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TWO NEW SPECIES OF *BEGONIA* (*BEGONIACEAE*) FROM SOUTH SULAWESI, INDONESIA

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Two new species of *Begonia* (*Begoniaceae*), *Begonia didyma* D.C.Thomas & Ardi and *Begonia guttapila* D.C.Thomas & Ardi, are described from the Latimojong Mountains, South Sulawesi (Sulawesi Selatan), Indonesia. Both species belong to *Begonia* sect. *Petermannia*.

Keywords. *Begonia*, new species, Sulawesi.

Introduction

The *Begonia* L. living collections at the Botanic Garden 'Eka Kaya' Bali, which hold more than 60 indigenous Indonesian species, are an important resource for *Begonia* systematics in SE Asia. Recent expeditions organised by the Botanic Garden Bali, seed exchange with numerous institutions, as well as collaborations with the Herbarium Bogoriense, Bogor Botanic Garden, the New England Tropical Conservatory and the Royal Botanic Garden Edinburgh, have led to a rapid increase in the number of species in the collection. The new accessions include several species collected on the Indonesian island of Sulawesi (Hartutiningsih, 2005).

The *Begonia* flora of undercollected Sulawesi is poorly known. Thirty-four indigenous species of *Begonia* have been reported, 30 of which are classified in *Begonia* sect. *Petermannia* (Klotzsch) A.DC., the other four belonging to *Begonia* sect. *Sphenanthera* (Hassk.) Warb. (Hughes, 2008; Thomas *et al.*, 2009). Recent expeditions have brought to light several new species (Hughes, 2006; Thomas & Hughes, 2008; Thomas *et al.*, 2009), and a close examination of all available *Begonia* herbarium specimens from Sulawesi from A, B, BM, BO, CEB, E, K, L and SING and the living collections at the Botanic Garden Bali and the Royal Botanic Garden Edinburgh indicates that there are numerous endemic species awaiting description.

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Two new species cultivated at the Botanic Garden Bali are described below. As with the majority of species on Sulawesi, the new species belong to *Begonia* sect. *Petermannia*. In common with most members of that section they exhibit: two-tepaled male flowers, anthers with unilaterally positioned slits, five-tepaled female flowers, two-flowered female inflorescences or solitary female flowers, three-locular ovaries with axile placentation and bilamellate placentae, and fruits with equal or subequal wings (Figs 1, 2).

Species Descriptions

Begonia didyma D.C.Thomas & Ardi, **sp. nov.** Sect. *Petermannia*. **Figs 1, 3.**

Begoniae gemellae Warb. ex L.B.Sm. & Wassh. similis a qua in caule, foliis et in tepalorum faciebus abaxialibus pilos multicellulares habenti, inflorescentia mascula semper biflora (non biflora ad quinqueflora), pedunculis inflorescentiarum feminearum brevioribus et pedicellis florum feminearum brevioribus differt. – Type: Cultivated at Bali Botanic Garden from vegetative material collected in the wild (Indonesia, Sulawesi, Sulawesi Selatan, Luwu District, Latimojong Mountains, Ranteballa village, 03°21′20″S, 120°07′36″E, 1225 m), 16 v 2008, *D.C. Thomas & W.H. Ardi* 08-77 (holo E; iso BO).

