EJB Edinburgh Journal of Botany

EDINBURGH JOURNAL OF BOTANY 79, *Begonia* special issue, Article 390: 1–10 (2022). https://doi.org/10.24823/EJB.2022.390

Published by the Royal Botanic Garden Edinburgh
ISSN (online): 1474-0036, ISSN (print): 0960-4286

OPEN ACCESS
PEER REVIEWED

BEGONIA NAEMMA (SECT. *PETERMANNIA*, BEGONIACEAE), A NEW SPECIES FROM NUEVA ECIJA, LUZON ISLAND, THE PHILIPPINES

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Within the Pantabangan–Carranglan Watershed Forest Reserve in Nueva Ecija, a small population of an inconspicuous *Begonia* was encountered. After thorough investigation, it is described here as a new Philippine *Begonia* species in sect. *Petermannia*. The new species, *Begonia naemma* Y.P.Ang, Aumentado & Magtoto, is distinguished from the allied species *B. polyclada* C.I Peng, C.W.Lin & Rubite by its larger leaves, leaf adaxially sparsely hirsute between the veins, more numerous stamens, and larger ovary wings that are ovate to oblong. Based on IUCN criteria, *Begonia naemma* is designated as Endangered (EN). A comprehensive description and illustration of *Begonia naemma* are provided.

Keywords. *Begonia polyclada*, Caraballo Mountain Range, Cucurbitales, Malesia, taxonomy.
Received 14 June 2021 Accepted 14 February 2022 Published 18 August 2022

Introduction

Begonia L. (Linnaeus, 1753: 1065) is the sixth largest angiosperm genus and one of the fastest growing genera recorded, due to ongoing species discovery (Hughes *et al.*, 2015–; Moonlight *et al.*, 2018). It currently comprises more than 2052 accepted species, and about 7% of the species diversity of the genus can be found in the Philippines (Hughes *et al.*, 2015–; Ang *et al.*, 2020a). Current records show that 139 of 143 species of *Begonia* are endemic to the Philippines (Pelser *et al.*, 2011–). Many species of Philippine *Begonia* have been recently discovered and described (Ang *et al.*, 2020a, 2020b; Bustamante *et al.*, 2020; Rubite *et al.*, 2020; Rule *et al.*, 2020; Buenavista *et al.*, 2021). Within this megadiverse genus, the Asian section *Begonia* sect. *Petermannia* (Klotzsch, 1854: 194; de Candolle, 1859: 128), comprising more than 416 species, is considered the most species-rich section (Hughes, 2008; Hughes & Coyle, 2009; Moonlight *et al.*, 2018). In the Philippines, Luzon Island has the greatest number of *Begonia* species in sect. *Petermannia*, having more than 63 documented species (Rubite, 2013; Hughes *et al.*, 2015–).

Located on the boundaries of Nueva Vizcaya, Nueva Ecija and Quirino Provinces in Luzon, the Pantabangan–Carranglan Watershed Forest Reserve (PCWFR) was established by Presidential Proclamation No. 561 under Republic Act (R.A.) 7586 and amended through

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R.A. 11038 of 2018 (Gojo Cruz & Afuang, 2018; Manuel & Velasco, 2019). The total land area covered by the PCWFR is about 94,865 ha (UNEP-WCMC, 2021). Thus, it serves as one of the primary water sources in Luzon and a critical wildlife sanctuary that caters to a myriad of rare and endangered flora and fauna (Manuel & Velasco, 2019). The PCWFR contains the Caraballo Mountain Range, which has been identified as one of the 19 terrestrial biodiversity corridors in the country and is listed in the Philippine Biodiversity Conservation Priority Areas as a high-priority area for biodiversity conservation (Ong *et al*., 2002; Gojo Cruz & Afuang, 2018). Unlike other mountain ranges found in Luzon Island, it has not been extensively studied and documented (Gojo Cruz & Afuang, 2018).

As a response to a call for research and conservation activities in the area, a four-day biodiversity assessment was conducted in the municipality of Carranglan, particularly Sitio Binbin. It was here that a small population of an unidentified *Begonia* species was encountered. Initial observation and examination of the unidentified *Begonia* were made in the field. Specimens were also collected and dried for further analyses.

Materials and methods

The unidentified *Begonia* was first compared with all *Begonia* species recorded from the island of Luzon. The morphological traits of the collections were then examined and cross-checked against those of digital type specimens and descriptions in protologues and other relevant literature. Using vernier calipers, measurements were taken from three individuals (living and spirit collections) and were found to be within the range of those recorded from the holotype.

