

A new species of *Begonia* and rediscovery of *B. loheri* (section *Petermannia*, Begoniaceae) from Luzon Island, Philippines

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ABSTRACT. A new species, *Begonia subaequifolia* Y.P.Ang & J.Collantes, is here described and illustrated from Luzon Island, Philippines. It closely resembles *Begonia jagori* Warb. by having an upright habit, stems covered with short brown hairs, short petioles, and an elliptic lamina with an oblique and shallowly cordate base. However, *Begonia subaequifolia* is distinct by having smaller stipules, sub-symmetrically oblong-ovate to narrowly elliptic-ovate lamina with pinnate venation, a crenate or serrulate leaf margin, the staminate inflorescence in a dichasial cyme, and smaller tepals in staminate flowers. We also report the rediscovery of *B. loheri* Merr., a poorly known Philippine endemic *Begonia* species, and provide an amended description, lectotypification, and photographs.

Keywords. Biodiversity, conservation, Sierra Madre Mountain Range, taxonomy

Introduction

The island of Luzon forms part of the northern archipelago of the Philippines and is considered the oldest and largest island in the country (Vallejo, 2014). Luzon has unique forest assemblages and extraordinary biodiversity spread across four major mountain systems (Caraballo, Central Cordillera, Sierra Madre, and Zambales mountain ranges) (Vallejo, 2011), in which many new species of animals, microbes and plants are still being discovered (e.g., Galindon et al., 2016; Rickart et al., 2019; Bustamante et al., 2020; Dela Cruz et al., 2024a). Many more species are expected to be discovered and described as remote areas become more accessible for biodiversity research and exploration.

The genus *Begonia* L. includes 182 species in the Philippines (Pelser et al., 2011 onwards). The past decade has been significant for the discovery of *Begonia* biodiversity in the country, with the addition of 70 endemic species. Many of these discoveries have occurred on the islands of Luzon, Mindanao, Palawan, Panay, and Samar, particularly within karstic, montane, and riverine ecosystems (e.g., Hughes et al., 2018; Rule et al., 2020; Ang et al., 2022; Dela Cruz et al., 2024b).

As part of ongoing efforts to create a local floristic inventory of the Aurora Memorial National Park (AMNP), the Philippine Taxonomic Initiative, Inc. (PTI) has been conducting botanical expeditions in this area since 2021. This initiative has led to the discoveries of *Begonia akaw* Mansibang et al. and *B. masilig* J. Collantes et al. (Ang et al., 2023). Given that much of AMNP is covered in dense and humid forests which provide ideal habitats for herbaceous plants like *Begonia*, we have discovered yet another new species which we describe here. Additionally, we report the rediscovery of *B. loheri* Merr., a poorly known Philippine endemic species, and designate a lectotype for this name. An amended description, photographs, distributional data, and ecological notes are also provided.

Materials and methods

Fieldwork was conducted in February, June, and July 2022. Specimens were vouchered under Wildlife Gratuitous Permit (WGP) No. III-2021-007 (New) issued by the Department of Environment and Natural Resources (DENR) Regional Office III. Descriptions were based on living specimens, herbarium materials, and spirit collections preserved in Copenhagen solution (RBGE, 2024). Herbarium specimens were prepared as described in Bridson & Forman (1992) and Bedford (1999). Relevant literature was consulted (Warburg, 1904; Merrill, 1911; Rubite, 2013), including online databases (e.g., Pelser et al., 2011; Hughes et al., 2015; GBIF, 2024), and digitised specimens available at B, K, L, M, P, PNH, and US. The GeoCat tool (Bachman et al., 2011) was used to estimate the area of occupancy (AOO) and extent of occurrence (EOO). Conservation status was assessed with the International Union for Conservation of Nature (IUCN) Criteria (IUCN Standards and Petitions Committee, 2024). Philippine forest classification follows that of Fernando et al. (2008). Specimens examined via digital images are indicated with an asterisk (*).