Perennial, monoecious herb with prostrate to erect stems, to c.35 cm tall, with a moderate to dense indumentum of multicellular, simple trichomes up to c.2 mm long and a sparse indumentum of microscopic, glandular trichomes on all aboveground vegetative parts. *Stems* much-branched, rooting at the lower nodes; internodes c.2–6 cm long. *Leaves* alternate; stipules persistent, 10–15 × 2–5 mm, elliptic, with an abaxially prominent midrib that projects up to c.4 mm at the apex, abaxially densely hairy along the midvein; petioles 2.5–5.6 cm long; lamina basifixed, 4.2–6.7 × 2.6–4.7 cm, very asymmetric, elliptic, base cordate, lobes not overlapping, apex acuminate, margin double serrate to double dentate, the teeth bristle-pointed, adaxial surface mid green and abaxial surface pale green, the margin reddish, venation palmate-pinnate. *Inflorescences*: *female flowers* solitary, basal to or not associated with the male inflorescences, branches bearing the female flowers c.1–2 mm long, subtending leaf foliose, 2 bracts present at the base of the pedicels of the female flowers, c.2–3 × 2–3 mm, broadly ovate; *male inflorescences* distal to or not associated with the female flowers, composed of 1–2 two-flowered partial inflorescences, each a once-branched monochasium, subtending leaves foliose, peduncles 2–7 mm long, bracts (subtending the pedicels) c.2–3 × 2–3 mm, elliptic to subcircular. *Male flowers*: pedicels 17–27 mm long, sparsely hairy; tepals 2, white or white with a tinge of pink, 12–17 × 10–14 mm, broadly ovate, base slightly cordate or with convex margins, apex rounded, abaxially sparsely hairy; androecium of c.35–43 stamens, yellow, filaments c.0.6–1.4 mm long, slightly fused at the very base, anthers c.0.9–1.2 mm long, obovate, dehiscing through unilaterally positioned slits c.1/2 as long as the anther, connective not projecting. *Female flowers*: pedicels

