

## A TAXONOMIC REVISION OF THE GENUS *DOLIANTHUS* (RUBIACEAE)

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### SUMMARY

A taxonomic revision of *Dolianthus* C.H. Wright (Rubiaceae–Psychotrieae) is presented, including a key to species, full descriptions, distribution maps, and a list of specimens examined. Eleven species are transferred from *Amaracarpus* to *Dolianthus*, resulting in ten new combinations. Two species are described as new to science: *D. kairoi* and *D. ovatifolius*. In total, thirteen species are included in *Dolianthus*. *Dolianthus* is endemic to the highlands (montane to subalpine and alpine zones) of Papua New Guinea.

**Key words:** *Amaracarpus*, *Dolianthus*, *Psychotria*, Psychotrieae, Papua New Guinea.

### INTRODUCTION

*Dolianthus* C.H. Wright was formerly included in *Amaracarpus* (e.g. Merrill & Perry, 1946; Van Royen, 1973), but morphological studies show that it is a distinct genus (Davis & Bridson, in prep.). *Dolianthus* can be separated from *Amaracarpus* by at least six characters (characters for *Amaracarpus* are given in parentheses): sympodial shoot architecture (monopodial); leaves arranged in many planes (in one plane); terminal inflorescences (axillary); pentamerous flowers (predominately tetramerous); large brightly or multi-coloured corollas, e.g. blue and yellow (small and white); anthers positioned above the ring of corolla throat hairs (within). *Dolianthus* differs from *Psychotria* L. s.s. (Davis et al., 2001) mainly due to the colour of its flowers and the position of the anthers in the corolla tube (see above).

### MATERIALS AND METHODS

Herbarium material was consulted from the following herbaria: A, B, BM, BO, K, L, NY, SING, and US. The measurements, colours and other details given in the descriptions are based on herbarium specimens, or data derived from field notes.

- 1) Nationaal Herbarium Nederland, Universiteit Leiden branch, P.O. Box 9514, 2300 RA Leiden, The Netherlands. Present address: The Herbarium, The Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, United Kingdom.
- 2) The Herbarium, The Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, United Kingdom.

## TAXONOMIC TREATMENT

## DESCRIPTION OF GENUS

## DOLIANTHUS

*Dolianthus* C.H. Wright, Kew Bull. (1899) 106. — Type species: *Dolianthus vaccinioides* C.H. Wright.

*Small trees, treelets or shrubs*, usually compact and often with dense, crowded foliage; branches erect to erecto-patent, or spreading to horizontal, if horizontal leaves not conspicuously in the same plane as the branches; when dried raphides visible on many parts, especially the leaves, inflorescence, flowers, pyrenes (Fig. 3d, e) and fruits. *Stipules* connate at the base and up to half the length of the stipule, or free; without setae or other conspicuous appendages; margins entire or fimbriate; persistent or soon falling to leave a scar with many short, stiff, brown to golden-brown 'hairs' (?colleters), or these 'hairs' absent. *Leaves* very small to small (1.5–35 mm long), petiolate to sessile, secondary veins 3–7(–10–12) pairs; venation reticulate. *Inflorescence* terminal, or subterminal (by substitution growth), greatly condensed and generally simple, with 1(–3) short ultimate flower stalks (homology not known: pedicels, peduncle or inflorescence axes?) terminated by 1(–3) flowers, rarely with a short subultimate flower stalks (inflorescence axis or peduncle?), or the inflorescence reduced to a single, 'sessile' flower. *Bracts* absent or present, if present 2, opposite. *Bracteoles* absent or present, if present 2, 4 or 8, if more than 2 pairs then one pair (or more) can be a different size to the others (for example with one pair half the size). *Flowers* heterostylous (short styled or long styled flowers present, existing on different plants, see below under 'stamens' and 'style'), 5-merous, sessile or rarely shortly pedicellate, erect to pendulous. *Calyx* campanulate to cupuliform; calyx limb lobed to truncate. *Corolla* narrowly infundibuliform-cylindrical, infundibuliform, or  $\pm$  obconoidal, glabrous or hairy, corolla tube rather thick and fleshy or rarely thin-walled and not very fleshy,  $\pm$  bicoloured, the corolla tube usually blue or yellow, the apex and/or lobes yellow, white, green, blue, cream or whitish blue; internal surface glabrous to finely papillate, or with a diffuse to dense ring of fine white hairs, ring of corolla hairs (if present) in the lower 1/2 to 1/3 of the corolla tube, lobes 5, deltoid to  $\pm$  triangular, usually thick, fleshy, and thickened at the apices. *Stamens* 5, white or greenish white, inserted either at the top of the corolla tube just below the throat (short styled flowers) or in a zone below the throat and above the middle of the corolla tube (long styled flowers), always inserted above the ring of corolla hairs (Fig. 1b, c) but never fixed within the ring of hairs (Fig. 1d); anthers  $\pm$  linear, dorsifixed, introrse; filaments glabrous or hairy. *Disc*  $\pm$  globose to subglobose, smooth to lobed, glabrous. *Style* included (short styled flowers) or just exserted (long styled flowers), white to pale greenish white; stigma composed of 2 large, flattened, divaricate lobes, surface papillate or smooth, mostly glabrous or sometimes sparsely covered with small, white hairs. *Fruit* ellipsoid to ellipsoid-obovoid,  $\pm$  smooth or with 6–8 longitudinal ridges, glabrous or rarely hairy, orange to red, or rarely purplish red; calyx usually persistent. *Pyrenes* ellipsoid to ob-ovoid, apex rounded, base  $\pm$  acute; abaxial surface convex, hemispherical in transverse section, with a weak central crest or 3 or 4 shallow to strong ridges, or smooth; adaxial

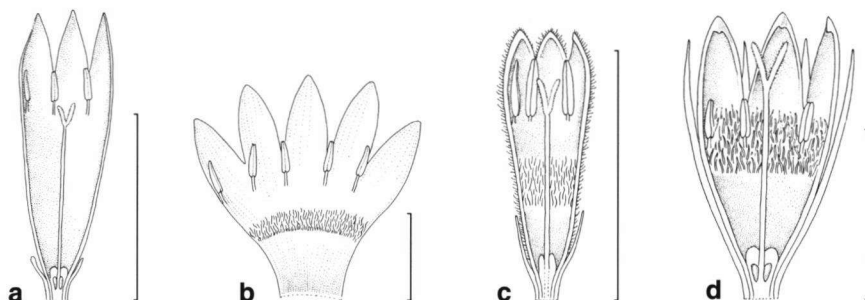


Fig. 1. a. *Dolianthus subalpinus* (P. Royen) A.P. Davis. Flower dissection. — b. *Dolianthus ovatifolius* A.P. Davis. Corolla dissection. — c. *Dolianthus trichanthus* (Merr. & L.M. Perry) A.P. Davis. Flower dissection. — d. *Psychotria magnasepala* Sohmer. Flower dissection (a: Womersley NGF 8897 (K); b: Womersley NGF 4385 (K); c: Croft LAE 61587 (K); d: Hoogland & Schodde 7551 (L, isotype)). — Scale bars: a–d = 1 cm. Drawn by L.T. Smith.

surface flat,  $\pm$  smooth, often with an inconspicuous, median, nerve-like ridge; pre-formed germination slits (PGSSs) running along the inside margins (adaxial face) of each pyrene for 1/3 to 2/3 of their length (Fig. 3d, e). *Seeds*  $\pm$  the same shape as the pyrenes, but flatter and slightly smaller, surface with fine pitted texture; endosperm homogeneous.

**Distribution** — Endemic to the highlands of Papua New Guinea.

**Habitat & Ecology** — Found in high altitude forest (lower montane to upper montane zones) to the subalpine/alpine zone, from (1500–)2400–3800 m. Occurring in a variety of upland vegetation types including different types of forest, as an understorey component, and in heath, scrub and grasslands. Present in either primary or secondary vegetation. Sometimes existing as a remnant of cleared or pyrogenic vegetation.

#### KEY TO SPECIES

- 1a. Leaves more than 8 mm long, usually more than 10 mm long ..... 2
- b. Leaves usually less than 8 mm long, usually less than 5 mm long ..... 10
- 2a. Ultimate flower stalks 1.5–25 mm long (Fig. 2a, c) ..... 3
- b. Ultimate flower stalks c. 1 mm long or less (Fig. 4a, b) ..... 8
- 3a. Inflorescences with bracts and/or bracteoles ..... 4
- b. Inflorescences without bracts and bracteoles ..... 7
- 4a. Stipules finely fimbriate; inflorescences with bracts and bracteoles; normally with 2 orders of inflorescence branching ..... **4. *D. fimbristipularis***
- b. Stipules entire; inflorescences with bracteoles only; always with 1 order of inflorescence branching ..... 5
- 5a. Bracteoles  $\pm$  free, elliptic to linear ..... **3. *D. clemensae***
- b. Bracteoles fused into a cup-like structure, or at least connate at the base .... 6
- 6a. Branchlets usually transversely ridged/fractured; leaves usually  $\pm$  elliptic, usually 2–3.2 cm long ..... **5. *D. montis-wilhelmii***
- b. Branchlets not ridged/fractured; leaves obovate, usually 1.2–2.5 cm long ....
- ..... **2. *D. buxifolius***

- 7a. Leaves 1.5–3.5 cm long; stipules 5–8 mm long ..... **1. *D. archboldianus***
- b. Leaves 0.8–1.5 cm long; stipules 2–3 mm long ..... **6. *D. vaccinioides***
- 8a. Leaves with 5–7 pairs of secondary veins ..... **8. *D. ovatifolius***
- b. Leaves with 3–5 pairs of secondary veins ..... **9**
- 9a. Leaves orbicular to obovate-orbicular, or rarely ovate; leaf base rounded to broadly cuneate ..... **7. *D. nummatus***
- b. Leaves deltoid to cordate; leaf base truncate to subcordate . **9. *D. epiphyticus***
- 10a. Branchlets glabrous; with bracteoles ..... **10. *D. bicolor***
- b. Branchlets hairy; without bracteoles ..... **11**
- 11a. Leaves more than 6 mm long, midrib (abaxial) always hairy .... **13. *D. kairoi***
- b. Leaves less than 6 mm long, midrib (abaxial) usually glabrous ..... **12**
- 12a. Leaves 1.5–3.5 mm long; corolla glabrous ..... **11. *D. subalpinus***
- b. Leaves 4–6 mm long; corolla densely covered with short, dark hairs on the outside surface ..... **12. *D. trichanthus***

#### SUBGENERIC CLASSIFICATION

At the present time we have not produced a subgeneric classification for *Dolianthus* but instead propose three informal species groups. We anticipate that these species groups, in conjunction with the key and ‘characteristic features’ (see after each species description) will aid the identification of species.

#### Species Group 1

Species with relatively large leaves (Fig. 2a), relatively long internodes (leaves not crowded), inflorescences with flower stalks (inflorescences ‘pedunculate’ or ‘pedicellate’, e.g. see Fig. 2a), and bracts and/or bracteoles present but absent in *D. archboldianus* (Fig. 2c). Key couplets: 3–7.

