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THREE NEW SPECIES OF *BEGONIA* FROM THE OUTER ISLANDS OF SOUTHEASTERN SULAWESI

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Three new species of *Begonia* sect. *Petermannia* (Begoniaceae), namely *B. batusangiensis* Ardi & D.C.Thomas, *B. kabaenensis* D.C.Thomas & Ardi and *B. labengkiensis* Ardi & D.C.Thomas, are described from the outer islands of southeastern Sulawesi, Indonesia. Photographs of these species, notes on their distribution and habitat preferences, and provisional IUCN conservation assessments are provided, as well as a key to the identification of 14 species of southeastern Sulawesi *Begonia*. The three new species are calciphile endemics to Sulawesi and assessed as Critically Endangered (CR).

Keywords. Limestone, Southeast Asia, taxonomy
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Introduction

Large genera such as the megadiverse genus *Begonia* (2117 spp.; Hughes *et al.* 2015–) are difficult to monograph and are generally considered the 'final frontier' of plant taxonomy (Begonia Phylogeny Group, 2022). Addressing knowledge gaps is necessary to allow species identification, inform conservation efforts, and enable future work on phylogenetics and biogeography in these groups. The *Begonia* flora of Indonesia had been very poorly studied due to inadequate collection efforts and poor availability of taxonomic information until essential baseline taxonomic information was made available as a checklist (Hughes, 2008) and online in the form of the Begonia Resource Centre (Hughes *et al.*, 2015–).

One of the most under-collected and botanically underexplored regions in Indonesia is the island of Sulawesi. Sulawesi is the largest island (c.176,000 km^2) in the central Malesian biodiversity hotspot known as Wallacea, which is a transition zone between the western Sunda and the eastern Sahul biota. The island hosts diverse ecosystems including lowland, upland and montane rain forests, extensive mafic outcrops, and limestone karst areas (Cannon *et al.*, 2007). The overall density of botanical collections on Sulawesi is one of the lowest of the major Indonesian islands (Cannon *et al.*, 2007; Middleton *et al.*, 2019).

Sulawesi harbours a rich and largely endemic *Begonia* flora. A total of 62 *Begonia* species have been reported from the island (Thomas *et al.*, 2013, continuously updated), but this number is certainly an underestimate and the number of Sulawesi *Begonia* species is

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expected to rise substantially. Several major expeditions to Sulawesi over the past 20 years have yielded material of new *Begonia* species, including species collected on smaller islands off the coast of Sulawesi, such as Buton, Wawonii and Selayar (e.g. Thomas *et al.*, 2009a, 2009b, 2011, 2013, continuously updated; Ardi *et al.*, 2014; Lin *et al.*, 2017; Ardi *et al.*, 2018; Thomas *et al.*, 2018; Ardi *et al.*, 2019; Ardi & Thomas, 2019; Thomas & Ardi, 2019; Ardi & Thomas, 2020; Dayanti *et al.*, 2020; Thomas & Ardi, 2020; Saleh *et al.*, 2023).

Examination of herbarium material (B, BO, E, K, L, SING; abbreviations follow Thiers, continuously updated) and specimen images from numerous other herbaria and available from the Begonia Resource Centre (Hughes *et al.*, 2015–), as well as newly available material collected on the islands of Kabaena and Labengki, off the coast of southeastern Sulawesi, in 2022, indicated that there are several new species from the area awaiting description. Here, we present descriptions, photographs, and provisional IUCN conservation assessments of three new species of *Begonia* from Kabaena and Labengki, and an identification key to *Begonia* species of southeastern Sulawesi. Like the majority of Sulawesi *Begonia* species, the three newly discovered species also fall under *Begonia* sect. *Petermannia*. Much like other members in this section, they display several characteristics including male flowers with two petals, anthers bearing slits positioned unilaterally, female flowers with five petals, female inflorescences containing two flowers or solitary female flowers, ovaries with three locules, axile placentation and bilamellate placentae, as well as fruits with wings that are either equal or subequal.

Key to the *Begonia* species of southeastern Sulawesi (modified from Ardi *et al.*, 2018)

1a. Plant erect, ascending or creeping; internodes > 10 mm long. _____ 2
1b. Plant rhizomatous; internodes strongly compressed, 1–3 mm long. _____ 12

2a. Plant erect; anthers opening with lateral slits and anther connectives projecting at the apex; fruits fleshy and indehiscent, fruit wings poorly developed and triangular, ridge-like or absent. _____ *B. aptera* Blume
2b. Plant erect, ascending or creeping; anthers opening by unilateral slits and anther connectives not projecting at apex; fruit, dehiscent (capsules), wings well developed. _____ 3

3a. Leaves palmately compound. _____ *B. balgooyi* D.C.Thomas & Ardi
3b. Leaves simple. _____ 4

4a. Stems and petioles with indumentum of branched hairs. ___ *B. ozotothrix* D.C.Thomas
4b. Plant glabrous or hairy with indumentum of simple hairs. _____ 5

5a. Plants up to 1.5 m tall; male flower with 4 tepals; inflorescences protandrous with multiple female flowers developed in the distal part. _____ *B. watuwilensis* Girm.

5b. Plants < 0.6 m tall; male flowers with 2 tepals; inflorescences protogynous with female flowers basal to male flowers, or male and female inflorescences separated; female flowers solitary or in pairs. _____ 6

6a. Stems covered in dense indumentum of bristly, whitish hairs up to c.1.5 mm long; peduncle of female inflorescence and infructescence very short (to c.2 mm), pedicel of fruits 2–2.8 cm long. _____ *B. johntanii* Ardi & D.C.Thomas

6b. Stems glabrous or with a sparse indumentum, hairs up to c.1 mm long; peduncle of female inflorescence and infructescence much longer than 2 mm, or if very short then pedicels of fruits < 2 cm long. _____ 7

7a. Basal stem semi-woody, male inflorescence a simple cyme (monochasium or dichasium); female flowers with 2 tepals. _____ **1. B. batusangiensis**

7b. Basal stem herbaceous, male inflorescences paniculate-cymose; female flowers with 5 tepals. _____ 8

8a. Plants dioecious; male partial inflorescence peduncle very short, 0.1–0.4 cm long. *B. mekonggensis* Girm. & Wiriad.

