM; 1096 (5) SAM; 1097 (5) SAM; 1098 (6) SAM; 1099 (6) SAM; 1100 (6) SAM; 1101 (11) SAM; 1107 (6) SAM; 1108 (2) SAM; 1487 (1) SAM; 1490 (8) SAM; 1832 (13) SAM; 1833 (6) SAM; 2403 (14) SAM; 3546 (6) SAM; 3547 (5) SAM; 3548 (6) SAM; 3549 (13) SAM; 4389 (5) SAM; 4455 (2) SAM; 4756 (5) SAM; 4757 (8) SAM; 4758 (10) SAM; 4759 (6) SAM; 4760 (5) SAM; 5020 (9) SAM; 5542 (11) NBG; 5645 (9) NBG; 6161 (5) NBG; s.n. (11) BOL. *Linder* 752 (8) BOL; 763 (5)

BOL; 811 (16) BOL; 831 (16) BOL; 841 (16) BOL; 934 (16) BR, BOL; 943 (16) BOL; 973 (16) BOL; 996 (16) BR; 1000 (16) BOL; 1129 (11) BOL; 1140 (11) BOL; 1149 (9) BOL; 1243 (5) BOL; 1479 (9) BOL; 1507 (4) BOL; 1508 (3) BOL; 1509 (11) BOL; 1510 (3 – 11) BOL; 1512 (11) BOL; 1513 (6) BOL; 1519 (5) BOL; 1524 (12) BOL; 1528 (2) BOL; 1536 (6) BOL; 1537 (5) BOL; 1551 (5) BOL; 1552 (16) BOL; 1563 (5) BOL; 1564 (15) BOL; 1570 (16) BOL; 1571 (12) BOL; 1578 (12) BOL; 1580 (5) BOL; 1583 (5) BOL; 1596 (12) BOL; 1599 (5) BOL; 1601 (9) BR, BOL; 1608 (12) BOL; 1610 (13) BOL; 1617 (7) BOL; 1694 (10) BOL; 1706 (12) BOL; 1742 (9) BR, BOL; 1745 (5) BOL; 1748 (10) BOL; 1807 (2) BOL; 1988 (16) BOL; 2078 (16) BOL. *Linley* in SAM 49536 (12) PRE, SAM; in SAM 49537 (9) SAM; 49538 (9) SAM; in SAM 49541 (9) SAM; in SAM 56094 (8) SAM; in SAM 56898 (13) SAM; in SAM 56902 (5) SAM; in SAM 56903 (5) SAM; in SAM 56904 (6) SAM; in SAM 56908 (6) SAM; in SAM 61249 (10) SAM. *Liversidge* 232 (16) NBG. *Long* 163 (5) K; 164 (5) K; 827 (5) K, PRE; 835 (16) K, PRE.

*MacOwan* 381 (5) K, SAM; 679 (16) BM, K, SAM, W, Z, ZT. *MacOwan & Bolus* 170 (9) BM, BOL, G, K, P, SAM, W, ZT; 171 (12) BM, BOL, G, K, P, W, ZT; 1374 (3) BOL, SAM. *Mann* 55 (5) K. *Manning* in CH 87243 (12) NBG. *Marais* 55 (16) PRE. *Marloth* 61 (9) PRE; 230 (12) PRE; 664 (9) PRE; 1768 (12) PRE; 1854 (11) PRE; 1864 (9) PRE; 4972 (6) BOL; 8916 (5) PRE. *Matheson* in SAM 59669 (16) SAM. *Mauve* 4761 (12) PRE. *McLoughlin* 12 (16) BOL; 42 (16) BOL; 164 (16) BOL; 403 (16) BOL; 488 (16) BOL; in PRE 26260 (16) BOL, K. PRE. *Meebold* 11895 (5) M. *Minicki* in SAM 59671 (2) SAM. *Moll* 2218 (16) PRE. *Moore* s.n. (16) BOL. *Morze* 2026 (5) BOL; 2027 (5) BOL. *Moss* 4141 (5) K; 19257 (5) K. *Muir* 664 (12) PRE; 746 (5) PRE; 748 (5) PRE; 1124 (12) PRE; 1125 (9) PRE; 1795 (6) PRE; 2330 (9) PRE; 2331 (9) PRE; 2332 (9) PRE.

*O'Brien* s.n. (16) K. *O'Connor* 213 (16) NU; 214 (16) NU; 296 (16) NU; 334 (16) NU. *Oliver* 3942 (9) STE; 4202 (5) STE; 4761 (14) K, PRE, STE; 5088 (9) STE; 5370 (9) PRE, STE; 5438 (5) STE; 5447 (9) PRE, STE; 5591 (9) STE; 6044 (9) STE; s.n. (5) BOL; s.n. (9) BOL.

