

Circumscription and Relationships of *Dimorphanthera* (Ericaceae) with Notes on some Papuanian Species

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Abstract

Stevens, P. F. Circumscription and relationships of *Dimorphanthera* (Ericaceae) with notes on some Papuanian species. *Contrib. Herb. Aust.* 8: 1–34, 1974. Evidence is given suggesting that *Vaccinium* sectio *Pachyantha* should be transferred to *Dimorphanthera*; new combinations are made for the taxa concerned. Evidence is also given that shows a close relationship between *Dimorphanthera* and *Satyria*: this genus pair has a tropical amphi-transpacific distributional pattern. Within Papuania *D. tridens* and *D. declinata* are reduced to synonymy under *D. kempteriana*, *D. brassii* and *D. clemensiae* under *D. anchorifera* and *D. gracilis* under *D. denticulifera*; *D. splendens* is considered to be a variety of *D. elegantissima*; *D. alba* is removed from the synonymy of *D. forbesii* and kept specifically distinct; *D. womersleyi* var. *continua*, *D. bracteata*, *D. glauca*, *D. longistyla*, *D. tedentii* and *D. viridiflora* are new taxa described.

During an examination of the tribal limits within the Ericaceae (Stevens 1971) it appeared that *Vaccinium* sect. *Pachyantha* Sleum. differed both in morphology and in some anatomical characters from the other South-East Asian sections of *Vaccinium* L. and was more similar to *Dimorphanthera* F. Muell. in these characters. During a discussion on the infrageneric status of those species of *Agapetes* D. Don found scattered between Malaya and Fiji, *Vaccinium* sect. *Pachyantha* had to be excluded from the other South-East Asian sections of *Vaccinium* under consideration because of the differences between them (Stevens 1972).

This paper is divided into three parts. In Part 1 *Vaccinium* sect. *Pachyantha* is transferred to *Dimorphanthera*. In Part 2, brief comments are made on the relationships of *Dimorphanthera* to other genera of the Vaccinieae. In Part 3 the specific limits of a number of Papuanian species of *Dimorphanthera* are examined; some names are reduced to synonymy and some new taxa are described.

The author has had the valuable opportunity of collecting a number of species of *Dimorphanthera*, *Vaccinium* sect. *Pachyantha* and other sections of *Vaccinium* whilst on trips in various parts of Papua New Guinea. There are almost 250 collections of *Dimorphanthera* held at Lae Herbarium (LAE) that have been collected in Papua New Guinea since Sleumer last revised the genus (Sleumer 1963); this material has all been examined and determinations have been included in successive general identification lists issued by LAE. Material of *Dimorphanthera* held at Brisbane (BRI), Canberra (CANB), Melbourne (MEL) and Sydney (NSW) has also been examined, and in addition some material from Edinburgh (E), Kew (K), Leiden (L) and Paris (P) has also been seen. I am very grateful to the Directors of all these institutions for permission to examine their material.

PART 1. THE TAXONOMIC POSITION OF *VACCINIUM* SECT. *PACHYANTHA*

Introduction

The taxa under discussion have been separated in earlier works by keys only and there has been no discussion of the significance of the key characters by which they differ. In the following discussion, the characters used to separate *Vaccinium* sect. *Pachyantha* from other sections of *Vaccinium* and from *Dimorphanthera* will be dealt with individually, primarily with reference to the genera in the South-East Asia-Malesian region but also with reference elsewhere when necessary. Only three species of *Dimorphanthera* grow outside Papuasias, two in the Philippines and one in the Moluccas; sect. *Pachyantha* is known only from the eastern half of the New Guinea mainland.

Discussion

Corolla size and shape

The first lead in the generic key to the Vaccinieae in Sleumer (1941) separated nine genera, including *Vaccinium*, with corollas small to moderate in size, cylindrical to urceolate or campanulate in shape and thin to slightly fleshy in texture, from the rest of the tribe, including *Dimorphanthera*, with corollas usually large, often cylindrical, rarely urceolate or campanulate in shape and almost always carnosose to coriaceous, more rarely subcarnosose, in texture. The species of sect. *Pachyantha* have a very-thick-walled, campanulate corolla 5-7(-9) mm long; it is thicker than that of any other section of *Vaccinium*. The corolla in *Dimorphanthera* sect. *Dimorphanthera* (containing about 10 species) is campanulate in shape. Although the corolla is usually large, in species like *D. intermedia* J. J. Sm. and *D. decockii* J. J. Sm. it is sometimes less than 1 cm long; in both it is thinner than that of sect. *Pachyantha*. Some species in the tubular-flowered *Dimorphanthera* sect. *Trochilanthe* Schltr. also have corollas little bigger than those of sect. *Pachyantha*, but again with thinner walls. Both sections of *Dimorphanthera* have some species with very-thick-walled corollas. Hence the inclusion of sect. *Pachyantha* in *Dimorphanthera* would not increase the variation of the genus in these characters very much.

Layering of the corolla

When Sleumer (1941, p. 417 *in clavis*) described sect. *Pachyantha* he separated it from the neighbouring sections in the key (all South American) by its thick, two-layered corolla. The 'inner layer' and 'outer layer' of the corolla refer to parts of the corolla that differ only in thickness and not in cell type, and there is a short zone of intermediate thickness between the two layers. A number of species of *Dimorphanthera* also have pronouncedly bistratose corollas (Fig. 1A, 1B), although not quite to the same extent as those of sect. *Pachyantha* (Fig. 1C). In addition to the species shown, other species, e.g. *D. brevipes* Schltr., *D. collinsii* Sleum. and *D. womersleyi* Sleum., also have prominently bistratose corollas and in many, if not most, others there is a tendency for the corolla to be bistratose at the angles of the lobes.

In neither the Central and South American sections of *Vaccinium* nor in those from Malesia is the corolla bistratose. Even in other genera that have thick, fleshy corollas such as *Agapetes* (S.E. Asia and Malesia) and *Macleania* Hook. f., *Notopora*

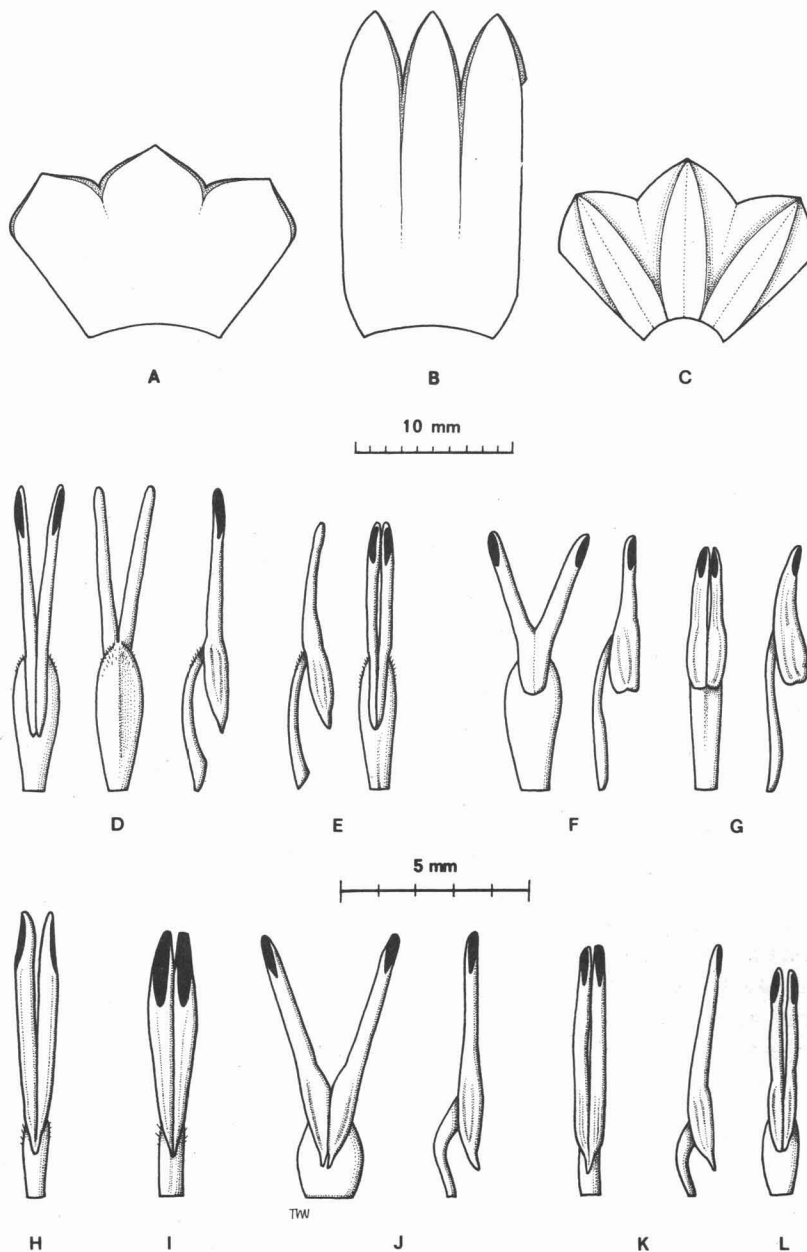


Fig. 1. Corollas: A, *Dimorphanthera dekokkii* J. J. Sm. var. *chlorocarpa* (Sleum.) Sleum., from NGF 43504; B, *D. forbesii* (F. Muell.) F. Muell., from NGF 34032; C, *Vaccinium keysseri* Schltr ex Diels, from Hoogland & Schodde 7223. Stamens: D and E, *V. amplifolium* F. Muell., from LAE 51399; D, major stamen from the front, back and side; E, minor stamen from the side and front; F and G, *V. ingens* Sleum., from NGF 21065 (spirit material); F, major stamen from the front and side; G, minor stamen from the front and side; H and I, *V. machainii* F. Muell., from *Giulianetti s.n. anno 1896*; H, major stamen from the front; I, minor stamen from the front; J and K, *V. fissiflorum* Sleum., from LAE 54670 (spirit material); J, major stamen from the front and side; K, minor stamen from the front and side; L, *V. keysseri* Schltr ex Diels, from LAE 54867, major stamen from the front.

Hook. f., *Psammisia* Klotzsch and other South American genera, this double layer has not been seen; one exception perhaps is *Hornemannia* Vahl (= *Symphysia* Presl).

Stamen type

The key in Sleumer (1966) separates *Dimorphanthera* from the other Malaysian Vaccinieae (*Agapetes*, *Costera* J. J. Sm. and *Vaccinium*) on stamen type; the stamens of *Dimorphanthera* are 'manifestly dimorphous and very unequal in length; tubules (are) expanded, i.e. conspicuously ear-shaped'. The major and minor anthers of *V. ingens* Sleum. (Fig. 1F, 1G) and *V. fissiflorum* Sleum. (Fig. 1J, 1K), both in sect. *Pachyantha*, differ only a little in shape but are nevertheless very similar to those of *D. dekokkii* (Fig. 2G) and very probably to those of *D. parviflora* J. J. Sm. (Smith 1936, t. 24). As can be seen from the illustrations (Fig. 2), the dimorphism of the stamens in *Dimorphanthera* itself is not always very strongly pronounced, the most obvious difference between major and minor stamens often being one of size rather than shape. There is a tendency in both *Vaccinium* sect. *Pachyantha* and *Dimorphanthera* for the anthers to be very woody in texture, as in *D. glauca* sp. nov., *D. elegantissima* K. Sch. and to a lesser extent in *V. ingens* and *V. fissiflorum*. In both *Vaccinium* sect. *Pachyantha* and *Dimorphanthera* there often appear to be only five stamens when the fresh flower is examined; this is because the stamens are very close to one another and the tubules of the major anthers overarch and obscure the minor anthers.

The main differences between the stamens of *Vaccinium* sect. *Pachyantha* and those of *Dimorphanthera* is that in the former the tubules are relatively long and the filaments are attached to the top of the thecae, rather than lower down. Neither difference is absolutely clear-cut.

As in most Ericaceae with twice as many stamens as petals, species in South-East Asian sections of *Vaccinium* have very slightly dimorphic stamens; however, this dimorphism is not nearly as pronounced as that even of sect. *Pachyantha*. These other sections of *Vaccinium* also do not have woody anther thecae like those of sect. *Pachyantha*. No other sections of *Vaccinium* or other genera of the Vaccinieae have stamens like those of *Dimorphanthera* and *Vaccinium* sect. *Pachyantha* apart from the American genus *Satyria* Klotzsch (see Part 2); *Cavendishia* Lindl. and some other genera have moderately dimorphic stamens but of a different type.

Ovary type

The key in Sleumer (1941) separates the South-East Asian sections of *Vaccinium* from sect. *Pachyantha* because they have a falsely 10-locular ovary whilst that of sect. *Pachyantha* is 5-locular. The majority of species of *Dimorphanthera* also have a 5-locular ovary. When taken in isolation the number of ovary loculi is not a very satisfactory character (Stevens 1972) and other sections of *Vaccinium* and genera of the Vaccinieae also have a 5-locular ovary.

Anatomy

Certain features of leaf and stem anatomy have been examined; hand sections have been cut and then stained using an aqueous solution of phloroglucinol and hydrochloric acid. A list of the species and specimens examined is given at the end of this paper.