1. *Dolianthus archboldianus*
2. *Dolianthus buxifolius*
3. *Dolianthus clemensae*
4. *Dolianthus fimbristipularis*
5. *Dolianthus montis-wilhelmii*
6. *Dolianthus vaccinioides*

#### Species Group 2

Species with relatively large leaves (Fig. 3a), relatively long internodes (leaves not crowded), inflorescences without flower stalks (inflorescences ‘sessile’, Fig. 3b), and bracts and/or bracteoles absent or insignificant (Fig. 3b). Key couplets: 8–9.

7. *Dolianthus nummatus*
8. *Dolianthus ovatifolius*
9. *Dolianthus epiphyticus*

### Species Group 3

Species with small leaves (Fig. 4a), short internodes (leaves crowded), inflorescences generally without flower stalks or stalks very short (inflorescences 'sessile', Fig. 4b, c), and bracts and/or bracteoles absent or insignificant but bracteoles present in *D. bicolor*, (Fig. 4a, b). Key couplets: 10–12.

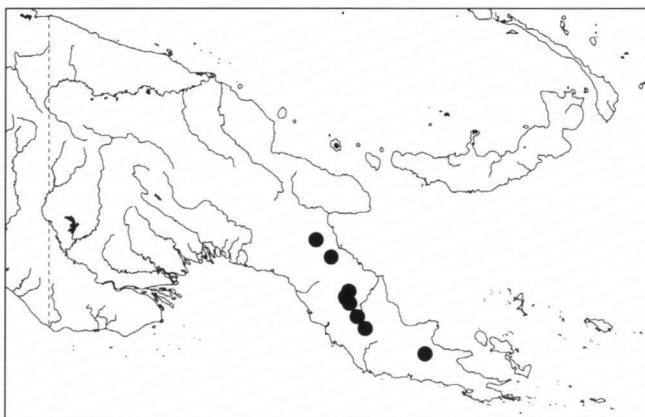
10. *Dolianthus bicolor*
11. *Dolianthus subalpinus*
12. *Dolianthus trichanthus*
13. *Dolianthus kairoi*

### DESCRIPTION OF SPECIES AND NOMENCLATURE

#### 1. *Dolianthus archboldianus* (Merr. & L.M. Perry) A.P. Davis, *comb. nov.* — Map 1

*Amaracarpus archboldianus* Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 232. — Type: *Brass* 4614 (holo A; iso K, L, NY), Papua New Guinea, Central Prov., Wharton Range, Murray Pass, 2840 m, June–Sept. 1933.

*Treelet* or *shrub*, 0.9–2.5(–3.65) m high, terminal shoot internodes 0.4–2 cm long, branches erecto-patent; outer bark brown, inner bark cream; wood straw-coloured. *Branches* 3.5–6 mm diam.,  $\pm$  terete, often longitudinally ridged, brown. *Branchlets* 2–4 mm diam., terete to weakly 4-angled, smooth or longitudinally ridged, dark brown, glabrous to hairy, particularly in the apical parts of the shoot, hairs thick, brown, erect to antrorse. *Stipules* oblong to almost pandurate, 5–8(–10) by 2.5–4 mm, usually with a longitudinal median ridge, subcoriaceous, glabrous, apex obtuse and often wrinkled, margin entire, soon falling to leave a scar with many short, stiff, brown 'hairs'. *Leaves* elliptic to elliptic-obovate, 1.5–3.5(–5.5) by 0.8–1.5(–2) cm, chartaceous to subcoriaceous, glabrous, base cuneate to narrowly cuneate, slightly decurrent, margins entire, apex slightly acuminate to acuminate, midrib dark brown when dry, covered with dark brown, appressed hairs, secondary veins 5–10(–12) pairs, prominent, ascending at an angle of c. 45°, curved near the margin and joining to form a distinct, straight intramarginal vein, venation reticulate, prominent, manifest on the adaxial surface; petioles 3–6(–10) mm long. *Inflorescence* terminal to subterminal in the axils of the 2nd or 3rd pair of leaves, with 1(–3) ultimate flower stalks, each stalk 1-flowered, 0.5–1(–1.5) cm long, puberulous. *Bracts* and *bracteoles* absent. *Flowers* erect or pendulous, 1.4–2.8(–3) by 0.6–1.5 cm,  $\pm$  glabrous. *Calyx* campanulate to cupuliform, 0.5–0.9(–1.3) by 0.4–0.5 cm, lobes deltate to triangular 2–4 by 1–1.2 mm, apices obtuse to acute, with round sinuses between lobes. *Corolla* narrowly infundibuliform-cylindrical, 1.2–2.5(–2.7) by 1.3–1.5 cm, whitish to yellow-green with bluish tips or slate-blue throughout, external surface glabrous, internal surface glabrous to finely papillate on the upper part of the corolla tube, lobes  $\pm$  triangular, 3.5–5.5 by 1.5 mm. *Stamens* fixed c. 2 mm below the corolla lobe sinuses (short styled) or in the middle of the tube, c. 7 mm below the throat (long styled); filaments 0.5–0.7 mm long; anthers 4–5 mm long. *Disc* slightly lobed. *Style* c. 1.5 (short styled) to 2.2 cm long (long styled). *Fruit* ellipsoid-obovoid, 5.5–7 by 3–4 mm, with several longitudinal



Map 1. Distribution of *Dolianthus archboldianus* (Merr. & L.M. Perry) A.P. Davis.

ridges, glabrous, orange to red; calyx persistent 5–10 mm long. *Pyrenes* ellipsoid, 6 by 4.5 mm, with 3 or 4 shallow ridges; preformed germination slits 2/3 the length of each pyrene.

Distribution — Morobe Prov., Central Prov. (Mt Albert Edward, Mt Victoria Range, Wharton Range), Northern Prov. (Mt Kenive), Milne Bay Prov.

Habitat & Ecology — Mid montane to subalpine zone, (2400–)2600–3550 m; rain forest, moss forest, and regrowth areas of disturbed forest; with, for example, *Elaeocarpus* and *Astronia*, and *Phyllocladus*.

Characteristic features — Glabrous throughout; stipules large (5–8 mm long); leaves large (1.5–3.5 cm long), chartaceous to subcoriaceous, secondary veins 5–10(–12) pairs, venation distinct; petioles long (3–6 mm long); inflorescence with 1–3 ultimate flower stalks, each stalk 1-flowered; bracts absent; bracteoles absent.

## 2. *Dolianthus buxifolius* (C.H. Wright) A.P. Davis, *comb. nov.* — Map 2

*Saprosma buxifolia* C.H. Wright, Kew Bull. (1899) 101. — *Amaracarpus buxifolius* (C.H. Wright) Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 230. — Type: *Giulianetti s.n.* (holo K; iso L), Papua New Guinea, Mt Scratchley, 10000–13000 ft [3050–4000 m], 1896.

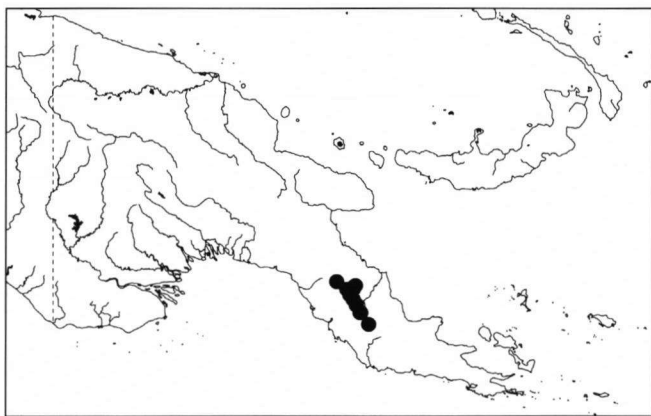
*Amaracarpus caeruleus* Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 229. — Type: *Brass* 4525 (holo A; iso L, NY), Papua New Guinea, Central Division, Wharton Range, Murray Pass, 2840 m, June–Sept. 1933.

*Amaracarpus confertifolius* Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 230. — Type: *Brass* 4715 (holo A; iso L, NY), Papua New Guinea, Central Division, Wharton Range, Murray Pass, 2840 m, June–Sept. 1933.

*Treelet* or *shrub*, (0.15–)1–3(–4) m high, terminal shoot internodes 0.2–0.6(–1.2) cm long, branches erecto-patent to horizontal; outer bark brown, with pale white patches. *Branches* 3.5–4 mm diam., terete, weakly ridged longitudinally, brown. *Branchlets* 2–3 mm diam., terete to  $\pm$  4-angled, weakly ridged longitudinally, light to dark brown,  $\pm$  glabrous. *Stipules* oblong to ovate, 2–4 by 1.4–2.5 mm, with a longitudinal median ridge, subcoriaceous, glabrous, apex acute or obtuse, margin finely fimbriate at first

becoming entire, soon falling to leave a scar with few short, stiff, brown 'hairs', or none at all. *Leaves* elliptic, or narrowly obovate to obovate, (0.7–0.9–)1.2–2.5(–3–4) by 0.4–1.2(–1.4–1.6) cm, chartaceous to subcoriaceous, glabrous, base cuneate to narrowly cuneate, slightly decurrent, margin entire, subrevolute to flat, apex obtuse to acute, midrib glabrous, secondary veins 4–9 pairs, prominent to obscure or infrequently invisible, ascending at an angle of 45–60°, curved near the margin and joining to form an undulating intramarginal vein, venation openly reticulate, prominent to obscure, manifest on the adaxial surface; petioles 3–5(–7) mm long. *Inflorescence* terminal to subterminal in the axils of the 2nd to 4th pair of leaves, composed of 1 or rarely 2 ultimate flower stalks, each stalk 1-flowered, (0–)3–8 mm long, glabrous. *Bracts* absent. *Bracteoles* 2 or 4, free or connate at the base, when connate forming a shallow cup-like structure with 2 lobes, when free, each bracteole linear or oblong-ovate, (1–)2–4(–5) by 0.5–1.2 mm, apices acute, or acuminate to cuspidate, bracteole of second pair reduced to approximately half the size of the 2-bracteole variant, but similar in shape, lobes, if present, deltate to narrowly triangular, 1.5–3 by 1.2–2 mm. *Flowers* erect or pendulous, 1.4–2.1 by 0.7–1 cm,  $\pm$  glabrous, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 3.5–5 by 3–4.5 mm, calyx lobes narrowly triangular to linear, 2–3.2 by 1–1.2 mm, apices obtuse to acute, with round sinuses between the lobes. *Corolla* narrowly infundibuliform-cylindrical, 1.2–1.8 by 0.8–0.9 cm, blue with yellow-green tips or bluish, tinged yellow, external surface glabrous, internal surface glabrous to finely hairy, hairs concentrated in a broad band from just below the point of anther insertion to the lower 1/2 to 1/3 of the corolla tube, lobes deltate to triangular, 3.5–4 by 1–1.2 mm. *Stamens* fixed c. 2 mm below the corolla lobe sinuses; filaments c. 1 mm long; anthers 3–4 mm long. *Disc* slightly lobed. *Style* 1–1.5 cm long. *Fruit* ellipsoid-obovoid, 6–7 by 4.5–5 mm,  $\pm$  smooth or 6–8-grooved, glabrous, red to red-brown; calyx persistent, 2–6 mm long; bracteoles persistent. *Pyrenes* ellipsoid, 6 by 4.5 mm, with 3 or 4 crests; preformed germination slits 2/3 the length of each pyrene.