Taxonomy

***Begonia subaequifolia* Y.P. Ang & J. Collantes, sp. nov. (§ *Petermannia*)**

Begonia subaequifolia resembles *B. jajori* Warb. by having an upright habit, stems covered with short brown hairs, a short petiole (< 5 mm long), a lamina with an oblique and shallowly cordate base that is sparsely hirsute on the adaxial surface, and a terminal inflorescence with 2-tepaled staminate flowers. It differs by having smaller stipules (6–8 × 1.5–3 mm vs 15–18 × 8–12 mm), a sub-symmetrically oblong-

ovate to narrowly elliptic-ovate lamina (vs inequilaterally widely ovate), with pinnate venation (vs palmate), crenate or serrulate leaf margin (vs dentate), a dichasial cymose staminate inflorescence (vs generally a raceme, each branch dichasial at the base and racemose apically), and smaller tepals in staminate flowers ($6-8 \times 7-8$ mm vs c. 12×12 mm). – TYPE: Philippines, Luzon, Aurora Province, Municipality of Maria Aurora, Barangay Villa Aurora, Marker #10, Biodiversity Assessment and Monitoring System plot (BAMS), $15^{\circ}41'40.99''\text{N}$ $121^{\circ}21'10.73''\text{E}$, 524 m, 1 July 2022, *Angiosperms of Aurora Memorial National Park (AAMNP)* 62 (holotype PNH [259152!]; isotypes BRIT [BRIT1096578!], CAHUP, PUH). (Figs 1, 2)

Herb, monoecious, erect, c. 50 cm tall. **Stem** terete, occasionally branched, pale green to brown, 3–5 mm diam., antrorsely brown-tomentulose, internodes 20–60 mm long. **Stipules** deciduous, pale green, ovate to oblong-ovate, $6-8 \times 1.5-3$ mm, abaxially keeled, keel lined with short, white simple hairs, adaxially glabrous, margin entire, apex acuminate, acumen 2–3 mm long. **Leaves** alternate; petiole terete, pale green, $2-8 \times 3-4$ mm, similar vestiture as stem; lamina sub-symmetrical, basifixed, oblong-ovate to narrowly elliptic-ovate, $13.3-17.2 \times 4.3-8(-10)$ cm, abaxially pale green, veins pinnately arranged, raised prominently, brown-tomentulose on veins, adaxially olive green, sparsely hirsute on intervein spaces, veins slightly sunken; base shallowly oblique and shallowly lobed, margin crenate to serrulate, apex acuminate, acumen 5.5–10 mm long. **Inflorescence** terminal, bisexual, protogynous; staminate flowers in a dichasial cyme, cyme 5–12 cm long; peduncle green, similar vestiture as stem, 3–4 cm long; pistillate flower solitary, axillary on terminal leaf node, basal to staminate flowers; bracts sub-persistent, white, hyaline, triangular to narrowly triangular, decreasing in size towards upper flowers, $1-4$ mm $\times$ c. 1 mm, abaxially with sparse simple hairs c. 0.5 mm long, margin entire, apex acuminate. **Staminate flower:** pedicel 8–12 mm long, antrorsely white-hirsutulous, with simple trichomes c. 0.2 mm long; tepals 2, white, broadly ovate, $6-8 \times 7-8$ mm, antrorsely hirsute abaxially with trichomes same as pedicel, veins obscure on both surfaces, margin entire, apex rounded; androecium sub-actinomorphic, $3-4 \times 2.5-4$ mm, filament fused at base, $0.8-1.5(-2.5)$ mm long; stamens 40–45, yellow, obovate in outline, $0.8-1.5$ mm long, apex retuse, locules 2. **Pistillate flower:** pedicel 9–12 mm long, with trichomes same as pedicel of staminate flower; tepals 5, white, glabrous, margin serrulate; outer tepals 2, elliptic-ovate, $8-10 \times 4-5.5$ mm, apex acute; inner tepals 3, obovate to elliptic, $9-12 \times 4.5-6$ mm, apex obtuse to acute; styles 3, yellow, bifid at distal half, twisted and papillose all around, $4.5-5$ mm long; ovary trigonous, ellipsoid, $9-12 \times 4-5.5$ mm (wings excluded), scabridulous, more so along median line on all sides, locules 3, placenta bifid; wings 3, narrowly triangular, subequal, tapered proximally, truncated distally, $15.5-17 \times 6.8-7.2$ mm, wing margin sparsely ciliate near pedicel, less so when mature, turning serrulate near distal part, less so when mature. **Capsule** nodding, pedicel c. 15 mm long, similar shape as ovary, dehiscing along ovary wing attachments when mature, c. 17×16 mm.