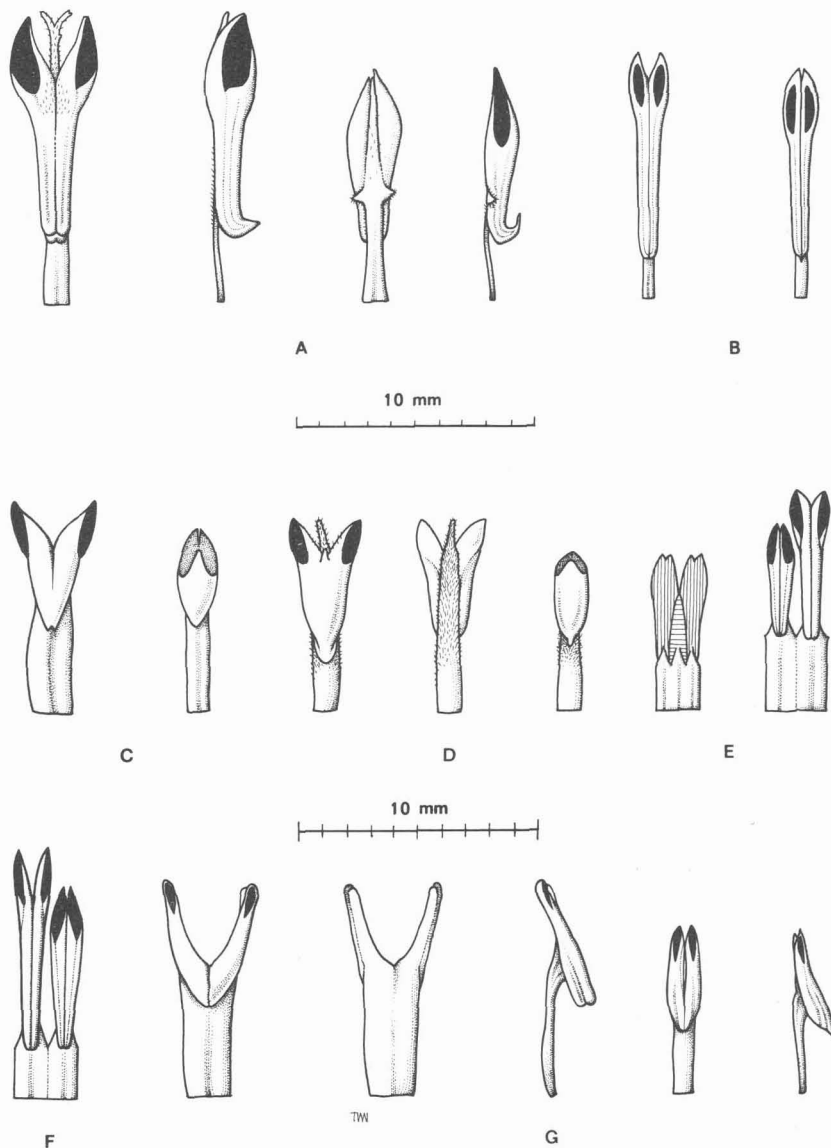


Fig. 2. Stamens: *A*, *Dimorphanthera glauca* Stevens, from NGF 42996, major stamen from the front and side, minor stamen from the back and side; *B*, *D. dryophila* Sleum. var. *trichoclada* Sleum., from Brass 22406, major and minor stamens from the front; *C*, *D. amblyornidis* (Becc.) F. Muell. var. *moorhousiana* (F. Muell.) Sleum., from Forbes 784, major and minor stamens from the front; *D*, *D. kempteriana* Schltr from NGF 15309, major stamen from the front and back, minor stamen from the front; *E*, *Satyria warszewiczii* Klotzsch, from Veitch 232, arrangement of stamens (semi-diagrammatic), major and minor stamens from the front (slightly pulled apart); *F*, *S. panurensis* (Benth.) Hook. f., from Forest Department, British Guiana (now Guyana), Field No. F1087, major and minor stamens from the front (slightly pulled apart); *G*, *D. dekokkii* J. J. Sm. var. *chlorocarpa* (Sleum.) Sleum., from NGF 43504 (spirit material), major stamen from the front, back and side, minor stamen from the front and side.

Those species of *Dimorphanthera* and *Vaccinium* sect. *Pachyantha* examined have a more or less circular petiole bundle; in the lamina the hypodermis is prominent, often more than one-layered, and lignified; and the spongy mesophyll adjacent to the lower epidermis is usually lignified. In the Malesian sections of *Vaccinium* the hypodermis, when present, is less prominent and usually unlignified, the petiole bundle is nearly always arcuate and the leaf lacks the lignified spongy mesophyll adjacent to the lower epidermis. There are exceptions to this. Several species of *Vaccinium* sect. *Oarianthe* Sleum., although having an arcuate petiole bundle, have a lignified hypodermis and also lignified spongy mesophyll, e.g. *V. decumbens* J. J. Sm., *V. microphyllum* Reinw. and *V. oreomyrtus* Sleum., and a similar pattern of lignification has been found in the appositely-named *V. ambivalens* Sleum. of sect. *Bracteata* Nakai (the only species of this section in which this was found).

The phellogen in *Dimorphanthera* and *Vaccinium* sect. *Pachyantha* is initiated in a deep-seated position in the stem, usually interior to the band of fibres surrounding the phloem. There are one or two partial exceptions. It appears that the phellogen may become superficial around the bases of leaves, and in *V. macbainii* F. Muell. it appears to be usual for the phellogen to be initiated in the cortex, but well below the epidermis. In *D. microphylla* Sleum. and *D. leucostoma* Sleum. and perhaps also in *D. obtusifolia* Sleum. (not examined), the young stem is ridged and the activity of the phellogen first becomes noticeable in the formation of long welts down the twigs between these ridges. A phellogen forms generally interior to the pericycle but its activity is initially rather localized. It is possible that expansion and perhaps also division of cortical cells may also be involved in the initial formation of these welts. In all the species of *Vaccinium* from Malesia which have been examined the phellogen is superficial, being formed just under the epidermis.

The anatomical characters discussed support the position of sect. *Pachyantha* in *Dimorphanthera* if other evidence suggests this; anatomical characters alone are also consonant with a position in numerous other genera of the Vaccinieae (see Niedenzu 1890; Stevens 1971, 1972 and Part 2 of this paper).

Conclusions

Of the characters used to separate both *Vaccinium* from *Dimorphanthera* and sect. *Pachyantha* from other sections within *Vaccinium*, the bistratose nature of the corolla and the stamen type both place sect. *Pachyantha* in *Dimorphanthera*. The other characters, corolla shape and size and the nature of the ovary, are in agreement with such a position but of themselves do not suggest it; the anatomical evidence presented is also in agreement with this. The general facies of the two is similar and in the field they are also very similar in ecological behaviour. Numerous species of *Dimorphanthera* are vigorous lianes, as are *V. fissiflorum*, *V. ingens*, *V. amplifolium* F. Muell. and *V. keysseri* Schltr ex Diels (the last three only sometimes). *Vaccinium sensu stricto* in New Guinea grows at similar altitudes, but it is not usually a virogous liane (exceptions few, e.g. *V. goodenoughii* Sleum. and *V. malacothrix* Sleum., see Sleumer 1967).

Sleumer (1941, p. 381) suggested that *Vaccinium* sect. *Pachyantha* was to some extent intermediate between *Dimorphanthera* and *Vaccinium*, but it is obviously far closer to the former. When the Vaccinieae in Malesia alone are considered the picture is more clear-cut than when the Vaccinieae in general, and species of *Vaccinium*

in particular, which grow in Central and South America are also taken into account, but even they do not affect the conclusion. Three of the four South American sections of *Vaccinium* which key out adjacent to sect. *Pachyantha* in Sleumer (1941) also have similar anatomy (sect. *Pseudodisterigma* Sleum. has not been examined); florally all are dissimilar to sect. *Pachyantha*, in particular, sect. *Nemochaeton* Sleum. is reminiscent of *Cavendishia* and sect. *Oreades* Sleum. of *Symphysia*.

Dimorphanthera sect. **Pachyantha** (Sleum.) Stevens, comb. nov. Basionym: *Vaccinium* sect. *Pachyantha* Sleum. in Bot. Jb. 71: 417. 1941.

A ceteris sectionibus Dimorphantherae corolla parva (minus quam 1 cm longa) bistratosa fere usque ad basin et staminibus leviter dimorphis filamentis ad apicem thecarum affixis differt. Typus: *D. macbainii* (F. Muell.) Stevens, comb. nov.

D. macbainii (F. Muell.) Stevens, comb. nov. Basionym: *V. macbainii* F. Muell. in Trans. R. Soc. Vict. n.s. 1: 17. 1889.

D. amplifolia (F. Muell.) Stevens, comb. nov. Basionym: *V. amplifolium* F. Muell. in Trans. R. Soc. Vict. n.s. 1: 18. 1889.

D. keysseri (Schltr ex Diels) Stevens, comb. nov. Basionym: *V. keysseri* Schltr ex Diels in Bot. Jb. 62: 488. 1929.

D. fissiflora (Sleum.) Stevens, comb. nov. Basionym: *V. fissiflorum* Sleum. in Bot. Jb. 72: 219. 1942.

D. ingens (Sleum.) Stevens, comb. nov. Basionym: *V. ingens* Sleum. in Bot. Jb. 72: 220. 1942.

PART 2. RELATIONSHIPS OF *DIMORPHANTHERA*

In neither morphology nor anatomy is *Dimorphanthera* close to South-East Asian *Vaccinium* or to *Agapetes* subgenus *Agapetes*, but in anatomy at least it approaches *Agapetes* subgenus *Paphia* (Seem.) Stevens (Stevens 1972) and *Costera* J. J. Sm. (unpublished data). In these anatomical characters it is also equally close to many Central and South American genera of the Vaccinieae (Niedenzu 1890; Stevens 1971), and to some sections of *Vaccinium* there, e.g. sect. *Nemochaeton* and *Oreades*. The taxa concerned have a deep-seated phellogen; probably also relatively broad rays and vessels in their xylem (although this needs confirming); a more or less circular petiole bundle; a prominent, often lignified, hypodermis; lignified spongy mesophyll adjacent to the lower epidermis; and often prominent vein endings. Some of these South American genera also have large, fleshy corollas and rather woody anthers, and it is of interest to note that in some species of *Macleania* Hook. f. the two pores of the anther become confluent as in the minor stamens of some species of *Dimorphanthera* sect. *Dimorphanthera* (Fig. 2D). Mueller (1886), in his initial description of *Dimorphanthera*, compared the stamens of *D. moorhousiana* F. Muell. [= *D. amblyornidis* (Becc.) F. Muell. var. *moorhousiana* (F. Muell.) Sleum.] with those of *Macleania*.

Satyria is one of these American genera sharing anatomical characters with *Dimorphanthera*, and it also has strikingly similar stamens (Fig. 2E, 2F). The anthers are very woody and are moderately dimorphic, the tubules flare as much as those of

a number of species of *Dimorphanthera*, and dehiscence is by a rounded slit or pore of limited extent. The main differences between the two are in corolla and androecium: the corolla of *Satyria* is narrowly tubular in shape, often contracted at the top and comparatively thin in texture and the stamens have connate filaments. The latter character is not very important; it varies infragenerically in *Agapetes* subgenus *Paphia* (Seem.) Stevens (Stevens 1972), *Thibaudia* Ruiz & Pav. and other South American genera. Macbride (1944) found that the extent of the connation was in part dependent on the age of the flower, and thought that it was significant only at the sectional level. The petiole bundle of *S. ovata* A. C. Sm. and *S. panurensis* (Benth.) Hook. f. forms a spiral in transverse section, although the petiole bundle of *S. chlorantha* Klotzsch is circular and similar to that of *Dimorphanthera*. All three species have a circular midrib bundle half way up the leaf (see also Niedenzu 1890); in all species of *Dimorphanthera* examined the midrib bundle half way up the leaf is arcuate, although at the bottom it is circular. Anatomical studies of *Satyria* must be extended, but the differences between *Satyria* and *Dimorphanthera* are clearly not great.

Dimorphanthera, with most of its species in New Guinea and a few others scattered from the Philippines to New Britain and New Ireland, and *Satyria*, in Central and tropical South America (not in the eastern part), are yet another example of a tropical amphi-transpacific affinity. Most of the species of these two genera are montane or high montane plants, but a few are found epiphytic in tropical lowland forests.

A comprehensive list of similar examples is given in van Steenis (1962) and more cases are coming to light, e.g. the recent interesting example of *Langsdorffia* Mart. of the Balanophoraceae (Geesink 1972). It is difficult to attempt to explain such distributions in the Vaccinieae because of the vagueness of generic boundaries and relationships in the tribe, but the ideas of Raven and Axelrod (1972) and Schuster (1972) as to how the concept of plate tectonics affects understanding of plant distributions, in particular those centring on lands around the Pacific Ocean, must be taken into consideration when reading van Steenis (1962) on these tropical amphi-transpacific affinities.

PART 3. NOTES ON *DIMORPHANTHERA* IN PAPUASIA

Introduction

In this part the first records of *Dimorphanthera* from New Britain are noted; *D. peekelii* Sleum., from New Ireland, was the only species previously known from the whole of the Bismarck Archipelago. In addition to *D. kempteriana* Schltr (7) and *D. bracteata* sp. nov. (51 A), a third species also occurs (LAE 58293, 1250 m, Mt Lululua: specimen in fruit, bracteoles small, basal).

The reduction of some species to synonymy and others to varietal rank has mostly been occasioned by a re-evaluation of the significance of three characters: (1) the serration of the leaf margin, (2) the indumentum of the flower and (3) the anther type.

- (1) Most species of *Dimorphanthera* have glandular hairs or points on the leaf margin; these seem to retard the growth of the leaf around them and hence come to be in depressions of the margin which is then serrulate. If a species has glandular hairs or points on the margin, then the margin is likely to be at

least slightly serrulate. Although the prominence of the serrulations often varies infraspecifically, some species are always markedly serrulate. A more constant character is the presence or absence of glandular hairs or points on the margin.

- (2) Floral pubescence appears to be a rather variable character. Intermediates between glabrous and pubescent corollas have now been collected in a number of species, e.g. *D. alpina* J. J. Sm., *D. brachyantha* Sleum., *D. kempteriana* Schltr and *D. denticulifera* Sleum. Pubescence of the vegetative parts must also be treated with caution.
- (3) Anther type is of considerable importance at the specific level in the taxonomy of the genus. Although the state of the spurs (e.g. whether connate or not, their length) is quite often variable within a species, as is the development of little appendages at the basal (developmentally apical) end of the anthers, the texture of the anther, whether woody or not, and its appearance at the base seem quite reliable specific characters. The breaking down of the adjacent loculi walls between the two separate pores in the minor anthers in several species in sect. *Dimorphanthera* is another useful character.