**Distribution** — Central Prov. (Mt Albert Edward, Mt Victoria, Wharton Range), Northern Prov. (Mt Kenive, Mt Scratchley, Owen Stanley Range).



Map 2. Distribution of *Dolianthus buxifolius* (C.H. Wright) A.P. Davis.

**Habitat & Ecology** — Upper montane to subalpine to alpine zone, 2700–3640 m; primary ridge forest, open forest and forest borders, open grassland and rocky river banks; with conifers and bamboo, and, for example, *Astronia* and *Elaeocarpus*, *Vaccinium*, *Weinmannia* and *Rapanea*, and *Dacrycarpus*.

**Characteristic features** — More or less glabrous throughout; stipules medium to large (2–4 mm long); leaves large (1.2–2.5 cm long), subcoriaceous, secondary veins 4–9 pairs, venation distinct; petioles long (3–5 mm long); inflorescence with 1 or rarely 2 ultimate flower stalks, each stalk 1-flowered; bracts absent; bracteoles 2–4, if 4 usually of two different sizes (fused to form a cup).

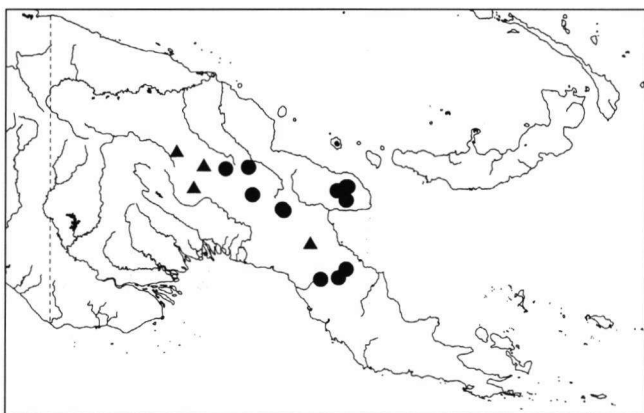
**Note** — This is a rather variable species in terms of leaf size and bracteole morphology. When more specimens have been collected and examined it is possible that the species could be separated into more than one taxon.

### 3. *Dolianthus clemensae* (Merr. & L.M. Perry) A.P. Davis, *comb. nov.* — Map 3

*Amaracarpus clemensae* Merr. & L. M. Perry, J. Arnold Arbor. 27 (1946) 231. — Type: *Clemens* 12328 (holo A; iso L), Papua New Guinea, Rawlinson Range, 7000–12000 ft [2100–3600 m], 19 June 1941.

**Treelet or shrub**, 1.2–2(–3) m high, terminal shoot internodes 0.3–1.2(–2) cm long, branches erecto-patent to spreading; bark grey-brown. **Branches** 4.5–5.5 mm diam., terete to rather flattened, often with small transverse fractures, brown to dark brown. **Branchlets** 2–3 mm diam., terete to weakly 4-angled or flattened, often longitudinally ridged, sometimes with many small, horizontal fractures or ridged, dark brown, glabrous or covered with crisp, erect, brown hairs. **Stipules** oblong to oblanceolate, or  $\pm$  rhombic, 4–8(–10) by 2–3(–9) mm, sometimes with a longitudinal median ridge, which is often hairy along its length and has a tuft of hairs at the apex, subcoriaceous, apex obtuse or undulate, margin  $\pm$  entire, soon falling to leave a scar with many short, stiff, golden-brown ‘hairs’, or ‘hairs’ absent. **Leaves** elliptic to elliptic-oblanceolate 0.9–3(–4–5) by 0.3–1.4(–1.7–2.2) cm, subcoriaceous, glabrous, base narrowly cuneate, slightly decurrent, margin entire, subrevolute to flat, apex acute to slightly acuminate, midrib glabrous, secondary veins 3 or 4(–7) pairs, prominent to weak, ascending at an angle of 45–60°, curved near the margin and joining to form an undulating intramarginal vein, venation openly reticulate, prominent to obscure, invisible to weak on the adaxial surface; petioles 2–6 mm long. **Inflorescence** subterminal in the axils of the 2nd or 3rd pair of leaves, composed of 1 ultimate flower stalk, each stalk 1-flowered, 0.5–1.5(–2.5) mm long, glabrous or hairy like the branchlets. **Bracts** absent. **Bracteoles** 4 or 8, usually free but sometimes fused at the base, either linear, 4–11 by 1–2 mm, or  $\pm$  elliptic and often leaf-like, or lanceolate, 7–11 by 2–2.5 mm, apices acute. **Flowers** erect to pendulous, 1.5–2.9 by 1.2 cm,  $\pm$  glabrous. **Calyx** campanulate to cupuliform, 5–10 by 4.5–6 mm, lobes triangular 2–3.2 by 1–1.2 mm, apices obtuse to acute, with round sinuses between the lobes. **Corolla** narrowly infundibuliform-cylindrical, 1.7–2.5 by 1.3–1.4 cm, yellow to yellowish green with blue to milky blue lobes, external surface glabrous, internal surface glabrous to finely puberulous on the upper part of the corolla tube, lobes triangular, 3.5–5 by 1.5–2 mm. **Stamens** fixed c. 2 mm below the corolla lobe sinuses (short styled), or in the middle of the corolla tube, 6–8 mm below the throat (long styled); filaments c. 1 mm long anthers 4–6 mm





Map 3. Distribution of *Dolianthus clemensae* (Merr. & L.M. Perry) A.P. Davis (●) and *D. fimbri-stipularis* (P. Royen) A.P. Davis (▲).

long. *Disc* slightly 5-lobed or not lobed. *Style* 0.8–1 (short styled) to 1.1–1.5 cm long (long styled). *Fruit* ellipsoid to ellipsoid-obovoid, 5.5–7 by 3.5–5 mm, either with several thin, longitudinal ridges or 2 or 3 grooves, glabrous, red to purplish red; calyx persistent, 1–1.5 mm long; bracteoles persistent. *Pyrenes* ellipsoid to obovoid, 7 by 4 mm, with 3 weak ridges; preformed germination slits 1/2 to 2/3 the length of each pyrene.

**Distribution** — Chimbu Prov., Eastern Highlands Prov. (Mt Kerigomna, Mt Michael, Mt Piora), Morobe Prov. (Mt Sarawaket [Salawaket], Cromwell Range, Rawlinson Range, Salawaket Range), Central Prov. (Mt Dickson, Mt Yule).

**Habitat & Ecology** — Upper montane to subalpine zone, (2400–)3100–3300 m; cloud forest, moss forest, and found as a remnant in pyrogenic grassland; in mixed conifer forest, such as *Podocarpus-Papuacedrus*, and *Podocarpus-Libocedrus* forest.

**Vernacular name** — Kokoh (Chimbu: Waimambuno).

**Characteristic features** — Branchlets hairy, especially the terminal portions; stipules large (4–8 mm long); leaves medium to large (0.9–3 cm long), subcoriaceous, secondary veins 3 or 4(–7) pairs, venation distinct to obscure; petioles long (2–6 mm long); inflorescence with 1 ultimate flower stalk; bracts absent; bracteoles 4, large, elliptic or linear.

**Note** — This is a rather variable species in terms of leaf size and bracteole morphology. When more specimens have been collected and examined it is possible that this species could be separated into more than one taxon.

#### 4. *Dolianthus fimbristipularis* (P. Royen) A.P. Davis, *comb. nov.* — Map 3

*Amaracarpus fimbristipularis* P. Royen, Alp. Fl. New Guinea 4 (1983) 2706. — Type: *Kalkman 5106* (holo L; iso K), Terr. of Papua, South Highl. Distr., Tari Subdistr., Mt Ambua, 3300 m, 8 Aug. 1966.

**Shrub**, 1.5–2 m high, terminal shoot internodes 0.2–1.5(–2.4) cm long, branches erecto-patent or spreading. **Branches** 4–9 mm diam., terete, sometimes weakly longitudinally

ridged, brown to dark brown. *Branchlets* 2–4 mm diam., terete or weakly 4-angled, longitudinally ridged, often with many small, horizontal fractures or ridges, dark brown, glabrous to sparsely hairy, or rather densely covered with crisp, brown hairs on the apical portions of the shoots. *Stipules* oblong to elliptic, oblanceolate, or almost pandurate, 6–9 by 2.5–3 mm, subcoriaceous, glabrous, apex obtuse to acute, margin entire, often conspicuously fimbriate, particularly at the apex, soon falling to leave a scar with many short, stiff, golden-brown ‘hairs’. *Leaves* elliptic to narrowly elliptic, or subobovate, (0.8–1.3–)2.5–3.4 by 0.8–1.2 cm, chartaceous, glabrous, base cuneate to narrowly cuneate, slightly decurrent, margin entire, subrevolute to flat, apex acute to very slightly acuminate, midrib glabrous, often discolorous against the lamina, secondary veins 5–7 pairs, rather obscure, ascending at an angle of 30–45°, curved near the margin and joining to form an undulating to straight intramarginal vein, venation openly reticulate, often obscure, invisible to weak on the adaxial surface; petioles 2.5–5(–7) mm long. *Inflorescence* terminal to subterminal in the axils of the 1st to 3rd pair of leaves, composed of 1 ultimate flower stalk, each stalk 1–3-flowered, and 1–3 subultimate flower stalk(s), or subultimate flower stalk absent; ultimate flower stalk 1.2–2.5 cm long, glabrous; subultimate flower stalk(s), if present, 0.2–5 mm long, glabrous. *Bracts* 2, conspicuous, either free or fused for 1/2 their length and then forming a cup-like structure or, subtending the upper part of the inflorescence and in the early stages of flowering enclosing the flower(s), when free lanceolate or narrowly cuneate, 7–12 by 4–6 mm, when fused 8–12 by 6–8 mm, apices acute, margin entire, ciliate. *Bracteoles* 4 (per flower) in 2 decussate pairs, free, linear to ± elliptic, 6–13 by 1.8 by 6 mm, apices acute, margin with occasional small, fine hairs. *Flowers* erect to ± pendulous, 1.2–1.7 by 0.7–1 cm, ± glabrous, *only long styled flowers seen*. *Calyx* campanulate to cupuliform, 5–6 by 4.5–6 mm, lobes short, ± deltate, c. 2 by 1 mm, apices obtuse to acute. *Corolla* narrowly infundibuliform-cylindrical, 1.3–1.7 by 0.7–1 cm, pale blue with white lobes, or corolla whitish and tinged with blue, external and internal surface glabrous, lobes triangular, 3.5–4 by 2.5–3 mm. *Stamens* fixed 3.5–4 mm below the corolla lobe sinuses; anthers 2–3 mm long; filaments 0.2–0.4 mm long. *Disc* 5-lobed. *Style* 0.8–1.2 cm long; bracts and bracteoles persistent or falling. *Fruit* ± ellipsoid, 6–7 by 3.5–4 mm, ± smooth, glabrous, orange to red; calyx persistent, 1–3 mm long; bracteoles persistent. *Pyrenes* ellipsoid to ob-ovoid, 6 by 4 mm; with 3 or 4 rounded ridges; preformed germination slits 1/2 to 2/3 the length of each pyrene.