8b. Plants monoecious; male partial inflorescence peduncle longer, 0.5–6 cm long. _____ 9

9a. Lamina margin serrate or biserrate to shallowly lobed (up to c.25% of the lamina width); female inflorescence 1-flowered. _____ *B. flacca* Irmsch.

9b. Lamina margin subentire to distantly dentate or crenate; female flowers in pairs. ___ 10

10a. Stem erect; stipule oblong and revolute, caducous; female inflorescence peduncle (0.3–)0.6–1.2 cm long and infructescence peduncle up to 1.6 cm long. **2. B. kabaenensis**

10b. Stem rhizomatous; stipule ovate to broadly ovate with entire margin, persistent; female inflorescence peduncle > 1.2 cm and infructescence peduncle up to 4.2 cm long. __ 11

11a. Lamina adaxially not bullate, glabrous, margin subentire to distantly dentate or serrate, and denticulate between the larger teeth, teeth bristle pointed; female inflorescence bracts elliptic, 4–5 × 2 mm; male and female flower tepals white or white tinged with pink; female flower pedicels not recurved; ovary (exclude wings) ellipsoid. *B. matarombeoensis* D.C.Thomas & Ardi

11b. Lamina adaxially bullate, white pilose hairs at the tip of bullae, margin crenate, and crenulate between the larger teeth, ciliate; female inflorescence bracts ovate, cymbiform, 4–5 × 3–4 mm; male and female flower tepals orange; female flower pedicels slightly recurved, ovary (without wings) obovoid to narrowly obovoid. **3. B. labengkiensis**

12a. Leaves peltate. _____ *B. tumburanoensis* D.C.Thomas & Ardi

12b. Leaves basifixed. _____ 13

13a. Stipules apex projecting 7–11 mm; petioles with dense indumentum of hairs up to 3 mm long; bracts persistent, anisophyllous, 2.5–6 × 2–4 mm; lamina elliptic, 4.5–12 × 4–8.8 cm; stamens c.61 or 62; ovary 4.5–5 × 3.5–4 mm, wings acute.
B. incudiformicarpa Ardi & D.C.Thomas

13b. Stipules apex projecting up to 3 mm; petioles with a sparse indumentum of hairs up to 1 mm long; bracts caducous, isophyllous, c.1 × 0.5 mm; lamina suborbicular to broadly ovate, 4.5–10 × 3.5–9 cm; stamens 42–44; ovary 5.5–6.5 mm, wings rounded-obtuse.
B. iskandariana Ardi & D.C.Thomas

Species descriptions

1. Begonia batusangiensis Ardi & D.C.Thomas, **sp. nov.** § *Petermannia*
Begonia batusangiensis has female flowers with 2 tepals, recurved pedicels, and a fusiform ovary with very narrow (up to 2 mm) wings, which distinguish it from all other species of *Begonia* sect. *Petermannia* with 2-tepaled female flowers (Table 1). – Type: Indonesia, Sulawesi, Southeast Sulawesi, Gunung Batusangia, 25 vi 2022, *W.H. Ardi* WI767 (holotype FIPIA; isotypes CEB, SING). **Figures 1, 2A.**

Perennial, monoecious herb with basal stem appressed to the substrate, rooting at the nodes, and distally ascending. *Stem* erect, succulent, semi-woody, up to 1 cm in diameter, brown, glabrous, internodes (0.5–)4.5–8 cm long, shorter in the most distal parts, younger stem reddish on upper part. *Leaves* alternate; *stipules* caducous, 8–10 × 5 mm, elliptic, with an abaxially weakly prominent midrib from the middle part to the apex, apex apiculate, apicule up to 1 mm long, margin entire and revolute in mature stipules, reddish-greenish, glabrous; *petioles* 1.5–8 cm long, terrete, red or reddish-brownish, glabrous; *lamina* 4–7.5 × 2.5–4.5 cm, asymmetrical, succulent, ovate to elliptic, base cordate and lobes sometimes slightly overlapping, apex acuminate, margin serrate, adaxial surface green to reddish green, glabrous, abaxial surface reddish, with sparse hairs on the veins; primary veins 6 or 7, actinodromous, secondary veins craspedodromous. *Inflorescences*: protogynous; *female inflorescences* 1- or 2-flowered, basal to male inflorescences, peduncles 1–10 mm long, pale green-reddish, glabrous, bracts caducous; *male inflorescences* cymose, a simple monochasium with up to 3 flowers or a dichasium with 5–9 flowers, peduncles 10–12 mm long, reddish, glabrous; bracts caducous, up to c.3 × 2 mm, ovate, pale green or creamy at base and reddish at the apex, midrib slightly prominent, apex apiculate, apicule up to 0.5 mm long. *Male flowers*: *pedicels* 1–2.2 cm long, pinkish, glabrous; *tepals* 2, white or pink, 10–19 × 13–21 mm, broadly ovate, base slightly cordate, margin entire, apex rounded; *androecium* of 35–37 stamens, yellow, filaments up to c.1.5 mm long, fused at the base for c.1 mm, anthers up to 1 mm long, obovate, dehiscing through unilaterally positioned slits that are c.1/2 as long as the anthers. *Female flowers*: *pedicels* 7–9 mm long, reddish, glabrous, recurved; *tepals* 2, white or white tinged with pink, 14–16 × 15–17 mm, broadly