In the discussions that follow certain points should be noted. The numbers refer to the number of the species in Sleumer's account of the genus in the Flora Malesiana (1967). The original reference only is given in those species whose status is changed; complete literature citations may be found in Sleumer (1967). In descriptions of new taxa, filament length refers to the length of the filaments below the base of the anthers.

Sect. *Dimorphanthera*

3. *Dimorphanthera tridens* J. J. Sm.

This is reduced to synonymy under *D. kempteriana* Schltr (7).

4. *Dimorphanthera declinata* Sleum.

This is reduced to synonymy under *D. kempteriana* Schltr (7).

5. *Dimorphanthera magnifica* Sleum.

The anthers of the minor stamens do not have confluent apertures.

6. *Dimorphanthera breviflos* Sleum.

The anthers of the minor stamens have confluent apertures like those of *D. kempteriana* Schltr. *D. breviflos* may be separated from *D. kempteriana* by its much smaller corolla and stamens.

7. *Dimorphanthera kempteriana* Schltr in Bot. Jb. 55: 187. f. 14. 1918. Type:

Schlechter 16643 (holo B destroyed, iso P, SING), 1000 m, Kani Mts (Madang District, north-east New Guinea).

D. tridens J. J. Sm. in Nova Guinea 18: 100. t. 22. 1936. Type: *Lam* 976 (holo BO, iso several), 100 m, near Prauwenbivouac, Mamberamo River (Djajapura, West New Guinea).

D. declinata Sleum. in Blumea 12: 137. 1963. Type: *Robbins* 2887 (holo CANB!), 1980 m, near Wapenamunda, Western Highlands, north-east New Guinea.

Four specimens were cited in the original description of *D. tridens*, of which the three paratypes (*Docters van Leeuwen* 9525, 75–100 m, Albatros bivouac, Mamberamo River, Djajapura; 11195, *ibid.*; 11348, *ibid.*) have been seen at BRI. NGF 37611 and NGF 47393 (both from the Baiyer River, Western Highlands) are two further specimens that are completely glabrous and key out to *D. tridens*, although all these specimens are perfect matches with pubescent specimens of *D. kempteriana* in other respects. *Docters van Leeuwen* 11195, NGF 37611 and NGF 47393 have some of their minor anthers dehiscing by a single confluent pore; the minor anthers have single pores in many, but not all, collections of the pubescent specimens of *D. kempteriana*. Other collections, including *Docters van Leeuwen* 11348, have two separate pores.

Dimorphanthera tridens is keyed out separately from *D. kempteriana* in Sleumer (1967) because it has glabrous calyx and corolla, but the pubescence of the flowers and vegetative parts does not give a clear-cut separation between *D. tridens* and *D. kempteriana*. NGF 45062 (Waria River, Morobe District) has only a minutely puberulous corolla, its calyx and pedicel sometimes have a few hairs whilst its leaves and stems are quite glabrous. NGF 41534 (Oksapmin, West Sepik District) has a shortly pubescent inflorescence, but its vegetative parts are glabrous. Thus the distinctions between the species break down.

Dimorphanthera declinata is reduced to synonymy under *D. kempteriana* for very similar reasons. *Robbins* 2887, the only collection, is also completely glabrous (apart from its stamens) and its minor anthers have but a single aperture. It was separated from *D. tridens* by its longer inflorescence (2.5–3 cm, as against *c.* 1.5 cm), shorter major anthers (cells plus tubules 5 mm, as against 7 mm) and finely crenulate, as against entire, leaves (Sleumer 1967). The length of the inflorescence in *D. declinata* is within the upper limit for pubescent specimens of *D. kempteriana* and its anther size is above the lower limit. Some pubescent specimens of *D. kempteriana* have slightly crenulate leaf margins and all specimens, including those described as *D. tridens*, have stout hairs on the leaf margin (Mr Henderson at Brisbane kindly confirmed this last point).

Dimorphanthera kempteriana has quite recently (1965) been collected in New Britain, the first collection of *Dimorphanthera* from the island. The specimen, NGF 21936, from Pirilongi Village, Kandrian Subdistrict, has large flowers with pedicels to 3 cm long and corollas *c.* 2.5 cm long, and the anther spurs exceed the tubules by about 1 mm. Whether or not this specimen of *D. kempteriana* represents a new infra-specific taxon awaits further collections, it was reported to be quite common in the area in which it was found.

8. *Dimorphanthera intermedia* J. J. Sm.

A third collection of this specimen has recently been obtained (NGF 43826, near Kiunga, Western District). Florally at least *D. intermedia* is close to *D. kempteriana*, the minor stamens often having only a single aperture. *D. intermedia* has smaller flowers than those of *D. kempteriana*; the anthers in some flowers have spurs which are more or less adnate to the tubules, in others spurs are lacking.

11. *Dimorphanthera amblyornidis* (Becc.) F. Muell.

The apertures of the minor anthers are confluent.

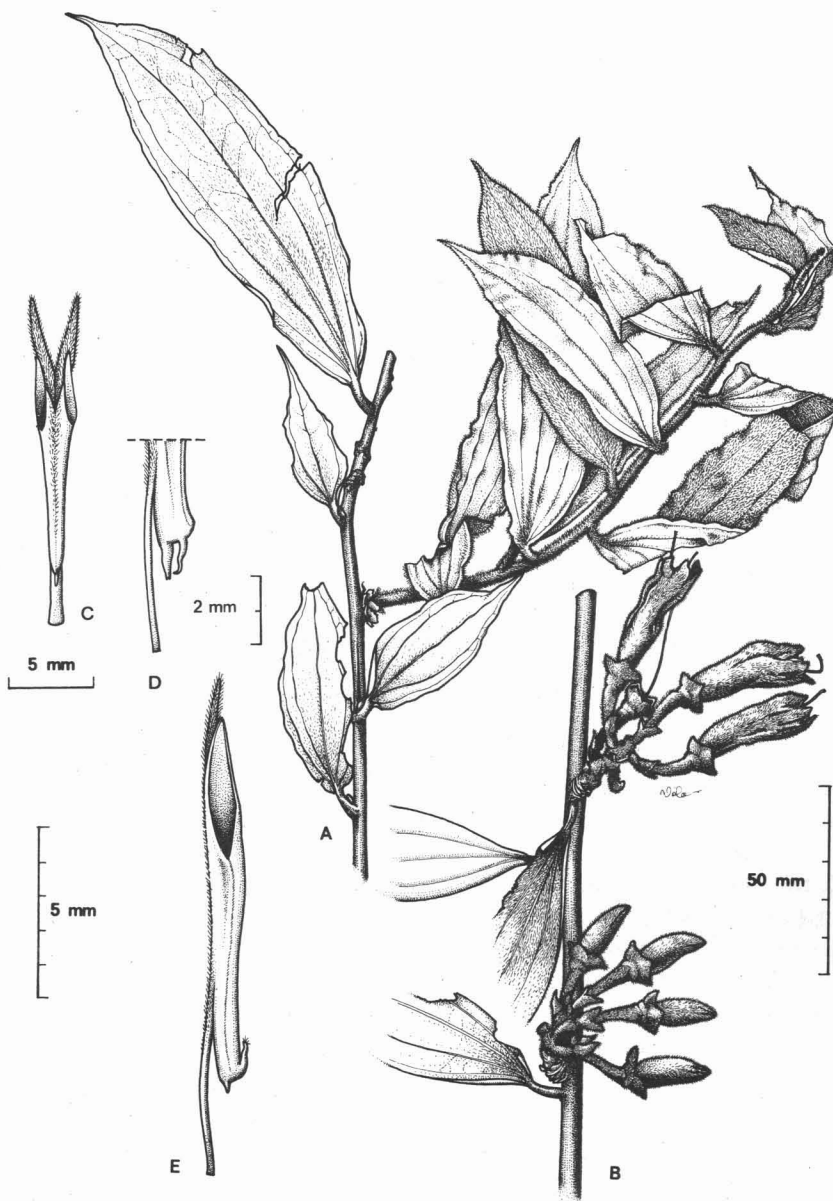


Fig. 3. *Dimorphanthera velutina* Schltr ssp. *rufa* Stevens, *A* from NGF 32079, *B–E* from NGF 37344. *A*, young shoot; *B*, older shoot with flowers; *C*, major stamen from the front; *D*, base of major stamen from the side; *E*, minor stamen from the side.

12. *Dimorphanthera decockii* J. J. Sm. var. *decockii*

NGF 33331, from 3350 m in the Star Mountains, Western District, has very small leaves 3.7×2.7 to 4.5×2 cm which are very coriaceous and dry dark brown. However, it is linked on to specimens with larger leaves (which may reach c. 18×8 cm) by *Craig* 106, from 3660 m in the Sirius Mountains, West Sepik District, which has leaves $5.0-7.0 \times 2.3-2.5$ cm.

The apertures of the minor anthers are not confluent.

Sect. *Trochilanthe* Schltr

16. *Dimorphanthera velutina* Schltr

16b. ssp. *rufa*, Stevens, ssp. nov.

Fig. 3

A subspecies *velutina* foliis, floribus, caulibusque pilis lanatis densis rufis praeditis, axibus inflorescentiarum 1.2-2.2 cm longis, et stylis glabris differt.

Differs from ssp. *velutina* in its dense, rufous, lanate indumentum on the stem, leaves, inflorescence and flowers, in its inflorescence axis 1.2-2.2 cm long, and in its glabrous style.

Type: NGF 37344 (*Womersley, Vandenberg & Galore*: holo LAE! iso BRI! CANB! NSW! further duplicates sent to L, A, K, BO), 4.xi.1968, 1650 m, 16 km from Kopiago on Koroba Road, Western Highlands, north-east New Guinea.

Further specimens. PAPUA: Southern Highlands: vicinity of Habono rest house, c. 10 km west of Mt Ne, NGF 24853 (*Frodin*); *ibid.*, 2072 m, NGF 32079 (*Frodin*).

Dimorphanthera velutina ssp. *velutina* is still known from only three classical collections from the East Sepik District (*Ledermann* 8879, holo B destroyed, iso K!; 8955 (K!); 10008). The two subspecies are almost identical florally, apart from the absence of hairs on the style of ssp. *rufa* (but see also sp. 17, *D. amoena* Sleum.); in particular, both have similar ovaries that are falsely 10-locular for at least half their length and major stamens that have small, hairy appendages at the only slightly incurved base, the minor stamens have prominently incurved anther bases and lack these hairy appendages. *D. velutina* ssp. *velutina* is densely pilose, but not brown-lanate like ssp. *rufa*; although ssp. *velutina* has a much longer inflorescence axis than that of ssp. *rufa* (5-6 cm, as against 1.2-2.2 cm) there are hardly enough specimens to assess the variability of this character, moreover, in the related *D. amoena* the length of the inflorescence axis is very variable, ranging from 2-18 cm.

17. *Dimorphanthera amoena* Sleum.

In facies this species is very similar to *D. velutina*. This similarity extends to the ovary; *D. amoena* has a falsely 10-locular ovary with inpushings of the ovary wall alternating with the septa, these inpushings are developed the length of the ovary. In *D. velutina* the inpushings are also present, and although better developed than in any other species examined (apart from *D. amoena*), they fade out in the bottom half of the ovary. The anthers of the two species are very similar although those of *D. amoena* lack appendages at the base. Although the style of *D. amoena* is reported as being glabrous there are a few rather short hairs towards the tip in some collections, e.g. LAE 51001, Marafunga, Eastern Highlands, a point of similarity with *D. velutina* ssp. *velutina*.

Dimorphanthera amoena and *D. velutina* are obviously closely related species and the discovery of *D. velutina* ssp. *rufa*, which has points of similarity both with *D. amoena* (glabrous style) and ssp. *velutina* (anthers and ovary), as well as differences with both (lanate, rufous indumentum), has made the situation more complicated. All three taxa have discrete, non-overlapping distributions, *D. amoena* being known from the Miorobe and Eastern Highlands district, *D. velutina* ssp. *velutina* from the East Sepik District and ssp. *rufa* from the Western and Southern Highlands. When *D. velutina* is better known adjustments in the rank of the three taxa may have to be made.

20. *Dimorphanthera brassii* Sleum.

This is reduced to synonymy under *D. anchorifera* J. J. Sm. (35).

26. *Dimorphanthera brachyantha* Sleum.

This species is known only from the type collection. *Brass* 31827, the paratype, and *Brass* 31854, which was cited as *D. brachyantha* in Sleumer (1964), belong to a new species, *D. viridiflora* (44A). *D. viridiflora* and *D. brachyantha* are not particularly closely related species and several differences separate the two. *D. viridiflora* has smaller leaves whose main lateral veins separate from the midrib at the very base of the lamina (not above the base, as in *D. brachyantha*), the inflorescence has 1-3 flowers (not c. 15) and the calyx tube is obconical, terete and continuous with the pedicel (not barrel-shaped, ribbed and articulated with the pedicel).

D. brachyantha is close to *D. cornuta* J. J. Sm. (24) from which it may most easily be separated by its fleshier flowers and larger stamens. *D. cornuta* has red corollas, the colour of the corolla of *D. brachyantha* is unknown.

27. *Dimorphanthera gracilis* Sleum.

This is reduced to synonymy under *D. denticulifera* Sleum. var. *pubens* Sleum. (40).

29. *Dimorphanthera brevipes* Schltr

This has previously been reported only from the East Sepik District, where it was twice collected by Ledermann (9019, type; 8931, paratype K!). The corollas of most specimens subsequently collected in the East and West Sepik Districts are short-pubescent outside, as in NGF 32122, *Hoogland & Craven* 10767 and *Steinkraus* 8, however, the corollas of *Vink* 17640 (West Sepik District) are subglabrous, having only minute hairs. Three collections are known from near Lake Kapiago in the Western Highlands (NGF 37325, 39997 and 41053) which have glabrous corollas but otherwise agree perfectly with the specimens from the West and East Sepik Districts which have hairy corollas.