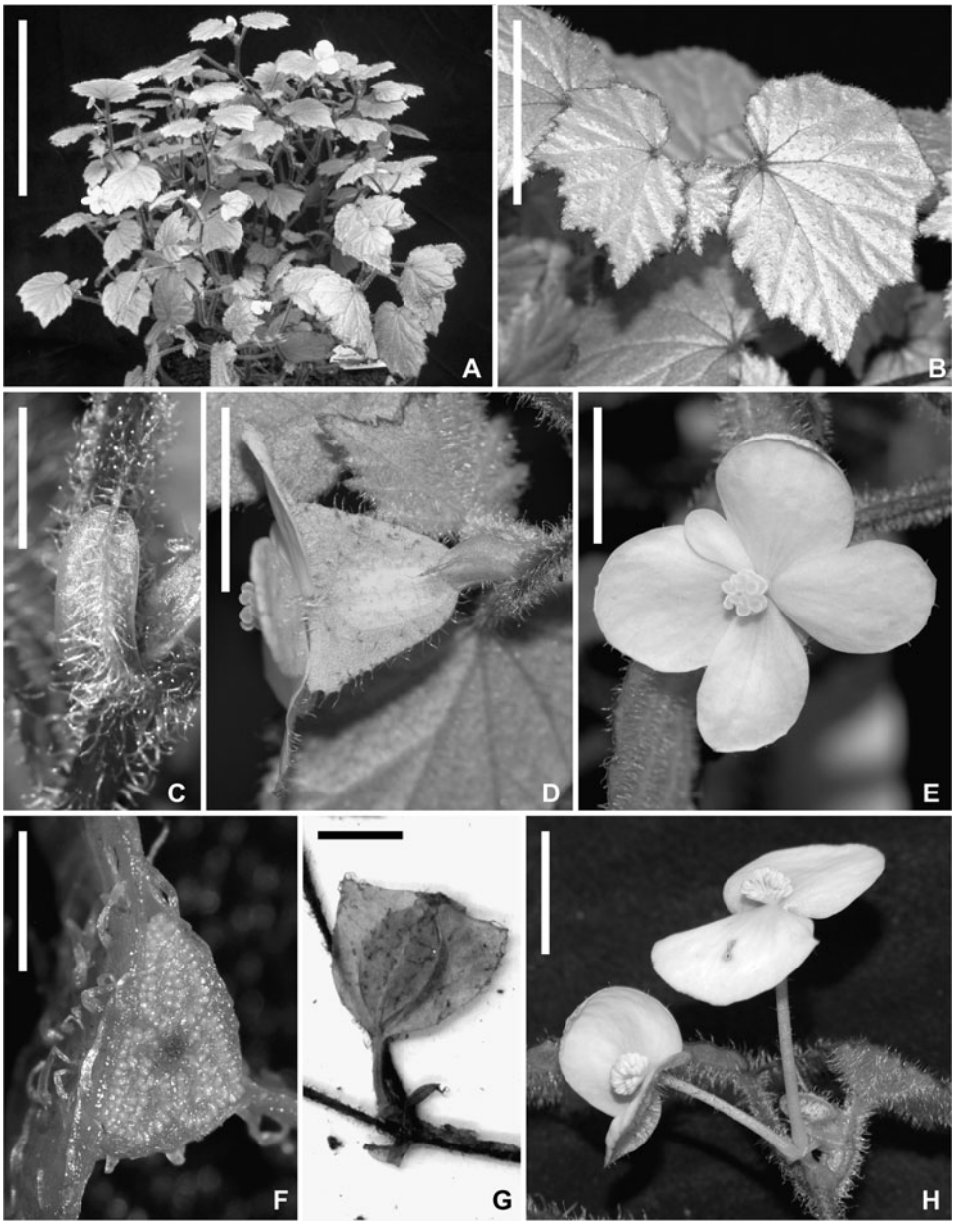

FIG. 1. *Begonia didyma* D.C.Thomas & Ardi. A, habit (scale bar = 15 cm); B, leaves (scale bar = 3 cm); C, stipule (scale bar = 6 mm); D, female flower, side view (scale bar = 12 mm); E, female flower, front view (scale bar = 10 mm); F, ovary, cross-section, three-locular with axile, bilamellate placentae (scale bar = 2 mm); G, fruit (scale bar = 5 mm); H, male inflorescence (scale bar = 10 mm). A–F, H: *D.C. Thomas & W.H. Ardi* 08-77; G: *Mogea et al.* 6596.