Distribution — Southern Highlands Prov. (Mt Ambra), Western Highlands Prov., Morobe Prov. (Mt Amangwiwa).

Habitat & Ecology — Upper montane to subalpine zone, 2800–3150 m; mixed montane forest, including *Nothofagus* forest.

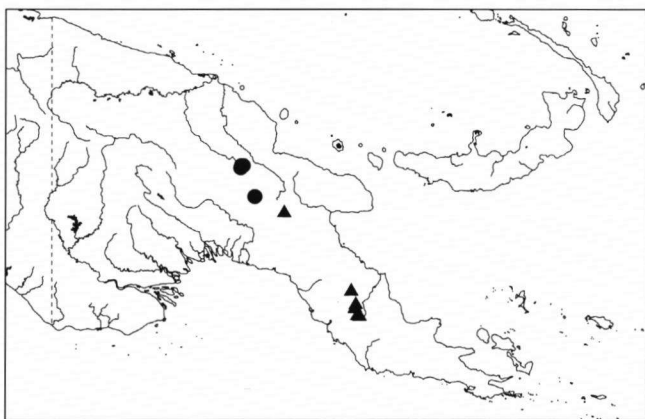
Vernacular name — Ypa (Enga language).

Characteristic features — Branchlets glabrous to densely hairy, especially the terminal portions; stipules large (6–9 mm long); leaves medium to large (2.5–3.4 cm long), chartaceous, secondary veins 5–7 pairs, venation more or less obscure; petioles long (2.5–5 mm long); inflorescence with at least ultimate flower stalks, 1–3-flowered; bracts present, 2; bracteoles 4, linear to ± elliptic.

**5. *Dolianthus montis-wilhelmii* (P. Royen) A.P. Davis, *comb. nov.* — Fig. 2, Map 4**

*Amaracarpus montis-wilhelmii* P. Royen, Alp. Fl. New Guinea 4 (1983) 2693. — Type: Millar & Van Royen NGF 14685 (holo L; iso K), Papua New Guinea, Eastern Highlands, Chimbu Sub-district, Lake Aunde, 12500 ft [3800 m], 26 Sept. 1962.

*Shrub or tree*, 1.5–6(–8) m high, dbh up to 10 cm, terminal shoot internodes (0.4–) 1.7(–2.2) cm long, branches erecto-patent; bark c. 2.5 mm thick, reddish orange to purple-brown, with short longitudinal fissures; inner bark straw coloured; wood straw coloured, slightly pinkish. *Branches* 3.5–4.5 mm diam., terete, longitudinally ridged, sometimes transversely ridged and/or fractured, dark brown. *Branchlets* 3–4 mm diam., terete to flattened, or weakly 4-angled, transversely ridged, ridges often folded and scale-like, dark brown to blackish, glabrous. *Stipules*  $\pm$  oblong to obtriangular,  $\pm$  oblanceolate or almost pandurate, 5–10(–12) by 3.5–9(–11) mm, subcoriaceous, glabrous, apex broadly acute to rounded or nearly truncate, often minutely apiculate or acuminate, margin  $\pm$  entire, soon falling to leave a scar with many short, stiff, golden-brown ‘hairs’. *Leaves* elliptic to elliptic-obovate, or narrowly rhombic, (1.8–)2–3.2(–3.5) by (0.7–) 1–1.4(–1.9) cm, subcoriaceous,  $\pm$  glabrous to slightly puberulous, base cuneate to narrowly cuneate or sometimes slightly decurrent, margin entire, subrevolute to flat, apex acute to slightly acuminate, midrib glabrous to puberulous, secondary veins 5–7 (or 8) pairs, rather obscure, ascending at an angle of c. 45°, curved near the margin or throughout the entire length and joining to form an undulating intramarginal vein, or vein endings free, venation openly reticulate, weak, venation obscure on the adaxial surface; petioles 2–5 mm long, often rather stout. *Inflorescence* subterminal in the axils of the 1st, 2nd or 3rd pair of leaves, or in the axils of the branchlets, composed of 1 ultimate flower stalk, each stalk 1-flowered, 6–12(–19) mm long, glabrous. *Bracts* absent. *Bracteoles* 2, fused for 1/2 to 1/3 of their length and forming a cup-like structure which frequently surrounds and covers the calyx, 6–7 by 5–6 mm, often with a distinct V-shaped connection to the flower stalk, lobes triangular to deltate, 2–4 by 1.2–1.5



Map 4. Distribution of *Dolianthus montis-wilhelmii* (P. Royen) A.P. Davis (●) and *D. vaccinioides* C.H. Wright (▲).



Fig. 2. *Dolianthus montis-wilhelmii* (P. Royen) A.P. Davis. a. Habit; b. detail of shoot, showing stipules and emergent leaves, and transversely ridged branchlet bark; c. young flower showing bracteoles (fused to form a cup-like structure), calyx, and calyptrate corolla (a–c: Millar & Van Royen NGF 14685 (L, holo)). Drawn by J. Wessendorp.

(–2) mm. *Flowers* erect to pendulous, (1.5–)1.9–2.5 by (0.5–)1.2–1.5 cm,  $\pm$  glabrous. *Calyx* campanulate to cupuliform, 5–6(–9) by 5 mm, lobes small,  $\pm$  deltate, 1 by 1.5 mm, apices acute, with angular sinuses between the lobes. *Corolla* narrowly infundibuliform-cylindrical, 1.5–1.7 by (0.5–)0.8–1.2 cm, either greenish white, yellow with blue lobes, or  $\pm$  totally blue to bluish white, external and internal surface glabrous,

lobes triangular, 3.5–4 by 1.5 mm. *Stamens* fixed 2–2.5 mm below the corolla lobe sinuses (short styled) or 4–5.5 mm below (long styled); filaments c. 0.7 mm long; anthers 3.5–4 mm long. *Disc* distinctly 5-lobed. *Style* c. 1.1 (short styled) to 1.6–1.8 cm long (long styled). *Fruit* ellipsoid to ellipsoid-obovoid, 5–6 by 3–3.5 mm, either  $\pm$  smooth or with 3–5 weak, longitudinal ridges, glabrous, orange to red; calyx persistent, rather thick, 3–4 mm long; bracteoles persistent. *Pyrenes* ellipsoid to obovoid, c. 7 by 4 mm; with 3 smooth ridges; preformed germination slits  $1/2$  the length of each pyrene.

**Distribution** — Chimbu Prov. (Mt Wilhelm), Eastern Highlands Prov. (Mt Kerigomna, Mt Michael).

**Habitat & Ecology** — Subalpine to alpine zone, 3400–3800 m; frequent in coniferous forest.

**Vernacular names** — Toron (Upper Chimbu); Dibinkur (Chimbu: Waimambano); Tolobeh (Chimbu: Masul); Pori (Wahyi: Minj).

**Characteristic features** — Branchlets hairy, especially the terminal portions; stipules large (4–8 mm long); leaves medium to large (0.9–3 cm long), subcoriaceous, secondary veins 5–7 (or 8) pairs, venation more or less obscure; petioles long (2–5 mm long); inflorescence with 1 ultimate flower stalk, each stalk 1-flowered; bracts absent; bracteoles fused to form a cup, which obscures the calyx.

## 6. *Dolianthus vaccinioides* C.H. Wright — Map 4

*Dolianthus vaccinioides* C.H. Wright, Kew Bull. (1899) 106; Bremek., Kew Bull. (1936) 105. — *Amaracarpus vaccinioides* (C.H. Wright) P. Royen, Bot. Not. 16 (1973) 423. — Type: *Giulianetti s.n.* (holo K), Mt Scratchley, 10000–13000 ft [3050–4000 m], 1896.

**Shrub**, 1–4(–5) m high, terminal shoot internodes 0.3–1 cm long, branches erect to spreading branches; bark maroon-brown. *Branches* 2.5–4 mm diam.,  $\pm$  terete, often with many small, horizontal fractures, dark brown to blackish. *Branchlets* 1–2.5 mm diam., terete to weakly 4-angled, transversely ridged and/or fractured, ridges sometimes folded and almost scale-like, dark brown to blackish, glabrous to hairy, particularly in the apical portions of the shoots, hairs brown, short, crisp, antrorse. *Stipules* triangular, 2–3 by 1–2 mm, subcoriaceous, glabrous, apex acute, usually hairy, hairs 0.5 mm long, brown to blackish, particularly at the apex, margin  $\pm$  entire, soon falling to leave a scar with few short, stiff, golden-brown ‘hairs’, or ‘hairs’ absent. *Leaves* elliptic to narrowly elliptic, or elliptic-lanceolate, (0.6–)0.8–1.5(–1.9) by 0.3–0.5 cm, subcoriaceous,  $\pm$  glabrous, base cuneate to narrowly cuneate or sometimes slightly decurrent, margin entire, subrevolute to flat, apex acute to obtuse, midrib glabrous, infrequently puberulous, secondary veins 4 or 5 pairs, rather obscure, ascending at an angle of 45–60°, curved near the margin or throughout the entire length and joining to form an undulating intramarginal vein, venation openly reticulate, obvious or weak, venation on the adaxial surface invisible; petioles 1.5–2 mm long. *Inflorescence* subterminal in the axils of the 2nd or 3rd pair of leaves, or in the axils of the branchlets, composed of 1 ultimate flower stalk, each stalk 1-flowered, 1.5–4(–7–12) mm long, glabrous. *Bracts* and *bracteoles* absent. *Flowers* erect to pendulous, 1.6–2.5(–2.7) by 0.8–1 cm,  $\pm$  glabrous, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 3 by 2.5 mm, lobes small, deltate, 1–1.7 by 1 mm, apices acute, with angular sinuses

between lobes. *Corolla* narrowly infundibuliform-cylindrical, 1.5–2.3(–2.5) by 0.5–0.8(–1) cm, white to pale blue at base with blue to pale yellow lobes, or corolla yellowish blue-green, external surface glabrous, internal surface glabrous or puberulous, lobes triangular, 3–3.5(–4) by 2 mm. *Stamens* fixed 2–3 mm below the corolla lobe sinuses; filaments c. 0.7 mm long, anthers 3–4 mm long. *Disc* with 8–10 short, angular lobes. *Style* 1.2–2.2 cm long. *Fruit* not seen.

**Distribution** — Eastern Highlands Prov. (Mt Piora), Central Prov. (Mt Albert Edward, Mt Scratchley, Mt Victoria, Owen Stanley Range), Northern Prov. (Owen Stanley Range).