Brass 12763A (Bernhard Camp, Idenburg River, Djajapura, West New Guinea) is probably a further specimen of *D. brevipes* although it was cited as *D. beccariana* (Koord.) J. J. Sm. (36; Sleumer 1961). *D. beccariana*, of which *Pulle* 646 (L!), Bijenkorf Bivouac, Helliwig Mountains, Digul/Snow Mountains, West New Guinea, has been seen, differs considerably. It has major stamens c. 1.2 cm long whose anthers are simply incurved at the base (*Brass* 12763A has major stamens c. 1 cm long which, although distorted and somewhat more robust than those of other specimens of *D. brevipes*, are, like them, horizontally S-shaped at the base), the calyx tube is more or less rounded at the base, not truncate, the corolla is red, not white, and there are

c. 12 glandular hairs per 4 mm² on the lower surface of the lamina, not 0–3. In all the character states in which *Brass* 12763A differs from *D. beccariana* it agrees with *D. brevipes*.

33. *Dimorphanthera robbinsii* Sleum.

This is now known from the lower slopes of Mt Piora, Eastern Highlands, an extension of range to the south-east of almost 100 km (*Hays* 221, 16 km south-east of Obura); it was previously known only from around Mt Wilhelm, Kerigomna and the Daulo Pass.

34. *Dimorphanthera clemensiae* Sleum.

This is reduced to synonymy under *D. anchorifera* J. J. Sm. (35).

35. *Dimorphanthera anchorifera* J. J. Sm. in *Nova Guinea* 12: 151. t. 40. 1914.

Type: *Gjellerup* 915 (holo BO), 300 m, Gauttier Mountains (Djajapura, West New Guinea).

D. brassii Sleum. in *Bot. Jb.* 70: 122. 1939. *Type*: *Brass* 5350 (holo NY, iso BRI!), 1700 m, Mafulu, Central District, Papua.

D. clemensiae Sleum. in *Bot. Jb.* 70: 123. 1939. *Type*: *Clemens* 6371 (holo B, iso K!), 1950 m, Ogeramnang (Morobe District, north-east New Guinea).

The key characters used to separate the three species are found in the anthers. *D. clemensiae* has anthers (cells plus tubules) of the major stamens 16–18(–20) mm long and lacks a prominent basal appendage, *D. brassii* has anthers up to 14 mm long and also lacks a basal appendage whilst *D. anchorifera*, which also has anthers up to 14 mm long, has a basal, anchor-like appendage to the theca. Close examination of the numerous specimens now available show that these differences are not maintained. The anthers of specimens cited as *D. anchorifera* have tubules plus thecae 10–14 mm long; their anchor-like appendages are 0.15–5 mm long and sometimes branched. The illustration of the type (Smith, *loc. cit.*) shows these processes clearly. *D. brassii* has tubules plus thecae (9–)10–16 mm long; anchor-like appendages are sometimes absent but are usually represented by small bumps or appendages up to 0.35 mm long. The type of *D. brassii*, *Brass* 5350, has appendages on its anthers; these are especially prominent on the minor anthers: NGF 13487, figured as *D. brassii* in Sleumer (1967) has appendages represented by small bumps. *D. clemensiae* has tubules plus thecae (13.5–)15.5–19.6 mm long; appendages are sometimes absent, or present and up to 0.35 mm long. The type of *D. clemensiae* (*Clemens* 6371) and other specimens of this species from the Rawlinson Range and the foothills of the Saruwaged Mountains (both Morobe District) have small appendages, and so has *Hoogland & Pullen* 5380, figured as *D. clemensiae* in Sleumer (1967).

Thus the key characters used to separate the species break down, their variation being continuous; there are no other characters that could separate the species. *D. clemensiae* was described from a form with long anthers that are often only rather gradually incurved at the base. This form is fairly common in north-east New Guinea. The type of *D. brassii* has the shortest anthers of any of the specimens examined but the other specimens placed in this species have longer anthers; specimens with short anthers and short appendages are commonest in the Central and Morobe Districts. Specimens with rather short anthers and long appendages come mainly from the West Sepik and Southern Highlands Districts westwards; the anthers in

these species are often rather abruptly incurved at the base. As at present circumscribed, *D. anchorifera* grows from 75 m (*Darbyshire & Hoogland* 8242, West Sepik District) to 2780 m (*Kalkman* 5197, Southern Highlands); it has been found in the montane zone through much of the New Guinea mainland west of the Central District.

36. *Dimorphanthera beccariana* (Koord.) J. J. Sm.

This occurs only on the Hellwig Mountains (Digul/Snow Mountains, West New Guinea); see also under *D. brevipes* (29).

37. *Dimorphanthera forbesii* (F. Muell.) F. Muell.

D. forbesii is close to *D. elegantissima* K. Sch. (50) from which it may be distinguished by its white corolla which does not exceed 2.7 cm in length; the base of the anther is horizontally sigmoid whilst in *D. elegantissima* it is simply incurved. Otherwise the anthers of the two species are similar.

Dimorphanthera forbesii has recently been collected on the lower slopes of Mount Suckling, on the north-western boundary of the Milne Bay District, Papua (NGF 34082, *Pullen* 8452), a considerable extension of its range since it was previously known only from the Central District (Mafulu, Woitape and Sogere, see also 37A).

37A. *Dimorphanthera alba* J. J. Sm. in *Nova Guinea* 18: 105. t. 24. 1936. Type: *Docters van Leeuwen* 10799 (holo BO, iso A (fragm.!), L!), 1200 m, Nassau Mountains (Snow Mountains/Digul, West New Guinea).

This species was included in the synonymy of *D. forbesii* without comment in *Sleumer* (1961). However, its stamens are longer, the major stamens being 13–14 mm long as against 7.5–11(–12) mm long, its anthers are much less woody and are incurved and then downwardly pointed at the base, rather than horizontally S-shaped, and the corolla and pedicels are longer (2.5–3 and c. 1.5 cm long as against 1.5–2.0(–2.3) and c. 1 cm long). The pedicels are much thinner, c. 1.5 as against 2.7–4 mm thick, and the calyx limb is broadly spreading, not suberect. It is considered these differences merit the removal of *D. alba* from the synonymy of *D. forbesii*, especially as the specimens of the latter show little variation.

Dimorphanthera alba was described as having a corolla 3.5–3.9 cm long ('Flores ... inter maximos generis') with major stamens about 1.6 cm long, although the open corollas of the isotype at L are only 2.5–2.9 cm long and the major stamens are only 1.4 cm long. These discrepancies are inexplicable, since the inflorescence figured by *Smith* (*loc. cit.*) is clearly that of the sheet at L.

The top half of the corolla of *D. forbesii* is pronouncedly furrowed (bistratose), a point noted in its original description; that of *D. alba* is also furrowed, albeit less deeply. The furrows of *D. alba* are only a little shorter than those of *D. forbesii* but, because of the longer corolla of the former species, they appear considerably shorter.

38. *Dimorphanthera splendens* Sleum.

This is considered to be a variety of *D. elegantissima* K. Sch. (50).

39. *Dimorphanthera alpina* J. J. Sm.

39a. var. *alpina*

There are several atypical specimens of var. *alpina* from the Southern Highlands that have been confused with *D. collinsii* Sleum. var. *montis-wilhelmi* Sleum. These

specimens (NGF 28106, *Kalkman* 4615, 4902, *Vink* 16988, 16994, 17021, 17023, 17069, 17306, all from the Doma Peaks area) have corollas that are only sparsely hairy and which, when mature, may even appear to be glabrous; the connective and the lower surface of the leaf are also only slightly hairy. However, these differences are not worth recognizing formally.

Dimorphanthera alpina var. *alpina* may be distinguished from *D. collinsii* by a number of characters; its leaf margin, which is set with numerous setulose hairs, is often serrulate and the fine venation on the lower surface of the leaf is inconspicuous. Apart from the very prominent basal glands, *D. collinsii* has no multicellular hairs on the leaf margin and the fine venation of the lower surface of the leaf is conspicuous. The anthers of *D. alpina* var. *alpina* are thick and woody in texture and are incurved at the base; the spurs exceed the thecae by 1–3 mm. In *D. collinsii* the anthers are not so robust and are downwardly pointed at the base; the spurs do not exceed the thecae.

Dimorphanthera alpina var. *alpina* has also recently been collected from Mts Hagen (Western Highlands: ANU 6143, LAE 50277) and Ialibu (Southern Highlands: LAE 55829).

39b. var. *pubigera* Sleum.

Var. *pubigera* may be distinguished from var. *alpina* by the pubescent stems and also by the clearer tertiary venation on the lower surface of the leaf, although this latter character is less obvious on the type (*Brass* 10656, holo L, iso BRI! CANB!, Lake Habbema, Snow Mountains, West New Guinea). There is no difference in corolla length between the two varieties. The clear tertiary venation on the leaf is similar to that of *D. collinsii*; however, the thick, woody anthers incurved at the base and the serrulate leaf margins are obvious points of similarity with var. *alpina*.

40. *Dimorphanthera denticulifera* Sleum.

40a. var. *denticulifera*

Dimorphanthera denticulifera var. *denticulifera* is not always easy to distinguish from var. *pubens* Sleum. Although var. *denticulifera* is perhaps more frequently truncate at the base of the calyx tube and var. *pubens* rounded, this is often not very helpful in separating the two. Var. *pubens* has a pubescent corolla tube, but in a number of specimens that are otherwise good matches with var. *denticulifera*, a few hairs are found at the apex of young corollas.

40b. var. *pubens* Sleum. in *Nova Guinea n.s. (Bot.)* 7: 92. 1961. Type: *Brass* 30911 (holo L, iso LAE!), 2200 m, south slopes of Mt Otto, Eastern Highlands, north-east New Guinea.

D. gracilis Sleum. in *Nova Guinea n.s. (Bot.)* 7: 80. 1961. Type: NGF 6910 (*Womersley & Floyd*: holo L, iso LAE! BRI!), c. 2370 m, Korofunota via Goroka, Eastern Highlands, north-east New Guinea.

Dimorphanthera gracilis keys out separately from *D. denticulifera* var. *pubens* in Sleumer (1967) because it has entire or sub-entire leaves and *D. denticulifera* var. *pubens* has regularly and markedly subserrate-denticulate or crenulate leaves. However, the density of setular hairs on the margins of the leaves in the two species is the same, and there are all intermediates between entire and serrulate leaf margins in var.

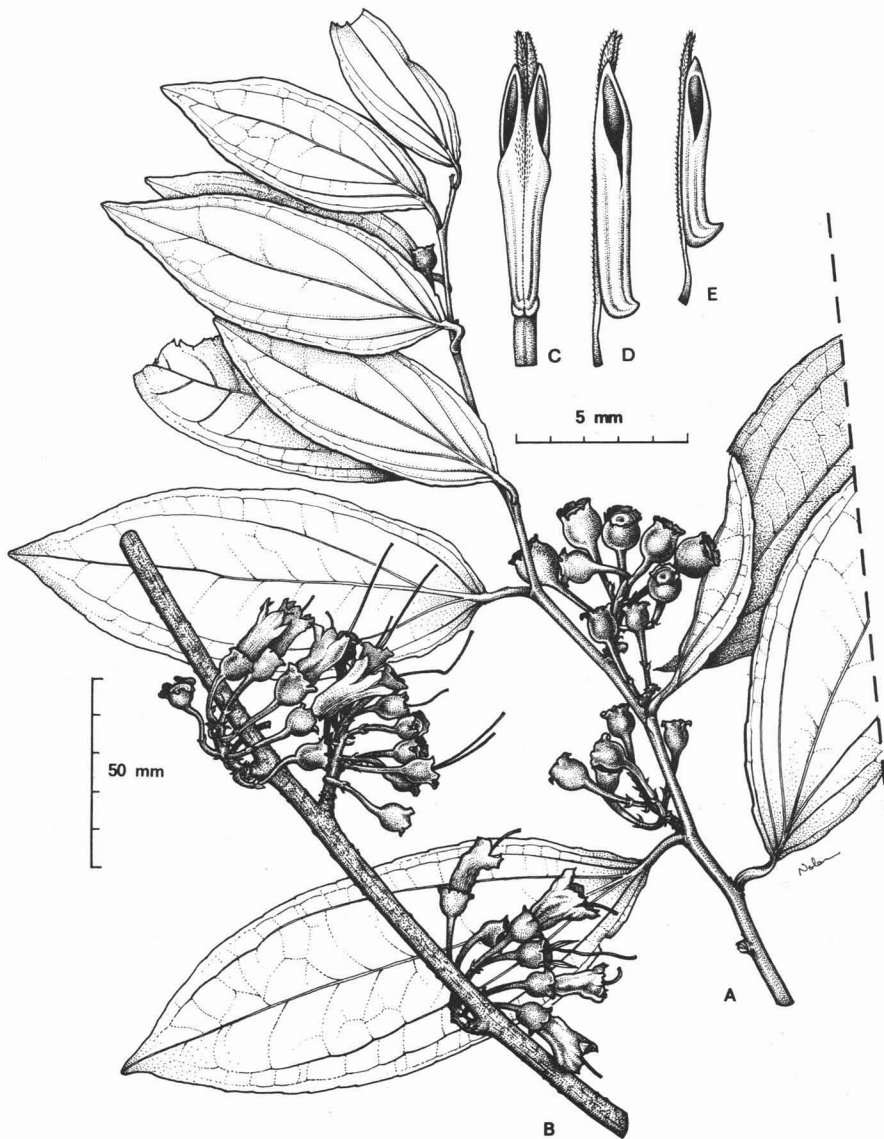


Fig. 4. *Dimorphanthera womersleyi* Sleum. var. *continua* Stevens, from NGF 15310. *A*, shoot; *B*, flowers from stem without leaves; *C*, major stamen from the front; *D*, major stamen from the side; *E*, minor stamen from the side.

pubens. In all floral details the types of *D. denticulifera* var. *pubens* and *D. gracilis* are the same.