*Page* in BOL. 16232 (6) BOL. *Pappe* in SAM 21989 (5) SAM; in SAM 21990 (5) K, SAM; in SAM 21985 (6) SAM; in SAM 21993 (14) SAM; s.n. (12) K. *Paterson* s.n. (5) BOL, PRE. *Penfold* 163 (5) NBG; in CH 57311 (11) NBG. *Penther* 46 (5) M; 53 (16) W; 57 (16) W; 60 (12) W; 65 (16) S, W; 81 (16) W; 99 (12) W; 104 (5) M; 179 (12) W; 186 (8) W; 215 (16) W; 236 (5) W; 277 (5) W; 329 (5) W. *Phillips* 1335 (5) SAM; 1337 (9) SAM; 1341 (12) SAM; 1852 (5) SAM. *Phillipson* s.n. (5) BOL. *Phipps* 666 (16) K. *Pillans* 2748 (5) PRE; 2748b (6) PRE; 8483 (5) BOL; 9176 (5) BOL; 9324 (5) BOL. *Pocock* 503 (9) STE. *Porter* in CH 57313 (12) NBG. *Prentice* in SAM 10789 (14) SAM; in SAM 10790 (9) SAM; in SAM 10791 (9) SAM. *Primos sub Marloth* 11705 (9) PRE. *Purcell* 424 (9) STE; in SAM 91219 (5) SAM; in SAM 91220 (5) SAM.

*Rabinowitz* in CH 57307 (14) NBG; in CH 77143 (14) NBG. *Ratray* in BOL 15784 (16) BOL. *Rehmann* 581 (8) Z; 582 (5) Z; 1950 (9) M. *Rogers* 2824 (16) Z; 17735 (5) Z; 23633 (5) PRE; 26494 (5) Z; 26569 (5) Z; 27166 (5) G; 27970 (16) Z; 29057 (8) K; s.n. (13) K. *Rudatis* 565 (16) STE; 784 (16) BM, K.

*Salter* 8290 (12) K; 8473 (12) BOL; 8479 (13) BOL; 8554 (3) SAM; 9374 (5) BM; 322/15 (6) BM; 322/17 (2) BM; 323/2 (12) BM; 323/5 (13) BM; in SAM 55850 (5) SAM. *Sanderson* 894 (16) BOL; 938 (5) K; s.n. (16) K. *Saunders* s.n. (16) BOL. *Schelte* 132 (16) NU; 4227 (5) BM; 4882 (11) BOL; 4895 (5) BOL; 4979 (5) BOL; 6328 (16) BOL, K; 7114 (16) BOL; 7118 (5) BOL; 7155 (16) BOL; 7162 (16) BOL. *Schlechter* 1479 (6) G, K, M, P, W, Z; 1550 (13) BM, G, GRA, K, S, W, Z; 4713 (16) BOL, K, P, PRE, W, Z; 5167 (11) BOL; 5791 (8) BOL, Z; 5958 (6) BOL, K, PRE; 5965 (5) BM, G, K, P, PRE, W, Z; 5974 (16) BM, K, Z; 9501 (4) BOL; 9502 (8) BOL; 9618 (2) BM, BOL, G, K, P, PRE, Z. *Schmidt* 606 (5) M; 607 (5) M. *Schonland* 610 (5) PRE. *Schur* in CH 57290 (6) NBG. *Scully* in BOL 4903 (10) BOL. *Seltzer* in CH 57304 (5) NBG. *Sim* 856 (16) NU; 864 (16) NU. *Smith* 4871 (5) PRE. *South* 617 (16) PRE. *Stokoe* 241 (12) PRE; 1151 (9) PRE; 6764 (9) BOL; 7382 (15) BOL; 9065 (9) BOL; in BOL 16649 (12) BOL; in BOL 17531 (4) BOL; in BOL 18388 (9) BOL; in CH 9904 (10) NBG; in SAM 36760 (13) SAM; in SAM 49534 (5) SAM; in SAM 49539 (9) SAM; in SAM 49540 (9) SAM; in SAM 55884 (9) SAM, in SAM 57747 (12) SAM; in SAM 57748 (9) SAM; in SAM 57749 (9) SAM; in SAM 57750 (5) SAM; in SAM 59668 (3) SAM; in SAM 61248 (5) SAM; in SAM 61250 (13) SAM; in SAM 63158 (5) SAM; in SAM 63159 (9) SAM; in SAM 63759 (12) SAM; in SAM 65620 (5) SAM; in SAM 68251 (9) SAM; *sub Marloth* 10569 (9) PRE; s.n. (4); s.n. (9) BOL; s.n. (9) BOL; s.n. (10) BOL; s.n. (10) BOL. *Strauss* 33 (11) NBG.

*Taylor* 247 (6) BOL; 252 (10) BOL; 258 (12) BOL; 6462 (9) STE. *Thode* A1021 (5) PRE; A2285 (5) PRE; in STE 3836 (16) STE; in STE 5427 (5) STE; in STE 6108 (5) STE; in STE 6110 (12) STE; in STE 8138 (16) STE. *Thomas* in CH 56374 (3) NBG. *Thoms* s.n. (5)



M. Thompson 3220 (5) STE. Trauseld 569 (16) PRE; 983 (16) PRE. Trinen s.n. (13) BM. Truter s.n. (13) STE.

Vahrmeijer 1062 (16) PRE. Van Niekerk 191 (5) BOL. Verreaux s.n. (5) G.

