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NEW TAXA IN *PAPHIA* AND *DIMORPHANTHERA* (*ERICACEAE*) IN PAPUASIA AND THE PROBLEM OF GENERIC LIMITS IN *VACCINIEAE*

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New species of *Ericaceae* recently collected in Papua New Guinea necessitate a re-evaluation of the status of *Agapetes* subgenus *Paphia* section *Paphia*. The combination of molecular and morphological data confirms that *Agapetes*, currently a genus of about 100 species from Fiji, New Caledonia and Queensland to mainland SE Asia, and most diverse in the latter area, cannot be maintained in its current circumscription. Various taxonomic solutions that do justice to our current knowledge of the morphology and relationships of the two main parts of the genus are discussed. The reinstatement of *Paphia* does least violence nomenclaturally. All 23 taxa recognized in *Paphia* are listed, 14 new combinations of *Agapetes* from the New Guinea–SW Pacific area are made in *Paphia*, three new species are described (*P. megaphylla*, *P. vulcanicola* and *P. woodsii*), and an incompletely known taxon is characterized. A key to all taxa is presented. In *Dimorphanthera*, five new species are described (*D. angiliensis*, *D. anomala*, *D. antennifera*, *D. cratericola* and *D. inopinata*), three reduced to synonymy, one reduced to a variety and one variety recognized as a species (*D. continua*). A key to the 87 taxa currently recognized in the genus is presented.

Keywords. Classification, East Malesia, *Ericaceae*, generic limits, phylogeny.

INTRODUCTION

The rate of collection in montane habitats in Malesia, and particularly in New Guinea, has slowed over the last decade. Nevertheless, among recent collections are several novelties in *Vaccinieae*, common in the montane and subalpine vegetation there, as well as material that breaks down the *differentiae* between species accepted in Sleumer's account of the *Vaccinieae* for Flora Malesiana (Sleumer 1967; see Kron *et al*., 2002b, and Stevens, 2004 for the circumscription of *Vaccinieae* and descriptions of included genera). Some of these novelties are members of *Dimorphanthera* F. Muell. and *Agapetes* D. Don subgenus *Paphia* (Seem.) P.F. Stevens section *Paphia* (see Sleumer, 1967; Stevens, 1972, 1974). Recent molecular work (Kron *et al*., 2002a) that encompasses the whole of the *Vaccinieae* will, if confirmed, seriously compromise generic limits throughout the tribe. However, any resolution of phylogenetic relationships in the tribe is at least five years away (K. Kron, pers. comm.). What is one to do in the meantime?

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I had earlier suggested (Stevens, 1972) that the species of *Agapetes* from Papua New Guinea to Fiji and New Caledonia (referred to as Oceanic *Agapetes* below, and recognized in Stevens, 1972, as *Agapetes* subgenus *Paphia* section *Paphia*) were not immediately related to *Agapetes* from mainland SE Asia (Mainland *Agapetes*) or to most other Indo-Malesian species of *Vaccinium* L., being separated by their deep-seated (not superficial) phellogen and 5-locular (not secondarily almost 10-locular) ovaries. *Agapetes scortechinii* (King & Gamble) Sleumer, from the Malay Peninsula, was included in subgenus *Paphia* as section *Pseudagapetes* Airy Shaw; it is clearly different from Oceanic *Agapetes*. When working on the 1972 paper, I had wanted to reinstate *Paphia* Seem., but Bill Burtt reasonably pointed out that the morphological evidence was weaker than that I had advanced to support the removal of *Agarista* G. Don from *Leucothoe* D. Don and its establishment as a separate genus closely related to *Agauria* (DC.) Hook.f. (Stevens, 1970). For most of us at that time, morphological difference was the most important line of evidence to be drawn on when establishing higher taxa. Morphological gaps were most important, although relationships also played their part. However, the latter were based on interpretations of morphology that relied, among other things, on evolutionary 'trends' believed to be widely applicable, and on the *a priori* weighting of characters. Ironically, given the denouement of the story in this paper, various lines of evidence suggest that *Agauria* is indeed sister to *Agarista*, and it is now synonymized with it (Judd, 1984; Kron & Judd, 1997; see also Kron *et al*., 2002b; Stevens, 2004), while *Paphia* has to be reinstated.

Recent preliminary cytological studies by Atkinson *et al*. (1995) suggest that Oceanic *Agapetes* species are polyploid, while Mainland *Agapetes* and Malesian *Vaccinium* are basically diploid ($x = 12$). This, along with morphological and anatomical evidence (Stevens, 1997), suggests that Malesian and SE Asian *Vaccinium* and Mainland *Agapetes*, which from now on I will call *Agapetes* s.l. (Stevens, 2004), form the core of a monophyletic unit (pers. obs.; see also Stevens, 1972, 1985). In a two-gene study of 93 species of *Vaccinieae*, including one or more representatives of most genera and of most sections of *Vaccinium*, there is some molecular evidence for *Agapetes* s.l. as delimited here (Fig. 1). Although it is weak (Kron *et al*., 2002a), there is stronger evidence for the association of Mainland *Agapetes* and a subset of Indo-Malesian *Vaccinium*. Where *Agapetes scortechinii* fits remains unclear.

Although section *Paphia*, now containing c.20 species, has never been further divided, it shows extensive variation in characters which in the past have been considered to indicate sectional or even generic differences in *Vaccinieae*. These include articulation of pedicel with calyx, winging of calyx and corolla, corolla shape, and many details of the androecium, including connation of filaments and degree of granulation of anther thecae. There is also considerable variation in altitudinal range, habit, leaf, and inflorescence, though too little is known about seed anatomy to say that this, too, varies. This heterogeneity is increased by the description of *Paphia vulcanicola* P.F. Stevens and *P. megaphylla* P.F. Stevens below.

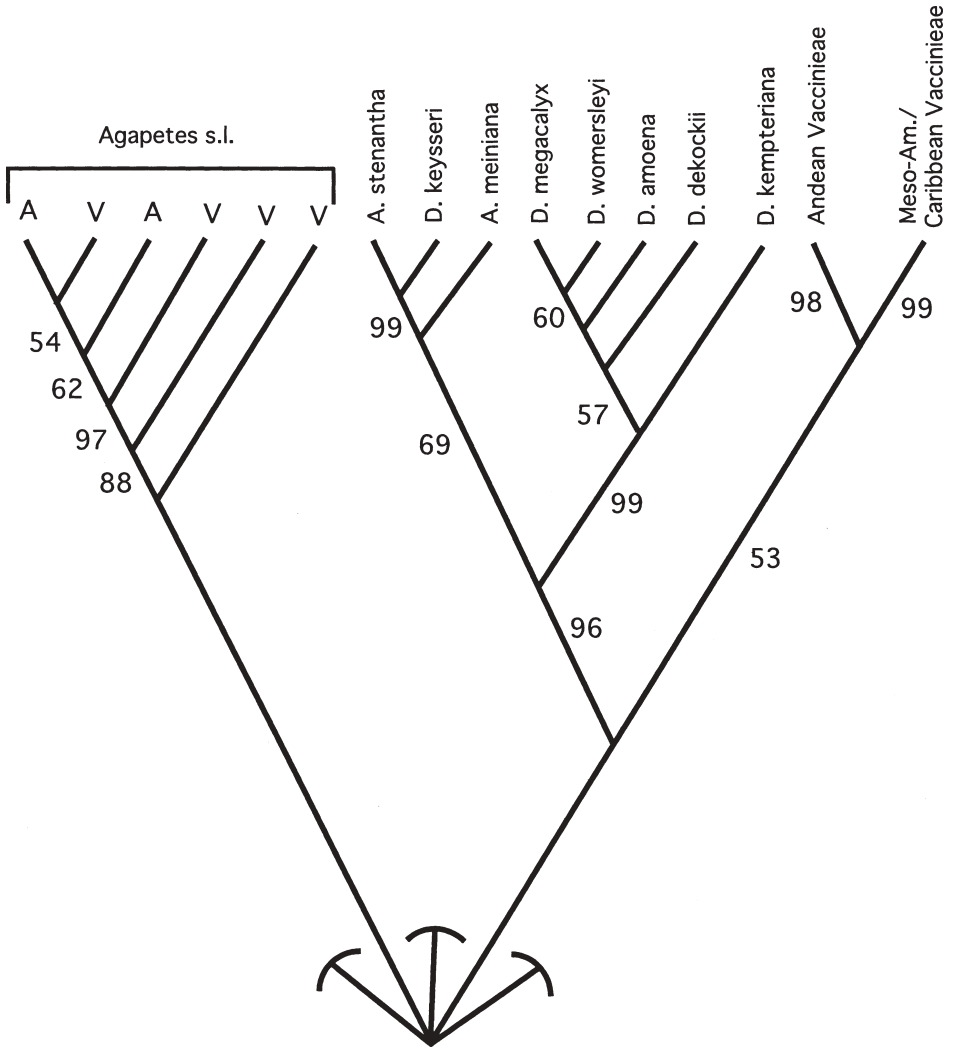

FIG. 1. Phylogeny of part of *Vaccinieae*, based on Kron *et al.* (2002a). A = *Agapetes*, V = *Vaccinium*, D = *Dimorphanthera*. Terminals with simply A or V include one or more species in those genera. Meso-Am./Caribbean *Vaccinieae* are *Vaccinieae* from Meso-America and the Caribbean region. Named species of *Agapetes* belong to Oceanic *Agapetes* (see text). Numbers indicate bootstrap support, internodes with no numbers have < 50% support. Note the basal polychotomy where the truncated lines refer to other clades of *Vaccinieae* not discussed here.

The evidence that *Agapetes* s.l. and Oceanic *Agapetes* do not form a monophyletic unit is now very strong. Kron *et al.* (2002a) found that two species of Oceanic *Agapetes* were linked with six species of *Dimorphanthera* from three different sections (*Dimorphanthera*, *Trochilanthe* Schltr. and *Pachyantha* (Sleumer) P.F. Stevens) with strong (96% bootstrap) support. They called this clade, which is centred on

New Guinea, the East Malesian clade, and it showed very weak relationships to a clade of *Vaccinieae* from the New World made up of a Meso-American/Caribbean clade and a large Andean clade (note that *Dimorphanthera* and the Central and South American *Satyria* Klotzsch seem not to be close – cf. Stevens, 1974). *Dimorphanthera* and Oceanic *Agapetes* share anatomical and other similarities (Stevens, 1972, 1974, 1977).

A collection made on Bougainville and recently distributed from the National Herbarium in Lae has brought the matter to a head. Although distributed as *Dimorphanthera denticulifera* Sleumer, it is in fact a very distinct new species in the Oceanic *Agapetes* group, the first from any of the islands immediately to the east of New Guinea. In the course of preparing the description, it became apparent that there were other undescribed species of Oceanic *Agapetes* from SE Papua New Guinea, and that one of these had also been distributed as *Dimorphanthera*. In what genus should these species be described?

Whatever systematic philosophy one might follow, genera like *Agapetes* in its current circumscription (e.g. Sleumer, 1967; Stevens, 1972, 1985) are not considered acceptable. There is certainly no point in discussing the distribution or diversification of *Agapetes* (cf. van Balgooy, 1993). It is not phenetically strongly characterized, the only character distinguishing it from other Malesian *Vaccinieae* being its long corolla (usually over 1cm long), but even this character is difficult to use since several species in both *Agapetes* and *Vaccinium* have corollas about 1cm long. To circumscribe a monophyletic genus that includes *Agapetes* in its current sense would probably entail including over 300 species of SE Asian/Malesian species of *Vaccinium*, as well as *Dimorphanthera*. Indeed, if the relationship of *Dimorphanthera*/Oceanic *Agapetes* to the Central and South American species of *Vaccinieae* holds up, the majority of New World *Vaccinieae* would also be part of the clade that includes *Agapetes* s.l. (Fig. 1 and Kron *et al*., 2002a).