Dimorphanthera denticulifera var. *pubens* may also occur in the Western Highlands but the specimens involved also approach *D. womersleyi* Sleum. (44). *Bowers* 639 (Kepaka, near Mt Hagen) has major stamens only 6.5 mm long and minor stamens only 5.5 mm long, about 1.5 mm shorter than those of most other specimens of both species; its corolla is like that of *D. womersleyi* in texture. ANU 591 (Lake Inim, near Sirunki), 2377 (near Wabag) and NGF 15206 (near Wabag) have larger stamens but their flowers, although thick-walled like those of *D. womersleyi*, are still shorter (c. 1.2 cm v. 1.6 cm). *Bowers* 639 has flowers articulated with the pedicel even at anthesis, in ANU 591 and 2377 and NGF 15206 this articulation is more or less visible only in bud and fruit. *D. womersleyi* does not have an articulated flower, that of *D. denticulifera* is articulated. The status of the specimens mentioned above is unclear.

44. *Dimorphanthera womersleyi* Sleum.

44b. var. *continua* Stevens var. nov.

Fig. 4

A varietate *womersleyi* axibus inflorescentiarum longioribus (0.8–2.2 cm longis in varietate *continua*, minus quam 1 cm longis in varietate *womersleyi*), corollis longioribus (circa 2 cm longis, non circa 1.6 cm longis), tubis calycum maioribus (circa 4.75×6.75 mm, non circa 3.5×4 mm) et antheris robustioribus (basi attenuatis introrsum flectentibus, non deorsum intendentibus) differt.

Differs from var. *womersleyi* in having a longer inflorescence axis (0.8–2.2 cm long in var. *continua*, less than 1 cm long in var. *womersleyi*), a longer corolla (c. 2 cm long, as against c. 1.6 cm long), a larger calyx tube (c. 4.75×6.75 mm, as against c. 3.5×4 mm) and more robust anthers which are incurved, rather than downwardly pointed, at the base.

Type: NGF 15310 (*Womersley*: holo LAE! iso BRI! CANB! NSW!, further duplicates sent to L, A, K, BO, SING, PNH, US, BSIP), 6.ix.1962, 457 m, Gurakor, Lae–Morobe Road, Morobe District, north-east New Guinea.

Sleumer (1964b, 1967) noted that the specimen from Gurakor differed from the others in the species because of its larger flowers. The differences in flower and inflorescence size, coupled with the difference in anthers, are thought important enough for taxonomic recognition. Attempts to re-collect the variety have failed. *D. womersleyi* var. *womersleyi* itself is now known from a number of collections, all from the Western Highlands.

44A. *Dimorphanthera viridiflora* Stevens, sp. nov.

Fig. 5

Dimorphanthera brachyantha auct. non Sleum. (1961): Sleum. in Nova Guinea n.s. (Bot.) 7: 86. 1961. typo excepto; Sleum. in Blumea 12: 139. 1963.

Frutex scandens. Ramuli 1.3–1.5 mm crassi, teretes, glabri. Petiolus 6–9 mm longus, glaber. Lamina ovata, suboblunga vel elliptica, 6–8.3 $\times$ 1.6–2.5 cm, apice basique acuta, glabra, coriacea, subtus laxe setulis appressis glandulosis nigris praedita, margine serrulata setulis brevibus glandulosis nigrescentibus subpersistentibus in angulis



Fig. 5. *Dimorphanthera viridiflora* Stevens, from Brass 31854. A, shoot; B, major stamen from the front; C, major stamen from the side; D, minor stamen from the side.

serrularum praedita, ad basin 5-plinervia, supra nervis leviter depressis infra leviter depressis vel elevatis, reti venarum supra obscuro, infra obscuro vel prominulo. Inflorescentiae fasciculatae ex axillis foliatis vel defoliatis ortae 1-2 flores ferentes; bracteae suborbiculares circa 1.75 mm longae. Pedicellus glaber 0.8-1.0 cm longus, 1.75 mm crassus, cum tubo calycis continuus, bracteolis duabus basalibus circa 2 mm longis plus minusve connatis pilis brevibus fimbriatis. Calyx glaber, tubo circa 2.5×4 mm basi truncato apicem versus leviter dilatato, limbo patenti circa 2.5 mm longo, lobis usque ad 1.2 mm longis late rotundatis apiculatis. Corolla tubularis viridis vel brunneolo-viridis, glabra, carnosae, circa 1.5 cm longa, cum lobis 5 triangularibus 1.5 mm longis, in angulis inter lobos tenuior. Stamina 10, dimorpha; filamenta 0.75-1.5 mm, glabra; antherae aliquantum lignosae, basi in processus deorsum intendentibus circa 0.75 mm longis attenuatae, pilis parvis paucis solum in antheris praeditis; antherae maiores (calcaria inclusa) 8.5-9 mm longae, tubulis divergentibus circa 2.5 mm longis, calcaribus complanatis subliberis vel connatis tubulos circa 0.75 mm superantibus; antherae minores 6.5-7.5 mm longa, tubulis erectis 1.5-1.75 mm longis, calcaribus connatis tubulos circa 1.5 mm superantibus. Ovarium 5-loculare; discus glaber; stylus 2.5 cm longus. Fructus ignotus.

Climbing shrub. Lamina ovate, suboblong or elliptic, $6-8.3 \times 1.6-2.5$ cm, apex and base acute, margin serrulate, main veins 5-plinerved at the base, veins depressed above, depressed or slightly elevated below, fine venation obscure above, obscure or prominulous below. Inflorescences from foliate or defoliate axils, fasciculate, 1-2-flowered. Bracts small, bracteoles basal, pedicels continuous with the calyx tube. Corolla tubular, green or brownish green, c. 1.5 cm long, glabrous. Anthers somewhat woody, narrowing to downwardly pointing processes at the base, glabrous apart from a few small hairs on the spurs, spurs of the major stamens half to completely adnate to the tubules, adnate to the tubules in the minor stamens; major anthers 8.5-9 mm long, minor anthers 6.5-7.5 mm long.

Type: Brass 31854 (holo LAE! iso CANB!), 2.ix.1959, 1950 m, Purosa, Okapa Area, Eastern Highlands, north-east New Guinea.

Further specimen. NORTH-EAST NEW GUINEA: Eastern Highlands: Purosa, Okapa area, 2000 m, Brass 31827.

Dimorphanthera viridiflora has been confused with *D. brachyantha* Sleum. (26); for the differences separating the two see the latter species.

Hornabrook 90 (near Okapa, 1829 m) is similar in leaf and inflorescence to *D. viridiflora*, but its calyx tube is prominently articulated with the pedicel, and the stamens are markedly hairy. More collections are needed to clarify this specimen's identity.

Dimorphanthera womersleyi Sleum. var. *womersleyi* is most similar to *D. viridiflora*, but the former has lateral nerves that always diverge well above the base of the larger leaf. It also has a 7- to 15-flowered inflorescence, a rounded base to the calyx tube and more hairy stamens.

49. *Dimorphanthera collinsii* Sleum.

There has been some confusion between this species and *D. alpina* J. J. Sm. (39), but the two species are easy to distinguish even in leaf; for the differences separating them, see *D. alpina*.

D. collinsii var. *collinsii* is known from Mts Michael, Otto, Kerigomna and possibly Wilhelm, all in the Eastern Highlands; it is not known from the Southern Highlands (cf. Sleumer 1967). *D. collinsii* var. *montis-wilhelmi* Sleum. is known from Mts Otto, Kerigomna and Wilhelm (Eastern Highlands) and in a slightly different form, with less prominent basal glands on the lamina, from the Minj-Nona divide in the Kubor Range (Western Highlands).

Two specimens from near Tomba, Mt Hagen, Western Highlands (NGF 43755 and LAE 54943) represent a rather unusual form of *D. collinsii* var. *montis-wilhelmi*. Although they are somewhat of the facies of *D. amoena*, they have a 5-locular ovary. From more typical var. *montis-wilhelmi* they differ in having long, $\pm$ elliptic leaves with the fine veins rather obscure below and in the very broad spurs of the minor anthers.

50. *Dimorphanthera elegantissima* K. Sch.

50a. var. *elegantissima*

This variety is known from the eastern part of the Eastern Highlands (as far west as near Kundiawa), Madang, Morobe and Milne Bay Districts.

NGF 11870 and *Ardley* s.n. (Morobe District) were cited as *D. denticulifera* Sleum. var. *denticulifera* in Sleumer (1963), but are really *D. elegantissima* var. *elegantissima*. The latter differs from *D. denticulifera* var. *denticulifera* in having a much more fleshy corolla, a thicker calyx tube more abruptly truncate at the base and in its calyx limb having only obscure lobes. The anthers of the two are very different; those of *D. elegantissima* are thicker, woody and rigid and are incurved at the base, whilst those of *D. denticulifera* var. *denticulifera* are thinner, hardly woody and are downwardly pointing at the base.

The two specimens mentioned above, as well as some others from the foothills of the Saruwaged and Finisterre Mountains (NGF 19782, *Osia Gason* s.n. LAE sheet number 128941) have very short corollas, sometimes only 1.6 cm long. However, the type of *D. kaniensis* Schltr (a synonym of *D. elegantissima*: *Schlechter* 16533, 1000 m, Bolobo Mountains, Madang District; holo B destroyed, iso P!) and that of *D. elegantissima* (*Biro* 26, c. 800 m, Sattelberg, Morobe District; holo B destroyed, iso BP), from foothills at opposite ends of this mountain system, have corollas about 3 cm long.

50b. var. *splendens* (Sleum.) Stevens, comb. et stat. nov.

Dimorphanthera splendens Sleum. in Nova Guinea n.s. (Bot.) 7: 91. 1961. Type: NGF 6002 (*Womersley, van Royen and Versteegh*: holo L, iso LAE! BRI!), 1830 m, Aiyura, Eastern Highlands, north-east New Guinea.

A varietate *elegantissima* corolla pubescenti, non glabra, differt.

Differs from var. *elegantissima* in having a pubescent, not glabrous, corolla.

From a comparison of the descriptions of *D. elegantissima* and *D. splendens* in Sleumer (1967) only minor differences appear to separate the two:

- (1) Leaf size of *D. elegantissima* is given as 11–20(–23) $\times$ 3–6(–8) cm, that of *D. splendens*, 7–14 $\times$ 2–4.5 cm. This difference is not maintained in the specimens now collected.

- (2) The basal glands of the leaf are reported to be conspicuous in *D. splendens*, less so in *D. elegantissima*. The type of *D. splendens* has more prominent basal glands than most other specimens, but there is no difference between these other specimens and those of *D. elegantissima*. Both species have a more or less serrulate margin to the leaf.
- (3) The calyx limb of *D. elegantissima* is given as being (2-)3-4 mm long, that of *D. splendens*, 1.5-2.0(-2.5) mm. With the more numerous specimens now available this difference breaks down.
- (4) The inflorescence of *D. elegantissima* is glabrous whilst that of *D. splendens* is subdensely short pubescent. This difference is clear-cut; there are no intermediates.
- (5) In the anthers of *D. elegantissima* the spurs are supposed to be 1-3 mm longer than the tubules, in *D. splendens* the two are about equal in length. There is great variation in spur type in specimens of both these species, with the spurs free or fused, as long as the tubules, or exceeding them by up to 3.5 mm. *Brass* 31951, cited as *D. elegantissima* in Sleumer (1961, as 31957 by mistake) has stamens almost identical to those of NGF 6002, the type of *D. splendens*.

The only consistent difference between the two is that of the pubescence of the inflorescence, hence varietal rank for *D. splendens* seems most appropriate. *D. elegantissima* var. *splendens* is known only from the Eastern (as far east as Kainantu), Western and Southern Highlands Districts.

51A. *Dimorphanthera bracteata* Stevens, sp. nov.

Fig. 6

Frutex epiphyticus, ramulis plus minusve scandentibus. Ramuli 1-1.75 mm crassi, glabri, lineis elevatis rotundatis e petiolis decurrentibus, perulis gemmarum ovatis 1 mm longis, glabris. Petiolus (3-)5-10 mm longus, glaber. Lamina elliptica vel lanceolata, 5-10 × 1.3-3.3 cm (saepe tantum 2.6 × 0.5 cm ad basin vel apicem incrementi), apice acuminata, basi acuta, glabra, juventute infra glanduloso-punctulata, margine integro, basi glandulis duabus praedita, venatione camptodroma, nervis maioribus 4-8, supra planis infra elevatis, reti venularum supra obscuro infra minute elevato. Inflorescentiae subfasciculatae ex axillis veteris foliatis vel defoliatis ortis, axibus 6-10 mm longis cum 6-10 floribus; bractee ovatae vel lanceolatae, 5-13 × 3-5 mm, glabrae, per anthesin persistentes. Pedicellus cum tubo calycis articulatus, 6-8 mm longus, glaber, bracteolis oppositis ad basin pedicelli insertis, 5-6.5 mm longis, glabris, marginibus bracteolarum versus axem inflorescentiae semiconnatis ab axe marginibus liberis. Calyx viridis, glaber, tubo 2-2.7 × 2.3-3 mm longo basi truncato plus minusve annulato, limbo 4-5 mm longo effuso, lobis 5, raro 4, triangularibus, interdum inaequalibus, 1-2.7 mm longi. Corolla tubularis rubra carnosae 2.2-2.8 cm longa (in vivo 3.5 × 1.1-1.3 cm) glabra, lobis 5, raro 4, triangularibus, 2.5-3 mm, in angulis inter lobos tenuior. Stamina 10, dimorpha; filamenta 2-3 mm longa, rubra, glabra; antherae lignosae, flavae, basi plus minusve acutae, incurvatae, connectivis et calcaribus albis pilis paucis praeditis; antherae maiores 7-8 mm longae (calcaribus inclusis), tubulis 2.5-3 mm longis divergentibus, calcaribus liberis complanatis tubulos haud vel leviter superantibus; antherae minores 5.8-7.2 mm longae, tubulis 2.8-3.5 mm longis, calcaribus connatis tubulos haud superantibus. Ovarium 5-loculare; disco glaber; stylus 2.5-3.3(-4.0) cm longus. Fructus immaturus in siccitate prope basin plus minusve abrupte annulato (in fructu vivo annulus haud visus).