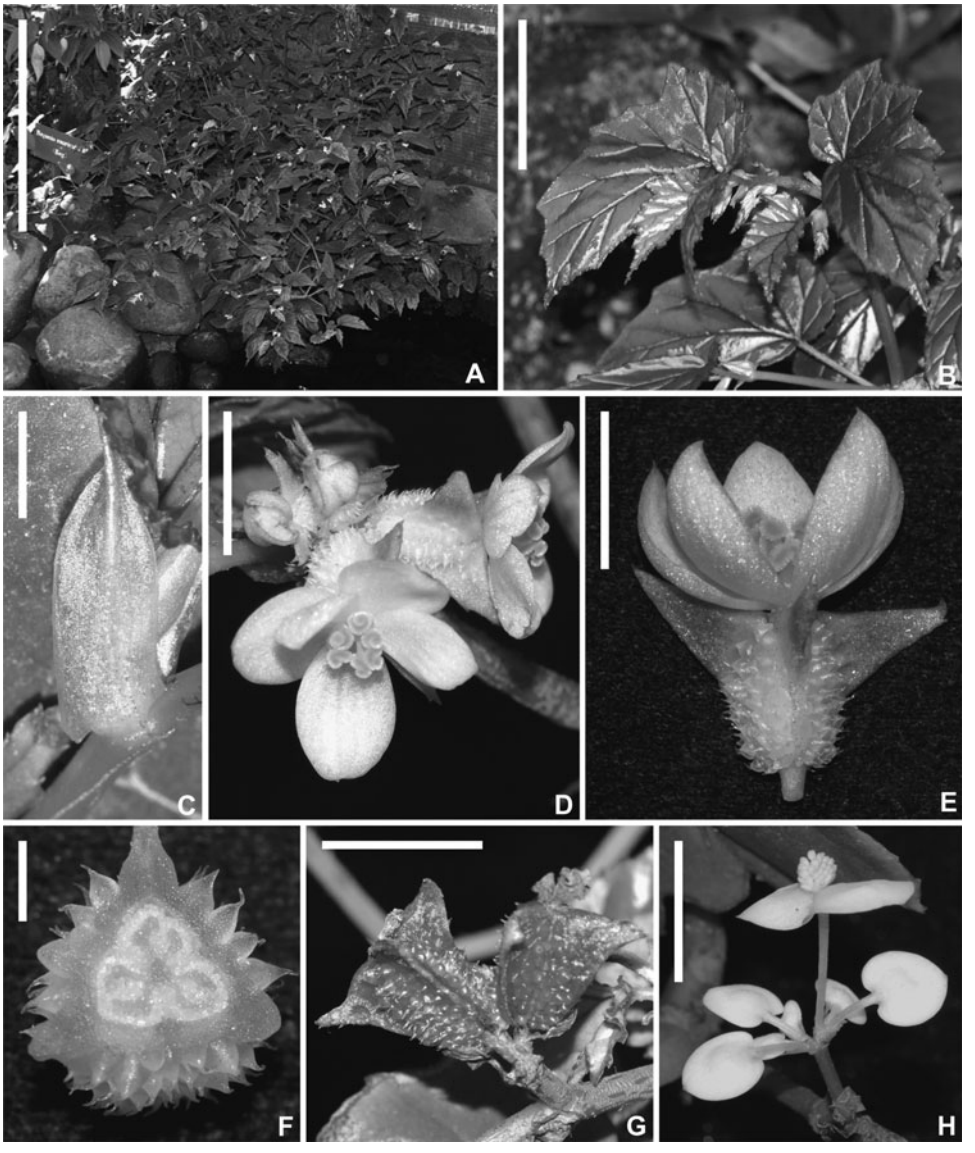

FIG. 2. *Begonia guttapila* D.C.Thomas & Ardi. A, habit (scale bar = 50 cm); B, leaves (scale bar = 5 cm); C, stipule (scale bar = 5 mm); D, female inflorescence (scale bar = 12 mm); E, female flower, side view (scale bar = 8 mm); F, ovary, cross-section, three-locular with axile, bilamellate placentae (scale bar = 2 mm); G, fruits (scale bar = 14 mm); H, male inflorescence (scale bar = 12 mm). A–H: *D.C. Thomas & W.H. Ardi* 08-81.

2–3 mm long, hairy; tepals 5, white, unequal, the two outer ones 12–13 × 10–12 mm, broadly obovate or elliptic, the two larger inner ones 13–14 × 8–9 mm, obovate, the smallest inner one 8–13 × 3–6 mm, obovate, abaxially sparsely hairy; ovary 10–13 × 11–14 mm, ellipsoid, locules 3, placentation axile, placentae bilamellate, wings 3,

narrowly triangular, rounded at base, widest at the truncate apex, hairy, style basally fused for c.1.5–2 mm, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, yellow. *Fruits* on thin, c.3–4 mm long, sparsely hairy pedicels; capsules ellipsoid, c.9–10 × 5–6 mm (excluding the wings), dehiscent, splitting along the wing attachment, drying pale brown, sparsely hairy, wing shape as for ovary, 4–7 mm wide at the widest point (at the apex), hairy. *Seeds* unknown.

Distribution. Indonesia, Sulawesi, South Sulawesi (Sulawesi Selatan), Luwu District, Latimojong Mountains (Fig. 3).

Habitat. Upland primary rain forest, on rocky ground, between c.1000 and 1250 m.

Proposed IUCN conservation category. VU D2. This species is only known from two collections on the eastern border of the Latimojong Forest Reserve. Despite the area's legal protection as a forest reserve, there are clear signs of anthropogenic disturbance (coffee plantations) close to the locality of this species. All available *Begonia* specimens from A, B, BM, BO, CEB, E, K, L and SING have been consulted, and hence it must be assumed, at least until more intensive collecting on