Wall 2228 (8) S; s.n. (5) S; s.n. (16) S. Walters 508 (5) BOL; 534 (8) BOL; 536 (15) BOL. Wasserfall 972 (5) K, PRE. Werdermann & Oberdieck 139 (5) PRE. Wild 938 (16) K. Wilson in SAM 21999 (13) SAM. Winkler 30 (5) NBG; 5049 (5) NBG. White 610 (5) Z. Wolley-Dod 394 (5) BM, BOL; 1788 (9) K; 1845 (5) K; 1846 (13)

BM; 2179 (8) BOL; 2992 (12) BOL, K; 3066 (13) BM, BOL; 3067 (12) BM, BOL, K; 3212 (6) K; 3506 (9) BOL; 3587 (6) BOL, K; 3601 (6) BM; 3602 (5) BM; 3635 (15) BOL, K; 5636 (4) BM, BOL. Wood 12254 (16) PRE; 12257 (16) SAM, Z. Worsdell 54b (5) K. Wright 135 (5) K; 2377 (16) NU. Wurts 436 (5) NBG; 2039 (5) NBG.

Zeyher 242 (12) K; 1564 (6) G, K, PRE, SAM, W; 1569 (15) BOL, K, SAM; 1570 (13) BOL, G, K, SAM, W; 3924 (12) BM, K, P, SAM, W; 3925 (9) BM, K, S, SAM, W; 4680 BOL, K, P, PRE, SAM.

## INDEX

	Page
<i>Brownleea pentheriana</i> Kraenzl. ex Zahlbr. ....	355
<i>Disa</i> Berg., pro parte .....	342
<i>Disa affinis</i> N. E. Br. ....	351
<i>atrorubens</i> Schltr. ....	354
<i>Disa auriculata</i> H. Bol. ....	348
<i>basutorum</i> Schltr. ....	361
<i>bolusiana</i> Schltr. ....	353
<i>bracteata</i> Swartz .....	346
<i>brevicornis</i> (Lindl.) H. Bol. ....	360
<i>cernua</i> (Thunb.) Swartz .....	358
<i>comosa</i> (Reichb. f.) Schltr. ....	351
<i>conferta</i> H. Bol. ....	343
<i>densiflora</i> (Lindl.) H. Bol. ....	348
<i>fragrans</i> Schltr. ....	361
<i>macrostachya</i> (Lindl.) H. Bol. ....	349
<i>micrantha</i> (Lindl.) H. Bol. ....	346
<i>multiflora</i> (Sond.) H. Bol. ....	348
<i>ophrydea</i> (Lindl.) H. Bol. ....	355
<i>physodes</i> Swartz .....	358
<i>praetermissa</i> Schltr. ....	346
<i>prasinata</i> Ker-Gawl. ....	359
<i>pygmaea</i> H. Bol. ....	345
<i>reticulata</i> H. Bol. ....	351
<i>rufescens</i> (Thunb.) Swartz .....	356
<i>sabulosa</i> H. Bol. ....	344
<i>stachyoides</i> Reichb. f. ....	361
<i>Monadenia</i> Lindl. ....	341
<i>atrorubens</i> (Schltr.) Rolfe .....	354
<i>auriculata</i> (H. Bol.) Rolfe .....	348

	Page
<i>australiensis</i> Rupp .....	346
<i>basutorum</i> (Schltr.) Rolfe .....	361
<i>bolusiana</i> (Schltr.) Rolfe .....	353
<i>bracteata</i> (Swartz) Dur. & Schinz .....	346
<i>brevicornis</i> Lindl. ....	360
<i>cernua</i> (Thunb.) Dur. & Schinz .....	359
<i>comosa</i> Reichb. f. ....	351
<i>conferta</i> (H. Bol.) Kraenzl. ....	343
<i>densiflora</i> Lindl. ....	348
<i>ecalcarata</i> Lewis .....	343
<i>inflata</i> Sond. ....	359
<i>junodiana</i> Kraenzl. ....	361
<i>lanceifolia</i> Sond. ....	356
<i>leptostachya</i> Sond. ....	356
<i>leydenburgensis</i> Kraenzl. ....	360
<i>macrocera</i> Lindl. ....	356
<i>macrostachya</i> Lindl. ....	349
<i>micrantha</i> Lindl. ....	346
<i>multiflora</i> Sond. ....	348
<i>ophrydea</i> Lindl. ....	354
<i>physodes</i> (Swartz) Reichb. f. ....	358
<i>prasinata</i> (Ker-Gawl.) Lindl. ....	359
<i>pygmaea</i> (H. Bol.) Dur. & Schinz .....	345
<i>reticulata</i> (H. Bol.) Dur. & Schinz .....	351
<i>rufescens</i> Lindl. non Thunb. ....	351
<i>rufescens</i> (Thunb.) Lindl. ....	356
<i>sabulosa</i> (H. Bol.) Kraenzl. ....	344
<i>Satyrium cernuum</i> Thunb. ....	359
<i>rufescens</i> Thunb. ....	356