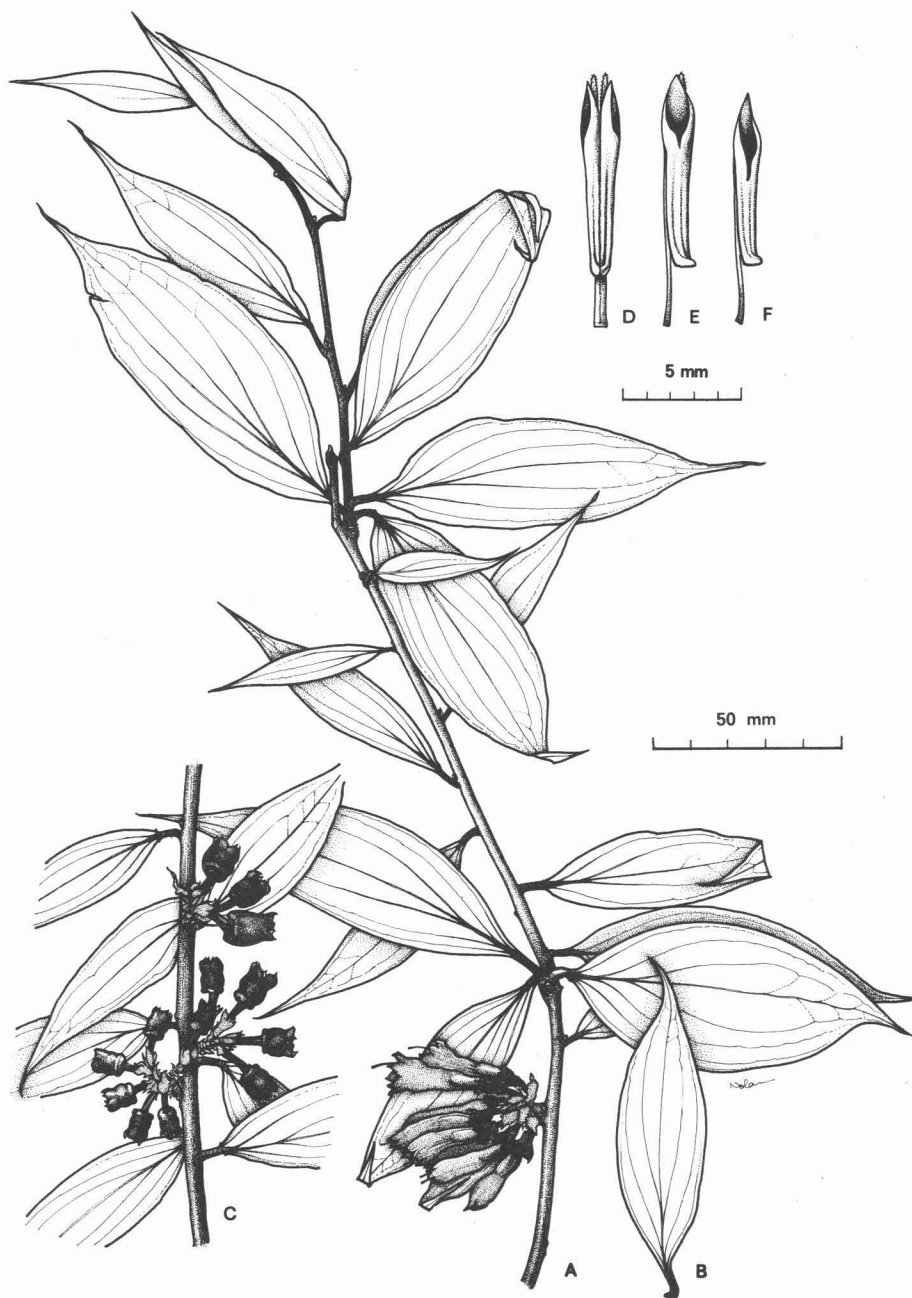


Fig. 6. *Dimorphanthera bracteata* Stevens, A–C from LAE 58386, D–F from LAE 58352. A, flowering shoot; B, submature fruits; C, leaf from above; D, major stamen from the front; E, major stamen from the side; F, minor stamen from the side.

Epiphytic shrub. Lamina elliptic or lanceolate, 5-10 × 1.3-3.3 cm (often as little as 2.6 × 0.5 cm at the beginning and end of a growth increment), apex acuminate, base acute, margin entire, venation camptodromous, fine veins obscure above, minutely raised below. Inflorescences from foliate or defoliate axils, subfasciculate, axis 6-10 mm long, 6-10-flowered. Bracts prominent, to 1.3 cm long, persisting until anthesis, bracteoles basal, pedicel articulated with the calyx tube, calyx tube drying more or less annulate at the base. Corolla tubular, red, 2-2.7 cm long, glabrous. Anthers woody, incurved at the base, with small hairs on the spurs and connectives, spurs free from the tubules, connate in the minor stamens; major anthers 7-8 mm long, minor anthers 5.8-7.2 mm long.

Type: LAE 58386 (*Stevens et al.*: holo LAE! duplicates sent to L, CANB, BRI, A, K, E seen before distribution), 11.v.1973, 1830 m, Mt Lululua (5°43'S., 150°58'E.), East New Britain District, Bismarck Archipelago.

Further specimens. BISMARCK ARCHIPELAGO: New Britain: Talasea, Mt Talawe, 1950 m, NGF 26814 (*Frodin*); lower slopes of Mt Lululua, 1525 m, LAE 58269 (*Stevens & Lelean*); Mt Lululua, 1830 m, LAE 58352 (*Stevens & Isles*).

Dimorphanthera bracteata was also seen at 1220 m on a mapping site at the edge of the Mengen Massif (5°04'S., 151°48'E.).

Dimorphanthera bracteata is probably most closely related to *D. megacalyx* Sleum. which has been found in the Saruwaged Mountains and Rawlinson Range area (Morobe District). Although similar in inflorescence and flower type, *D. megacalyx* is a much more robust plant with unicellular hairs at least fringing the bracts and sometimes also occurring on the stem and lower surface of the leaves, the leaves are large, do not show the great variation in size on the one shoot, are sub-oblong to ovate in shape and are not acute at the base. The margin, although sometimes entire, is set with black setular hairs. Florally the most obvious differences are the more robust flowers of *D. megacalyx* and much more densely hairy anther connectives and spurs. The dried fruits of *D. megacalyx* are more or less rounded at the base and lack the distinctive shape of those of *D. bracteata*.

The bracteoles are partly connate on the side of the pedicel towards the inflorescence axis and are free on the other side; this is a point of similarity shared with other species of *Dimorphanthera* (including *D. megacalyx*) with partly connate bracteoles; if they are partly fused on the abaxial side as well this connation is less than that on the adaxial side. In some at least of those species that have free bracteoles, the bracteoles are closer together on the adaxial than on the abaxial side.

52A. *Dimorphanthera glauca* Stevens, sp. nov.

Figs 24, 7

Frutex scandens. Ramuli circa 3 mm crassi, glabri, obtusangulati. Petiolus 1-1.3 cm longus, glaber. Lamina lanceolata, 10.7-19 × 3-4.5 cm, apice acuminata, basi breviter decurrens, glabra, subtus setulis nigris numerosis praedita, margine anguste serrulataeque recurvata minute serrulata setulis brevibus subpersistentibus in angulis serrularum praedita, prope basin 5-plinervia, nervis supra leviter elevatis vel depressis, infra manifeste elevatis, reti venarum supra obscuro, infra leviter elevato. Inflorescentiae fere fasciculatae ex axillis foliatis vel saepe defoliatis ortae, axibus tumulos ad 7 × 7 × 4 mm facientibus 3-8 flores gerentibus; bracteae late ovatae, circa 2 mm longae, pilis paucis crassis glandulosis fimbriatae. Pedicellus cum tubo calycis articulatus, glaber,

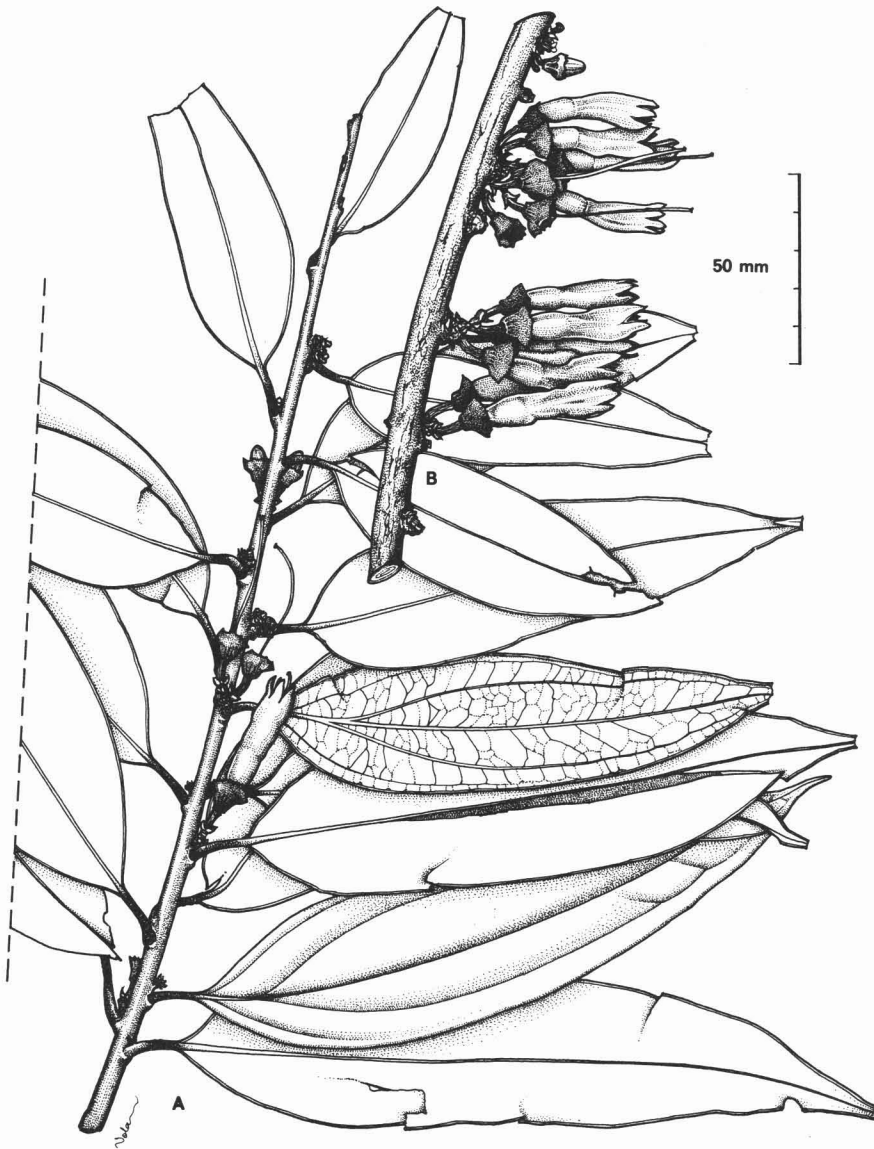


Fig. 7. *Dimorphanthera glauca* Stevens, from NGF 42996. A, shoot; B, flowers from stem without leaves.

7-9 × 1.75 mm, bracteolis duabus, fere basalibus, liberis vel fere connatis, late ovatis, circa 2 mm longis, setulis crassis glanduliferis fimbriatis. Calyx glaber, tubo circa 1.75-3 × 5 mm, basi truncato, versus apicem leviter dilatato, limbo 3-3.5 mm longo quam tubo latiore dilatato, lobis circa 0.4 mm longis. Corolla tubularis, hebetopurpurea, glauca, carnosa, glabra, 3-3.6 × circa 0.6 cm, lobis 5 triangularibus 2-2.5 mm longis. Stamina 10, dimorpha; filamenta circa 2.3 mm longa, apice pilosis; antherae lignosae, ad basin incurvatae connectivis calcaribus et apicibus antherarum antice pilis praeditis, antherae maiores circa 9.75 mm longae, tubulis circa 5 mm longis divergentibus, calcaribus tubulos aequantibus, basi connatis, apicem versus plerumque abrupte divaricatis, connectivo infra tubulos in processus duos pilosos laterales circa 0.5 mm longis producto; antherae minores circa 7.75 mm longae, tubulis erectis circa 3.5 mm longis, calcaribus connatis tubulos aequantibus. Ovarium 5 loculare; discus glaber; stylus circa 3.7 cm longus. Fructus ignotus.

Scandent shrub. Lamina lanceolate, 10.7-19 × 3-4.5 cm, apex acuminate, base shortly decurrent, margin entire, narrowly and clearly recurved, main veins 5-plinerved near the base, fine venation obscure above, slightly elevated below. Inflorescences from foliate or defoliate axils, almost fasciculate, 3-8-flowered. Bracts small, bracteoles almost basal, pedicels articulated with the calyx tube. Corolla tubular, dark purple, glaucous, 3-3.6 cm long, glabrous. Anthers woody, incurved at the base, with hairs on connectives, spurs and the fronts of the thecae, connectives with two hairy lateral processes arising below the thecae, spurs free from the tubules, connate in the basal half in the major stamens and fully connate in the minor stamens; major anthers c. 9.75 mm long, minor anthers c. 7.75 mm long.

Type: NGF 42996 (Henty & Barlow: holo LAE! iso BRI!, further duplicates sent to L, CANB, A, K), 29.vii.1970, 110 m, Ningerum, Western District, Papua.