Dimorphanthera itself seems easily recognized by its woody, dimorphic anthers, but the details of its relationship with Oceanic *Agapetes* recently suggested by Kron *et al*. (2002a, and Fig. 1 here) confuse the nomenclatural situation. The one species of *Dimorphanthera* section *Pachyantha* included, *D. keysseri* (Diels) P.F. Stevens, is sister to *P. stenantha* Schltr. (99% bootstrap); incomplete data place *Paphia megaphylla* P.F. Stevens near here (K. Kron, pers. comm.) and there is moderate support (69% bootstrap) for *P. meiniana* (F. Muell.) Schltr. as sister to these two species. This clade is in turn sister (96% support) to a clade including two species of *Dimorphanthera* section *Dimorphanthera* and three species of section *Trochilanthe* (Kron *et al*., 2002a). Sampling is still very poor, but if these relationships are maintained in future studies, one solution would be to unite the whole clade under the earliest name, *Paphia*, which I hesitate to do on the current evidence. An alternative might be to recognize two genera, *Paphia* (including *Dimorphanthera* section *Pachyantha*) and *Dimorphanthera*, although some members would be rather difficult to distinguish morphologically. Smith (1981) thought that *A. neocaledonica* Guillaumin might have to be placed in a separate genus by itself, but this was largely

because he thought that its non-articulated calyx was an important character. Pending further studies, a cautious nomenclatural solution is to recognize Oceanic *Agapetes* alone as *Paphia*. It separates a clearly different and phylogenetically separate element of *Agapetes*, and subsequent nomenclatural adjustments relative to *Dimorphanthera* can be made as and when necessary. However, given the extensive variation within *Paphia*, future molecular studies will have to sample rather deeply within the genus before we gain a clear understanding of its phylogeny and evolution. Of course, the limits of *Agapetes* s.l., as a clade including many species of *Vaccinium* from Malesia and mainland SE Asia, have not been adjusted, but more phylogenetic work is needed to clarify relationships within this large clade.

There is one immediate biogeographic implication of the relationships suggested by these preliminary molecular studies. *Dimorphanthera* section *Pachyantha*, alone of the four sections of *Dimorphanthera*, is found in the eastern half of the island of New Guinea (Sleumer, 1967; Stevens, 1982), and this is the area of diversification of *Paphia*; indeed the latter is particularly diverse in the general area of the Owen Stanley range, in the southeast of the island (Stevens, 1972, 1982). While *Dimorphanthera* is also found on islands immediately adjacent to the main island of New Guinea (but no further east than New Ireland, and no further west than the Philippines), *Paphia* has a much wider distribution to the south and east of the main island as *Agapetes* (van Balgooy, 1993). For recent biogeographical studies on Malesian *Ericaceae*, see Heads (2003).

Systematics

All measurements in the keys and descriptions below are taken from dry flowers at anthesis. Note that the bistratose corolla mentioned below is one in which the thick corolla thins gradually to the edges of the lobes, a thinned area also extending from the sinuses down the corolla tube, sometimes for the great part of its length. Voucher specimens seen are indicated '!'.

Given our current level of knowledge, no significance should be attributed to the fact that some species include varieties and others, subspecies.

Paphia Seem.

Key to all taxa recognized in *Paphia*

1a. Corolla ± pubescent outside, at least along angles — 2
1b. Corolla glabrous outside — 9

2a. Leaf blade 0.8–1.6(–2.2)cm long; filaments c. as long as anthers **5. P. helenae**
2b. Leaf blade (1–)1.5cm or more long; filaments much shorter than anthers — 3

3a. Corolla urceolate, 0.8–0.9cm long — **11. P. sclerophylla**
3b. Corolla (urceolate–)tubular, (1–)1.2cm or more long — 4

4a. Filaments at least 7mm long; leaf blade ovate to oblong ——— **2A. P. brassii** subsp. **brassii**
4b. Filaments to 4.5mm long; leaf blade ovate to elliptic ——— 5

5a. Leaf blade (7.5–)8–10cm long, apex long and sharply acuminate **3. P. carrii**
5b. Leaf blade to 5cm long, apex rounded to shortly (c.5mm) acuminate ——— 6

6a. Leaf blade 1–2.4cm long; corolla c.3cm long ——— 7
6b. Leaf blade 3–5cm long; corolla to 2cm long ——— 8

7a. Leaf blade rounded at apex; flowers from leafless axils; filaments free ——— **9. P. prostrata**
7b. Leaf blade shortly acuminate at apex; flowers from leafy axils; filaments connate ——— **19. P. woodsii**

8a. Calyx tube sparsely glandular hairy; corolla at least 2cm long ——— **10A. P. rubrocalyx** var. **rubrocalyx**
8b. Calyx tube pubescent, not glandular; corolla to 2cm long ——— **10B. P. rubrocalyx** var. **pilicalyx**

9a. Leaf blade usually to 2.5cm long, corolla to 2cm long; filaments longer than anthers, basally connate ——— **17. P. vitis-idaea**
9b. Leaf blade usually more than 2.5cm long; corolla at least 2cm long (except *P. vulcanicola*); filaments usually very much shorter than anthers, usually free ——— 10

10a. Calyx continuous with pedicel ——— **8. P. neocaledonica**
10b. Calyx articulated with pedicel ——— 11

11a. Branchlets and lower surface of leaf blades at least initially spreading pubescent ——— **4. P. costata**
11b. Branchlets and lower surface of leaf blade glabrous ——— 12

12a. Corolla c.1.3cm long ——— **18. P. vulcanicola**
12b. Corolla at least 2cm long ——— 13

13a. Leaf blade ± deeply cordate at base ——— **6. P. kudukii**
13b. Leaf blade attenuate to truncate or rounded at base ——— 14

14a. Bracteoles (1/3–)2/3 up the pedicel; calyx limb c.3mm long, erect to spreading, accrescent and to c.5mm long in fruit, lobes to 2mm long **1. P. alberti-eduardii**
14b. Bracteoles to 1/4(–2/5) up the pedicel; calyx limb variable, not or barely accrescent and less than 3mm long in fruit ——— 15

15a. Filaments almost 1/3 of stamen length; leaf blade 2.2–5.4cm long ——— 16
15b. Filaments to 1/6 of stamen length; leaf blade 3.5–20cm long ——— 18

16a. Leaf blade acute to attenuate at base; filaments connate — **12. P. shungolensis**
16b. Leaf blade ± truncate at base; filaments free ——— 17

17a. Leaf blade lacking glandular spots beneath, 2.8–5.4cm long; corolla dirty whitish — **2B. P. brassii** subsp. **serratifolia**
17b. Leaf blade with glandular spots beneath, 2.2–4.5cm long; corolla red-pink — **13. P. sleumerana**

18a. Leaf blade 15–20cm long; corolla more than 4.5cm long — **20. P. megaphylla**
18b. Leaf blade to 10cm long; corolla less than 4.3cm long — 19

19a. Corolla 3.5–4.3cm long — 20
19b. Corolla 2–3cm long — 21

20a. Corolla yellow; anthers strongly incurved–recurved at base; pedicels 2–3cm long, bracteoles up to 2/5 from base of pedicel — **16. P. vitiensis**
20b. Corolla green; anthers ± straight at base; pedicels c.2cm long, bracteoles sub-basal — **15. P. viridiflora**

21a. Calyx limb 0.5–1.5mm long; corolla greenish or greenish red (rarely red) — **14. P. stenantha**
21b. Calyx limb 2–2.5mm long; corolla red — **7. P. meiniana**

Enumeration of taxa included in *Paphia*

Below are listed all species and infraspecific taxa in *Paphia*. Sleumer (1960, 1967) adds detailed synonymy and descriptions for most species (see also Smith, 1981, for *P. vitiensis*). Names in *Paphia* are provided for all taxa previously in *Agapetes*; three new Papuasian species are described, an incompletely known but probably new taxon is characterized, and notes are given for some taxa.

1. Paphia alberti-eduardii (Sleumer) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes alberti-eduardii* Sleumer, Bot. Jahrb. Syst. 70: 100 (1939). Type: Papua, Central Division, Mt Albert Edward, 3600m, 29 vi 1933, *Brass* 4380 (holo. NY!, iso. K!).

2. Paphia brassii (Sleumer) P.F. Stevens, **comb. nov.**
Basionym: *Agapetes brassii* Sleumer, Bot. Jahrb. Syst. 70: 103 (1939). Type: Papua, Central Division, Mt Tafa, 2300m, 27 v 1933, *Brass* 4109 (holo. NY!).

2A. Subsp. **brassii** – SE Papua New Guinea.
Collections assignable to this subspecies have recently been made along the Bulldog Trail (Morobe Province) between 1700 and 1890m altitude; these include *Vander Kloet* 15875 and 55875 and *Fallen* 611. The leaf blade of these is rather smaller than in other collections, being 2.2–6.8 × 1.2–3.5cm versus 6–10 × 2.4–3.5cm, the secondary veins tend to be pinnate, rather than ascending from near the base, and

the apex varies from acute to subacuminate, rather than being sharply acuminate for c.1.5cm. There is considerable variation in the nature and number of multicellular hairs on the abaxial surface of the leaf blade, but all specimens have a corolla that varies from red to yellow, but is tinged red, and is rather densely hairy on the outer surface. The androecium also shows little variation.

2B. Subsp. **serratifolia** (P.F. Stevens) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes brassii* Sleumer subsp. *serratifolia* P.F. Stevens, Notes Roy. Bot. Gard. Edinburgh 32: 21 (1972). Type: Papua, Central District, Tapini Subdistrict, Mt Strong, 3445m, 2 v 1971, *LAE* 51411 coll. *Stevens & Coode* (holo. LAE!; iso. A!, CANB!, K!, L!).

3. Paphia carrii (Sleumer) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes carrii* Sleumer, Bot. Jahrb. Syst. 70: 103 (1939). Type: Papua, Mt Victoria, 'The Gap', 7000ft [2290m], 9 xii 1935, *Carr* 13708 (iso. BM!, LAE!).

4. Paphia costata (C.H. Wright) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes costata* C.H. Wright, Kew Bull. 102 (1889). Type: Papua, Mt Scratchley, 10,000′ [3050m], anno 1896, *Giulianetti* s.n. (holo. K!).

5. Paphia helenae (F. Muell.) Schltr., Bot. Jahrb. Syst. 55: 182 (1918) – SE Papua New Guinea.
Knowledge of this apparently rare species has been much improved by two collections made from the SE slopes of Mt Victoria, 3200m, *LAE* 61712 (A, MO), *LAE* 61755 (A), and by a collection made in the Mt Victoria area: Track from Kona Creek to the Rock Pile, SE of Mt Service, 3900m, *van Royen* 11013 (MO).

6. Paphia kudukii (Veldkamp) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes kudukii* Veldkamp, Blumea 36: 161 (1991). Type: Papua New Guinea, Central District, Mt Yule, 3270m, 15 x 1989, *Veldkamp & Kuduk* 8531 (holo. L!).