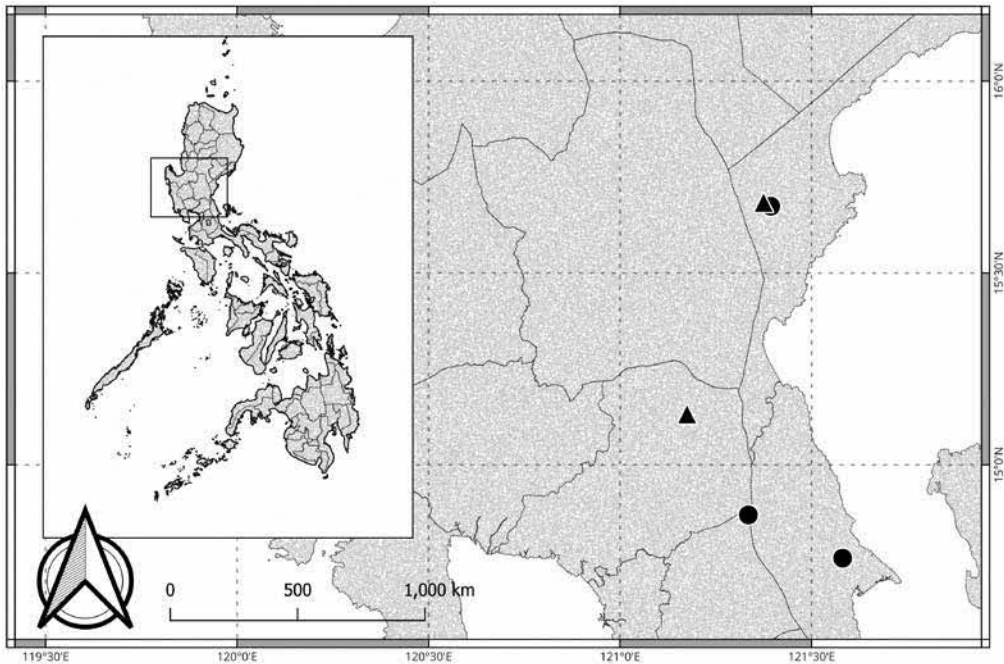


Fig 1. Distribution of *Begonia subaequifolia* (triangle) and *B. loheri* (dots).

Distribution. The new species is endemic to Luzon, specifically in the provinces of Aurora and Bulacan. *Begonia subaequifolia* was first documented within the premises of AMNP. Additional populations were recorded by J.P.R. Collantes during a hiking trip in Bulacan Province (part of central Sierra Madre, adjacent to Aurora Province). The population in Bulacan was observed growing along a hiking trail at c. 750 m elevation (Fig. 1). Although no collection was made in the absence of permits, the photo documentation was sufficient for ascertaining identification of the species.

Habitat and ecology. *Begonia subaequifolia* grows on a hilly terrain near a water source in a tropical lowland evergreen rainforest. It was observed on a 10–30° north-facing slope under a well-shaded canopy along the BAMS trail at AMNP. It was also observed in clay-loam soil overtopped by abundant leaf litter and a humus-rich horizon of topsoil growing sympatrically with *B. loheri*. In Bulacan Province, it was observed on a well-shaded area along a trail frequented by tourists.

Phenology. Flowering and fruiting from late June to August.

Etymology. The specific epithet refers to the sub-symmetric leaves of the species.

Provisional IUCN conservation assessment. Our surveys identified four subpopulations across two locations of this species (three within AMNP and one in Bulacan), each consisting of c. 100 mature individuals. We estimate the extent of occurrence (EOO)