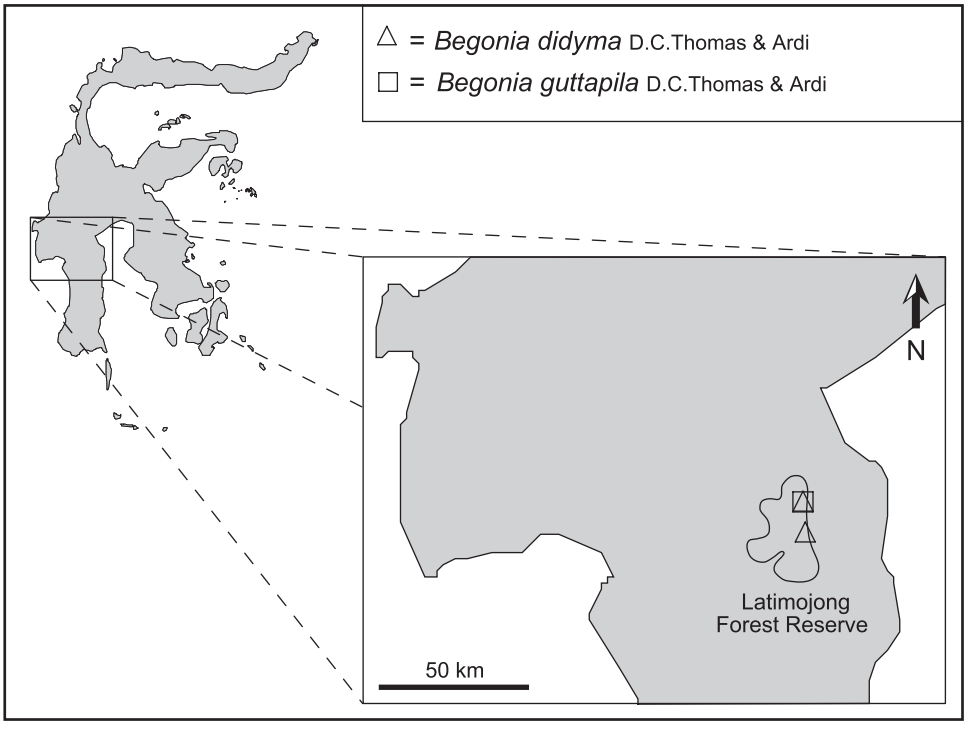

FIG. 3. Distribution of *Begonia didyma* and *Begonia guttapila* in South Sulawesi (Sulawesi Selatan), Indonesia.

Sulawesi may reveal otherwise, that this species has a very restricted range. Therefore, it is 'prone to the effects of human activities or stochastic events within a very short time period in an uncertain future' (IUCN, 2001).

Additional specimen examined. SULAWESI. **South Sulawesi**: Luwu District, Latimojong Mountain Range, Desa Lambanan Dusun Tibusan, 2 xi 1994, *J.P. Mogea, M. Amir & H. Alrasyid* 6596 (BO).

The epithet '*didyma*' (Greek *didymos* – twin) refers to the two-flowered male inflorescences of this species. *Begonia didyma* is morphologically similar to *Begonia gemella* Warb. ex L.B.Sm. & Wassh. Both species exhibit relatively thin stems rooting at the nodes, few-flowered monochasial male inflorescences and solitary female flowers. However, *Begonia didyma* can easily be distinguished from *Begonia gemella* by its moderate to dense indumentum of up to c.2 mm long, multicellular trichomes on all above-ground vegetative parts and on the tepals and the ovary of the female flowers (versus only sparsely and microscopically glandular hairy in *B. gemella*). The male inflorescences of *Begonia didyma* are strictly 2-flowered monochasial without any rudimentary, unopened flowers (Fig. 1H), while the male inflorescences of *Begonia gemella* are few-flowered monochasial (2–5-flowered). Warburg (see Koorders, 1904) probably chose the epithet '*gemella*' (Latin – twin) as reference to the male inflorescences of *Begonia gemella*, which predominantly show two fully developed flowers, but an examination of recently collected material of this species (*K. Armstrong* 364 at E), as well as the illustration in Koorders-Schumacher (1922: pl. 94) and a sketch by Irmscher on a herbarium sheet of type material of *Begonia gemella* (*S.H. Koorders* 16243β at B), show that the male inflorescences of this species comprise two to five flowers. Moreover, *Begonia didyma* exhibits very compressed branches bearing the female flowers (up to 2 mm long) and very short pedicels of the female flowers and fruits (up to 4 mm long), while in *Begonia gemella* these structures, though still short, are distinctly longer than in *B. didyma* (the branches bearing the female flowers are 5–25 mm long and the pedicels of the female flowers and fruits are 7–18 mm long).

Begonia guttapila D.C.Thomas & Ardi, **sp. nov.** Sect. *Petermannia*. **Figs 2, 3.**

Ab aliis speciebus celebicis sectionis *Petermanniae* in ovariis pilis insignibus basi bulboso habenti differt. – Type: Cultivated at Bali Botanic Garden from vegetative material collected in the wild (Indonesia, Sulawesi, Sulawesi Selatan, Luwu District, Latimojong Mountains, Ranteballa village, 03°21′33″S, 120°07′33″E, 1359 m), 16 v 2008, *D.C. Thomas & W.H. Ardi* 08-81 (holo E; iso BO).