The two collections of this species differ substantially in corolla length (Veldkamp, 1991) and in the length of filament relative to anther. *Veldkamp & Kuduk* 8531 has a corolla 2.8–3.5cm long, filaments c.7mm long, and anthers c.2.6cm long, while *Woods* 2966b (from Woitape) has a corolla c.2.3cm long, filaments to 3mm long and anthers c.1.9cm long. Further collections are needed to clarify the taxonomic significance of this variation.

7. Paphia meiniana (F. Muell.) Schltr., Bot. Jahrb. Syst. 55: 183 (1918) – Australia, Queensland.

8. Paphia neocaledonica (Guillaumin) P.F. Stevens, **comb. nov.** – New Caledonia.
Basionym: *Agapetes neocaledonica* Guillaumin, Bull. Mus. Hist. Nat. Paris, Sér. 2, 31: 178 (1959). Type: New Caledonia, Plateau de Dogny, 900–1000m, 10 ix 1958, *McKee* 6555 (holo. P!).

9. Paphia prostrata (P.F. Stevens) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes prostrata* P.F. Stevens, Notes Roy. Bot. Gard. Edinburgh 32: 21, fig. 3 (1972). Type: New Guinea, Morobe District, S of Wau, Mt Amungwiwa, 11,400ft [3475m], 3 xi 1963, *NGF* 17925 coll. *Womersley* (holo. LAE!).

10. Paphia rubrocalyx (Sleumer) P.F. Stevens, **comb. nov.**
Basionym: *Agapetes rubrocalyx* Sleumer, Bot. Jahrb. Syst. 70: 102 (1939). Type: New Guinea, Morobe District, Ogeramnang, 6000ft [1820m], 24 ii 1937, *M.S. Clemens* 5477 (iso. K!).

10A. Var. **rubrocalyx** – Papua New Guinea.

10B. Var. **pilicalyx** (Sleumer) P.F. Stevens, **comb. nov.** – Papua New Guinea.
Basionym: *Agapetes rubrocalyx* Sleumer var. *piliicalyx* Sleumer, Nova Guinea Bot. 1: 4 (1960). Type: New Guinea, Morobe District, Matap, 1525–1830m, ii–iv 1940, *Clemens* 11166 (holo. A!).

11. Paphia sclerophylla (Sleumer) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym*: Agapetes sclerophylla* Sleumer, Bot. Jahrb. Syst. 70: 104 (1939). Type: Papua, Central District, Murray Pass, Wharton Range, 2840m, 19 ix 1933, *Brass* 4566 (holo. NY!; iso. A!, L!).

This is a rather variable species. The leaf blade is more (*NGF* 36968) or less (*Veldkamp & Kuduk* 8329) strongly punctate on the adaxial surface, and the calyx may be truncate (*NGF* 36968) or obconical (*Veldkamp & Kuduk* 8329) at the base. The corolla varies from urceolate to tubular, although it is always broader in the middle, and the inflorescence may be ramiflorous or in the axils of leaves. Sleumer (1967) described the anthers as being more or less recurved at the base; they are in fact quite strongly incurved.

Field notes of *Veldkamp & Kuduk* 8329 record the calyx as being blackish purple, the corolla pink with yellow-white ridges in bud, and the fruit as being woody.

12. Paphia shungolensis (P.F. Stevens) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes shungolensis* P.F. Stevens, Notes Roy. Bot. Gard. Edinburgh 32: 23, fig. 4 (1972). Type: New Guinea, Morobe District, Mt Shungol, c.5 miles (8km) S of Wagau, c.7000ft [2290m], 17 xii 1963, *Hartley* (coll. *Sayers*) 12561 (holo. LAE!; iso. A!, CANB!, K!, L!).

13. Paphia sleumerana (P.F. Stevens) P.F. Stevens, **comb. nov.** – SE Papua New Guinea.
Basionym: *Agapetes sleumerana* P.F. Stevens, Notes Roy. Bot. Gard. Edinburgh 32: 25, fig. 5 (1972). Type: Papua, Goilala Subdistrict, between Mt Dickson and Kupitivava, c.10,500ft [3200m], 12 ii 1964, *Hartley* 13208 (holo. A!; iso. CANB!, K!, L!).

Paphia sleumerana may be closest to the poorly known *P. brassii* var. *serratifolia* (2B in this account).

14. Paphia stenantha Schltr., Bot. Jahrb. Syst. 55: 184 (1918) – SE Papua New Guinea.

15. Paphia viridiflora Schltr., Bot. Jahrb. Syst. 55: 183 (1918) – SE Papua New Guinea.

16. Paphia vitiensis Seem., J. Bot. 2: 77 (1864) – Fiji.
Little is known about seeds and embryos in *Paphia*, since material with ripe fruits still remaining is uncommon. The embryo of *P. vitiensis* is white and the testa is crustaceous, not mucilaginous (*Webster et al.* 14195, Mba, Mt Victoria).

17. Paphia vitis-idaea (Sleumer) P.F. Stevens, **comb. nov.** – C Papua New Guinea.
Basionym: *Agapetes vitis-idaea* Sleumer, Nova Guinea Bot. 1: 4 (1960). Type: New Guinea, Western Highlands, Waghi Divide area, 6 ix 1953, *NGF* 5189 coll. *Womersley* (holo. LAE!, iso. L (fragm.)!).

18. Paphia vulcanicola P.F. Stevens, **sp. nov.**
A speciebus aliis Paphiae in calyce corollaque valde angulatis, corolla urceolati-tubulosa circa 12mm longa, 5-alata, alis setulis sparsis praedita, et staminibus circa 12.5mm longis filamentis circa 4.5mm longis, differt.
Type: Papua New Guinea, North Solomons Province, Wakunai, summit of Mt Balbi, 2400m, 8 v [19]88, *LAE* 78580 coll. *O.G. Gideon et al.* (holo. A!).

Terrestrial or epiphytic shrub; stems glabrous, c.3mm in diameter. *Leaves* 0.5–2.5cm apart; petiole 2–3mm long; leaf blade ± obovate, 3.5–7.5 × 1.6–4.4cm, rounded to cuneate at apex, rounded at base, margin flat, distantly subserrate with glandular teeth 4–10mm apart, texture coriaceous, glabrous apart from a few stout glandular hairs on abaxial surface, vein pairs c.3, ascending, in basal half, tertiary venation indistinct, subdepressed above and raised below. *Inflorescences* few-flowered fascicles from leafy axils; pedicels c.12.5mm long, with a ring of stout, multicellular glandular hairs at apex, bracteoles c.1.5mm long, c.3mm from base. *Calyx tube* obconic, c.3.5 × 4.5mm, 5-ridged, calyx limb slightly spreading, c.2mm long, ridges alternating with teeth, teeth c.0.7mm long. *Corolla* tubular-urceolate, c.12 × 4.5mm, 2.5mm across at mouth, bistratose for c.3mm, shortly winged opposite corolla lobes,

with sparse setae c.1mm long, lobes 2mm long. *Stamens* 1.2–1.3cm long, filaments c.4.5mm long, with sparse spreading hairs, anther thecae c.3mm long, papillate, especially on incurved base, tubules c.5mm long, smooth, ± erect, with introrse slits c.2.5mm long. *Ovary* 5-locular, disc glabrous; style c.13mm long. *Fruit* unknown.

LAE 78580 was distributed as *Dimorphanthera denticulifera* Sleumer var. *pubens* Sleumer, but the anthers are not strongly dimorphic and the specimen is clearly a *Paphia*. The strongly ridged, almost alate calyx and corolla is much more common in *Paphia* than in *Dimorphanthera*.

The field notes record the flowers as being pinkish white, with the corolla being pierced at the base ('pollinators eat anthers by piercing corolla at base').

The discovery of *Paphia* on Bougainville was unexpected, the other Papuasian species being restricted to mountains in the eastern part of mainland Papua New Guinea, some 700km distant from Mt Balbi. However, the genus is widely spread in the SW Pacific, being known from Australia (Queensland), New Caledonia and Fiji. *Paphia vulcanicola* has a deep-seated phellogen.

19. Paphia woodsii P.F. Stevens, **sp. nov.**

A speciebus aliis Paphiae in laminis 2.1–3.9cm longis in siccitate convexis, calyce basi truncato limbo 1.5–2.5mm longo, corolla curvata 3.5–3.7cm longa extus pubescente, et staminum filis brevibus connatis, differt.

Type: [Papua] New Guinea, border of Northern and Central District, ridge above Doma, 1500m, 15 xi 1962, *Woods* 346 (holo. A!, iso. K!).

Epiphytic shrub; twigs c.2mm in diam., pubescent. *Leaves* dense; petiole 1.5–3mm long; leaf blade ovate, (1.7–)2.1–3.9 × (0.6–)0.9–2.2cm, shortly acuminate at apex, ± broadly rounded at base, coriaceous, margins slightly recurved and whole blade convex when dry, minutely serrate by black setae, 2 near base especially prominent, vein pairs 2, ascending, arising from or near the base, ± impressed above, raised below, tertiary veins obscure, deciduous unicellular hairs on abaxial surface and adaxial midrib, glandular hairs numerous on abaxial surface. *Flowers* solitary in leafy axils, with c.3 pairs of basal bracts to 1mm long; pedicels 13–16mm long, broadening towards apex, pubescent, bracteoles narrowly triangular, c.1.7 × 1mm, borne 1/4–1/3 up pedicel. *Calyx tube* 4.5–5 × c.5mm, pubescent, with alternisepalous ridges, base truncate, limb 1.5–2.5mm long, lobes 0.5–1.3mm long. *Corolla* yellowish green, curved, tubular, 3.5–3.7 × c.0.7cm, pubescent outside, narrowly bistratose for c.1.2cm, slightly angled, angles opposite lobes, flushed pale purplish brown, lobes yellowish green, c.4mm long, recurved. *Stamens* glabrous, filaments pale green, c.3mm long, connate, anthers golden brown, thecae c.1.6cm long, ± smooth, base incurved, tubules c.1.7cm long, narrow, with introrse slits c.1cm long. *Ovary* 5-locular, disc glabrous; style green, 3.6–3.9cm long. *Fruit* black.

Paphia woodsii has something of the facies of *P. costata*, but differs in its pubescent corolla, truncate calyx base and short calyx limb that is little accrescent in fruit. It is one of the very few *Paphia* species with connate filaments; *P. shungolensis*, with

more elliptic leaf blades and a glabrous corolla, is another. It was collected at a much lower altitude than those at which *P. costata* grows.

Paddy Woods, formerly at the Royal Botanic Garden Edinburgh, after whom this species is named, provides a detailed description of *Woods* 346: 'flowers ± pendulous, basal part thick, yellowish green, angular, ridges flushed pale purplish brown, recurved lobes yellowish green, filaments pale green, anthers golden brown, appendages [=tubules] paler; style green, fruit fleshy, black'.

20. Paphia megaphylla P.F. Stevens, **sp. nov.**
A speciebus aliis Paphiae in foliis ovatis percoriaceis 15–20cm longis et floribus 4.8–5.2cm longis valde differt.
Type: Papua New Guinea, Morobe Province, Kamiali Wildlife Management Area, ultrabasics along Tabare (Tabile) River, 20m, 12–18 vi 2001, *Takeuchi, Ama & Towati* 15383B (holo. MO!).