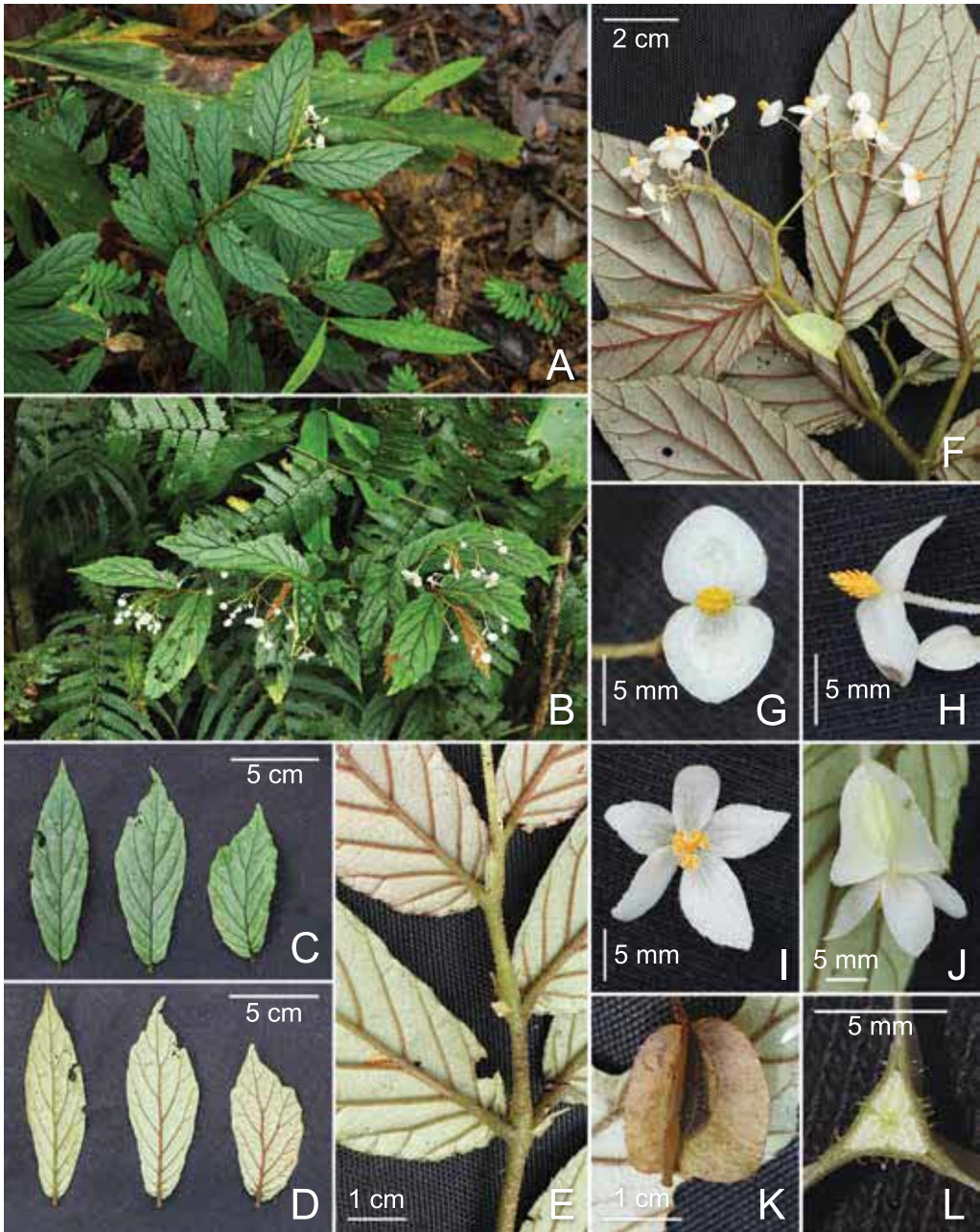


Fig. 2. *Begonia subaequifolia* Y.P.Ang & J.Collantes. **A, B.** Habit and flowering branches. **C.** Leaf adaxial surface. **D.** Leaf abaxial surface. **E.** Stem showing indumentum, stipules, and leaf abaxial surface. **F.** Inflorescence. **G.** Staminate flower, ventral view. **H.** Staminate flower, lateral view. **I.** Pistillate flower, ventral view. **J.** Pistillate flower, lateral view, showing ovary. **K.** Capsule. **L.** Ovary cross section. (Photos: Y.P. Ang)

at c. 137 km² and the area of occupancy (AOO) at 12 km². The presence of *Begonia subaequifolia* is closely linked to the availability of clean water sources and intact forests. As such, any environmental disturbance which may lead to water resource depletion, or the decline and fragmentation of forest cover, is likely to threaten its survival. From 2001 to 2023, the area within the boundaries of EOO lost c. 281 ha of tree cover, equivalent to a 10% decrease in tree cover since 2000 (Global Forest Watch, 2023). At AMNP, we have observed signs of forest conversion and the creation of new logging trails, which transects directly within the habitat of *B. subaequifolia*. In Bulacan Province, the populations are subjected to tourist related disturbances resulting from hiking. Thus, we propose a conservation status of Endangered (EN B1ab(ii,iii,iv)+2ab(ii,iii,iv)) for *B. subaequifolia* (IUCN Standards and Petitions Committee, 2024).