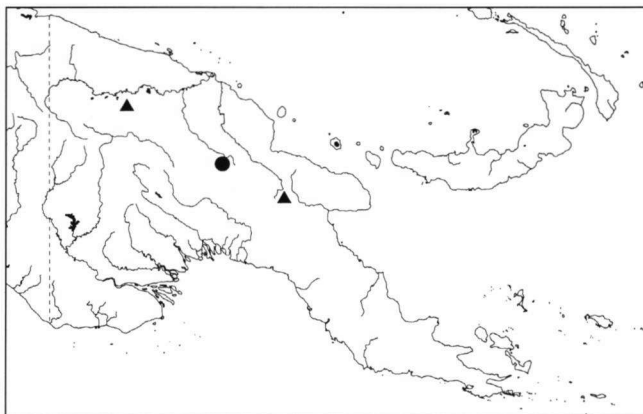
**Habitat & Ecology** — Upper montane to subalpine zone, 3200–3700 m; forest, tussock heath, scrub, mossy thickets, subalpine grassland; with, for example, *Drimys-Rapanea-Vaccinium-Rhododendron*, *Cyathea gleichenioides*, Ericaceae, *Dacryocarpus* spp., *Dimorphanthera*, *Rapanea* spp., *Tasmania*, and *Eurya*.

**Characteristic features** — Stipules usually hairy, midrib infrequently puberulous; stipules small (2–3 mm long); leaves small to medium (0.8–1.3 cm long), subcoriaceous, secondary veins 4 or 5 pairs, venation more or less obscure; petioles long (1.5–2 mm long); inflorescence with 1 ultimate flower stalk, each stalk 1-flowered; bracts and bracteoles absent.

## 7. *Dolianthus nummatus* (P. Royen) A.P. Davis, *comb. nov.* — Map 5

*Amaracarpus nummatus* P. Royen, Alp. Fl. New Guinea 4 (1983) 2696. — Type: *Vink 16153* (holo L), Papua New Guinea, Western Highlands, Kubor Range, Nona-Minj-Divide, 3220 m, 22 July 1963.

*Shrub*, c. 1.6 m high, terminal shoot internodes 0.4–1.2 cm long, branches erecto-patent to spreading; bark unknown. *Branches* terete, 4–6 mm diam., brown. *Branchlets* c. 2 mm diam.,  $\pm$  terete, dark brown to blackish, densely covered with short, antrorse to spreading, crisp brown hairs. *Stipules*  $\pm$  obovate, c. 2.7 by 1 mm, subcoriaceous, with a dense covering of very short, brown hairs, apex acute, often minutely apiculate or acuminate, margin  $\pm$  entire, soon falling to leave a naked scar. *Leaves*  $\pm$  orbicular to broadly obovate, rarely ovate, (5–)7.5–9(–12) by 6.5–10(–11) mm, chartaceous, puberulous to hairy, margin entire, subrevolute to flat, apex rounded, midrib hairy, either like the leaves or petioles, secondary veins 3–5 pairs, rather inconspicuous to invisible, ascending at an angle of 30–45°,  $\pm$  straight or slightly curved, dichotomising towards the margin and joining to form an undulating intramarginal vein, venation openly reticulate, obscure to invisible, venation not manifest on the adaxial surface, abaxial leaf surface pubescent, with many fine, whitish hairs, adaxial leaf surface puberulous or glabrous; petioles 1.5–2 mm long, usually densely hairy like the branchlets. *Inflorescence* terminal, with or without an ultimate flower stalk, 1-flowered, c. 1 mm long, glabrous. *Bracts* absent. *Bracteoles* 2, ?or infrequently 1, stipule-like, free or connate for 1/2 of their length and then forming a cup-like structure, each bracteole 1–1.2 by 0.4–0.5 mm. *Flowers* pendulous, c. 1.6 by 0.8 cm,  $\pm$  glabrous, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 2.5 by 2.5 mm, margins puberulous or glabrous, lobes indistinct, 0.5 by 1 mm, or calyx truncate. *Corolla* narrowly infundibuliform-cylindrical, 1.5–1.7 by 0.8 cm, expanded somewhat above the ovary and slightly constricted in the middle, very light blue, apex light green, lobes greenish



Map 5. Distribution of *Dolianthus epiphyticus* (Valeton) A.P. Davis (▲) and *D. nummatus* (P. Royen) A.P. Davis (●).

yellow, external surface glabrous, internal surface with a ring of fine, whitish hairs near the base of the anthers, lobes deltate to triangular, 2–3 by 1 mm. *Stamens* fixed 2–3 mm below corolla lobe sinuses; filaments 0.5–0.7 mm long; anthers 3–4.5 mm long. *Disc* not lobed. *Style* 1.5 cm long. *Fruit* not seen.

**Distribution** — Western Highlands Prov. (Kubor Range).

**Habitat & Ecology** — Upper montane to subalpine, 2850–3220 m; tall, mossy forest.

**Vernacular name** — Dogmbakl-ont (Minj).

**Characteristic features** — Branchlets and stipules hairy, leaves puberulous to hairy; stipules small (c. 2.7 mm long); leaves small to medium (7.5–9 mm long), chartaceous, base rounded or broadly cuneate, secondary veins 3–5 pairs, hairy, venation obscure to invisible; petioles short (1.5–2 mm long); inflorescence with or without an ultimate inflorescence stalk, each stalk 1-flowered; bracts absent; bracteoles 2, ?or infrequently 1, stipule-like.

## 8. *Dolianthus ovatifolius* A.P. Davis, *spec. nov.* — Fig. 3, Map 6

Affinis *D. nummato* (P. Royen) A.P. Davis foliis ovatis vel rarissime ellipticis (non orbicularibus nec late obovatis), 12–20 mm longis (non 7.5–12 mm longis), ad basin plerumque subcordatis vel rarissime tantum cuneatis rotundisve (non late cuneatis nec plerumque rotundus), nervis lateralibus 5–7 (non 3–5), differt. — *Typus*: *Brass 31571* (holo L; iso K, US), Papua New Guinea, Eastern Highlands Distr., Mt Michael, northeast slopes, 2000 m, 13 Sept. 1959.

**Treelet or shrub**, 0.5–1 m high, terminal shoot internodes 0.2–0.7(–1.2) cm long, branches ± erect to erecto-patent or spreading; outer bark brown. **Branches** 2.5–7 mm diam., ± terete, light to mid brown. **Branchlets** 1–2 mm diam., ± terete, light to mid brown, densely covered with short to medium length, antrorse to spreading, crisp, brown hairs. **Stipules** deltate to ± obovate, 1.5–2(–4) by 1.5–2(–3) mm, membranous to chartaceous, with a dense covering of very short, crisp, brown hairs, or these hairs either concentrated into a longitudinal, median line or hairs only at the apex, apex rounded to blunt, often with a small hairy apiculus, margin ± entire, persistent or soon

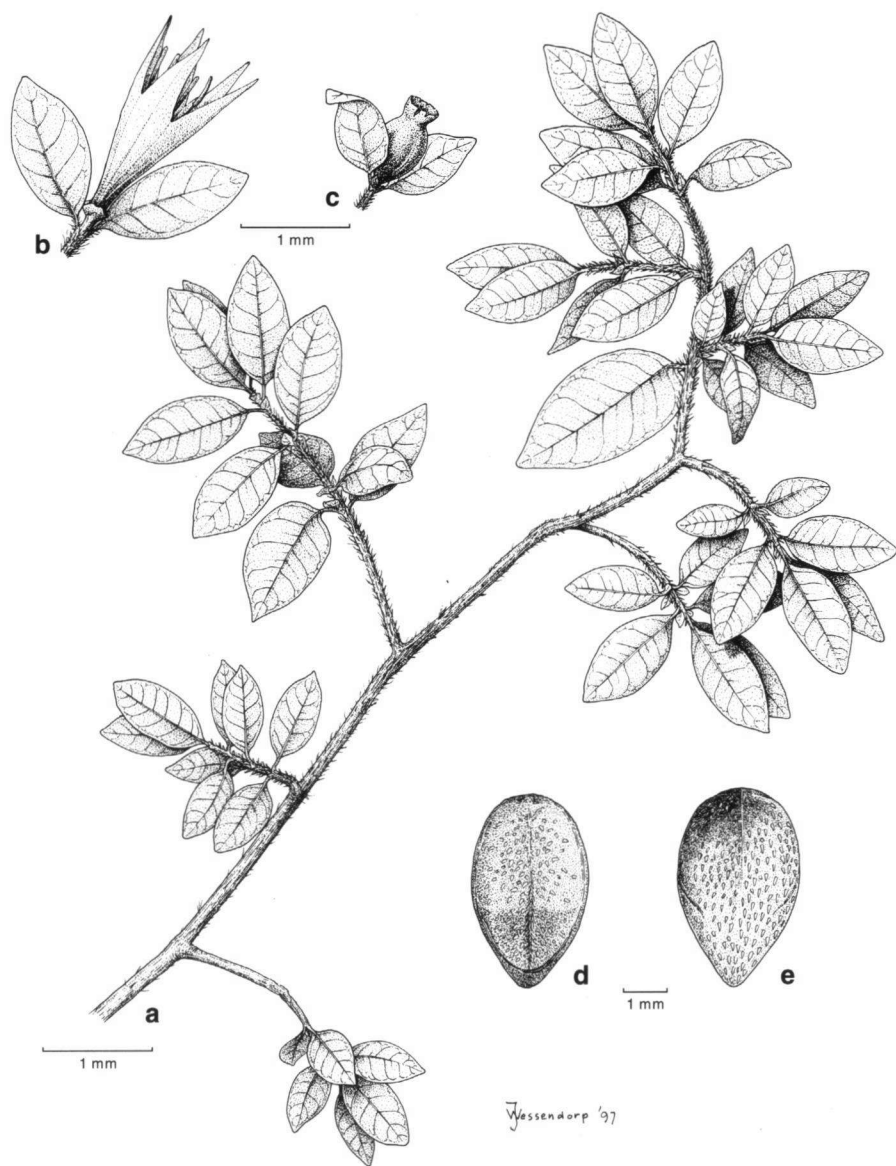


Fig. 3. *Dolianthus ovatifolius* A.P. Davis. a. Habit; b. flower; c. fruit; d. pyrene (adaxial view), showing the raphides and preformed germination slits (PGSs); e. pyrene (abaxial view), showing the raphides (a, b: *Brass* 31571 (holo L; iso K, US); c–e: *Borgmann* 353 (B, L)). Drawn by J. Wessendorp.

falling to leave a ?naked scar. *Leaves* ovate to ovate-oblong, rarely elliptic (1–)1.2–2 by (0.6–)0.8–1.2 cm, chartaceous, glabrous, base rounded to subcordate, rarely cuneate, margin entire, flat, apex acute, midrib  $\pm$  glabrous, or hairy at the base, secondary veins 5–7 pairs, ascending at an angle of 30–45°,  $\pm$  straight or slightly curved, dichotomising