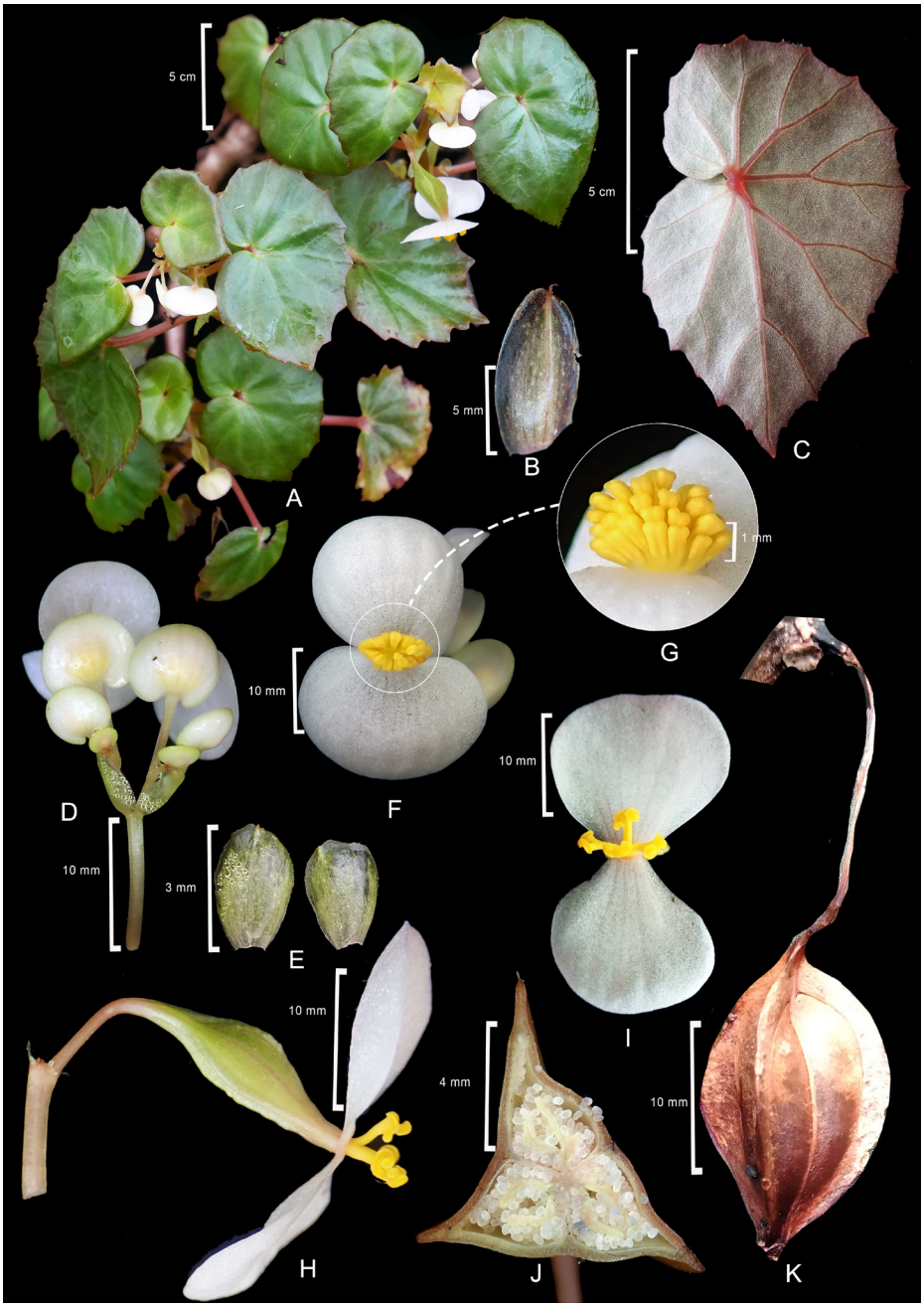

Figure 1. *Begonia batusangiensis* Ardi & D.C.Thomas, sp. nov. A, Habit; B, stipule; C, leaf lamina (abaxial surface); D, male inflorescence; E, bracts of male inflorescence; F, male flower; G, androecium; H, female flower (side view); I, female flower (front view); J, ovary (cross-section); K, fruit. Photographs: A–J (*W.H. Ardi* WI767), W. H. Ardi; K, Arman.

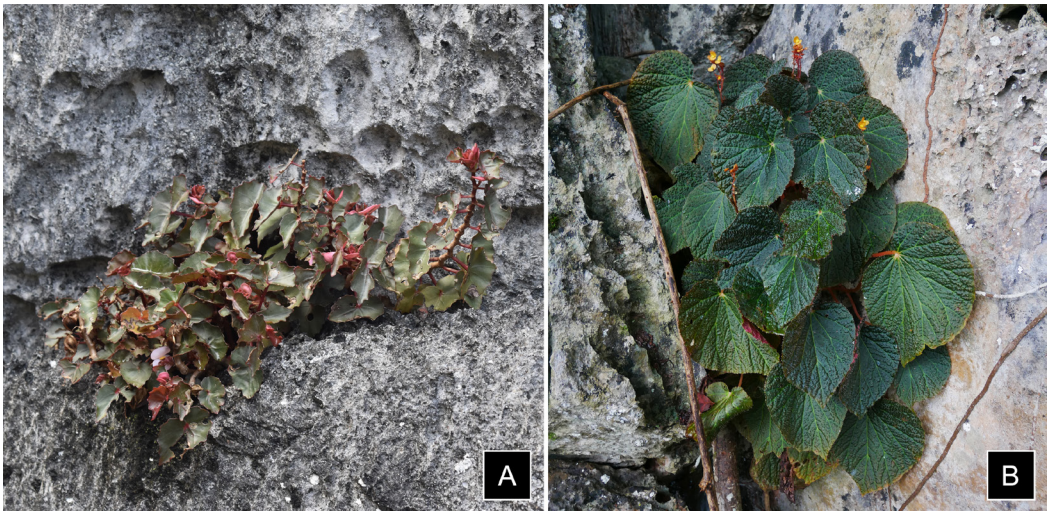

Figure 2. *Begonia batusangiensis* Ardi & D.C.Thomas, sp. nov. (A) and *B. labengkiensis* Ardi & D.C.Thomas, sp. nov. (B) in their natural habitats. Photographs: A (*Arman s.n.*), Arman; B (*W.H.Ardi* WI773), W. H. Ardi.

ovate, margin entire, apex rounded; *ovary* (without wings) c.10 × 4 mm, fusiform, pale green to reddish green, wings 3, very narrow, up to 2 mm at the widest point (middle part), cuneate at the base and apex, style up to 5 mm long, basally fused, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. *Fruit*: *peduncle* up to 10 mm long; *pedicels* 15–20 mm long, strongly recurved; *seed-bearing part* c.13–15 × 8–10 mm (excluding the wings), ellipsoid, dehiscent, splitting along the wing attachment, wings equal, base rounded to cuneate, apex cuneate, up to 2 mm at the widest point (middle part). *Seeds* barrel-shaped, c.0.3 mm long.