Rediscovery of *Begonia loheri*

Begonia loheri was first collected by August Loher in 1906 at Angilog, Rizal Province, Philippines. Elmer Drew Merrill studied the specimens from Loher's collection and formally described and published this species in 1911 (Merrill, 1911). During fieldwork at AMNP, we documented an unknown *Begonia* species. A literature review and comparison of our specimen to digitised herbarium images online confirm that it represents the rare and poorly known species *B. loheri*. Although our rediscovery is not from the type locality, we are confident with this identification because the plants we found match well with both the protologue and extant type material. *Begonia loheri* is distinctive among the Philippine begonias by its small, semi-erect to prostrate habit; compactly and distichously arranged leaves with purplish brown veins, serrate margins, and adaxially raised intervein spaces bearing sparse hairs; and a terminally positioned, monochasial cymose male inflorescence.

Begonia loheri Merr., Philipp. J. Sci., C 6: 382 (1911); Enum. Philipp. Fl. Pl. 3: 124 (1923). (§ *Petermannia*) – TYPE: Philippines, Luzon, Rizal Province, Angilog, 15 March 1906, *Loher 6090* (lectotype K [K000761135*], designated here; isoelectotypes B [B 10 0238325*], M [M-0145706*], US [00115372*]). (Figs 1, 3)

Herb, monoecious, erect to prostrate, c. 20 cm tall. **Stem** terete, rarely branched, pale green to brown, 3–5 mm diam., antrorsely brown setose, internodes 21–35 mm long. **Stipules** persistent, pale green, obliquely ovate to oblong-ovate, 7–10 × 4–7 mm, adaxially glabrous, abaxially white puberulent, keeled, keel lined with short white simple hairs, margin ciliate, apex aristate, arista c. 3 mm long. **Leaves** alternate; petiole terete, pale green to brown, up to 3 mm long, similar vestiture as stems; lamina asymmetric, basifixed, oblong-elliptic, 2–5(–5.6) × 0.7–2(–2.5) cm, veins pinnately arranged, adaxially green with purplish brown veins, sparsely hirsute (c. 0.5 mm long) on intervein spaces, veins sunken, abaxially pale green, veins prominently raised, brown-setose (c. 0.5 mm long); base inequilateral, narrowed, shallowly