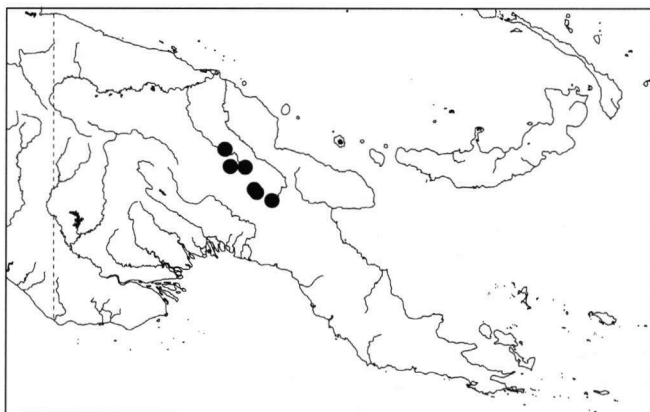


towards the margin and joining to form an undulating intramarginal vein, a second, faint intramarginal nerve often present very close to the margin, venation openly reticulate, obscure to prominent, usually manifest on the adaxial surface; petioles (0.1–) 0.5–2 mm long, glabrous to densely hairy like the branchlets. *Inflorescence* terminal, without an ultimate flower stalk ('sessile'), composed of 1 flower. *Bracts* absent. *Bracteoles* 2, stipule-like, connate for 1/2 of their length from the base upwards and forming a cup-like structure, 1.5–1.7 by 1 mm, this structure infrequently obscuring the calyx, with a tuft of short hairs at the apex of each bracteole or hairs running in a median line along the length of each bracteole. *Flowers* pendulous to erect,  $\pm$  glabrous, buds and developing flowers often obscured by the leaves, (0.9–) 1.7–2.4 by 0.8–1.2 cm, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 2.2–3(–4) by 1.5–2.5 mm, lobes small or insignificant and cusp-like, 0.4–1 by 0.25 mm, or calyx  $\pm$  truncate with an undulating margin. *Corolla*  $\pm$  obconoidal to infundibuliform, 1.5–2 by 0.8–1.2 cm, white to bluish white (colour not sufficiently known), external surface glabrous, internal surface with a well-defined, dense, almost tufty, ring of antrorse, whitish hairs either inserted in the middle or lower 1/3 of the corolla tube, lobes  $\pm$  triangular, 4–8 by 1.5–4 mm. *Stamens* fixed 3–4 mm below the corolla lobe sinuses; filaments 3–4 mm long, anthers 3–4 mm long. *Disc* not lobed. *Style* 0.6–0.9 cm long. *Fruit* ellipsoid to ellipsoid-obovoid, 5–6.5 by 3.5–4 mm, fruit body  $\pm$  smooth, either glabrous or covered with fine, brown, appressed hairs, orange to red; calyx persistent, c. 2 mm long; stipules often persistent. *Pyrenes* ellipsoid to obovoid, 5–6 by 3–3.5 mm;  $\pm$  smooth (without ridges); preformed germination slits 1/3 to 1/2 the length of each pyrene.

*Distribution* — Western Highlands Prov., Chimbu Prov., Eastern Highlands Prov. (Mt Michael).

*Habitat & Ecology* — Mid montane to upper montane, 1940–2400 m; forest, ridge forest, and in disturbed forest; with, for example, Fagaceae.

*Characteristic features* — Branchlets and stipules hairy, leaves glabrous to densely hairy, petioles hairy; stipules small (1.5–2 mm long); leaves medium sized (1.2–2 cm long), base rounded to subcordate, rarely cuneate, chartaceous, secondary veins 5–7



Map 6. Distribution of *Dolianthus ovatifolius* A.P. Davis.

pairs, venation obscure to prominent; petioles short (0.5–2 mm long), or absent; inflorescence without an ultimate flower stalk ('sessile'); bracts absent; bracteoles 2, stipule-like.

Note — *Dolianthus ovatifolius* is similar to *D. nummatus* but can be separated by the shape and size of the leaves, and by the number of secondary veins. *Dolianthus ovatifolius* has ovate (rarely elliptic) leaves, 1.2–2 cm long, rounded to subcordate (rarely cuneate) leaf bases, and 5–7 pairs of secondary veins. *Dolianthus nummatus* has more or less orbicular to broadly obovate leaves, 7.5–9 mm long, rounded or broadly cuneate leaf bases, and 3–5 pairs of secondary veins.

### 9. *Dolianthus epiphyticus* (Valeton) A.P. Davis, *comb. nov.* — Map 5

*Amaracarpus epiphyticus* Valeton, Bot. Jahrb. Syst. 61 (1927) 126. — Type: *Ledermann* 8471 (holo B†; iso SING), Neu-Guinea, Sepik-Gebiet, Hunsteingebirge, 1050 m, 20 Aug. 1912.

*Treelet* or *shrub*, c. 1 m high, stem c. 2 cm diam. at the base, horizontally branched. *Branches* not seen. *Branchlets* 1–2 mm diam., ± terete, light to mid brown, rather corky, densely covered with short to medium length, antrorse to spreading, brown hairs. *Stipules* ± deltate, 1–1.5 by 1–1.3 mm, membranous to chartaceous, either with a longitudinal median line of short, brown, antrorse hairs or only hairy at the base, apex obtuse to blunt, often with a small hairy apiculus, margin ± entire, persistent or soon falling to leave a naked scar. *Leaves* ± deltate to cordate, 6–10 by 3.5–6 mm, chartaceous, glabrous, base truncate to cordate, margin entire, flat, apex acute, midrib sparsely hairy, secondary veins 3–5 pairs, ascending at an angle of 30–45°, ± straight or slightly curved, dichotomising towards the margin and joining to form an undulating intramarginal vein, venation openly reticulate, obscure to prominent, obscure on the adaxial surface; petioles 0.5–1.5 mm long, densely hairy like the branchlets. *Inflorescence* terminal, without an ultimate flower stalk ('sessile'), composed of 1 flower. *Bracts* absent. *Bracteoles* ?absent, flowers subtended by 2 modified stipules, these connate at the base, c. 1.2 by 0.7 mm, with a tuft of short hairs at the apex of each modified stipule. *Flowers* pendulous to erect, c. 0.9 by 0.5–0.7 cm, ± glabrous, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 2.2–2.5 by 1.5 mm, lobes small and cusp-like, 0.4 by 0.25 mm, or calyx ± truncate with an undulate margin. *Corolla* narrowly infundibuliform-cylindrical, 0.7–0.8 by 0.5–0.7 cm, whitish to bluish (colour imperfectly known), external surfaces glabrous, internal surface with a well defined, dense, almost tufty, ring of antrorse, whitish hairs in the middle of the corolla tube, lobes triangular, 3.5–4.2 by 1.5–2 mm. *Stamens* fixed c. 2 mm below the corolla lobe sinuses; filaments c. 0.5 mm long; anthers c. 1.5 mm long. *Disc* not lobed. *Style* 0.6–0.7 cm long. *Fruit* not known.

Distribution — East Sepik Prov. (Hunstein Range), Eastern Highlands Prov.

Habitat & Ecology — Lower montane zone, c. 1050 m; in forest with *Castaniopsis*, on ridges.

Characteristic features — Branchlets, stipules, and petioles hairy; stipules small (1–1.5 mm long); leaves small (6–10 mm long), base truncate to cordate, chartaceous, secondary veins 3–5 pairs, venation obscure to prominent; petioles short (0.5–1.5 mm long); inflorescence without an ultimate flower stalk ('sessile'); bracts absent; bracteoles probably absent.

**10. *Dolianthus bicolor* (Merr. & L.M. Perry) A.P. Davis, *comb. nov.* — Fig. 4, Map 7**

*Amaracarpus bicolor* Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 230. — Type: *Brass* 5019 (holo A; iso K, L, NY), Papua New Guinea, Central Division, Mt Tafa, 2400 m, May–Sept. 1933.

*Treelet or shrub*, (0.15–)0.8–2(–3) m high, terminal shoot internodes 0.5–1(–3) mm long, branches spreading to horizontal; bark brown. *Branches* 3–5 mm diam., terete, very pale brown to dark brown, or greyish. *Branchlets* 1–2 mm diam.,  $\pm$  terete or weakly 4-angled and sometimes slightly winged, often weakly longitudinally ridged, sometimes with short transverse fractures, very pale brown to dark brown, glabrous.

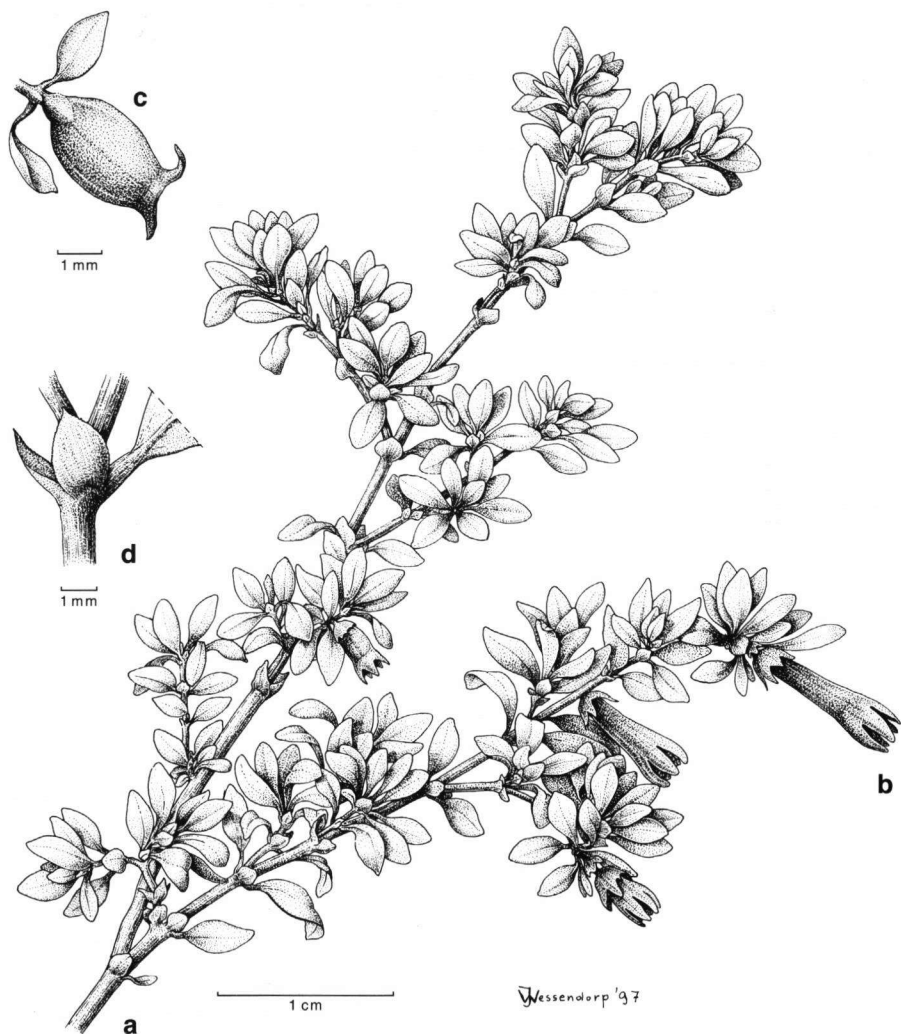
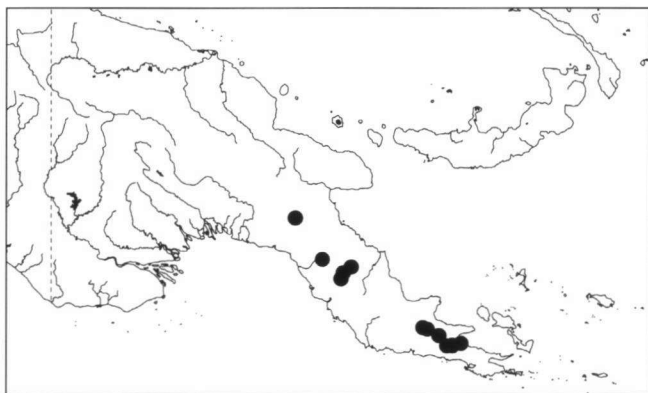


Fig. 4. *Dolianthus bicolor* (Merr. & L.M. Perry) A.P. Davis. a. Habit; b. flower; c. fruit; d. detail of shoot and branching (a–d: *Veldkamp & Stevens LAE 54388* (L)). Drawn by J. Wessendorp.