Climber. Twigs 1.3–2mm in diam., glabrous; bud scales c.1.5mm long. *Leaves* distant; petiole 1.7–2.3cm long, glabrous; leaf blade ovate, 15–20 × 6–7.5cm, apex gradually acuminate, acumen 1–3cm long, base ± broadly rounded and shortly attenuate, margin recurved, entire-subsinuous, with black punctations 5–10mm apart, texture very coriaceous, rigid, glabrous but with dense, obscure punctations on lower surface, vein pairs 2–3, ascending, arising to 4(–5)cm from base, slightly raised above, strongly raised below, tertiary veins slightly raised on both surfaces. *Inflorescences* c.4-flowered fascicles from leafy axils; pedicels 3–3.3cm long, bracteoles c.1mm long, within 3mm of base. *Calyx* glabrous, tube obconical, 3–3.5mm long, not angled, base truncate, limb spreading, 3–3.3mm long, lobes obscure, c.1mm long. *Corolla* red at base, otherwise green, tubular, possibly curved [?in bud only], glabrous, 4.8–5.2cm × c.6mm, narrowly bistratose for c.3cm, lobes c.2mm long. *Stamens* glabrous, filaments connate, c.6mm long, anthers smooth, straw-coloured, thecae c.2cm long, narrowed and incurved at base particularly on alternating anthers, merging imperceptibly into tubules, tubules c.2.2cm long, with introrse slits c.1.1cm long. *Ovary* 5-locular, disc glabrous; style c.5.4cm long. *Fruit* unknown.

Ecology. Woody climber along riverbank at contact between hill forest and sago (*Metroxylon*) swamp, 20m alt. Flowering in June.

A remarkable species with its large, very coriaceous and rigid leaf blades, long-tubular flowers and stamens with connate filaments. It is the only species of the genus collected at very low altitudes, and it is interesting that in general texture the leaves are like those of some low-altitude species of *Dimorphanthera*, e.g. *D. glauca* P.F. Stevens and *D. intermedia* J.J. Sm.

The corolla of a single pickled flower is c.5.5cm × 12mm and straight; the pedicel is gradually swollen towards the apex where it is c.3mm in diameter. Field notes on *Takeuchi, Ama & Towati* 15383B note that the corolla is 5-sulcate in bud.

Paphia sp.

Epiphytic shrub. Twigs (1–)1.5–2.2mm in diam., pubescent; bud scales to 2mm long. *Leaves* scattered; petiole 4–6mm long, pubescent; leaf blade ovate, 3–5.8 × 1.5–3mm, apex acute to subacuminate, base broadly rounded, margin slightly recurved, serrate, sub-basal glands obscure, coriaceous, unicellular hairs persisting on midrib below and margins, lower surface with dense glandular hairs, vein pairs 2–3, ascending, arising to 1(–1.5)cm from the base, slightly raised above, raised below, tertiary veins slightly raised above, obscure below. *Inflorescences* fasciculate, 2–3-flowered, from upper axils of shoot; bracts triangular, c.1–1.5 × 2.2mm, pedicels 13–17mm long, pubescent, bracteoles to 2mm long, borne on lower 1/4 of pedicel. *Calyx tube* c.2.5 × 3.5–4mm, pubescent, angled, base truncate, limb c.2mm long, pubescent, lobed to near base; 'flowers light green'. *Ovary* 5-locular, disc with a few erect hairs. '*Fruit* green, dark red brown.'

Specimen examined. Papua [New Guinea], Dist. Northern, Subdist. Kokoda, eastern side Lake Myola No. 1, 2000m, 23 vii [19]74, *LAE* 61969 coll. *Croft* (A!, K!).

LAE 61969 was distributed as *Agapetes carrii*, but that species has much larger, strongly acuminate leaf blades, and the calyx is larger and obconical. Although *LAE* 61969 probably represents an undescribed species, formal naming awaits collection of flowers. These are mentioned on the field label, but are absent from all of the duplicates seen (and from that in Leiden: J.F. Veldkamp, pers. comm.). One calyx lobe is frequently much longer than the others, being up to 4.5mm long. Two shoots on the duplicate at K have subopposite leaves, matching the illustration of *Paphia viridiflora* in Schlechter (1918, fig. 13), which also shows similarly sized leaf blades. Both species are reported to have green flowers. However, the leaf blades of *P. viridiflora* are broadly attenuate at the base, the glands on the lower surface are lax, the flowers are glabrous, and the calyx limb is barely 1mm long.

DIMORPHANTHERA F. MUELL.

Five new species of *Dimorphanthera* are described here, including the second species recorded from New Ireland; two new combinations are made, and three names reduced to synonymy. All new taxa have deep-seated phellogen, a 1- or 2-layered hypodermis on the adaxial surface of the leaf blade, and lignified mesophyll cells adjacent to the abaxial epidermis (see also Stevens, 1974), although *D. inopinata* lacks this last feature.

Sleumer (1967) recognized 65 species in *Dimorphanthera*. Since his revision, five species of *Vaccinium* have been transferred to the genus, eight species of *Dimorphanthera* reduced to synonymy, two removed from synonymy, four reduced to varieties, and 16 new species and one subspecies described. A key to the 87 taxa (75 species) recognized in the genus is provided that takes account of these changes. The numbers before taxon names refer to the species numbers in Sleumer's account, where full descriptions and synonymies may be found; the prefix 'V' means that the

species was in *Vaccinium* section *Pachyantha* in his treatment. A capital letter after the number means that the species has been described since 1967 and is best inserted in Sleumer's sequence after the number indicated, while a lower case letter refers to infraspecific taxa. Numbers in parentheses after taxon names refer to species recognized by Sleumer but here reduced to synonymy, e.g. **11a. amblyornidis** (Becc.) F. Muell. var. **amblyornidis** (11b, 15), while those in curly brackets refer to species that serve as basionyms for varietal names, e.g. **11b. amblyornidis** (Becc.) F. Muell. var. **steinii** (Sleumer) P.F. Stevens {14}.

Unless otherwise stated, descriptions of anthers refer to the anthers of the major stamens.

KEY TO ALL TAXA RECOGNIZED IN *DIMORPHANTHERA*

1a. Calyx tube conspicuously winged or ribbed ——— 2
1b. Calyx tube not conspicuously winged or ribbed, sometimes angled ——— 3

2a. Leaf blade 22–28cm long; pedicels c.1cm long; corolla c.2.6cm long ——— **1. D. macleanifolia** Wernham
2b. Leaf blade 8–13mm long; pedicels 1.5–2(–2.5)cm long; corolla 1.8–2.2cm long ——— **2. D. umbellata** Wernham

3a. Corolla narrowly to widely campanulate, rarely suburceolate, lobed for (1/5–)1/4–1/2 its length ——— 4
3b. Corolla tubular (taxa 37, 40b, 64A, 64B and 65A may appear subcampanulate as they dilate distally on pressing), lobed to c.1/5 its length ——— 22

4a. Corolla to 1cm long, very thick, entire length bistratose or almost so ——— 5
4b. Corolla usually at least 1cm long, thick to thin, rarely very thick, bistratose for up to 1/2 its length, or not bistratose ——— 10

5a. Leaf blade ovate, gradually acuminate, (6–)7.5cm or more long; inflorescence corymbose ——— **V3. D. fissiflora** (Sleumer) P.F. Stevens
5b. Leaf blade elliptic to obovate or oblong, sometimes ovate, acute to rounded at apex, variable in size; inflorescence racemose to subcorymbose, rarely corymbose ——— 6

6a. Pedicels without multicellular hairs; calyx (5–)6–7mm long, tube cylindrical to campanulate ——— 7
6b. Pedicels with multicellular hairs; calyx (2–)3–5(–6)mm long, tube globose to subcylindric ——— 9

7a. Leaf blade to 4.5cm long, ovate, sometimes elliptic, not punctate above; pedicel minutely puberulent ——— **V1. D. macbainii** (F. Muell.) P.F. Stevens
7b. Leaf blade (2.5–)6cm or more long, ± elliptic, punctate above; pedicel glabrous ——— 8

8a. Leaf blade 4.3–15cm long, with (2)3–4 pairs of secondary veins, usually clearly punctate above; calyx limb 2–3.5mm long, ± spreading, lobed almost to base ____ **V2. D. ingens** (Sleumer) P.F. Stevens

8b. Leaf blade 2–7.5cm long, with 2–3 pairs of secondary veins, not obviously punctate above; calyx limb 1.8–2.4mm long, erect, c.1/2 lobed ____ **V2A. D. albida** P.F. Stevens

9a. Multicellular hairs at apex of pedicel stout, flattened; some secondary veins leaving midrib above base of leaf blade _ **V4. D. keysseri** (Diels) P.F. Stevens

9b. Multicellular hairs at apex of pedicel slender, not flattened; secondary veins leaving at or near base of leaf blade **V5. D. amplifolia** (F. Muell.) P.F. Stevens[1]

10a. Anther processes ± connate or closely parallel, free from and between the generally much diverging tubules ____ 11

10b. Anther processes more or less parallel to tubules, or fused to them and indistinct ____ 13

11a. Corolla 3–3.5cm long, 1.25–1.5 times longer than broad when flattened ____ **5. D. magnifica** Sleumer

11b. Corolla to 2.5cm long, hardly longer than broad when flattened ____ 12

12a. Anthers of minor stamens confluent, with a single aperture; disc glabrous ____ **7b. D. kempteriana** Schltr. var. **breviflos** (Sleumer) P.F. Stevens {6}

12b. Anthers of minor stamens usually with two apertures; disc pubescent ____ **7a. D. kempteriana** Schltr. var. **kempteriana** (3, 4)

13a. Inflorescence shortly racemose, axis to 5cm long; flowers white ____ **9. D. albiflora** Schltr.

13b. Inflorescences ± fasciculate, axis to 1.5cm long; flowers pink or red (white in *D. dekockii* var. *chlorocarpa*, 12b in this account) ____ 14

14a. Corolla (1.3–)1.5cm or more long ____ 15

14b. Corolla to 1.3cm long ____ 17

15a. Leaf blade clearly punctate above at maturity; anthers incurved at the base ____ **11A. D. arfakensis** J.J. Sm.

15b. Leaf blade not clearly punctate above at maturity; anthers ± downward pointed at the base ____ 16

16a. Pedicel and calyx densely pubescent ____ **11b. D. amblyornidis** (Becc.) F. Muell. var. **steinii** (Sleumer) P.F. Stevens {14}

16b. Pedicel and calyx glabrous to sparsely pubescent ____ **11a. D. amblyornidis** (Becc.) F. Muell. var. **amblyornidis** (11b, 15)

[1] The distinction between *D. keysseri* and *D. amplifolia* is unclear. Work is needed to circumscribe these taxa satisfactorily and delimit any infraspecific taxa within them.