Distribution. Indonesia; endemic to Sulawesi, southeastern Sulawesi, Kabaena Island, Gunung Batusangia (**Figure 3**).

Habitat and ecology. Crevices of a vertical limestone hill, open, at 950–1250 m elevation (see **Figure 2A**).

Etymology. The species epithet refers to the Batusangia peak on Kabaena Island, southeastern Sulawesi, where the type material was collected.

Proposed IUCN conservation category. CR B1ab(i,ii,iii)+2ab(i,ii,iii). *Begonia batusangiensis* is known only from the type location on Gunung Batusangia, Kabaena Island, which is not in a legally protected area. The species is found restricted to limestone cliffs in the upper part of the mountain. Most of the vegetation of the lower part of the mountain has been converted to clove plantations, and there are substantial nickel-mining operations in the vicinity. Owing to its restricted distribution (a single location) and associated small extent of occurrence

Table 1. Comparison of species in *Begonia* sect. *Petermannia* with 2-tepaled female flowers: *B. batusangiensis*, *B. brangbosangensis*, *B. fairchildii*, *B. lombokensis* and *B. willemii*

Character	*B. batusangiensis*	*B. brangbosangensis*	*B. fairchildii*	*B. lombokensis*	*B. willemii*
Habitat	Vertical limestone walls, open	Understorey of montane forest, shaded	Understorey of costal forest, half to full shade	Understorey of montane forest, half shade	Vertical walls of limestone or rock boulders, understorey
Habit	Basal stem appressed to substrate, distally erect, soft-wooded at the stem base	Erect, herbaceous	Erect, herbaceous	Erect, herbaceous	Creeping, herbaceous
Leaf lamina	4–7.5 × 2.5–4.5 cm, ovate to elliptic	13–20 × 5.3–7.5 cm, elliptic to oblong	9–20 × 2.5–6 cm, ovate to oblong	8–15 × 3–7 cm, ovate	3–8 × 2.5–6 cm, broadly ovate to ovate
Male inflorescence	Simple monochasium or dichasium with few flowers	Thyrse	Thyrse	Thyrse	Simple monochasium
Male flowers					
Pedicel length	1–2.2 cm	0.7–1 cm	c.1 cm	1–2 cm	2–4.7 cm
Tepals	10–19 × 13–21 mm, broadly ovate	8–13 × 12–16 mm, broadly ovate	8–15 × 5–10 mm, ovate	8–10 × 6–9 mm, ovate	5–12 × 7–14 mm, broadly ovate
Stamen number	35–37	20–25	c.24	c.45	19–23
Female flowers					
Pedicel	7–9 mm long, recurved	1–2.5 cm long, not recurved	1–2 cm long, not recurved	1 cm long, not recurved	7–15 mm long, not recurved
Ovary wings	Narrow, subequal, cuneate at base and apex	Well developed, unequal, rounded at base, apex subtruncate	Well developed, equal, rounded at base, apex truncate	Well developed, unequal, rounded at base, apex subtruncate	Well developed, base rounded, apex truncate to rounded
Fruit pedicel	1.5–2 cm long, strongly recurved	2.4–4.6 cm long, not recurved	1.5 cm long, recurved	1.2–2.8 cm long, pendulous	5–15 mm long, slightly recurved

(EOO) and area of occupancy (AOO), in combination with observed anthropogenic disturbances that are negatively affecting the margins of the species' habitats and are likely to result in further habitat loss in the future, we assess this species as Critically Endangered (IUCN Standards and Petitions Subcommittee, 2022).

Notes. Two-tepaled female flowers are rare in *Begonia* sect. *Petermannia*, and there are only four species known to show this character state, namely *B. willemii* Ardi *et al.* from Sulawesi, *B. fairchildii* Ardi & D.C.Thomas from the Moluccas, and *B. brangbosangensis* Girm. and *B. lombokensis* Girm. from the Lesser Sunda Islands (Girmansyah, 2016; Ardi *et al.*, 2022).