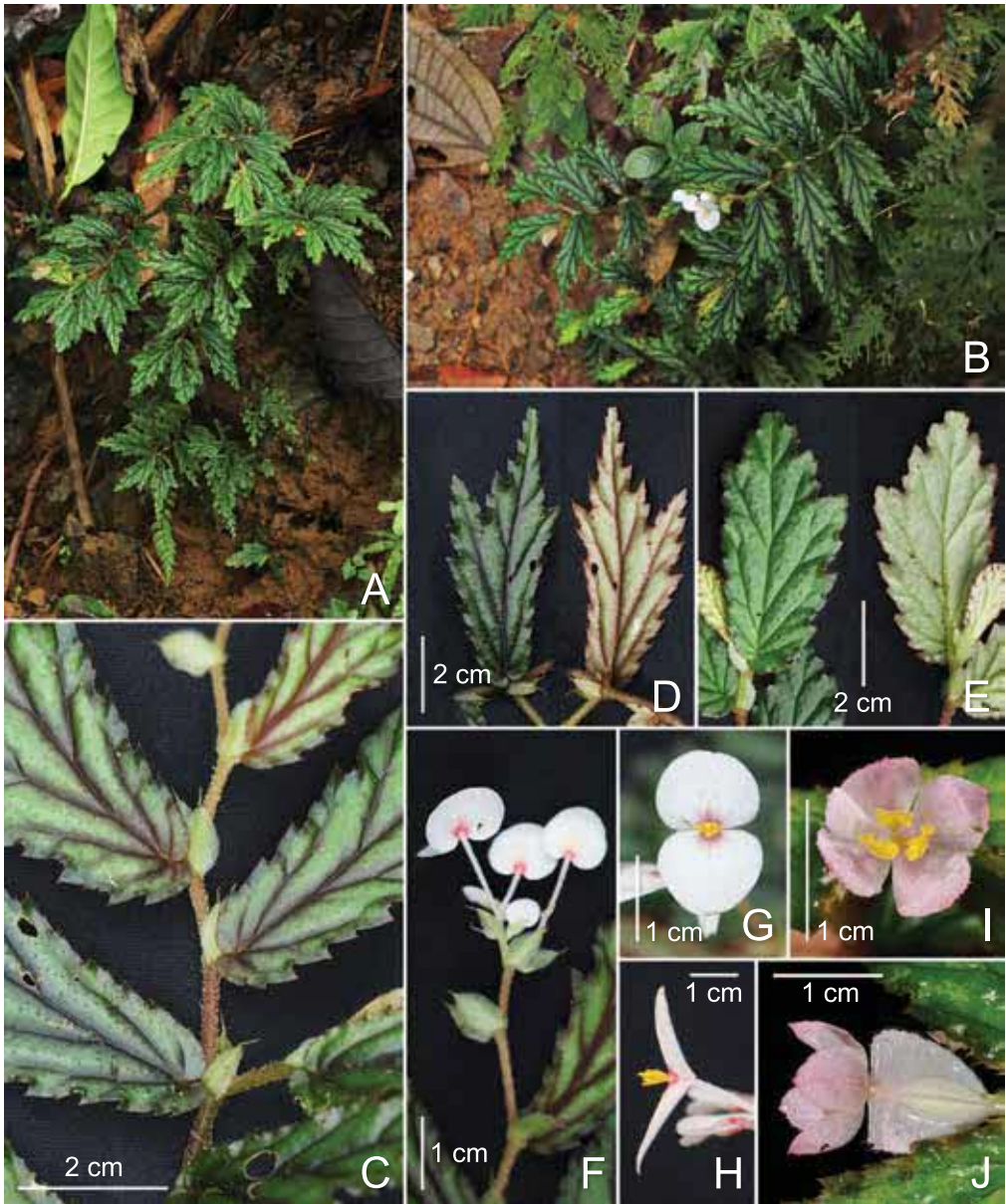


Fig. 3. *Begonia loheri* Merr. **A, B.** Habit. **C.** Portion of stem showing indumentum, stipules, and leaves. **D, E.** Variation in leaf morphology: adaxial (left) and abaxial (right) surfaces. **F.** Male inflorescence, dorsal view, showing staminate flowers and bracts. **G.** Staminate flower, ventral view. **H.** Staminate flower, lateral view. **I.** Pistillate flower, ventral view. **J.** Pistillate flower, lateral view, showing ovary. (Photos: A–H, Y.P. Ang; I, J, P.B. Pelser & J.F. Barcelona)

cordate, margin dentate to setose-dentate, irregularly lobed to shallowly lacerated towards apex, apex acuminate. **Inflorescence** terminal, bisexual, protogynous, few flowered, panicle 3–6 cm long, staminate flowers in a monochasial cyme, peduncle 12–20 mm long, similar vestiture as stem, green; pistillate flower solitary, axillary on terminal leaf node, basal to staminate flowers; bracts persistent, hyaline, pale green, oblong-ovate, glabrous, decreasing in size towards apex of inflorescence, lowest bract 6(–7) × c. 4 mm, margin entire, apex acuminate. **Staminate flower:** pedicel 6–10 mm long, antrorsely white-hirsute (c. 0.2 mm long); tepals 2, white to white flushed with dark pink near pedicel attachment, venation indistinct, widely ovate, 8–10 × 10–12 mm, glabrous, base cordate, margin entire, apex rounded; androecium zygomorphic, filament fused at base, 0.8–1.5 mm long; stamens 14–18, yellow, obovate in outline, c. 0.8 mm long, apex distinctly retuse. **Pistillate flower:** pedicel 5–10 mm long, antrorsely white hirsute (c. 0.2 mm long); tepals 5, white, glabrous, margins minutely serrate; outer tepals 2, obovate, 8–10 × 4–5.5 mm, apex obtuse to rounded; inner tepals 3, obovate, 9–12 × 4.5–6 mm, apex obtuse to rounded; styles 3, yellow, forked at distal half, stigma a twisted band and papillose all around, c. 4 mm long; ovary trigonous-ellipsoid, 10–12.5 × 4–5 mm (wings excluded), sparsely puberulent (c. 0.5 mm long), locules 3, placenta bifid; wings 3, triangular, subequal, tapered proximally, truncate distally, 11–12 × 5–7 mm. **Capsule** similar shape and dimension as ovary, dehiscing along ovary wing attachments when mature.