*Stipules*  $\pm$  deltate to  $\pm$  triangular, 0.9–1.5 by 1–1.2 mm, chartaceous to subcoriaceous, often with a longitudinal, median crest, apex obtuse or broadly acute, margin entire, persistent on young shoots and sometimes after leaves have fallen, finally falling, leaving a  $\pm$  naked scar with the very base of the stipule still attached to the shoot, without ‘hairs’. *Leaves* obovate to oblanceolate, 2.5–5.5(–7.5) by 1.5–2.5(–3–3.5) mm, chartaceous to subcoriaceous, glabrous, base narrowly cuneate, attenuate, margin entire, subrevolute to flat, apex broadly acute to rounded, midrib concolorous with rest of leaf, glabrous, secondary veins 3 or 4 pairs, obscure to invisible, ascending at an angle of 30–45°,  $\pm$  straight or slightly curved, dichotomising towards the margin and joining to form an undulating intramarginal vein, venation  $\pm$  invisible, not manifest on the adaxial surface; petioles (0.1–)0.5–1 mm long. *Inflorescence* terminal, without an ultimate flower stalk (‘sessile’) or flower stalk short, 0.2–0.3 mm long, composed of 1 flower. *Bracts* absent. *Bracteoles* 2 or rarely 4, if 4 one pair usually much reduced and insignificant but rarely equal, inconspicuous to obvious, half elliptic to narrowly triangular, or narrowly oblanceolate, free or connate at the base and often slightly connate to the base of the calyx, when bracteoles connate forming a cup-like structure, 0.8–2.2 by 0.7–2(–2.5) mm, the cup-like structure often having 2 distinct lobes, lobes narrowly triangular to narrowly oblanceolate, 0.5–1.5(–2) mm long, the base of each bracteole often with a tuft of minute hairs, upper margins sometimes puberulous. *Flowers* sessile or very shortly pedicellate, erect to  $\pm$  pendulous, 1.5–2.3 by 0.5–0.8 cm,  $\pm$  glabrous, pedicel (0.1–)0.3–0.5 mm long. *Calyx* campanulate to cupuliform, 3–4 by 2–2.2 mm, glabrous, lobes short, triangular, 1.5–2 by 0.4–0.9 mm, apices acute, sinuses cuneate. *Corolla* narrowly infundibuliform-cylindrical, 0.7–1.9 by 0.6–1 cm, bluish green to pale blue, immature corolla white or greenish yellow, external surface glabrous, internal surface with a diffuse ring of fine, whitish, antrorse hairs, in the middle or the lower 1/3 of the corolla tube, below the anthers, or sometimes hairs scarce and few, lobes triangular, 2.5–4 by 1–2 mm. *Stamens* fixed c. 2 mm below the corolla lobe sinuses (short styled) or 4–5 mm below (long styled); filaments 0.2 mm long; anthers 2–3 mm long. *Disc* not lobed. *Style* 0.7–0.9 (short styled) to 1.2–1.4 cm long (long styled), rather thick; stigma sparsely covered with small, white hairs. *Fruit* ellipsoid, 4–6 by 3–4 mm, smooth, glabrous, orange to red; calyx persistent,



Map 7. Distribution of *Dolianthus bicolor* (Merr. & L.M. Perry) A.P. Davis.

c. 1–1.5 mm long; bracteoles persistent. *Pyrenes* ellipsoid, 3–5 by 2–3.5 mm; smooth (without ridges); preformed germination slits 1/2 to 2/3 the length of each pyrene.

Distribution — Morobe Prov., Central Prov. (Mt Tafa, Mt Wosa, Wharton Range), Milne Bay Prov. (Mt Dayman, Mt Keria, Mt Manaman, Mt Simpson, Mt Suckling, Maneau Range). [District not known for Mt Maveao or Mt Yauyama.]

Habitat & Ecology — Mid montane to upper montane zone, (1800–)2100–3000 m; stunted, moss forest, ridge forest, and on grasslands at the edges of forest; with, for example, *Astronia-Elaeocarpus*, *Nothofagus* and *Araucaria*.

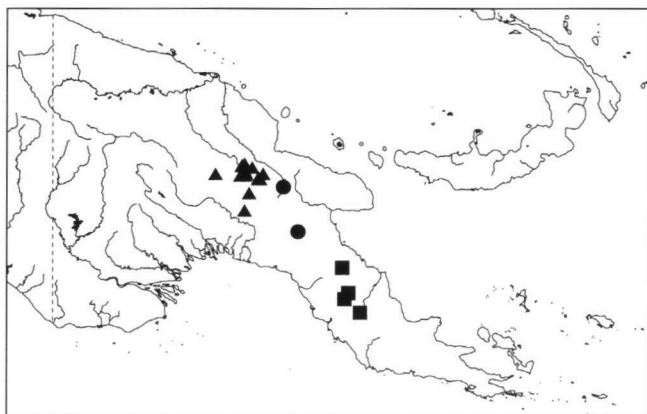
Vernacular name — Goraut (Guale: Movoi).

Characteristic features — More or less glabrous throughout; stipules small (0.9–1.5 mm long); leaves small (2.5–5.5 mm long), chartaceous to subcoriaceous, secondary veins 3 or 4 pairs, venation obscure; petioles very short (0.5–1 mm long), or absent; inflorescence more or less without an ultimate flower stalk (more or less ‘sessile’), composed of 1 flower; bracts absent; bracteoles 2, narrowly triangular, or narrowly oblanceolate.

# 11. *Dolianthus subalpinus* (P. Royen) A.P. Davis, *comb. nov.* — Fig. 1a, Map 8

*Amaracarpus subalpinus* P. Royen, Alp. Fl. New Guinea 4 (1983) 2682. — Type: Millar & Van Royen NGF 14690 (holo L; iso BO, K), Papua New Guinea, Eastern Highlands District, Chimbu Subdistrict, Below Lake Aunde, 12500 ft [3800 m], 26 Sept. 1962.

*Treelet* or *shrub*, (0.3–)1.5–4(–5) m high, terminal shoot internodes 0.3–2.5 mm long, branches horizontal to spreading; bark brown. *Branches* 4–5(–10) mm diam., terete, mid brown. *Branchlets* 2–3 mm diam.,  $\pm$  terete to weakly 4-angled, light to mid brown, glabrous in the lower parts but nearly always hairy, and often densely covered with hairs on the young shoots, hairs short, crisp, brown, antrorse to  $\pm$  appressed. *Stipules*  $\pm$  deltate, or oblong-oblanceolate (0.6–)1.5–3 by (0.5–)1.5–2 mm, membranaceous to chartaceous, glabrous or puberulous, apex broadly rounded to obtuse or truncate, margin entire, persistent, often as a tube, then later splitting irregularly leaving small pieces of stipule, finally falling to leave a ?naked stipule scar. *Leaves* obovate to obovate-elliptic, or ovate, 1.5–3.5(–4.5) by 1.5–3(–3.5) mm, chartaceous to subcoriaceous, glabrous, base narrowly cuneate, slightly decurrent, margin entire, subrevolute to flat, sometimes minutely puberulous, apex obtuse to rounded, midrib dark brown or concolorous with rest of leaf, glabrous or infrequently puberulous, secondary veins 3 pairs, rather inconspicuous to invisible, ascending at an angle of 30–45°,  $\pm$  straight or slightly curved, dichotomising towards the margin and joining to form an undulating intramarginal vein, venation reticulate, obscure to invisible, not manifest on the adaxial surface; petioles 0.5–1(–2) mm long, or leaves nearly  $\pm$  sessile. *Inflorescence* terminal, without an ultimate flower stalk (‘sessile’), composed of 1 flower. *Bracts* and *bracteoles* ?absent, flowers subtended by 2 modified stipules, these free to connate. *Flowers* pendulous, 1–1.6 by 0.6–0.9 cm,  $\pm$  puberulous to pubescent, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 2–2.5 by 2 mm, puberulous to pubescent, or glabrous, sometimes with a ring of minute hairs around the very base, lobes rather short, linear to oblanceolate, (0.5–)1–1.5 by 0.5 mm, apices  $\pm$  obtuse to acute, with broad, rounded sinuses between each lobe. *Corolla* narrowly infundibuliform-cylindrical, 0.8–1.5 by 0.5–0.9 cm, either pale blue tipped with white, greenish blue, blue and creamy and yellow at tips, ice-blue, or very light blue, external surface gla-



Map 8. Distribution of *Dolianthus kairoi* A.P. Davis (●), *D. subalpinus* (P. Royen) A.P. Davis (▲) and *D. trichanthus* (Merr. & L.M. Perry) A.P. Davis (■).

brous or pubescent at the apex, particularly on the lobes, internal surface with a rather dense ring of fine, long, antrorse hairs, positioned below the anthers in the upper 2/3 or middle of the corolla tube (short styled), lobes triangular, 2–4 by 1–1.5 mm. *Stamens* fixed 1.5–2 mm below the corolla lobe sinuses; filaments 0.9–1 mm long, anthers 1.5–2.5 mm long. *Disc* not lobed. *Style* 0.8–1.5 cm long, rather thick. *Fruit* ellipsoid, 3–4 by 2.5–3 mm, smooth, glabrous, orange to red; calyx persistent, rather short, 0.6 mm long; bracts persistent. *Pyrenes* ellipsoid, c. 3 by 2 mm; smooth (without ridges); preformed germination slits 1/2 the length of each pyrene.