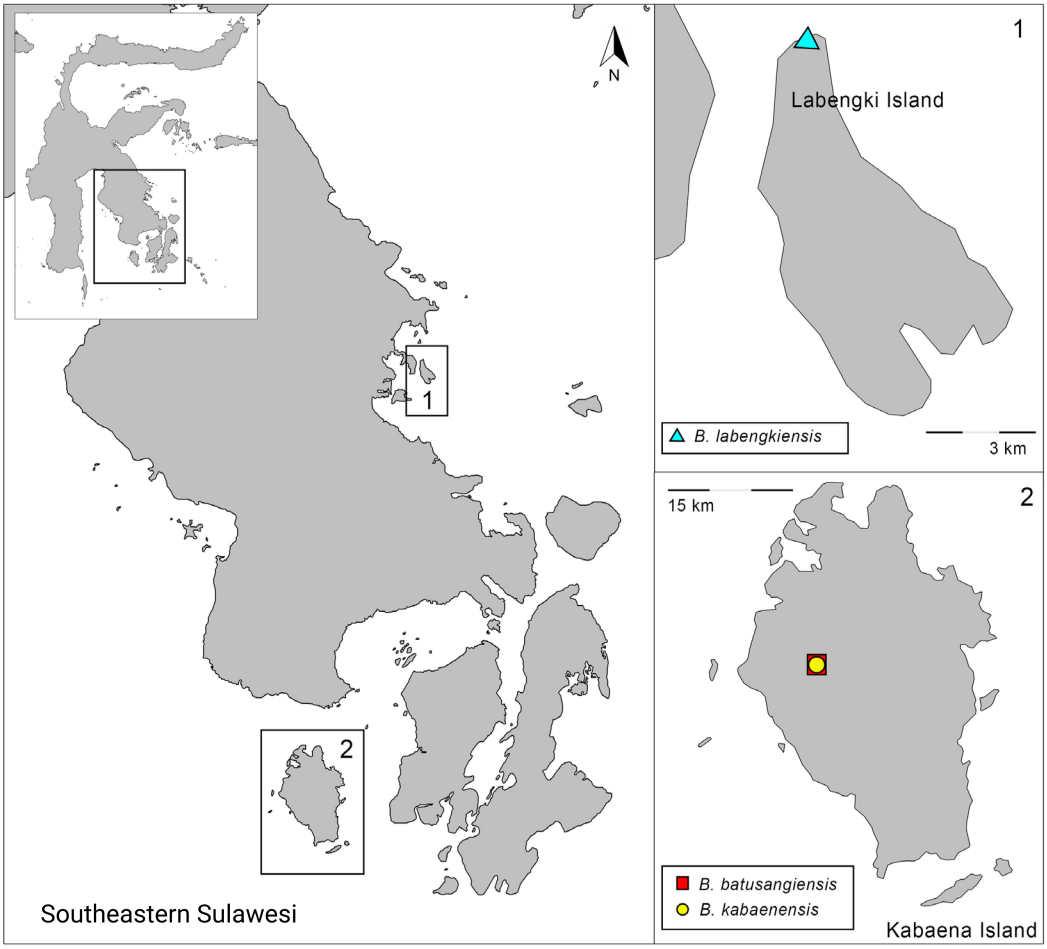

Figure 3. Map showing the distribution of *Begonia batusangiensis*, *B. kabaenensis* and *B. labengkiensis*.

However, the new species can be easily distinguished from these species, as shown by the comparison in Table 1.

Additional specimens examined. INDONESIA. **Sulawesi**: ***Southeastern Sulawesi***: Kabaena Island, Batusangia peak, 3 viii 1993, *McDonald & Ismail* 4108 (A, BO, K, L); 24 vi 2022, *W.H. Ardi* WI764 (FIPIA); 29 xi 2022, *Arman s.n.* (FIPIA).

2. Begonia kabaenensis D.C.Thomas & Ardi, **sp. nov.** § *Petermannia*

Similar to the sympatric species *Begonia batusangiensis* in having succulent, ovate to elliptic leaves, but *B. kabaenensis* can be distinguished by its paniculate-cymose male inflorescences (vs a simple monochasium or dichasium with few flowers), a shorter female flower pedicel (4–6 mm vs 7–9 mm long), female flowers with 5 tepals (vs 2-tepaled female flowers), well developed ovary wings with a rounded base and

subtruncate apex and a subapical widest point up to 6 mm (vs narrow ovary wings with rounded to cuneate base and cuneate apex, widest point in the middle part up to 2 mm); and slightly recurved and shorter fruit pedicels up to 7 mm long (vs strongly recurved, 15–20 mm long). The broadly dentate-denticulate leaf lamina margin and the paniculate-cymose male inflorescence of *Begonia kabaenensis* are similar to those of *B. imperfecta* Irmsch.; however, the new species can be differentiated by being monoecious (vs dioecious) and having female flowers with 3 narrow equal wings (vs wingless) and dry, dehiscent capsules (vs fleshy and indehiscent fruit). – Type: Indonesia, Sulawesi, Southeast Sulawesi, Gunung Batusangia, 25 vi 2022, *W.H. Ardi* WI769 (holotype FIPIA; isotypes CEB, SING). **Figure 4**.

Perennial, monoecious herb with erect stems, many-branched. *Stem* erect, soft-wooded at the base, up to 1 cm in diameter, brownish-reddish, glabrous except for microscopic glandular hairs, internodes 2–8 cm long. *Leaves* alternate; *stipules* caducous, 16–20 × 8–10 mm, oblong, with an abaxially slightly prominent midrib, apex apiculate, apicule up to 1.5 mm long, margin entire and revolute in mature stipules, brownish, glabrous; *petioles* 2–14 cm long, terrete, reddish-brownish, glabrous; *lamina* 7.5–14 × 5–9 cm, asymmetrical, ovate, base cordate and lobes often overlapping, apex acuminate, margin broadly dentate and denticulate in between the larger teeth, adaxial surface green, glabrous, abaxial surface reddish, with sparse hairs on the veins; primary veins 6–8, actinodromous, secondary veins craspedodromous. *Inflorescences*: protogynous; *female inflorescences* 1- or 2-flowered, basal to male inflorescences, peduncles (3–)6–12 mm long, pale green, glabrous, bracts semi-persistent, 7 × 4–5 mm, ovate, pale green, translucent; *male inflorescences* paniculate-cymose (a compound thyrse), with up to 4 or 5 partial inflorescences, cymes monochasially branching with up to 7 flowers, peduncles of partial inflorescences up to 16 mm long, reddish green, glabrous; bracts caducous. *Male flowers*: *pedicels* 1–2.2 cm long, whitish, glabrous; *tepals* 2, white, 11–15 × 13–14 mm, suborbicular to broadly ovate, margin entire, apex rounded; *androecium* of c.45 stamens, yellow, filaments up to c.1.5 mm long, anthers c.1.2 mm long, obovate, dehiscing through unilaterally positioned slits that are c.1/2 as long as the anthers. *Female flowers*: *pedicels* 4–6 mm long, slightly recurved in flower stage, green, glabrous; *tepals* 5, white, subequal, 15–17 × 7–14 mm, elliptic to slightly obovate, margin entire, apex rounded; *ovary* (without wings) c.15 × 4 mm, narrowly obovoid to ellipsoid, pale green, wings 3, narrow, convex at base, apex subtruncate, up to 6 mm at the widest point (subapical), style up to 5 mm long, basally fused, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. *Fruit*: *peduncle* up to 16 mm long; *pedicels* up to 7 mm long, greenish-reddish, glabrous, slightly recurved; *seed-bearing part* c.20 × 6 mm (excluding the wings), ellipsoid, dehiscent, splitting along the wing attachment, wing shape as for ovary, widest point subapically, up to 6 mm wide. *Seeds* unknown.