Dimorphanthera glauca is perhaps closest to the imperfectly known *D. militaris* J. J. Sm. (52), another lowland species known only from a single specimen (*Docters van Leeuwen* 10278 (holo BO, iso BRI! L!), 250 m, Rouffaer River, Djajapura, West New Guinea). *D. glauca* has larger, relatively narrower leaves with a prominently revolute margin; its flowers are borne on stouter pedicels, are considerably larger and are purple in colour, rather than red. The major anthers of *D. glauca* have spurs not exceeding the anthers (Fig. 2A), whilst in *D. militaris* the spurs exceed the anthers by about 1.5 mm (possibly unimportant), the minor anthers of *D. glauca* have acute apices to the tubules and the rather curious paired lateral processes; in *D. militaris* the apices of the tubules are ± truncate and there are no paired lateral processes.

It may be of some significance that *D. glauca*, *D. militaris* and *D. intermedia* J. J. Sm., all species growing at low altitudes, have leaves of similar texture; they are thick, with the main veins prominently raised below and the fine venation obscure.

53. *Dimorphanthera lancifolia* Sleum.

This species is known only from the type, *Darbyshire* 441 (holo CANB! iso BRI! LAE!), collected in the Toricelli Mountains, West Sepik District. Leaf size cannot be used to separate it from *D. denticulifera* var. *denticulifera* (40); it is best keyed out from that variety on its rounded, little spreading calyx lobes (in *D. denticulifera* they are pointed and often spreading) and its corolla, which is narrowly furrowed in its top half (that of *D. denticulifera* is not furrowed).

63. *Dimorphanthera microphylla* Sleum.

This has recently been collected from Mt Kerigomna in the Eastern Highlands (LAE 54594).

65. *Dimorphanthera dryophila* Sleum.

65a. var. *dryophila*

This variety is very common on Mt Suckling (in the north-west part of the Milne Bay District), its altitudinal range being 680–2455(–c. 2750) m (LAE 54015, 54070, 54984, 55577).

65b. var. *trichoclada* Sleum.

Two further collections of this variety have been made just to the south-east of Mt Dayman, the locality of the type specimen: Mt Param, *Cruttwell* 1545; Mt Duau, LAE 58143. These two specimens are less prominently velutinous than the type (*Brass* 22406, iso LAE! CANB!) and the stem is soon glabrescent. LAE 58143 was growing with var. *dryophila*, and there was no difference in the colour of the corollas of the two varieties (*pace* Sleumer 1967). However, there may be a further difference between the two varieties; the corollas of LAE 58143 were slightly, but noticeably, constricted at the apex and this was also seen in a slide of *Cruttwell* 1545. The corolla of var. *dryophila* does not seem to be constricted at the apex.

65A. *Dimorphanthera longistyla* Stevens, sp. nov.

Fig. 8

Frutex epiphyticus vel scandens. Ramuli circa 2.5 mm crassi, glabri, lenticellis praediti, perulis gemmarum ovatis circa 1.2 mm longis, pilis paucis parvis praeditis. Petiolus 0.6–1.2 cm longus, spissescens ubi vetustus. Lamina ovata vel oblonga, 13.5–22 × 4.4–8 cm, apice acuminate (acumine 1–2 cm longo), basi acuta vel cuneata, glabra, juventute infra laxe glanduloso-punctulata, margine serrulata setulis brevibus glandulosis subpersistentibus in angulis serrularum, basi glandulis duabus praedita, ad basin 5–7-plinervis, saepe nervis duobus parum supra basin ortis, nervis supra plus minusve elevatis, infra manifeste elevatis, reti venularum supra prominulo, infra manifeste elevato. Inflorescentiae subfasciculatae ex axillis veteribus foliatis et defoliatis ortae, axibus tumulos ad 0.75 × 1.25 × 0.5 cm facientibus 4–10 floribus gerentibus; bracteae ovatae, circa 4 mm longae, apice acutae, pilis praeditae. Pedicellus cum tubo calycis articulatus, 7–10 mm longus, bracteolis oppositis basin pedicelli insertis, 4–5.5 mm longis, interdum marginibus pilis praeditis, connatis versus axem inflorescentiae subconnatis ab axe. Calyx viridis, tubo 2–2.75 mm longo glabro, basi truncato apicem versus aliquantum dilatato, limbo 2.75–3.25 mm longo plus minusve patenti, intus pilis brevibus praedito, lobis 5 triangularibus, circa 1.5 mm longis, interdum pilis brevibus fimbriatis. Corolla tubularis, rubra, carnea, glabra, 0.9–1.2 cm longa, lobis 5 triangularibus, alba, circa 2 mm longa. Stamina 10, dimorpha; filamenta circa 2 mm longa, glabra; antherae lignosae, basi acutae deorsum intendent, connectivis pilosis; antherae maiores 6–7 mm longae, tubulis divergentibus circa 2 mm longis; antherae minores circa 5 mm longae, tubulis erectis circa 1.75 mm longis. Ovarium 5-loculare; discus 10-lobus, glaber vel prope centrum pilis brevibus praeditus; stylus curvatus demum longe exsertus, circa 2 cm longus. Fructus ignotus.

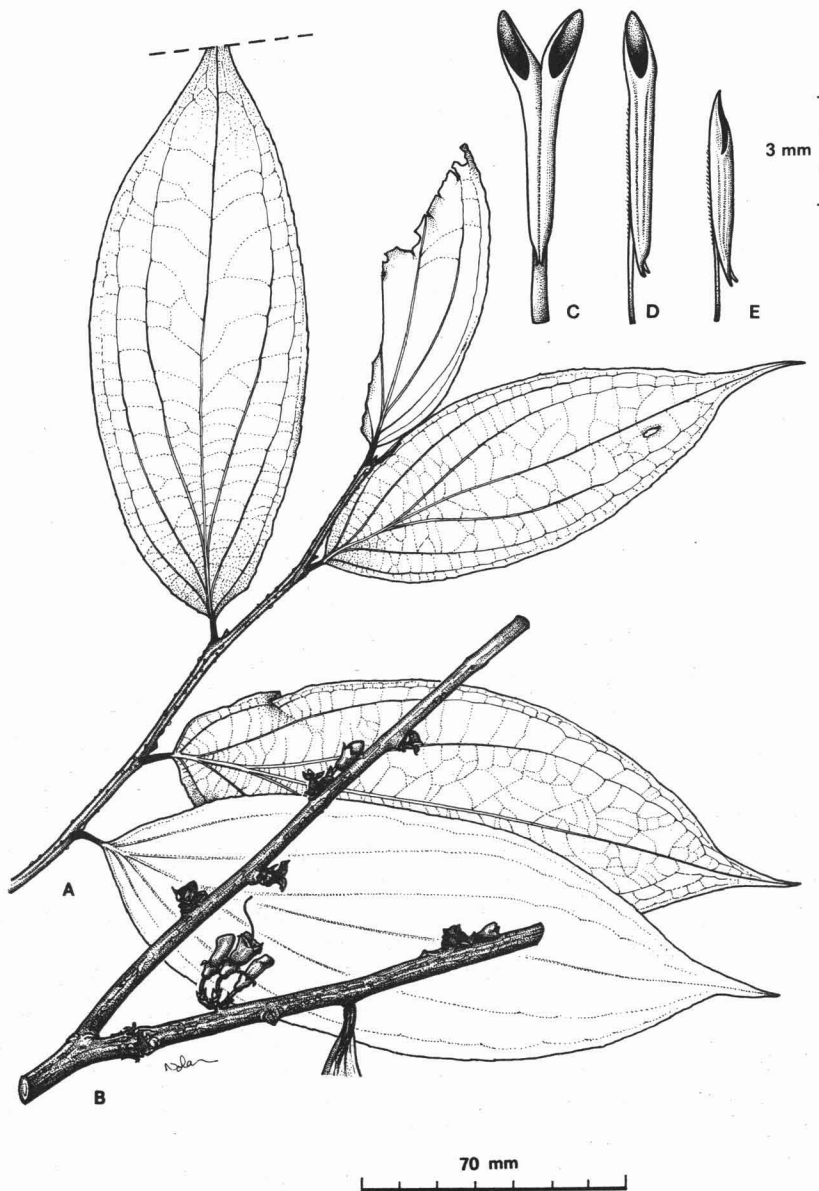


Fig. 8. *Dimorphanthera longistyla* Stevens, *A* from Pullen 5557, *B–E* from Pullen 5482. *A*, leafy shoot; *B*, flowering stem; *C*, major stamen from the front; *D*, major stamen from the side; *E*, minor stamen from the side.

Epiphytic or scandent shrub. Lamina ovate or oblong, 13.5–22 × 4.4–8 cm, apex acuminate, base acute or cuneate, margin serrulate, main veins 5-plinerved at the base, fine venation prominulous above, clearly raised below. Inflorescences from foliate or defoliate axils, subfasciculate, 4–10-flowered. Bracts small, bracteoles basal, pedicel articulated with the calyx tube. Corolla tubular, red, 0.9–1.2 cm long, glabrous. Anthers woody, acute base downwardly pointing, connectives only with hairs, spurs absent; major anthers 6–7 mm long, minor anthers *c.* 5 mm long.

Type: Pullen 5482 (holo CANB! iso LAE!), 28.vii.1964, 1128 m, south slopes of Hydrographers Range near Siurane Village, Managalase area, Northern District, Papua.

Further specimen. PAPUA: Northern District: Managalase Area, near Siurane Village, 1128 m, Pullen 5557.

Dimorphanthera longistyla is close to *D. dryophila* Sleum. (65) especially in stamen type. However, *D. dryophila* has an inflorescence with only 3–5 flowers; these flowers are larger (calyx tube plus limb 6–9 mm long, corolla 1.5–2 cm long, major stamens *circa* 10 mm long and minor stamens *circa* 8.5 mm long) and the corolla thicker. The pedicels hardly exceed the bracteoles and the corolla is more robust, being relatively little distorted during pressing. The corolla tube of *D. longistyla* is easily squashed during pressing and then appears to be campanulate.

Pullen 5482 has a glabrous disc, a barrel-shaped calyx tube and oblong leaves; Pullen 5557 has a shortly pubescent disc, a calyx tube widening gradually towards the top and more or less ovate leaves. Otherwise the specimens agree well.

66. *Dimorphanthera tedentii* Stevens, sp. nov.

Fig. 9

Frutex scandens. Ramuli *circa* 1 mm crassi, glabri, teretes. Petiolus 6–7 mm longus, *circa* 2 mm crassus, verruculosus. Lamina ovata, 14.7–20 × 5.4–6.7 cm, apice acuminata (acumine *circa* 2 cm longo), basi rotundata, coriacea, glabra, margine plus minusve integra (ad basin excepta ubi plerumque pari uno dentium usque ad 1 mm longorum praedita), ad marginem glandulis parvis setiformibus praedita, ad basin 5–7-plinervia, nervis duobus parum supra basin ortis, nervis supra leviter elevatis, infra manifeste elevatis, reti venularum utrinque prominulo, elevato. Inflorescentiae ex axillis defoliatis ortae, puberulae, axibus 6–8 mm longis cum 1–3 floribus; bracteae ovatae, 2 mm longae, apice acutae. Pedicellus cum tubo calycis articulatus, 1.5–1.9 cm longus, bracteolis duabus suboppositis, 4–8 mm supra basin pedicelli insertis, ovatis 2–2.5 mm longis, apicibus acutis. Calyx puberulus, tubo obconico 3–4 × 5–6 mm, limbo patenti 4–4.5 mm longo lobis nullis vel obscuris. Corolla tubularis, atro-rosea, carnosa, *circa* 4.3 × 0.8 cm, extus puberula, intus glabra, lobis 5 triangularibus, 3.5 mm longis, in angulis inter lobos tenuior. Stamina 10, dimorpha; filamenta *circa* 1.7 mm longa apicem versus pilosa; antherae lignosae basi incurvatae connectivis cum pilis numerosis, calcaribus cum pilis paucis, et apicibus antherarum antice cum pilis numerosis praeditae; antherae maiores *circa* 11.5 mm longae (calcaribus inclusis), tubulis 3–3.5 mm longis divergentibus, calcaribus liberis complanatis divergentibus tubulos *circa* 2 mm superantibus; antherae minores *circa* 10.5 mm longae, tubulis erectis *circa* 2.7 mm longis, calcaribus connatis erectis tubulos *circa* 2.5 mm superantibus. Discus glaber. Stylus *circa* 4.5 mm longus. Fructus ignotus.