**Distribution** — Chimbu Prov. (Mt Wilhelm), Eastern Highlands Prov. (Mt Keri-gomna, Mt Otto).

**Habitat & Ecology** — Mid montane to subalpine zone, (2430–)2900–3400(–3800) m; forest, moss forest, and as a remnant in pyrogenic grassland; with, for example, *Myrtaceae*, *Podocarpus*, and *Rapanea*; often found near water, such as on the edges of river banks and near waterfalls.

**Vernacular name** — Kengena-pildigamp (Hagen: Wankl).

**Characteristic features** — Branchlets hairy, stipules glabrous to hairy, leaves infrequently puberulous; stipules small (1.5–3 mm long); leaves very small (1.5–3.5 mm long), chartaceous to subcoriaceous, secondary veins 3, venation obscure to invisible; petioles very short (0.5–1 mm long), or absent; inflorescence without an ultimate flower stalk ('sessile'), composed of 1 flower; bracts absent; bracteoles absent.

## 12. *Dolianthus trichanthus* (Merr. & L.M. Perry) A.P. Davis, *comb. nov.*

— Fig. 1c, Map 8

*Amaracarpus trichanthus* Merr. & L.M. Perry, J. Arnold Arbor. 27 (1946) 229. — Type: *Brass* 4615 (holo A; iso L, NY), Papua New Guinea, Central Division, Wharton Range, Murray Pass, 2840 m, June–Sept. 1933.

**Tree or shrub**, 1–2(–5) m high, terminal shoot internodes 0.3–2.7 mm long, branches spreading to horizontal. *Branches* 4–7 mm diam., terete, mid brown. *Branchlets* 1–3 mm diam., ± terete or weakly 4-angled, light to mid brown, densely covered with

hairs, particularly on young shoots, hairs short, crisp, brown, antrorse to  $\pm$  appressed. *Stipules*  $\pm$  deltate to oblong, (1–)1.5–1.7 by 1–1.5 mm, membranaceous to chartaceous, sparsely covered with thick, blackish hairs, or hairs concentrated into 2 lines, each running from the outside edge of the stipule to the apex, apex broadly rounded to obtuse or broadly acute, margin entire, persistent or soon falling, leaving a naked scar. *Leaves* oblanceolate to obovate, 4–6 by 1.5–2(–3.5) mm, chartaceous to subcoriaceous, glabrous, base narrowly cuneate, slightly decurrent, margin entire, flat, apex rounded to broadly acute, midrib concolorous with rest of leaf, glabrous, secondary veins 3 or 4 pairs, obscure to  $\pm$  invisible, ascending at an angle of 30–45°,  $\pm$  straight or slightly curved, dichotomising towards the margin and joining to form an undulating intra-marginal vein, venation obscure to invisible, not manifest on the adaxial surface; petioles 0.5–1.5(–2) mm long, glabrous. *Inflorescence* terminal, without an ultimate flower stalk ('sessile'), composed of 1 flower. *Bracts* and *bracteoles* absent. *Flowers* pendulous, 1–1.3 by 0.3–0.5 cm, hairy, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 1.7–2.7 mm, sparsely covered with short, darkish hairs, lobes rather short,  $\pm$  linear, 0.5 by 0.2 mm, apices  $\pm$  obtuse to acute, with rounded sinuses, or calyx truncate with a puberulous margin. *Corolla* narrowly infundibuliform-cylindrical, 0.9–1.2 by 0.3–0.5 cm, pale blue or blue-green, external surface densely covered with short, dark hairs (which gives the corolla tube a  $\pm$  echinate appearance when rehydrated), internal surface with a diffuse ring of fine, whitish, antrorse hairs in the lower 1/2 to 1/3 of the corolla tube, lobes  $\pm$  triangular, c. 2 by 1 mm. *Stamens* fixed 2–2.5 mm below the corolla lobe sinuses; filaments c. 0.7 mm long; anthers 1.5–2.5 mm long. *Disc* not lobed. *Style* 0.6–0.7 cm long, rather thick. *Fruit* ellipsoid to ellipsoid-obovoid, 4 by 3 mm, smooth, glabrous, orange to red; calyx persistent, 1–1.5 mm long. *Pyrenes* ellipsoid, 4 by 3 mm, smooth (without ridges); preformed germination slits 1/2 to 2/3 the length of each pyrene.

**Distribution** — Morobe Prov., Central Prov. (Mt Victoria, Wharton Range), Northern Prov.

**Habitat & Ecology** — Mid montane to upper montane zone, 2430–2840 m; forest.

**Characteristic features** — Branchlets densely hairy, stipules and flowers hairy; stipules small (1.5–1.7 mm long); leaves small (4–6 mm long), chartaceous to subcoriaceous, secondary veins 3 or 4 pairs, venation obscure to more or less invisible; petioles short (0.5–1.5 mm long); corolla densely covered with short, dark hairs on the outside surface; inflorescence without an ultimate flower stalk ('sessile'), composed of 1 flower; bracts absent; bracteoles absent.

### 13. *Dolianthus kairoi* A.P. Davis, *spec. nov.* — Fig. 1b, Map 8

Affinis *D. subalpino* (P. Royen) A.P. Davis foliis 6–8 mm longis (non 1.5–3 mm longis), petiolo 1.5–2.5 mm longo (non 0.5–1 mm longo), costa hirsuta (non glabra nec puberula), calycis lobis pusillis circa 1  $\times$  0.5 mm (non linearibus nec oblanceolatis circa 1–1.5  $\times$  0.5 mm) differt. — Typus: *Streimann & Kairo NGF 44514* (holo L; iso BO, BRI, CANB, K, LAE, SING), Papua New Guinea, Morobe Distr., Menyama subdistr., Oteti Village, Langimar River, 5000 ft [1524 m], 25 Nov. 1970.

**Shrub**, c. 0.3 m high, terminal shoot internodes 0.4–2 mm long, branches spreading to horizontal; bark unknown. *Branches* 4–6 mm diam., terete, mid brown. *Branchlets* 1.5–2 mm diam.,  $\pm$  terete, pale brown to dark brown, densely covered with short,

crisp, brown, spreading to antrorse hairs. *Stipules* ovate to shortly oblanceolate, 1.5–2 by 1.2–1.5 mm, membranaceous to chartaceous, sparsely covered with short, blackish hairs, which are often concentrated in the middle or at the apex to form a tuft, apex obtuse, apiculate, margin entire, soon falling, leaving a naked scar. *Leaves* obovate to  $\pm$  obovate-rhombic, or oblanceolate to  $\pm$  oblanceolate-rhombic, (5–)6–8 by (2–)2.5–3.5 mm, chartaceous, some parts hairy, base cuneate to narrowly cuneate, slightly decurrent, margin entire, flat, apex acute to abruptly acuminate, the margins of the midrib with a rather sparse covering of thick, blackish hairs, secondary veins 3 or 4 pairs, not prominent, ascending at an angle of c. 45°,  $\pm$  straight or slightly curved, dichotomising towards the margin and joining to form an undulating intramarginal vein, venation openly reticulate, obscure to invisible, not manifest on the adaxial surface, petioles 1.5–2.5 mm long, sparsely covered with thick, blackish hairs. *Inflorescence* terminal, without an ultimate flower stalk ('sessile'), composed of 1 flower. *Bracts* and *bracteoles* absent. *Flowers* pendulous to erect, 1.1–1.3 by 0.5–0.6 cm,  $\pm$  glabrous, *only short styled flowers seen*. *Calyx* campanulate to cupuliform, 1.5–3 by 1.5–2.5 mm, lobes not prominent, cusp-like, c. 1 by 0.5 mm. *Corolla* narrowly infundibuliform-cylindrical, 0.9 by 0.5–0.6 cm, rather thin and not fleshy, bluish (colour imperfectly known), external surface glabrous, internal surface with a well-defined, dense, almost tufty, ring of antrorse, whitish hairs at the lower 1/3 of the corolla tube, lobes triangular, c. 4 by 1.5 mm, rather thin, not fleshy. *Stamens* fixed c. 2 mm below corolla lobe sinuses; filaments 1–1.5 mm long; anthers 1.5–2 mm long. *Disc* not lobed. *Style* short, 0.5–0.6 cm long. *Fruit* not known.

Distribution — Eastern Highlands Prov.; Morobe Prov.

Habitat & Ecology — Lower montane zone, c. 1500 m; rain forest.

Characteristic features — Branchlets hairy, stipules more or less hairy, petioles hairy, midrib hairy; stipules small (1.5–2 mm long); leaves small (6–8 mm long), chartaceous to subcoriaceous, secondary veins 3 or 4 pairs, venation obscure; petioles short (1.5–2.5 mm long); inflorescence without an ultimate flower stalk ('sessile'), composed of 1 flower; bracts absent; bracteoles absent.

Notes — *Dolianthus kairoi* is named after A. Kairo, who was originally attached to the Forestry School in Bulolo, and collected widely in Papua New Guinea, from the late 1960s onwards.

*Dolianthus kairoi* is similar to *D. subalpinus* but can easily be separated by the size of the leaves, the hairy midrib, length of the petiole, and the shape and size of the calyx lobes. The leaves of *D. kairoi* are 6–8 mm long, the margins of the midrib have a rather sparse covering of thick, blackish hairs, and the petioles are 1.5–2.5 mm long; the calyx lobes are cusp-like, c. 1 by 0.5 mm. The leaves of *D. subalpinus* are 1.5–3.5 mm long, the midrib is glabrous or infrequently puberulous, and the petioles are 0.5–1 mm long; the calyx lobes are linear to oblanceolate, c. 1–1.5 by 0.5 mm.

The distribution of *D. kairoi* does not overlap with *D. subalpinus*.

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## IDENTIFICATION LIST

The numbers behind the collections refer to the species numbers as given in the key and the descriptions above. Dates are used where the collection number is unknown. If only the year is known, it is placed in square brackets.

<i>Dolianthus</i>	7 = <i>D. nummatus</i>
1 = <i>D. archboldianus</i>	8 = <i>D. ovatifolius</i>
2 = <i>D. buxifolius</i>	9 = <i>D. epiphyticus</i>
3 = <i>D. clemensae</i>	10 = <i>D. bicolor</i>
4 = <i>D. fimbristipularis</i>	11 = <i>D. subalpinus</i>
5 = <i>D. montis-wilhelmii</i>	12 = <i>D. trichanthus</i>
6 = <i>D. vaccinioides</i>	13 = <i>D. kairoi</i>

- Borgmann 54: 5; 77: 11; 353: 8 — Brass 4019: 10; 4373: 1; 4379: 2; 4525: 2; 4614: 1; 4615: 12; 4715: 2; 4766: 2; 5019: 10; 22332: 10; 22691: 10; 22915: 10; 29838: 5; 30201a: 11; 30276: 11; 30384: 11; 30945: 11; 31475: 8; 31571: 8 — Brass & Collins 31199: 5; 31285: 3 — Brown 324: 10.  
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Accepted names are in roman type. Synonyms are printed in *italics*. New names are in **bold type**.

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