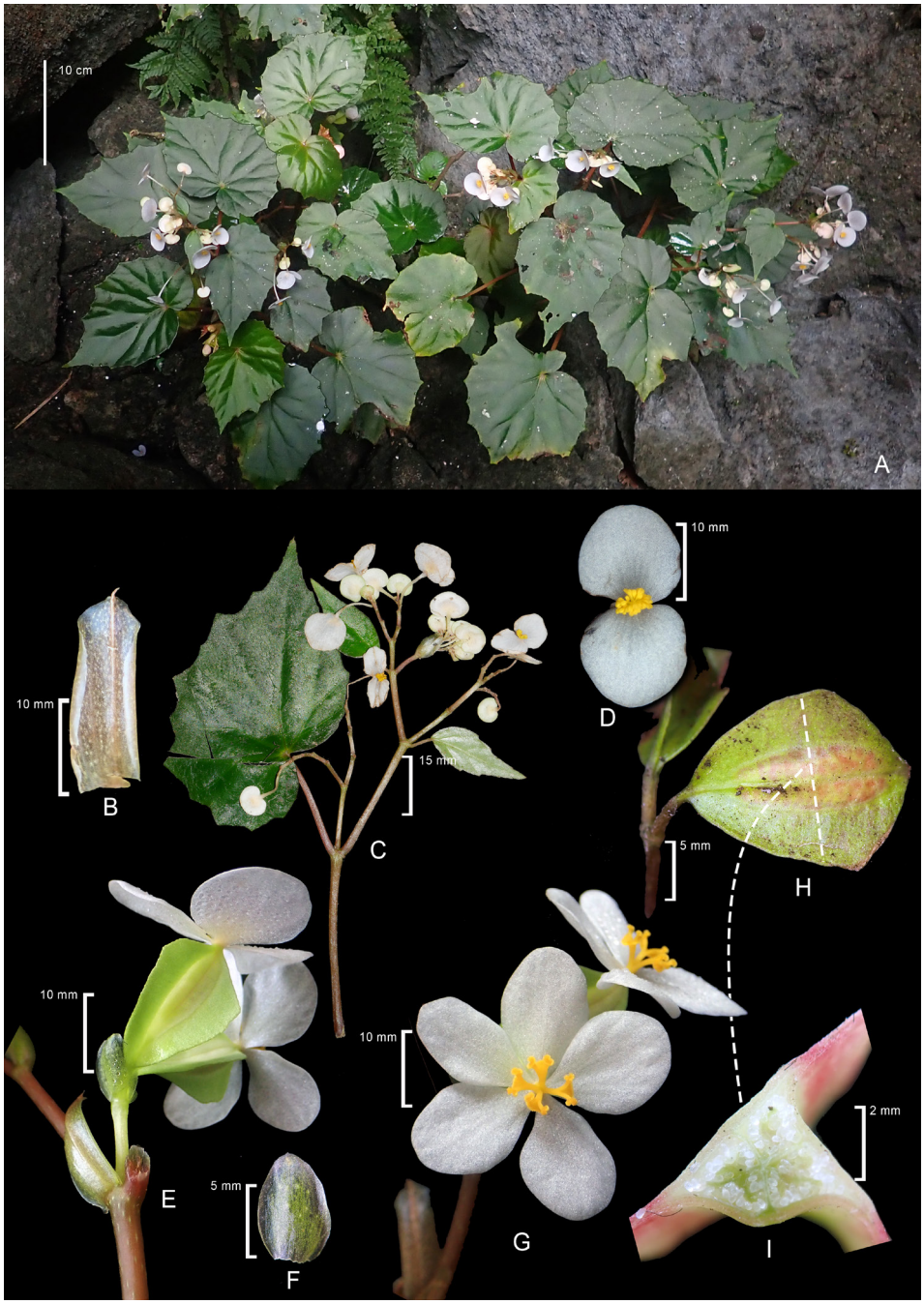

Figure 4. *Begonia kabaenensis* D.C.Thomas & Ardi, sp. nov. A, Habit *in situ*; B, stipule; C, male inflorescence; D, male flower (front view); E, female inflorescence; F, bract; G, female flowers (front and side views); H, fruit; I, ovary (cross-section). All photographs of *W.H. Ardi* WI769, taken by W. H. Ardi.

Distribution. Indonesia; endemic to Sulawesi, southeastern Sulawesi, Kabaena Island, Gunung Batusangia (see **Figure 3**).

Habitat and ecology. Base of limestone cliffs, in full shade, at 1000–1250 m elevation.

Etymology. The species epithet refers to the island of Kabaena, southeastern Sulawesi, where the type material was collected.

Proposed IUCN conservation category. CR B1ab(i,ii,iii)+2ab(i,ii,iii). *Begonia kabaenensis* is known from only two collections from the type location on Gunung Batusangia, Kabaena Island, which has no legal protection status. The species is restricted to the base of vertical walls at caves or shaded cliffs in the upper part of the mountain. It grows in rather inaccessible areas that are difficult to reach for humans, but there is substantial anthropogenic disturbance nearby negatively impacting the margins of the species' habitat. Most of the lower parts of the mountain have been converted into clove plantations, and the surrounding areas include nickel-mining sites. Because of its very restricted distribution and associated small EOO and AOO, in combination with observed anthropogenic disturbances and likely future habitat loss, we asses this species as Critically Endangered (IUCN Standards and Petitions Subcommittee, 2022).

Notes. Limestone karst areas in Malesia harbour numerous species of *Begonia*, many of which are narrow endemics, and its microhabitats generally support a high floristic diversity (Clements *et al.*, 2006). Kiew (1998) observed that calciphile begonias in Sabah showed strong niche partitioning in the limestone habitats of Bukit Dulong (Gomatong Cave). At the shaded base of the cliff, two understorey *Begonia* species were found (*B. gomatongensis* Kiew and *B. postari* Kiew). At slightly higher elevations where the canopy provides less shade and lower humidity, more drought-tolerant species that are adapted to direct sunlight and heat, such as *Begonia malachosticta* Sands, were found growing in rock crevices in the cliffs of jagged outcrops. Similar conditions were also observed in the limestone karst of Gunung Batusangia, where *Begonia kabaenensis* and *B. batusangiensis* occur sympatrically: *B. kabaenensis* is found growing in humid and shaded habitats at the base of the hill, whereas *B. batusangiensis* is growing in rock crevice habitats in the vertical limestone cliffs that are exposed to direct sunlight.