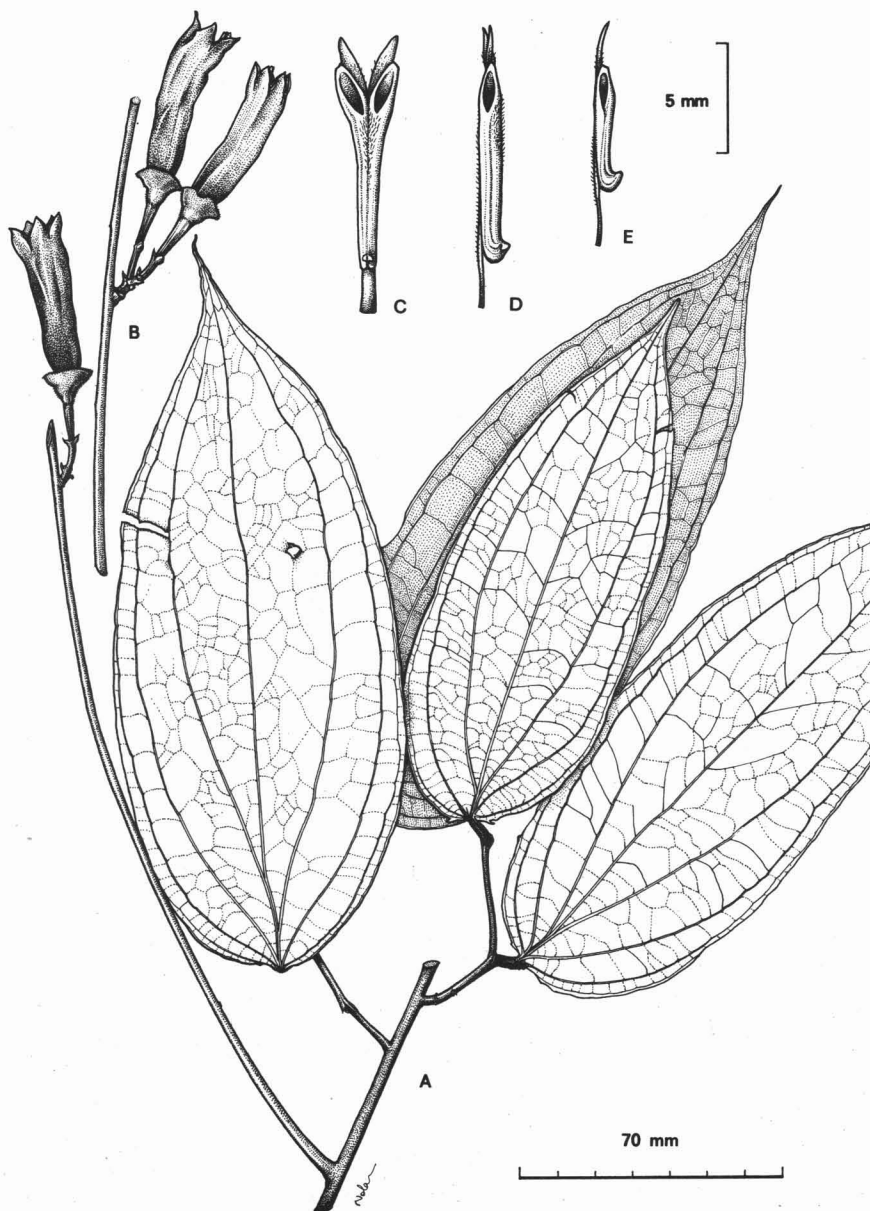


Fig. 9. *Dimorphanthera tedentii* Stevens, from NGF 42768. *A* and *B*, parts of the plant; *C*, major stamen from the front; *D*, major stamen from the side; *E*, minor stamen from the side.

Scandent shrub. Lamina ovate, 14.7–20 × 5.4–6.7 cm, apex acuminate, base rounded, margin almost entire except at the base where there are often a pair of prominent teeth, main veins 5- to 7-plinerved at the base, fine venation prominulous on both surfaces. Inflorescences from defoliate axils, axis 6–8 mm long, 1- to 3-flowered, puberulous. Bracts small, bracteoles inserted on the bottom ¼–½ of the pedicel, pedicel articulated with the calyx tube, calyx tube obconical. Corolla tubular, dark red, c. 4.3 cm long, puberulous on the outside. Anthers woody, incurved at the base, with hairs on the connectives, spurs and on the tops of the anthers in front, spurs free from the tubules, in the minor stamens connate; major anthers c. 11.5 mm long, minor anthers c. 10.5 mm long.

Type: NGF 42768 (*Henty, Foreman and Galore*: holo LAE! iso BRI! further duplicates sent to L, CANB, A, K), 29.ix.1969, 835 m, near Kennecott field camp, Ok Tedi headwaters, Kiunga Subdistrict, Western District Papua.

Further specimen. PAPUA: Western District: Fly River, 528 mile camp, 80 m, *Brass* 6682 (A).

Dimorphanthera tedentii is a very distinctive species, not obviously close to any others. Its inflorescence, with a few, large flowers, and its calyx, widening steadily from the point of articulation with the pedicel, immediately distinguish it from all other species of the genus.

ACKNOWLEDGMENTS

Thanks are due to Mr B. L. Burtt (Edinburgh) for his comments on a draft of the manuscript and to members of the Division of Botany, Department of Forests, Lae, for discussion. I am also very grateful to Terry Nolan, Illustrator at the Division of Botany, for making the drawings.

LIST OF SPECIMENS EXAMINED ANATOMICALLY

Specimens of *Dimorphanthera* and Malesian *Vaccinium* whose anatomy has been examined (* = stem only, † = leaf only, numbers preceding species are those used in Sleumer 1967).

Dimorphanthera F. Muell.

Sect. *Dimorphanthera*

- 7 *D. kempteriana* J. J. Sm., NGF 11429, 15039, 21936
- *8 *D. intermedia* J. J. Sm., NGF 43826
- †11 *D. amblyornidis* (Becc.) F. Muell. var. *moorhousiana* (F. Muell.) Sleum., *Forbes* 784
- 12 *D. dekockii* J. J. Sm. var. *dekockii*, NGF 42643
- †13 *D. apoana* (Merr.) Schltr, Philippine Island Plants 11258

Sect. *Trochilanthe* Schltr

- *16 *D. velutina* Schltr ssp. *rufa* Stevens, NGF 28452, 32079
- *17 *D. amoena* Sleum., NGF 13961
- *24 *D. cornuta* J. J. Sm.
var. *cornuta*, *Vink* 17235
var. *tenuiflora* Sleum., NGF 43754
- *28 *D. vestita* Sleum., *Brass* 13219
- 31 *D. nigropunctata* Sleum., *Royen & Sleumer* 7379
- 32 *D. thibaudifolia* Sleum., *Sleumer & Vink* 4388
- *33 *D. robbinsii* Sleum., NGF 6357
- *37 *D. forbesii* (F. Muell.) F. Muell., NGF 34082
- 40 *D. denticulifera* Sleum. var. *pubens* Sleum., *Balgooy* 961
- 41 *D. leucostoma* Sleum., *Balgooy* 385, *Sleumer* 4148
- †44 *D. womersleyi* Sleum. var. *continua* Stevens, NGF 15310

Sect. *Trochilanthe* Schltr (Continued)

- 44A *D. viridiflora* Stevens, Brass 31854
- †50A *D. glauca* Stevens, NGF 42996
- *51 *D. megacalyx* Sleum., Hoogland 9362
- 51A *D. bracteata* Stevens, LAE 58386
- 53 *D. lancifolia* Sleum., Darbyshire 441
- 63 *D. microphylla* Sleum., Borgmann 21, NGF 35043, 39543
- *65A *D. tedentii* Stevens, NGF 42768

Sect. *Pachyantha* (Sleum.) Stevens (numbers refer to the account of *Vaccinium* in Sleumer 1967)

- 1 *D. macbainii* (F. Muell.) Stevens, *Giulianetti* s.n. anno 1886, NGF 45535, LAE 54528
- 2 *D. ingens* (Sleum.) Stevens, LAE 58805, Woods, cult. in E
- 3 *D. fissiflorum* (Sleum.) Stevens, LAE 54690
- 4 *D. keysseri* (Schltr ex Diels) Stevens, Hoogland & Schodde 7223, Robbins 334
- 5 *D. amplifolium* (F. Muell.) Stevens, LAE 51413

Vaccinium L.Sect. *Rigiolepis* (Hook. f.) J. J. Sm.

- 9 *V. borneense* W. W. Sm., Flora of Sarawak 66 (native collector)
- 11 *V. uniflorum* J. J. Sm., Sibat ak Luang S21783
- 19 *V. uroglossum* Sleum., Clemens 29854 = 29857, 40889 = 40802
- 22 *V. acuminatissimum* Miq., Wray 1418
- 27 *V. leptanthum* Miq., Sinclair 10627

Sect. *Oarianthe* Schltr

- 30 *V. villosiflorum* J. J. Sm., Sleumer & Vink 4223
- 33 *V. finisterrae* Schltr, NGF 17927
- 35 *V. brachycladum* Sleum., Kalkman 4479
- 36 *V. hatamense* Becc., BW 11466
- 37 *V. parvuliflorum* F. Muell., NGF 28476
- 39 *V. versteegii* Koord., Kalkman 4168
- 40 *V. myrsinoides* Schltr, Pullen 243
- 45 *V. cyclopense* J. J. Sm., NGF 30864
- 52 *V. whiteanum* Sleum., NGF 31285
- 54 *V. sororium* J. J. Sm., Brass 9317
- 55 *V. decumbens* J. J. Sm., Brass 9015
- 57 *V. oreomyrtus* Sleum., Brass 12446
- 58 *V. oranjense* J. J. Sm., Brass & Meyer Drees 9904A
- 59 *V. microphyllum* Reinw. ex Bl., Philippine Island Plants 9540, 11394
- 60 *V. globosum* J. J. Sm., Sleumer & Vink 4382
- 61 *V. leptospermoides* J. J. Sm., Royen & Sleumer 7441, Woods 1361
- 69 *V. amblyandrum* F. Muell., ANU 7162, Balgooy 131, 344, NGF 17968, Vink 16213, 16222
- 70 *V. evandinervum* Sleum., Pullen 215
- 72 *V. prostratum* Sleum., NGF 16187
- 73 *V. woolastonii* Wernh., NGF 20673

Sect. *Neojunghuhnia* (Koord.) Sleum.

- 75 *V. kostermansii* Sleum., Royen & Sleumer 6910, Sleumer & Vink 4249
- 78 *V. oreites* Sleum., Brass 9270
- 84 *V. spaniotrichum* Sleum., BW 8824

Sect. *Bracteata* Nakai

- 95 *V. auriculifolium* Sleum., NGF 11090, 40077
- 97 *V. wisselianum* Sleum., BW 8738
- 98 *V. thibaudifolium* Wernh., NGF 33304
- 100 *V. barandanum* Vid., Merrill 8334
- 101 *V. scortechinii* King & Gamble, Purseglove 4238
- 106 *V. dominans* Sleum., Brass 9422

Sect. *Bracteata* (Continued)

- 115 *V. varingifolium* Miq., cult. in E
- 124 *V. megalophyes* Sleum., *Brass* 12170
- 126 *V. daphniphyllum* Schltr, *Darbyshire* 322
- 127 *V. convallariiflorum* J. J. Sm., *Brass* 12458
- 130 *V. cordifolium* Stapf, *Clemens* 33151
- 134 *V. muriculatum* J. J. Sm., *Sleumer & Vink* 4384
- 136 *V. goodenoughii* Sleum., *Brass* 24832
- 139 *V. longiporum* Schltr, *Hoogland & Craven* 9435
- 142 *V. albicans* Sleum. var. *albicans*, NGF 14698
- 144 *V. aitapense* Sleum., *Darbyshire & Hoogland* 8370
- 147 *V. pachydermum* Stapf, *Flora of North Borneo* 102 (native collector)
- 152 *V. palawanense* Merr., *Elmer* 11470
- 155 *V. coriaceum* Hook. f., *Clemens* 27825A
- 156 *V. stapfianum* Sleum., *Clemens* 27116
- 157 *V. horizontale* Sleum., NGF 15271, 15780, 23266
- 158 *V. bancanum* Miq., *Clemens* 29952
- 161 *V. tenuipes* Merr., *Philippine Island Plants* 9819
- 163 *V. molle* J. J. Sm. var. *mollissimum* (Sleum.) Sleum., LAE 51068
- 169 *V. cuneifolium* Miq., *Warburg* 15078
- 170 *V. ambivalens* Sleum., *Royen & Sleumer* 6888
- 172 *V. amphoterum* Sleum., *Brass* 22902
- 174 *V. crenatifolium* Sleum., *Royen & Sleumer* 7494
- 175 *V. apophysatum* Sleum., *Lam* 3259
- 191 *V. angienae* Kan. & Hat., *Sleumer & Vink* 4379
- *192 *V. cruentum* Sleum., NGF 24632
- *194 *V. cavendishoides* Sleum., *Royen & Sleumer* 6849
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- *205 *V. schoddei* Sleum., NGF 24539
- *212 *V. xerampelinum* Sleum., BW 612
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- 237 *V. striicaule* Sleum., *Hoogland & Schodde* 7402

REFERENCES

- Geesink, R. (1972). A new species of *Langsdorffia* from New Guinea (Balanophoraceae). *Acta. Bot. Neerl.* 21, 102–6.
- Macbride, J. F. (1944). *Vaccinium* and relatives in the Andes of Peru. *Univ. Wyo. Publs* 11, 37–40.
- Mueller, F. von (1886). Description of a new Papuan *Vacciniaceae* plant. *Sth. Sci. Rec.* n.s. 2, 159–60.
- Niedenau, F. (1890). Über den anatomischen Bau der Laubblätter der Arbutoideae und Vaccinioideae in beziehung zu ihrer systematische Gruppierung und geographische Verbreitung. *Bot. Jb.* 11, 134–263.
- Raven, P. H., and Axelrod, D. I. (1972). Plate tectonics and Australasian paleobiography. *Science (Wash. D.C.)* 76, 1379–86.
- Schuster, R. M. (1972). Continental movements, 'Wallace's Line', and Indomalayan–Australasian dispersal of land plants; some eclectic concepts. *Bot. Rev.* 38, 3–86.
- Sleumer, H. (1941). *Vaccinioideen-Studien*. *Bot. Jb.* 71, 375–510.
- Sleumer, H. (1961). *Florae Malesianae precursores* XXVI. The genus *Dimorphanthera* F. v. M. *Nova Guinea* n.s. (Bot.) 7, 74–102.
- Sleumer, H. (1963). *Florae Malesianae precursores* XXXV. Supplementary notes towards the knowledge of the Ericaceae in Malaysia. *Blumea* 12, 89–144.
- Sleumer, H. (1966). Ericaceae (part) in 'Flora Malesiana'. Ser. 1, vol. 6, part 4, 469–668. (P. Noordhoff Ltd.: Groningen.)
- Sleumer, H. (1967). Ericaceae (part) in 'Flora Malesiana'. Ser. 1, vol. 6, part 5, 669–914. (P. Noordhoff Ltd.: Groningen.)

- Smith, J. J. (1936). Ericaceae. *Nova Guinea* 18, 89–121.
- Steenis, C. G. G. J. van (1962). The land-bridge theory in botany. *Blumea* 11, 235–372.
- Stevens, P. F. (1971). A classification of the Ericaceae; subfamilies and tribes. *Bot. J. Linn. Soc.* 64, 1–53.
- Stevens, P. F. (1972). Notes on the infrageneric classification of Agapetes, with four new taxa from New Guinea. *Notes R. Bot. Gard. Edinb.* 32, 13–28.

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