17a. Pedicels 2–3 times longer than corolla; anthers of minor stamens usually with confluent pores — **8. D. intermedia** J.J. Sm.
17b. Pedicels up to 2 times longer than corolla; anthers of minor stamens with separate pores — 18

18a. Anthers with tubules diverging for 1/3–2/3 their length; outer scales of vegetative buds frequently acuminate — 19
18b. Anthers with tubules diverging for up to 1/2 their total length; outer scales of vegetative buds not acuminate — 21

19a. Corolla ± pubescent outside **12c. D. dekockii** J.J. Sm. var. **pubiflora** Sleumer
19b. Corolla glabrous outside — 20

20a. Corolla pinkish to blackish red — **12a. D. dekockii** J.J. Sm. var. **dekockii**
20b. Corolla white to green — **12b. D. dekockii** J.J. Sm. var. **chlorocarpa** (Sleumer) Sleumer (26)

21a. Leaf blade punctate below; corolla ± pubescent outside — **13a. D. apoana** (Merr.) Schltr. var. **apoana**
21b. Leaf blade not punctate below; corolla glabrous outside — **13b. D. apoana** (Merr.) Schltr. var. **mindanaensis** (Merr.) P.F. Stevens {10}

22a. Articulation of calyx with pedicel none or indistinct — 23
22b. Articulation of calyx with pedicel distinct — 27

23a. Calyx obconical; anther processes shorter than tubules — **44C. D. cratericola** P.F. Stevens
23b. Calyx rounded at base; anther processes longer than tubules — 24

24a. Secondary veins arising at base of leaf blade; flowers green, 2 or 3 per inflorescence — **44A. D. viridiflora** P.F. Stevens
24b. Secondary veins arising from above base of leaf blade; flowers white or red, 5–15 per inflorescence — 25

25a. Inflorescence axis 0.8–2.2cm long; corolla c.2cm long; anthers incurved at base — 26
25b. Inflorescence axis to 1cm long; corolla 1.5–1.7cm long; anthers pointing down at base — **44. D. womersleyi** Sleumer

26a. Corolla c.2cm long, white; anther processes shortly hairy; calyx limb suberect — **44D. D. continua** (P.F. Stevens) P.F. Stevens
26b. Corolla c.3.5cm long, red; anther processes sericeous; calyx limb widely spreading — **44B. D. antennifera** P.F. Stevens

27a. Anther processes free from tubules at least in upper 1/3 — 28
27b. Anther processes fused to tubules, or imperceptible — 77

28a. Flowers in racemes, more than 1.5cm long, if only c.1cm long, then branchlets rufous tomentose — 29

28b. Flowers solitary or in short racemes or fascicles, axis to 1.5cm long ____ 42

29a. Corolla shortly pubescent to subtomentose outside ____ 30
29b. Corolla glabrous outside or pubescent at lobes only ____ 38

30a. Inflorescence axis, pedicel and calyx velutinous or subtomentose ____ 31
30b. Inflorescence axis, pedicel and calyx glabrous or laxly and very shortly pubescent ____ 34

31a. Anthers with appendages at base ____ 32
31b. Anthers lacking appendages at base ____ 33

32a. Inflorescence axis 5–6cm long; style pilose ____ **16a. D. velutina** Schltr. subsp. **velutina**
32b. Inflorescence axis 1.2–2.2cm long; style glabrous ____ **16b. D. velutina** Schltr. subsp. **rufa** P.F. Stevens

33a. Corolla 3cm or more long; anthers 13mm or more long ____ **17. D. amoena** Sleumer
33b. Corolla to 2.5cm long; anthers c.10mm long ____ **17A. D. ceramica** Argent & Warwick

34a. Corolla to 2.3cm long ____ 35
34b. Corolla 3cm or more long ____ 37

35a. Filaments connate ____ **18B. D. anomala** P.F. Stevens
35b. Filaments free ____ 36

36a. Anthers c.15mm long; disc glabrous ____ **18. D. latifolia** Schltr.
36b. Anthers c.10.5mm long; disc puberulent ____ **18A. D. inopinata** P.F. Stevens

37a. Calyx subglabrous; corolla hirsute–tomentose ____ **19. D. hirsutiflora** Sleumer
37b. Calyx and corolla ± densely short pubescent ____ 38

38a. Anthers 9–20mm long ____ **35. D. anchorifera** J.J. Sm. {20, 34}
38b. Anthers c.8mm long ____ **21. D. wollastonii** Wernham

39a. Leaf blade to 25 × 14cm; anthers c.15mm long ____ **18. D. latifolia** Schltr.
39b. Leaf blade to 20 × 8cm; anthers less than 12mm long ____ 40

40a. Leaf blade elliptic, with 5–7 secondary veins from near the base; inflorescence axis 3.5–4cm long ____ **22. D. racemosa** Schltr.
40b. Leaf blade subovate or elliptic-oblong, with 7(–9) secondary veins from near the base; inflorescence axis 2–2.5cm long ____ 41

41a. Pedicels 10–13 × 0.7–1mm; calyx tube c.3 × 3mm ____ **23. D. eymae** Sleumer
41b. Pedicels 8–10 × c.2mm; calyx tube (4–)5 × 4–5mm ____ **43. D. doctersii** J.J. Sm.

42a. Anther processes at most papillate or laxly muriculate ____ 43
42b. Processes of at least major anthers ± hairy at least below, usually to the top ____ 45

43a. Corolla thick, greenish to white; anthers 7–8mm long ——— **25. D. torricelliensis** Schltr.
43b. Corolla membranous, red; anthers 5–6mm long ——— 44

44a. Branchlets and outside of corolla pubescent ——— **24a. D. cornuta** J.J. Sm. var. **cornuta**
44b. Branchlets and outside of corolla glabrous ——— **24b. D. cornuta** J.J. Sm. var. **tenuiflora** Sleumer

45a. Corolla ± entirely pubescent to subtomentose outside ——— 46
45b. Corolla glabrous outside or at most pubescent at the lobes ——— 61

46a. Corolla to 1.8(–2)cm long; anthers to 8(–10)mm long ——— 47
46b. Corolla (2.2–)2.5cm or more long; anthers at least 9mm long ——— 54

47a. Calyx and pedicels glabrous ——— **40b. D. denticulifera** Sleumer var. **pubens** Sleumer {27}
47b. Calyx, and usually pedicels, at least sparsely pubescent ——— 48

48a. Entire inflorescence and young leaves tomentulose —— **28. D. vestita** Sleumer
48b. Calyx at most shortly pubescent; leaves glabrous ——— 49

49a. Corolla at least 2/5 strongly bistratose, sometimes subcampanulate; anthers horizontally S-shaped at base —— **37. D. forbesii** (F. Muell.) F. Muell. {29}
49b. Corolla bistratose in apical 1/3, not subcampanulate; anthers ± incurved at base ——— 50

50a. Stamens alternately c.7 and c.5mm long, processes distally glabrescent ——— **30. D. crassifolia** Sleumer
50b. Stamens alternately 8–10 and 6–8.5mm long, processes hairy throughout 51

51a. Bracteoles borne 6–10mm from base of pedicel; corolla laxly hairy inside; disc hairy ——— **32. D. thibaudifolia** Sleumer
51b. Bracteoles borne less than 4mm from base of pedicel; corolla glabrous inside; disc glabrous or not ——— 52

52a. Leaves serrulate, glandular-setular points conspicuous **33. D. robbinsii** Sleumer
52b. Leaves entire, glandular-setular points inconspicuous ——— 53

53a. Calyx rounded at base; corolla to 1.5cm long — **31. D. nigropunctata** Sleumer
53b. Calyx truncate at base; corolla 1.7–2cm long **31A. D. angiliensis** P.F. Stevens

54a. Calyx tube cup- or goblet-shaped, rounded to cuneate at base ——— 55
54b. Calyx tube broadly cylindric or obconical, truncate to widened at base — 57

55a. Corolla 2–2.3cm long ——— **36. D. beccariana** (Koord.) J.J. Sm.
55b. Corolla at least 3cm long ——— 56

56a. Flowers 1–3 together; bracteoles c.1/3 of way up pedicel; ovary falsely 10-locular ——— **65B. D. tendentii** P.F. Stevens

56b. Flowers 5 or more together; bracteoles sub-basal; ovary 5-locular ——— **35. D. anchorifera** J.J. Sm. {20, 34}

57a. Leaf blade glabrous beneath ——— 58
57b. Leaf blade pubescent on midrib and main veins beneath ——— 59

58a. Corolla red, 2.8–4.5cm long ——— **50b. D. elegantissima** K. Schum. var. **splendens** (Sleumer) P.F. Stevens {38}
58b. Corolla white, 2.5–3cm long ——— **37A. D. alba** J.J. Sm.

59a. Leaves entire, fine veins usually distinct beneath ——— **49b. D. collinsii** Sleumer var. **montis-wilhelmi** Sleumer
59b. Leaves regularly denticulate at margin, fine veins often subobscure beneath ——— 60

60a. Branchlets glabrous ——— **39a. D. alpina** J.J. Sm. var. **alpina**
60b. Branchlets pubescent ——— **39b. D. alpina** J.J. Sm. var. **pubigera** Sleumer

61a. Calxy tube rounded at base ——— 62
61b. Calxy tube truncate or slightly widened at base ——— 68

62a. Leaves closely subserrate-crenulate or denticulate ——— 63
62b. Leaves remotely subcrenulate, denticulate or entire ——— 64

63a. Corolla 1.6–2.4cm long; leaf blade usually at least 7cm long ——— **40a. D. denticulifera** Sleumer var. **denticulifera**
63b. Corolla 2.5–3cm long; leaf blade to 6cm long ——— **41. D. leucostoma** Sleumer

64a. Anthers with basal anchor-shaped appendages ——— **42. D. meliphagidum** (Becc.) F. Muell.
64b. Anthers without such appendages ——— 65

65a. Leaf blade with 7(–9) secondary veins from base; anthers 10–12mm long ——— **43. D. doctersii** J.J. Sm.
65b. Leaf blade with 5–7 secondary veins from base; anthers 7–9mm long ——— 66

66a. Corolla white; calyx laxly short-pubescent; leaf blade subcaudate-acuminate for 3–4cm ——— **45. D. longifolia** Kaneh. & Hatus.
66b. Corolla red; calyx glabrous; leaf blade acuminate or attenuate for up to 1.5cm ——— 67

67a. Leaf blade ovate, 5–9cm long, rounded to subcordate at base ——— **46. D. ovatifolia** Sleumer
67b. Leaf blade elliptic to ovate-oblong, 9–16(–19)cm long, broadly attenuate at base ——— **47. D. peekelii** Sleumer

68a. Leaf blade punctate on both surfaces ——— **48. D. kalkmanii** Sleumer
68b. Leaf blade punctate on lower surface only, sometimes obscurely so ——— 69

69a. Anthers 13–15mm long — **49a. D. collinsii** Sleumer var. **collinsii**
69b. Anthers to 11mm long — 70

70a. Corolla (2.8–)3–3.5cm long — 71
70b. Corolla to 2.5cm long — 72

71a. Leaves entire, narrowly recurved; flower purple, glaucous outside — **52A. D. glauca** P.F. Stevens
71b. Leaves slightly denticulate-crenulate, not recurved; flower red, not glaucous outside — **50a. D. elegantissima** K. Schum. var. **elegantissima**

72a. Leaf blade (2.6–)5–10cm long (very variable on single specimen); young fruit slightly widened at the base — **51A. D. bracteata** P.F. Stevens
72b. Leaf blades mostly longer; young fruit not widened at the base — 73

73a. Corolla tubular or subcampanulate, up to 2/5 bistratose; anthers horizontally S-shaped at base — **37. D. forbesii** (F. Muell.) F. Muell. {29}
73b. Corolla tubular, up to 2/5 bistratose; anthers not horizontally S-shaped at base — 74

74a. Calyx c.8mm long — **51. D. megacalyx** Sleumer
74b. Calyx to 6mm long — 75

75a. Leaf blade thick-coriaceous, at most slightly crenulate, fine veins below ± invisible; calyx lobes to 0.5mm long — **52. D. militaris** J.J. Sm.
75b. Leaf blade coriaceous, denticulate to subserrate-crenulate, fine veins below ± visible; calyx lobes 1–1.5mm long — 76

76a. Flowers white; calyx lobes broadly rounded, hardly spreading — **53. D. lancifolia** Sleumer
76b. Flowers usually pink to red; calyx lobes acute, usually rather widely spreading — **40a. D. denticulifera** Sleumer var. **denticulifera**