3. **Begonia labengkiensis** Ardi & D.C.Thomas, **sp. nov.** § *Petermannia*

   Distinguished by the basal stem that is appressed to the substrate, the long-pedunculate female inflorescences, and the paniculate-cymose male inflorescences. Morphologically similar to *Begonia matarombeoensis*, but *B. labengkiensis* can be differentiated by its apiculate stipules (apicule 1 mm long vs seta at stipule apex to 6 mm long); leaves adaxially bullate, each bulla tipped with a white pilose hairs (vs not bullate and glabrous); bract of female inflorescence ovate, cymbiform (vs elliptic); tepals of male and female flowers orange (vs white or white tinged with pink); female flower pedicel 5–9 mm long,

recurved (vs 9–11 mm, not recurved); ovary shape (without wings) obovoid to narrowly obovoid (vs ellipsoid) (Table 2). – Type: Indonesia, Sulawesi, Southeast Sulawesi, Labengki Besar Island, 28 vi 2022, *W.H. Ardi* WI773 (holotype FIPIA; isotypes CEB, SING). **Figures 2B**, 5.

Perennial, monoecious herb, basal stem appressed to the substrate and rooting at the nodes, distally often ascending to erect, many branched. *Stem* succulent, up to 1.2 cm in diameter, greenish-brownish, with microscopic glandular hairs and a few villose hairs to glabrescent, internodes 1–4 cm long. *Leaves* alternate; *stipules* persistent, 8–12 × 6–13 mm, broadly ovate, asymmetrical, with an abaxially slightly prominent midrib from the middle part to the apex, apex apiculate, apicule up to 1 mm long, margin crenate, and crenulate between the larger teeth, ciliate, reddish, glabrous; *petioles* 11–22 cm long, terrete, pale orange, sparsely pilose hairy; *lamina* 12–20 × 8.5–14 cm, asymmetrical, ovate to broadly ovate, base cordate and lobes sometimes overlapping, apex acuminate, margin crenate-crenulate, ciliate, adaxial surface reddish green, slightly bullate, bullae tipped by white pilose hairs, abaxial surface red, pale orange on the veins, hairy on the veins, primary veins 7 or 8, actinodromous, secondary veins craspedodromous. *Inflorescences*: protogynous; *female inflorescences* 1- or 2-flowered, basal to male inflorescences, peduncles 2–3 cm long, becoming shorter in the distal part, red, glabrous, bracts persistent, 4–5 × 3–4 mm, ovate, asymmetrical, cymbiform, reddish, translucent at the margin, midrib slightly prominent; *male inflorescences* paniculate-cymose, composed up to 12 subumbellate partial inflorescences, each with up to 10 flowers, peduncles of partial inflorescence up to 3.5 cm long, reddish, glabrous; bracts persistent, 2–6 × 2–4 mm, ovate, asymmetrical, apiculate, apicule up to 0.5 mm long at the apex. *Male flowers*: *pedicels* 4–11 mm long, orange, glabrous; *tepals* 2, orange-yellowish, 5–12 × 7–12 mm, broadly ovate, base slightly cordate, margin entire, apex rounded; *androecium* of c.22 stamens, yellow, filaments up to c.1 mm long, anthers up to 0.75 mm long, obovate, dehiscing through unilaterally positioned slits that are c.1/2 as long as the anthers. *Female flowers*: *pedicels* 5–9 mm long, reddish, slightly recurved, glabrous; *tepals* 5, orange-yellowish, subequal or unequal, four larger 11–13.5 × 9–11 mm, ovate, one smaller c.11 × 5 mm, elliptic, margin entire, apex rounded; *ovary* (without wings) 7.5–8.5 × 4–6 mm, obovoid to narrowly obovoid, reddish, glabrous, wings 3, subequal, rounded to cuneate at base and truncate to subtruncate at apex, up to 2.5–4.5 mm at the widest point (apical to subapical), style up to 4.5 mm long, basally fused, 3-branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. *Fruit*: *peduncle* up to 4 cm long; *pedicels* 10–15 mm long, strongly recurved; *seed-bearing part* c.9–16 × 4–7 mm (excluding the wings), obovoid to narrowly obovoid, dehiscent, splitting along the wing attachment, wing shape as for ovary, up to 8 mm long at the widest point (apically or subapically). *Seeds* barrel-shaped, c.0.3 mm long.