Distribution. Endemic to Luzon, specifically in Aurora, Quezon, and Rizal Provinces (Fig. 1).

Habitat and ecology. *Begonia loheri* grows in well-shaded areas within montane rainforest, adjacent to clean water sources. In Aurora Province, it was found growing sympatrically with *B. subaequifolia*.

Phenology. Flowering and fruiting from May to July.

Provisional IUCN conservation assessment. Surveys conducted in AMNP identified at least three subpopulations of *Begonia loheri*, each consisting of c. 30 mature individuals. The species is strongly associated with undisturbed hill stream banks and faces similar threats to those of *B. subaequifolia* within AMNP. We estimate the extent of occurrence (EOO) at c. 1,825 km² and the area of occupancy (AOO) at c. 12 km². Between 2001 and 2023, the EOO experienced a 2.9% decline in tree cover compared to 2000 (Global Forest Watch, 2023). As based on the IUCN Red List criteria, *B. loheri* qualifies as Critically Endangered (CR C1) due to the limited number of mature individuals per subpopulation (< 50) and the total observed mature individuals (< 250) (IUCN Standards and Petitions Committee, 2024). Furthermore, ongoing habitat degradation poses a significant risk to its survival. However, as the other two collection locations for *B. loheri* in Rizal and Quezon Provinces have not been surveyed by the team, the current conservation assessment may be conservative. Because of the relatively intact forest cover within the Sierra Madre Mountain range where *B. loheri* is recorded, a reassessment may be warranted when more information is available.

Notes. In the protologue of *Begonia loheri*, E.D. Merrill mentioned two collections, *Loher 6090* and *Loher 6098*, both from Angilog, Rizal Province. Merrill did not explicitly mention which among these collections represents the holotype; therefore, all these collections under these numbers are presumed syntypes. We selected the K [K00076135] specimen of *Loher 6090* as the lectotype because it bears both the complete vegetative and reproductive forms (i.e., both male and female flowers are present) of the plant. Moreover, this specimen bears the original handwriting of E.D. Merrill, denoting that he had seen this specimen.

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Appendix 1. Other specimens studied, with those examined via digital images indicated with an asterisk (*).

Begonia brevipes Merr.

Philippines, Luzon, Cagayan Province, Pamplona, Mar. 1909, *Bur. Sci. 7431 Ramos* (K [K000761131*], US [00115263*]).

Begonia jagori Warb.

Philippines, Luzon Island, 1861, *F. Jagor 889* (B [B 10 0238230*], lectotype); ibidem, *F. Jagor 890* (B [B 10 0238230*]); ibidem, *F. Jagor s.n.* (B [B 10 0238231*, B 100238232*, B 100238233*]); ibidem, Albay Province, Barangay Sugcad, Mt Malinao, 13°24'24.4"N 123°37'44.5"E, 1003 m, 2 Apr. 2023, *PTI-SLP1 3 with J.P.R. Collantes* (CAHUP, PNH).

Begonia loheri Merr.

Philippines, Luzon, Aurora Province, Municipality of Maria Aurora, Barangay Villa Aurora, Sitio Dimani, primary forest, 15°41'35.99"N 121°21'32"E, c. 500 m, 2 Jul. 2022, *AAMNP 150* (BRIT 1145755); ibidem, Rizal Province, Angilog, 15 Mar. 1906, *G. Lopez 42043* (B [B 10 0238324*], L [L.2471059*], P [P06844050*], US [00328458*]); ibidem, Tayabas Province (now Quezon Province), Mt Binuang, May 1917, *M. Ramos & G. Edaño 28822* (US [00328457*]).