77a. Corolla ± pubescent outside, or glandular muricate at least in upper half 78
77b. Corolla glabrous outside, or with sparse hairs near apex in bud — 83

78a. Leaves strongly subserrate-denticulate by glandular-setular hairs; corolla 2.6–3cm long — 79
78b. Leaves entire or nearly so; corolla c.1.5cm long — 80

79a. Inflorescence axis c.2cm or more long; twigs and inflorescence axis pubescent to tomentose — **54. D. calodon** Sleumer
79b. Inflorescence fasciculate; twigs and inflorescence axis glabrous — **54A. D. papillata** P.F. Stevens

80a. Hairs on flower multicellular, glandular-muriculate; filaments c.1.5mm long — **55. D. praineana** (Koord.) J.J. Sm.
80b. Hairs on flower unicellular, eglandular; filaments 3–4.5mm long — 81

81a. Petiole c.2mm long; pedicels 8–13mm long **56. D. vonroemeri** (Koord.) J.J. Sm.
81b. Petiole (2.5–)4–7mm long; pedicels 15–20mm long — 82

82a. Leaf blade ± ovate, 8.5–16cm long — **57. D. parvifolia** J.J. Sm.
82b. Leaf blade ± elliptic, 5–7.5cm long — **58. D. vaccinioides** Sleumer

83a. Leaf blade 1.5–4.5(–8)cm long — 84
83b. Leaf blade at least 6cm long, usually much longer — 89

84a. Corolla (2.5–)3–3.5cm long — 85
84b. Corolla 1.5–2cm long — 86

85a. Leaf blade 1–1.5(–1.7)cm wide; pedicels pubescent **41. D. leucostoma** Sleumer
85b. Leaf blade 0.4–0.8(–1.1)cm wide; pedicels glabrous **63. D. microphylla** Sleumer

86a. Leaf blade 0.4–1cm wide — **59. D. parvifolia** J.J. Sm.
86b. Leaf blade (1–)1.2–2.7cm wide — 87

87a. Calxy c.7mm long, rounded and narrowed well above articulation — **60. D. alpivaga** Sleumer
87b. Calxy 4–5mm long, rounded or truncate at base — 88

88a. Leaf margin slightly revolute and clearly subserrate; calyx truncate at base — **61. D. obtusifolia** Sleumer
88b. Leaf margin not as above; calyx rounded at base — **62. D. myzomelae** (Becc.) J.J. Sm.

89a. Calyx 3.3–5.5(–6)mm long; bracteoles sheathing pedicel for at most 1/5 its length — 90
89b. Calyx (5–)6–9mm long; bracteoles sheathing pedicel for c.1/2 its length — 92

90a. Leaf margin without glandular-setular points, densely punctate beneath; pedicels c.20 × 0.5mm; calyx c.3.3mm long — **64B. D. wisselensis** P.F. Stevens
90b. Leaf margin glandular-setulose, not punctate beneath; pedicels less than 15 × 0.7mm; calyx (3.8–)4mm or more long — 91

91a. Leaf blade almost entire; corolla at most 2cm long, tubular; calyx limb suberect — **64. D. wrightiana** (Koord.) J.J. Sm.
91b. Leaf blade clearly crenulate; corolla 2.2–3.1cm long, subcampanulate; calyx limb spreading — **64A. D. napuensis** P.F. Stevens

92a. Inflorescence 5–10-flowered; calyx 5–6mm long; corolla 0.9–1.2cm long, becoming subcampanulate — **65A. D. longistyla** P.F. Stevens
92b. Inflorescence 2–5-flowered; calyx 6–9mm long; corolla 1.5–2cm long, tubular — 93

93a. Branchlets and leaves glabrous — **65a. D. dryophila** Sleumer var. **dryophila**
93b. Branchlets and leaves pubescent to velutinous — **65b. D. dryophila** Sleumer var. **trichoclada** Sleumer

Notes, nomenclatural changes and new species in *Dimorphanthera*

V1. Dimorphanthera macbainii (F. Muell.) P.F. Stevens.
Field notes on *Hopkins* 684 (Owen Stanley Mountains, English Peaks, Lake Omha, 3640m (A)), a profusely flowering specimen, observe: 'Attractive to birds, such as Sooty Melidictes, Belford's Melidictes, Plum-faced Lorikeet and Red-caped Myzomela'. Note that *Hopkins* 684 and 832 (see below) were collected more than two years apart.

V5. Dimorphanthera amplifolia (F. Muell.) P.F. Stevens cf. var. **stabilipes** (Sleumer) P.J.B. Woods.
Woods (1984) provided combinations for the varieties of *Vaccinium amplifolia* in *D. amplifolia*: var. *gigantea* (Sleumer) P.J.B. Woods, var. *stabilipes* (Sleumer) P.J.B. Woods, and var. *oblongum* (Sleumer) P.J.B. Woods. See Sleumer (1967) for the differences between these varieties, which are not easy to distinguish. Belford's Melidictes was recorded as visiting the single open flower on a shrub of this species (*Hopkins* 832, Owen Stanley Mountains, English Peaks, Lake Omha, 3640m (A)).

6. Dimorphanthera breviflos Sleumer.
See 7b. *D. kempteriana* var. *breviflos*.

7a. Dimorphanthera kempteriana Schltr. var. **kempteriana**.
LAE 77585 (Morobe Province, Wantoat Subprovince, Mt Buruman, 1600m (K)) has distinctive leaf blades to 14.7 × 6cm, subcordate at base and secondary veins arising from the base. Florally, this specimen is indistinguishable from other specimens of the variety. In some specimens the leaf margin is flat and more or less minutely serrate, while in others it is recurved and has marginal setae on the upper surface up to 1mm from the true margin.

7b. Dimorphanthera kempteriana Schltr. var. **breviflos** (Sleumer) P.F. Stevens, **comb. nov.**
Basionym: *Dimorphanthera breviflos* Sleumer, Nova Guinea Bot. 7: 81 (1961). Type: [Irian Jaya], Japen, Biak, Wamiassi near Seroei, 1 viii 1939, *Aet & Idjan* (exp. *v. Dijk*) 262 (iso. K!).

Differs from var. *kempteriana* in the minor anthers usually dehiscing by a single aperture, not two, and its glabrous, not pubescent, disc.

Additional specimens seen. Irian Jaya. Cycloop Mountains, Ifar-Ormuz, *van Royen & Sleumer* 5908 (A). Papua New Guinea. East Sepik: Mt Hunstein, 100–1100m, *Takeuchi* 5248 (A, K); Hunstein Range (Mt Samsai) near camp 3, *Takeuchi* 5167 (A); on route from 'Camp 3' to 'Camp 4', near 'Camp 4', *Takeuchi* 5301 (A, K).

Var. *kempteriana* usually has more or less densely pubescent branches and often also lower leaf surfaces, although a few specimens in the west of its range are glabrous

(e.g. *BW* 8652, *Eyma* 4925, both from the Wissel Lakes; *NGF* 41534, Oksapmin, Telefomin; and *NGF* 37611, Baiyer River). All except the last specimen have a densely and shortly pubescent disc. Var. *breviflos* often has glabrous twigs and leaves, although this is not true of the type specimen. Of the 37 specimens of var. *kempteriana* examined, all but three have minor anthers with two apertures. Of the exceptions, two (*NGF* 4727, 15039) are from the Edie Creek area, Morobe Province, Papua New Guinea, although other specimens (e.g. *NGF* 15270, 39071) in which the minor anthers have two apertures have been collected from this area. The third collection is *LAE* 51458, from Torura, Tapini, in Central Province.

Other specimens of *D. kempteriana* with very small flowers have been collected in Papua New Guinea. *Takeuchi* 11783 (Chimbu Province, Crater Mountain Wildlife Management Area, 760m (A)) has rather densely hairy leaves, while *Takeuchi* 11498 (Gulf Province, east branch of the Avi Avi River, 175m (A)) has almost glabrous leaves. In addition, the lateral veins in *Takeuchi* 11498 arise at or within 5mm of the base whilst those of other specimens of *D. kempteriana* (including *Takeuchi* 11783) arise within 2(–4)cm of the base. In both the corolla is as little as 1cm long and the major anthers are as little as 3mm long, but they do have minor anthers with single apertures and bases that are first incurved and then strongly downward-pointing as is characteristic of var. *kempteriana*.

11a. Dimorphanthera amblyornidis (Becc.) F. Muell. var. **amblyornidis**.
Syn.: *Dimorphanthera pulchra* J.J. Sm., Ic. Bogor. 4: 175, tab. 353 (1913); Sleumer, Fl. Males. 1, 6: 896 (1967), and synonymy. Type: Ambon, auf den Toena, vii 1900, *Boerlage* 283 (fragm. iso. A!). **Syn. nov.**

Sleumer (1967: 896) notes of *Dimorphanthera pulchra*: 'Much allied to *D. amblyornidis* var. *amblyornidis*, but with probably constantly larger flowers'. A recent collection from central Ceram (Manusela National Park, along a trail from Maraina (810m) to Gunung Murkele Kecil (2500m or above), on the northern slope of Murkele Ridge, 1300–2090m, *Ueda et al.* C-3917 (A)) has corollas only c.2.2cm long and major stamens with anthers only c.6.3mm long, both within the range given by Sleumer for *D. amblyornidis* var. *amblyornidis* (1.5–2(–2.5)cm and (4–)5–6(–6.5)mm, respectively); the corresponding ranges for *D. pulchra* are 2–2.5(–2.7)cm and c.8mm, respectively. *Kato et al*. C-11454 (southern slope of Murkele Ridge, near Saunulu, 800–1010m (A)) has major anthers barely 6mm long. J.J. Smith (1913) himself was not sure about the distinctness of his *D. pulchra*, and his and Sleumer's suspicion that the two species might not be separable is justified; *D. pulchra* is here reduced to synonymy under *D. amblyornidis* var. *amblyornidis*.

The two specimens mentioned above have leaves of very different sizes. The blades of C-11454 are 4–5.5cm long, while those of C-3917 are 10–17cm long, as is normal for the species. However, leaf length on a single shoot can show considerable variation.

Dimorphanthera pulchra was known from Buru, Ceram and Ambon, at the very western end of the range of the genus. Despite its reduction to synonymy, there

appear to be endemic species of the genus in this area. Argent & Warwick (1989) recently described *D. seramica* from Ceram, and they suggested relationships between it, *D. amoena*, and other taxa from the central part of New Guinea. *Kato et al.* C-4617, also from Manusela National Park on Ceram (Gunong Hausane (650m) near Elemata-Makualaina, 100–650m (A)), in young fruit only, represents a third taxon, probably undescribed. It has leaves thinner than those of *D. amblyornidis*, almost entirely lacking short glandular hairs below. They are dense in the type of *D. pulchra* and indeed in specimens throughout the range of *D. amblyornidis*. Furthermore, the young twigs are glabrous (pubescent in *D. seramica*) and the inflorescence axis is only c.1cm long (c.4–7cm long in *D. seramica*).

11b. Dimorphanthera amblyornidis (Becc.) F. Muell. var. **steinii** (Sleumer) P.F. Stevens.
Recently collected from the Arfak Mountains (path to the summit of Mt Koebre, 2500–3000m, *Johns et al.* 8049 (K)) and the West Sepik District (Telefomin subdistrict, Folongonom, ridge below Tamanagabip on track to Bulsimin, 2300m, *LAE* 59538 (A)).