Perennial, monoecious herb, stems first erect, but soon arching over and trailing-scrambling, to c.60 cm tall, with a sparse indumentum of microscopic, glandular hairs on all above-ground vegetative parts and a very sparse indumentum of multicellular hairs on the stems and the abaxial lamina surface or multicellular hairs absent. *Stems* branched; internodes c.2–16.5 cm long. *Leaves* alternate; stipules

14–18 × 4–6 mm, elliptic to oblong, with abaxially prominent midrib that projects shortly at the apex, caducous; petioles 1.5–5.2 cm long; lamina basifixed, 5–13 × 2.5–6 cm, very asymmetric, narrowly elliptic, elliptic, narrowly ovate or ovate, base cordate, lobes not overlapping, apex acuminate, margin double serrate, the teeth not or only slightly bristle-pointed, adaxial surface dark green and abaxial surface pale green, venation palmate-pinnate. *Inflorescences*: *female inflorescences* solitary, composed of 1–2 two-flowered partial inflorescences, subtending leaves foliose, peduncles c.2 mm long, bracts (subtending the pedicels) c.6–7 × 3–4 mm, narrowly ovate to narrowly elliptic; *male inflorescences* solitary, subtending leaves foliose, peduncles 6–9 mm, cymose-subumbellate with one dichotomous branching at the base, each of the two resulting branches branching once dichasially, the lateral branches of the dichasia branching up to three times monochasially, bracts (subtending the pedicels) c.1.5–6 × 1–2 mm, ellipsoid to oblong. *Male flowers*: pedicels 8–12 mm long, sparsely, microscopically, glandular hairy; tepals 2, white, 8–10 × 9–11 mm, broadly ovate to suborbicular, base slightly cordate or with convex margins, apex rounded, abaxially sparsely, microscopically, glandular hairy; androecium of c.38–46 stamens, yellow, filaments c.0.4–1.6 mm long, slightly fused at the very base, anthers c.0.7–1.2 mm long, obovate to oblong, dehiscing through unilaterally positioned slits > 1/2 as long as the anther, connective not projecting. *Female flowers*: pedicels 1–2 mm, sparsely, microscopically, glandular hairy; tepals 5, subequal, 10–17 × 5–9 mm, elliptic to obovate, white or pale pink, abaxially sparsely, microscopically, glandular hairy; ovary 8–12 × 12–15 mm, ellipsoid, locules 3, placentation axile, placentae bilamellate, wings 3, not developed in the basal part of the ovary, but expanding distally after c.1/3–1/2 of the ovary's length, equal, triangular, with concave margin at the base, widest at the truncate apex, microscopically, glandular hairy, the ovary surface between the wings hairy with c.0.6–2 mm long, multicellular trichomes with broad, bulbous base narrowing into a fine extended tip, style fused at the base, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, yellow. *Fruits* on stout, c.1–2 mm long, microscopically, glandular hairy pedicels; capsule ellipsoid, 12–15 × 5–9 mm (excluding the wings), fleshy and indehiscent, red, wings thickened and hardened, 6–9 mm wide at the widest point (at the apex), wing shape and indumentum as for ovary. *Seeds* ellipsoidal, c.0.3–0.4 mm long, collar cells c.1/2–2/3 of the length of the seed.

Distribution. Indonesia, Sulawesi, South Sulawesi (Sulawesi Selatan), Luwu District, Latimojong Mountains (Fig. 3).

Habitat. This species grows in upland primary rain forest at c.1350 m.

Proposed IUCN conservation category. VU D2. This species is only known from one collection on the eastern border of the Latimojong Forest Reserve. All available *Begonia* specimens from A, B, BM, BO, CEB, E, K, L and SING have been consulted, and hence it must be assumed, at least until more intensive collecting on

Sulawesi may reveal otherwise, that this species has a very restricted range. Therefore, it is 'prone to the effects of human activities or stochastic events within a very short time period in an uncertain future' (IUCN, 2001).