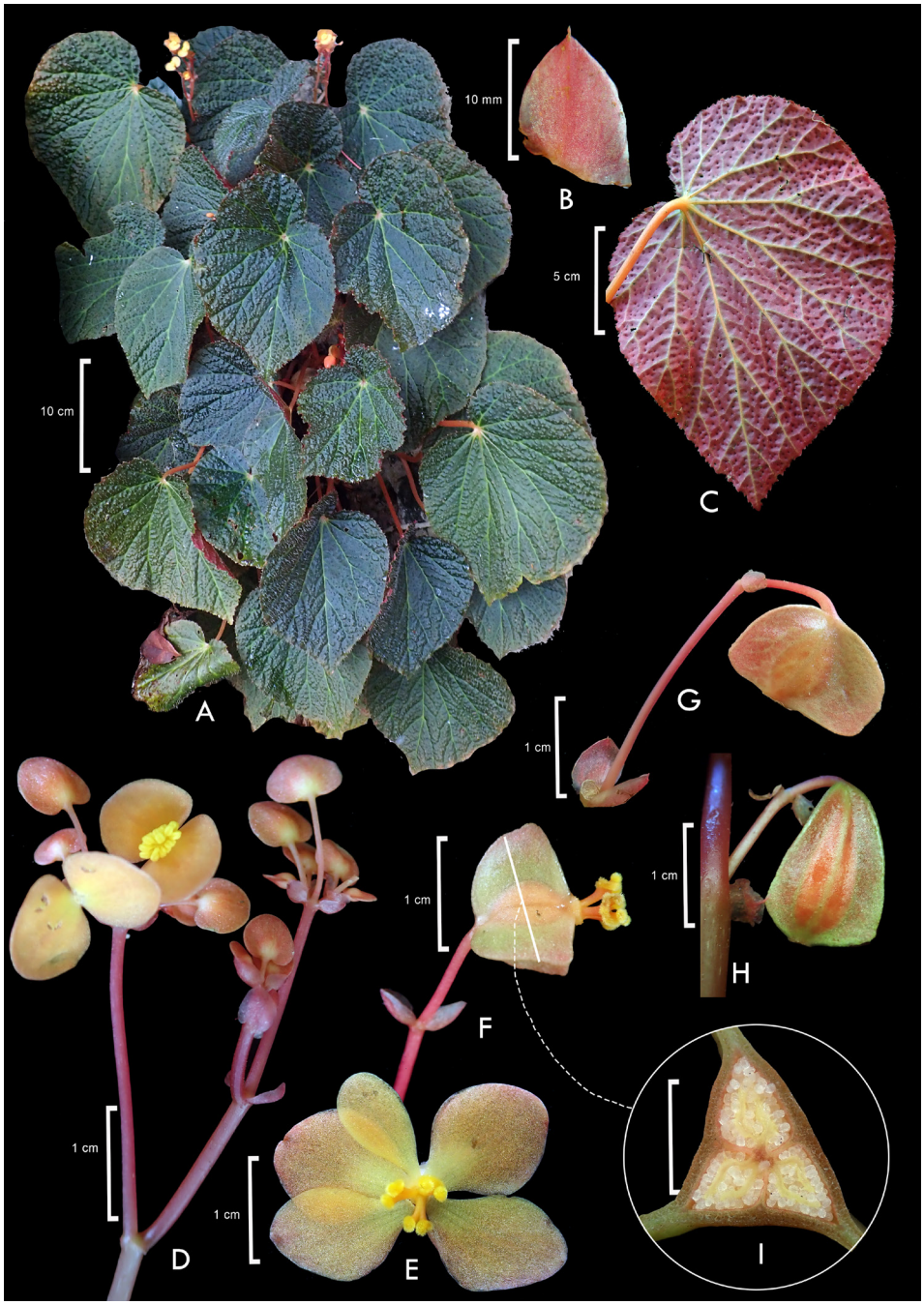

Figure 5. *Begonia labengkiensis* Ardi & D.C.Thomas, sp. nov. A, Habit; B, stipule; C, leaf lamina (abaxial surface); D, male inflorescence; E, female flower (front view); F, female flower with bracts; G and H, fruits; I, middle part of ovary (cross-section). All photographs of *W.H. Ardi* WI773, taken by W. H. Ardi.

Table 2. Morphological comparison of *Begonia labengkiensis* with *B. matarome*o*ensis*, to which it is most morphologically similar, and the orange-tepaled Sulawesi species *B. ignita* and *B. tjiasmantoi*

Character	*B. labengkiensis*	*B. matarombeoensis*	*B. ignita*	*B. tjiasmantoi*
Leaf lamina	12–20 × 8.5–14 cm, ovate to broadly ovate, strongly asymmetrical, adaxially bullate, hairy	7–19 × 4.5–12.5 cm, asymmetrical, elliptic, ovate, broadly elliptic or broadly obovate, not bullate, glabrous	7–12 × 6.5–11 cm, ovate, slightly asymmetrical, not bullate, glabrous	8–11 × 3.5–5.5 cm, ovate to elliptic, strongly asymmetrical, not bullate, glabrous
Male flowers				
Pedicel length	4–11 mm	11–20 mm	11–18 mm	10–15 mm
Tepals	5–12 × 7–12 mm, broadly ovate, orange-yellowish	8–13 × 9–12 mm, broadly ovate to suborbiculate, white or white-tinged pink	10–15 × 9–11 mm, broadly ovate to suborbicular, orange	6–8 × 7.5–8.5 mm, broadly ovate to suborbicular, yellow
Stamen number	c.22	(13–)25–39	35–45	22–24
Female flowers				
Pedicel	5–9 mm long, recurved	9–11 mm, stiff, not recurved	6–13 mm long, stiff, not recurved	3–4 mm long, stiff, not recurved
Ovary (excluding wings)	7.5–8.5 × 4–6 mm, obovoid	9–15 × 4–10 mm, ellipsoid	9–11 × 7 mm, ellipsoid	6–12 × 2–4 mm, cylindrical
Ovary wings	Rounded to cuneate at the base, truncate to subtruncate at the apex	Rounded or cuneate at the base, cuneate to subtruncate at the apex	Rounded at the base, truncate at the apex	Rounded to cuneate at the base, truncate or subtruncate at the apex
Fruit pedicel	10–15 mm long, strongly recurved	15 mm long, recurved	Fruit not known	4–5 mm long, not recurved

Distribution. Indonesia; Sulawesi, southeastern Sulawesi, Labengki Besar Island (see Figure 3).

Habitat and ecology. Crevices on vertical limestone hill, coastal karstic forest, shaded, at 1 m elevation (see Figure 2**B**).

Etymology. The species epithet refers to Labengki Island, southeastern Sulawesi, where the type material was collected.

Proposed IUCN conservation assessment. Critically Endangered CR B1ab(i,ii,iii)+2ab(i,ii,iii). This species is known only from the type location, Labengki Besar Island, which has no legal protection status. The species is restricted to limestone cliffs. During fieldwork, fewer than 10 mature individuals were observed. There were no signs of direct anthropogenic threats such as limestone mining observed during fieldwork, but some forest cover loss of about 1 ha in 2016, predominantly due to fire, is indicated by remote-sensing data within a 2-km buffer from the type locality (Global Forest Watch, 2023). Given the very small AOO (4 km^2), a single known location, and the observed forest cover loss in close proximity to the type locality, we assess this species as Critically Endangered (IUCN Standards and Petitions Subcommittee, 2022).

Notes. *Begonia labengkiensis* has orange tepals, which is very rare in Sulawesi species from *Begonia* sect. *Petermannia*. There are only two species in Sulawesi that share this character: *Begonia ignita* C.W.Lin & C.I Peng and *B. tjiasmantoi* Ardi & D.C.Thomas (Lin *et al.,* 2017; Ardi & Thomas, 2019). *Begonia labengkiensis* can be easily distinguished from these two species by the character combination shown in **Table 2**.

Additional specimens examined. INDONESIA. **Sulawesi**: ***Southeastern Sulawesi***: Cultivated specimen collected from the wild, Labengki Besar, North Cliff, Tapu Batusahan, 27 vi 2022, *W.H. Ardi* WI772 (FIPIA); Labengki Besar, north cliff, Tapu Batusahan, 29 vi 2022, *W.H. Ardi* WI774 (FIPIA, UI).

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