12b. Dimorphanthera dekockii J.J. Sm. var. **chlorocarpa** (Sleumer) Sleumer.
Syn.: *Dimorphanthera brachyantha* Sleumer, Nova Guinea Bot. n.s. 7: 87 (1961), *quoad typo*. Type: Papua New Guinea, Western Highlands, Wabag Subdistrict, Merimanta, Porget Logging Area, 7500ft [2286m], 14 vii 1959, *NGF* 11312 coll. *Womersley* (holo. L!, iso. A!). **Syn. nov.**

Though the type specimen of *D. brachyantha* is in late bud, the corolla is short and looks likely to be campanulate, and the major anthers have tubules that are already somewhat diverging with glabrous connectives free from them only at the very tip. These are features of *D. dekockii*, a member of section *Dimorphanthera*, which has campanulate flowers; for an illustration of the anthers of *D. dekockii* see Stevens (1974). However, Sleumer (1967) placed *D. dekockii* in section *Trochilanthe*, with tubular flowers, presumably because the bud is more or less tubular, and it is keyed out there in a group of species which have the processes of the major stamens free from the anther tubules in at least the upper third. However, these features are all more obvious in *Brass* 31854 and *Brass* 31827, previously excluded from *D. brachyantha* and placed in *D. viridiflora* (Stevens, 1974, fig. 5, B–D: 44A in the sequence). The flowers (?corolla) of *NGF* 11312 are reported to be white and contrast with the red corollas of *D. cornuta*, with which *D. brachyantha* s.s. was compared (cf. Stevens, 1974).

15. Dimorphanthera pulchra J.J. Sm.
In synonymy under 11a. *D. amblyornidis* var. *amblyornidis*.

18A. Dimorphanthera inopinata P.F. Stevens, **sp. nov.**
A speciebus aliis *Dimorphantherae* sectionis *Trochilanthes* quibus antheras calcaratas habent in axibus inflorescentiarum 1.5–2.2cm longis glabris circa 15-floris, corollis

circa 1.9cm longis extus indumento breviter puberulo praeditis, staminibus maioribus circa 10.5mm longis et disco minute puberulo differt.
Type: Papua New Guinea, Central Dist., Moresby Subdist., Astrolabe Range, south of Sirinumu, 650m, 27 iv 1975, *NGF* 48742 coll. *Womersley* (holo. A!).

Habit not known. Twigs c.3.5mm in diam., ± terete, glabrous apart from a few glandular hairs; bud scales broadly ovate, c.1.3mm long. *Petiole* 7.5–14 × c.2.5mm; leaf blade suboblong, 10.8–c.19 × 2.3–5.9cm, apex acuminate, base acute, margin entire apart from a pair of glands near base, coriaceous, both surfaces with inconspicuous glandular hairs when young; main veins 3(4), ascending, in basal 4(–6)cm, slightly impressed above, sharply raised below, fine veins slightly raised above, sharply raised below. *Inflorescences* from leafless axils on twigs, axis 1.5–2.2cm long, glabrous, c.15-flowered; bracts broadly ovate, 4.5–5.5mm long, pedicels 8–11mm long, glabrous, bracteoles basal, c.3mm long, adaxially connate. *Calyx* articulated with pedicel, sparsely pubescent, tube c.1.9 × 2.7mm, base subtruncate, limb c.1.5mm long, broadly spreading, lobes broadly triangular, c.0.6mm long. *Corolla* tubular, coral red, c.19 × 4.5mm, slightly bistratose towards apex, shortly puberulent outside, glabrous inside, lobes triangular, c.3mm long. *Stamens* 10; filaments c.1.7mm long, conspicuously curved, with short ascending hairs, thecae downward-pointing at base, appendages free from tubules, major anthers 8.5–9mm long, thecae 5–5.5mm long, tubules c.3.5mm long, somewhat flaring, appendages close to tubules and to 0.5mm shorter, apex sparsely papillate and with reflexed hairs, minor anthers c.6.8mm long, thecae c.4.5mm long, tubules c.2.3mm long, appendage single, erect, c.0.8mm shorter than tubules, with sparse ascending hairs. *Ovary* 5-locular, disc minutely puberulent; style to 2.8mm long. *Fruit* not seen (recorded as black; *NGF* 48742).

Will also key out as *D. latifolia* in Sleumer (1967). It may be distinguished by its narrower leaf blade (to 19 × 5.9cm versus to 25 × 14cm in *D. latifolia*), smaller corolla (c.1.9cm versus c.2.3cm), shorter major stamens (c.10.5mm versus c.15mm long) and disc (minutely puberulent versus glabrous).

Somewhat similar to *D. denticulifera* var. *pubens*. However, the latter has smaller, serrulate leaves, a fasciculate inflorescence with fewer than seven flowers, and a larger calyx that is rounded at the base.

There are distinctive, vertically elongated pits c.12μm tall on the anticlinal walls of the two-layered adaxial hypodermis of the leaf blade.

18B. Dimorphanthera anomala P.F. Stevens, **sp. nov.**
A *Dimorphanthera latifolia* Schltr. cui ut videtur similis est in foliis angustioribus et inflorescentiis cum 10–16 floribus (haud 5–7) recedit, et a speciebus omnibus *Dimorphantherae* in filamentis connatis (haud liberis) differt.
Type: New Guinea, West Sepik District, Telefomin subdist., Lilinmogu, first bush camp below Tamangabip on track to Bulsimin, 2700m, 12 v 1975, *LAE* 59446 coll. *Vinas & Wiakabu* (holo. LAE!; iso. A!, BRI!, L!).

Climber. Twigs 4–5mm in diam., terete, glabrous; bud scales broadly triangular, c.1mm long. *Petiole* 6–11mm long; leaf blade ovate, (8.5–)13–21.5 × (2.6–)6.3–9.3cm, acuminate for 1–1.5cm, base broadly rounded to cuneate, margin with minute glandular hairs, otherwise entire, coriaceous, both surfaces clearly and rather densely glandular-punctate, main veins 3(4), ascending, in basal 2.5(–5)cm, slightly impressed above, raised below, fine veins obscure above, raised below. *Inflorescences* from leafy axils, axis 2–2.5cm long, 10–16-flowered, glabrous; bracts broadly triangular, 2–2.5mm long, pedicels 10–13 × c.1.5mm, glabrous, bracteoles sub-basal, c.2mm long, adaxially connate. *Calyx* articulated with pedicel, sparsely pubescent, tube 3.5–4 × 5–5.5mm, rounded at base, limb c.2.5mm long, spreading, lobes broadly triangular, c.1mm long. *Corolla* tubular, pink, white at top, c.20 × 4–5mm, bistratose only at very apex, adpressed pubescent outside, especially towards the top, glabrous inside, lobes triangular, c.1mm long. *Stamens* 10; filaments connate, c.1mm long, with adpressed hairs towards top on both surfaces, anthers with short crisped hairs, appendages free, with adpressed hairs, major anthers c.12mm long, thecae c.7.5mm long, slightly incurved at base, outer thecae notably longer than inner, tubules c.4.5mm long, slightly divergent, appendages close to tubules and about same length, minor stamens c.10mm long, thecae c.5.5mm long, incurved at base, tubules erect, c.4.5mm long, appendages erect. *Ovary* 5-locular, disc glabrous; style unknown. *Fruit* shiny purple; seeds c.1.5mm long, testa cells polygonal, anticlinal and inner periclinal walls strongly thickened, pitted areas close to each other, minute; embryo c.0.5mm long, straight, white.

The only species in the genus known to have connate filaments, in which it is similar to *Satyria*, a genus from Central and western South America (but see above). The epidermis of the filaments is shortly and closely papillate; this may help in the establishment of the connation, which is evident even in bud. Like other species of *Dimorphanthera*, but unlike *Satyria* Klotzsch, *D. anomala* has a thick, fleshy corolla (see Stevens, 1974). Filament connation, as with other characters treated singly, should be used with caution when circumscribing taxa in *Vaccinieae* (see also Sleumer, 1960; Stevens, 1972).

Dimorphanthera anomala keys out to *D. latifolia* in Sleumer (1967), but may be readily distinguished by the characters in the diagnosis above. However, *D. latifolia* is a very poorly known species, and the type (*Ledermann* 13099, 1400–1500m, Lager Felsspitze, East Sepik District) has apparently been destroyed. Schlechter (1918) notes neither the connate filaments, the crisped hairs on the anthers, nor the glandular punctations on both sides of the leaf blade, all features of *D. anomala*. Furthermore, he recorded the leaf blade of *D. latifolia* as being up to 24 × 17cm and mentioned that the calyx limb was low.

Dimorphanthera anomala has a two-layered hypodermis on the adaxial surface of the leaf blade.

The duplicate of *LAE* 59446 at LAE has a parasitic ascomycete on the leaf blades. One flower associated with the duplicate at A does not belong to *D. anomala*, and is

unlike any other species I know, having small, outward-pointing projections near the bases of the anthers; the other flower is that of *D. anomala*. Otherwise, the specimen at A is in fruit, as is the duplicate at L; that at BRI is in late bud.

19. Dimorphanthera hirsutiflora Sleumer.
Still known only from the type specimen. It is probably close to *D. collinsii*, both having distinctive leaves with a very prominent marginal gland at the base of the leaf blade and hairy below with quite sharply and narrowly raised fine veins. *Dimorphanthera hirsutiflora* differs most obviously in having a much longer inflorescence (see key).

21. Dimorphanthera wollastonii Wernham.
Only doubtfully distinct from 35. *D. anchorifera*.

26. Dimorphanthera brachyantha Sleumer.
In synonymy under 12B. *D. dekockii* var. *chlorocarpa*.

29. Dimorphanthera brevipes Schltr.
In synonymy under 37. *D. forbesii*.

31A. Dimorphanthera angiliensis P.F. Stevens, **sp. nov.**
[*D. angiliensis* P.F. Stevens, *nomen*, Takeuchi & Wiakabu in Beehler & Alonso, Southern New Ireland, Papua New Guinea: A Biodiversity Assessment 82 (2001).]
A speciebus aliis *Dimorphantherae* sectionis *Trochilanthes* in inflorescentiis floribus pubescentibus, corollis usque ad 2cm longis, staminibus maioribus usque ad 10mm longis filamentis c.3.2mm longis et antheris basibus valde incurvatis differt.
Type: Papua New Guinea, New Ireland, Namatanai Subprovince, Hans Meyer Range, summit ridge of Mt Angil, 2250m, 25 x 1975, *Sands, Pattison, Woods & Croft* 2473 (holo. A!, iso. K!).