The epithet '*guttapila*' is a compound of *gutta* (Latin – a drop of fluid) and *pilus* (Latin – hair). It refers to the very unusual hairs on the ovaries and fruits of this species, which, with their bulbous base narrowing into a fine extended tip (Figs 2E–F), resemble stylised drops of water. The fruits of this species are unusual in *Begonia* sect. *Petermannia* not only because of their indumentum, but also because of their fleshy pericarp. In contrast to the dry, thin-walled capsules predominantly found in this section, *Begonia guttapila* exhibits red, fleshy and apparently indehiscent fruits, which have thickened, relatively hard wings. These characters might be adaptations to zoochory, but as for the other fleshy-fruited species of *Begonia* in SE Asia, observations of animal dispersal are lacking (Lange & Bouman, 1999; Tebbitt *et al.*, 2006), and the dispersal of the seeds of this species might be mainly by rain-wash from the decomposing fruit.

The male inflorescence morphology predominantly found in *Begonia* sect. *Petermannia* is characterised by dichasial branching, few or no distal monochasial branchings, and clearly developed axes (Irmscher, 1914; Doorenbos *et al.*, 1998). However, Irmscher (1914) also emphasised that there are several variations of this typical syndrome in the huge section *Petermannia*. The male inflorescences of *Begonia guttapila*, which are characterised by strongly compressed axes resulting in an umbel-like appearance, are similar to the subumbellate male partial inflorescences found in the Sulawesian endemic *Begonia ozotothrix* D.C.Thomas (Thomas *et al.*, 2009). An examination of herbarium material from A, B, BM, BO, CEB, E, K, L and SING shows that a similar syndrome is present in several other undescribed species from Sulawesi. Compressed subumbellate male partial inflorescences have also been described for the Sulawesian endemic *Begonia siccacaudata* J.Door., which shows male partial inflorescences with one basal dichasial branching and the end flower flanked by two monochasia (Doorenbos, 2000). Compressed cymose partial inflorescences are also present in the '*Begonia rieckei* Warb. complex', which includes two taxa endemic to Sulawesi, *B. koordersii* Warb. ex L.B.Sm. & Wassh. and *B. strictipetiolaris* Irmsch., but also *B. rieckei* (Sulawesi, Moluccas, New Guinea), *B. pseudolateralis* Warb. (Philippines), *B. brachybotrys* Merr. & L.M.Perry (New Guinea and surrounding islands), and *B. peekelii* Irmsch. (Bismarck Archipelago) (Hughes, 2008). According to Hughes (2008), these taxa may be best considered as one widespread species, as they show only minor morphological differences. Examination of material from Sulawesi and the Philippines showed that in contrast to the cymose-subumbellate male inflorescences of some Sulawesian species, and in contrast to all other species in *Begonia* sect. *Petermannia*, the cymose-subumbellate partial inflorescences of species in the *Begonia rieckei* complex comprise both male and female flowers. Despite this major difference, the subumbellate partial inflorescence architecture in the *Begonia rieckei* complex seems to indicate a close

relationship with the cymose-subumbellate taxa from Sulawesi. It is tempting to speculate that the observed variation in male inflorescence morphology of Sulawesian *Begonia* sect. *Petermannia* species may be the result of evolution from many-flowered male inflorescences with well-developed axes and predominantly dichasial branching (e.g. *B. grandipetala* Irmsch., *B. macintyreana* M.Hughes, *B. stevei* M.Hughes, *B. varipeltata* D.C.Thomas) to subumbellate, dichasial–monochasial male inflorescences with strongly compressed axes (e.g. *B. guttapila*, *B. ozotothrix*) to compressed, purely monochasial inflorescences including the two-flowered monochasial inflorescences of *B. didyma*. Other Sulawesian species, such as *Begonia chiasmogyna* M.Hughes, exhibit male inflorescences with monochasial branching and well-developed axes, which are most likely derived from dichasial–monochasial male inflorescences with well-developed axes. However, phylogenetic analyses of morphological and/or molecular data are necessary to investigate these hypotheses.

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