Epiphytic shrub. Twigs 3–5mm in diam., with broadly raised ridges decurrent from petioles, glabrous; bud scales ovate, c.4.5mm long. *Petiole* 3.5–10mm long, glabrous; leaf blade ovate, 7–18.5 × 2.1–5.8cm, apex gradually acuminate, base rounded, with a pair of subprominent glands, margin ± flat, with inconspicuous setae decreasing in size towards apex, coriaceous, lower surface densely but inconspicuously glandular-punctate, otherwise glabrous, main veins 2–6 pairs, ascending, in basal 2cm, fine veins ± raised on both surfaces. *Inflorescences* from leafless axils, axis (4.5–)8–15mm long, to 9-flowered, pubescent; bracts ovate, c.3mm long, pubescent; pedicels yellow green, flushed maroon, 8–14 × c.1mm, pubescent, bracteoles arising in basal 1.5mm, ovate, c.2.7mm long, connate adaxially, sparsely pubescent. *Calyx* articulated with pedicel, sparsely pubescent, tube dull green, 2.5–2.7 × 3.5–4mm, obscurely 5-angled, base truncate, limb spreading, 2.5–3mm long, lobes flushed olive, 0.7–1.2mm long. *Corolla* crimson to pink, tubular, 1.7–2 × c.0.5cm, fleshy, not notably bistratose, pubescent outside, glabrous inside, lobes 1.8–2mm long, papillate on the margins

and generally inside. *Stamens* 10, free; filaments white, 2–3.2mm long, glabrous at base, densely ascending-pubescent above, anthers coffee-coloured, bases strongly incurved, sparsely pubescent, apices erose, sparsely hairy adaxially, major anthers 6–7.4mm long, thecae 3–3.5mm long, tubules somewhat flaring, 3–4mm long, appendages free, pubescent, borne between and 0.5–0.7mm shorter than tubules, minor anthers 5–6mm long, thecae 2.7–3mm long, at base sometimes with obscure downward-pointing process, tubules 2.3–3mm long, erect, appendages inconspicuous, connate, subglabrous. *Ovary* 5-locular, disc sparsely to shortly and densely pubescent; style 1.8–2.1cm long. *Fruit* reddish purple, spherical, c.10 × 9mm; seeds (submature) many, angled, c.1.5 × 0.6mm, testa cells polygonal, anticlinal and inner periclinal walls thickened; embryo straight, purplish.

Additional specimens seen. PAPUA NEW GUINEA. New Ireland: Namatanai Subprovince, Hans Meyer Range, summit ridge of Mt Angil, 1650m, *Sands et al*. 1960 (K); Angil Mountain, 1800m, *Takeuchi & Wiakabu* 9397 (A), ridge adjacent to Weika River, 1175m, *Takeuchi & Wiakabu* 9486 (A).

Ecology. Ridge, mossy and cloud forest, 1175–2250m alt. Flowering in January, February, October.

May be characterized by its rather short and pubescent inflorescence axis and smallish, pubescent flowers. The stamens are less than 10mm long, but have relatively long filaments 3mm or more long; the anthers are very strongly incurved at the base.

Dimorphanthera angiliensis keys out at *D. nigropunctata* and *D. robbinsii* in Sleumer (1967), but may be readily separated by the characters given here and in the key above. Furthermore, the anthers of *D. robbinsii* are not incurved at the base and the calyx tube of *D. nigropunctata* is not weakly pentagonal and is rounded at the base. *Dimorphanthera peekelii* is the only other species known from New Ireland, but the two are easily distinguished as *D. peekelii* has leaves strongly punctate below, robust, glabrous pedicels to 1.7cm long, and a strongly lobed calyx.

The flowers of *D. angiliensis* are reported to be c.2.8cm long when fresh.

37. Dimorphanthera forbesii (F. Muell.) F. Muell.
Syn.: *Dimorphanthera brevipes* Schltr., Bot. Jahrb. Syst. 55: 187 (1918), **syn. nov.** Type: Nordöstl. Neu Guinea, Sepik-gebiet, Etappenberg, 850m, x 1912, *Ledermann* 9019 (iso. K!, L!).

Dimorphanthera brevipes is a variable species (see also Stevens, 1974), and with more collections now available it cannot be distinguished from *D. forbesii* (excluding *D. alba* – see Stevens, 1974). *Dimorphanthera forbesii* also has serrate leaf blades, fasciculate inflorescences, and rather short, tubular, strongly bistratose, white corollas, all features of *D. brevipes*, as well as generally similar stamens.

A specimen from Chimbu Province (Crater Mountain Wildlife Management Area, E of Haia village, 745m, *Takeuchi* 11721 (A)) has a rather thick, tubular corolla that is bistratose for its entire length, unique among the tubular-flowered

species. This at first seemed like an undescribed species, but another specimen from the same area (10km due E of Haia, Crater Mountain Biological Research Station, 850–1350m, *Mack* 434 (A)) has the corolla bistratose for only c.half its length, relatively common in *D. forbesii*. The field notes for *Takeuchi* 1171 describe the corolla as sulcate, as also drawn on *Mack* 434.

There is also considerable variation in the anthers. Their texture varies from somewhat to very woody, and the appendages usually well exceed the tubules and are more or less hairy to glabrous (the latter in *Takeuchi* 11721), but are rarely only equal in length to tubules and very hairy (West Sepik District, Telefomin Subdistrict, Hindenburg Range, Feramin, 1520m, *Vink* 17640 (A)). The anther base is usually incurved and more or less S-shaped, but rarely also has basal appendages (East Sepik District, Hunstein range (Mt Samsai), 150m, *Takeuchi* 6378 (A)). The leaf blade may lack subpersistent glandular hairs below, as in the type of *D. forbesii*, or these may be quite numerous and conspicuous (e.g. *Takeuchi* 11721).

37A. Dimorphanthera alba J.J. Sm.
Earlier removed from synonymy under *Dimorphanthera forbesii* when the variation of the latter was poorly understood (Stevens, 1974). Now that the limits of *D. forbesii* have been extended, the separation of *D. alba* may need reconsidering.

44a. Dimorphanthera womersleyi Sleumer var. **continua** P.F. Stevens.
Now recognized as a separate species; see 44D.

44A. Dimorphanthera viridiflora P.F. Stevens.
A collection in bud (Papua New Guinea, Chimbu Province, 10km due east of Haia, Crater Mountain Biological Research Station, 850–1350m, *Mack* 433 (A)) probably belongs to this little-collected species. *Mack* 433 has leaves rather less coriaceous than those of other specimens, but is otherwise a good match.

44B. Dimorphanthera antennifera P.F. Stevens, **sp. nov.**
A speciebus aliis *Dimorphantherae* in laminis ovatis rigide coriaceis, calyce cum pedicello haud articulato, corolla rubra, et processis antherarum e tubulis liberis eisque c.2.5mm superantibus differt.
Type: Papua New Guinea, West Sepik Prov., Bewani S/Province, 10km SSW of Bewani, N slopes of Bewani Mts, gorge N of Meinat flood plain, 300m, *LAE* 50559 coll. *Wiakabu et al.* (holo. K!).

Climber 3–6m tall. Twigs c.3mm in diam., terete, glabrous; bud scales not seen. *Petiole* c.13 × 1.8mm, glabrous; leaf blade ovate, 11–15 × 4.3–5.3cm, gradually acuminate for c.1cm, base acute, margin minutely recurved, with obscure setae, rigidly coriaceous, rather densely glandular-punctate below, main veins c.7, ascending, in basal 1(–1.5)cm, flat above, raised below, fine veins invisible (obscurely raised below). *Inflorescence* axis 1.5–2.2cm long, 10–15-flowered, glabrous; bracts ovate, c.1.5 × 1.2mm, pedicels 16–19 × 1.2–1.4mm, glabrous, bracteoles in basal 3mm,

c.1.2mm long, connate adaxially. *Calyx* not articulated with pedicel, glabrous, c.2 × 3mm, rounded at base, limb spreading, 2.5–2.8mm long, lobes as minute apiculae. *Corolla* red, c.35 × 6–6.5mm, glabrous, barely bistratose, lobes triangular, c.2mm long. *Stamens* 10; filaments c.3.5mm long, glabrous, anthers fairly woody, base incurved, pointed, tubules erect, processes glabrous, major anthers c.10mm long, thecae c.4.5mm long, with irregularly bilobed and papillate process at base, tubules c.5.5mm long, slightly diverging, introrse, connectives free, exceeding tubules by c.2.5mm, free, black, minor anthers c.6mm long, tubules c.3mm long, connectives connate, exceeding tubules by c.1.5mm, acicular. *Ovary* 5-locular, disc low, glabrous; style c.4.6cm long, stigma punctate. Immature *fruit* c.7 × 8mm.

Ecology. Lowland rainforest by river, c.300m alt.

The epithet 'antennifera' refers to the conspicuous, long, black-drying, glabrous processes of the major stamens that are characteristic of the species. Other distinctive features include the rigidly coriaceous leaf blades with, at most, obscure fine venation, the calyx continuous with the pedicel, and the long, red, tubular corolla. In some ways *D. antennifera* is similar to *D. continua*, but the latter has a much smaller, white corolla, and the processes of the major anthers are less conspicuous and shortly hairy.

44C. Dimorphanthera cratericola P.F. Stevens, **sp. nov.**
A speciebus aliis *Dimorphantherae* in floribus fasciculatis calyce obconica cum pedicello haud articulato pilis erectis praeditis, corolla 12–14mm longa in siccitate chartacea, staminibus antheris basibus valde incurvatis et appendicibus bilobatis praeditis differt.
Type: Papua New Guinea, Chimbu Province, 10km due east of Haia, Crater Mountain Biological Research Station, 850–1350m, *Wright* 586 (holo. A!).

Epiphyte. Twigs c.1.3mm in diam., glabrous, terete; bud scales c.1mm long. *Petiole* 3–5 × 1–2mm; leaf blade ovate, 19–c.23 × 4.4–6cm, gradually narrowed to the acute or subacuminate apex, base cuneate, margin slightly recurved, entire except for two small sub-basal glands, texture thinly coriaceous, glabrous, midrib raised above and below, sulcate above, main veins c.2, ascending, in basal 1cm, fine veins raised on both surfaces, especially below. *Inflorescences* subfasciculate, from leafy axils and along the branches, axis c.3mm long; bracts not seen, pedicels not articulated with calyx, 7–8 × c.1mm, broadening apically, pubescent, bracteoles c.2.2mm long, subbasal. *Calyx* light green, obconical, pubescent, tube c.3.5 × 3.5mm, limb suberect, c.1.7mm long, glabrous inside, teeth triangular, c.0.5mm long. *Corolla* red, tubular, 12–14 × 3–5mm, rather thin, pubescent outside, glabrous inside, lobes c.1mm long. *Stamens* 10, glabrous, filaments c.1mm long, anthers yellow, woody, sharply incurved and almost upward-pointing at base, and with two ± bilobed downward-pointing appendages at point of inflection, major anthers c.8.5mm long, tubules slightly spreading, c.3mm long, connective blackish, free only in apical 1/3, c.0.8mm

shorter than tubules; minor anthers c.6mm long, tubules erect, c.2.8mm long, connective free only at apex, c.0.5mm shorter than tubules. *Ovary* loculi not seen, disc glabrous; style c.17.5mm long, expanded at the apex. *Fruit* unknown.

A very distinctive species with a fasciculate inflorescence and flowers with rather short red corollas and an obconical calyx that is continuous with the pedicel. Its anthers are very sharply incurved at the base and have paired, more or less bilobed appendages, and thus look rather like the anthers of *D. anchorifera*. Other than this, *D. cratericola* has little in common with that species.

The flowers are reported to be c.20mm long when fresh (*Wright* 586).

44D. Dimorphanthera continua (P.F. Stevens) P.F. Stevens, **comb. et stat. nov.**
Syn.: *Dimorphanthera womersleyi* Sleumer var. *continua* P.F. Stevens, Contrib. Herb. Austral. 8: 18 (1974). Type: Papua New Guinea, Morobe District, Lae–Morobe road, Gurakor, 457m, 6 ix 1962, *NGF* 15310 coll. *Womersley* (holo. LAE!; iso. A!, BRI!, CANB!, K!, L!, NSW!).

Although still known only from the type specimen, the magnitude of differences between it and var. *womersleyi* are such that it clearly merits species status. Its immediate relatives are unclear.

47. Dimorphanthera peekelii Sleumer.
Recently recollected (New Ireland, Konos Subprovince, high ridge NE of Lelet farm, 1400m, *LAE* 77145 (K)).

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