Results

Comparison of the unidentified *Begonia* with other species in the genus showed it to be distinct from all formerly described species of *Begonia* and allied to *B. polyclada* C.I Peng, C.W.Lin & Rubite (Peng *et al*., 2017). Based on these findings, a new species of Philippine *Begonia* from sect. *Petermannia* is described accordingly.

Taxonomic treatment

Begonia naemma Y.P.Ang, Aumentado & Magtoto, **sp nov.** § Petermannia.

Allied to *Begonia polyclada* C.I Peng, C.W.Lin & Rubite by having a branched and erect stem with an antrorsely tomentose vestiture and bearing numerous small leaves that are held horizontally. Additionally, both species produce inflorescences in the upper axils or terminally, with 2-tepaled staminate flowers and 5-tepaled pistillate flowers. However, the new species is distinct from *Begonia polyclada* by having larger leaves (20–45 × 6–19 mm vs 7–16 × 3.5–8 mm); leaf adaxially sparsely hirsute between the veins (vs glabrous); more numerous stamens (c.25 vs c.15); pistillate flower tepals

elliptic to obovate (vs narrowly elliptic to ovate); and ovary wings ovate-oblong, rounded proximally and truncated distally (vs rounded triangular in shape) and comparatively larger (c.18 × 5–7 mm vs c.10 × 3.5–5.5 mm). – Type: Philippines, Luzon, Nueva Ecija, Pantabangan–Carranglan Watershed Forest Reserve, elevation c.1200 m a.s.l., 16°00'27.2"N, 121°11'03.3"E, 12 iii 2021, *PTI-PCWFR1-0021* (holotype PNH [accession no. 258608]; isotypes CAHUP [accession no. 074230], PNH [accession no. 258609]). **Figures 1, 2.**

Monoecious herb, perennial c.25 cm tall. *Stem* much branched, erect, olive to brown, c.2 mm thick, antrorsely tomentose; internodes 7–15 mm long on upper axils. *Stipules* brown, persistent, narrowly triangular, c.3 × 1–1.5 mm, glabrous, chartaceous, margins entire, slightly keeled, apex cuspidate, cusp c.1.5 mm long. *Leaves* numerous, alternate, distichous, held horizontally; petiole terete, olive green, 0.5–3 mm long, same texture as stems; lamina oblong-lanceolate-ovate, slightly asymmetrical, 20–45 × 6–19 mm; adaxially dark green, hyaline, sparsely hirsute between the veins; abaxially pale green, appressed puberulous on veins; base shallowly oblique; margins coarsely serrate, pointed on vein endings, apex acute; venation pinnate, midrib 20–45 mm long, lateral primary veins c.3 on each side, adaxially slightly sunken and abaxially slightly raised. *Inflorescence* protogynous, axillary on upper branches to terminal, typically held under the leaves, staminate flowers on 3–5 few-flowered monochasial cymes, borne on short lateral stems 2–6 mm long; pistillate flowers solitary and basal to staminate flowers; peduncle 3–11 mm long, pale green, same texture as stem. *Bracts* hyaline pale green, persistent, glabrous, narrowly triangular, lowest bract c.3 × c.1.5 mm, margins entire, decreasing in size towards summit of inflorescence. *Staminate flower* pedicel 5–11 mm long, antrorsely puberulous, tepals 2, widely ovate to orbicular, 9–11 mm in diameter, hyaline white to pale pink near attachment, base shallowly cordate, apex rounded, margins entire, abaxially sparsely puberulous; androecium nearly actinomorphic, c.4 mm in diameter; stamens yellow, c.25; filaments 0.8–1.2 mm long, slightly fused at base; anthers obovate, apex retuse, dehiscing along 2 arched slits that run along the length of the anther, c.1 mm long. *Pistillate flower* pedicel c.12 mm long; tepals 5, antrorsely puberulous, hyaline white to pale pink near apex, margins entire, elliptic to obovate, 9–11 × 5–6 mm, base cuneate, apex rounded to acute; ovary white with a pale pink band along the middle, trigonous-ellipsoid, c.11 × c.5 mm (wings excluded), wings subequal, ovate-oblong, rounded proximally and truncated distally, c.18 × 5–7 mm, glabrous except sparsely hirsute at the wing margin, 3-locular, placentation axile; styles 3, yellow, bifid, c.3 mm long; stigmas in a spiral band and papillose all around; ovate to oblong. *Capsule* not seen.

Etymology. The specific epithet, *naemma*, is the word in Ilocano that means ‘shy and humble’. This reflects the difficulty in noticing the species *in situ* due to its resemblance to other herbaceous plants such as *Elatostema pilosum* Merr. (Merrill 1919: 376), with which it was growing sympatrically. The species was discovered only by chance because it was flowering.

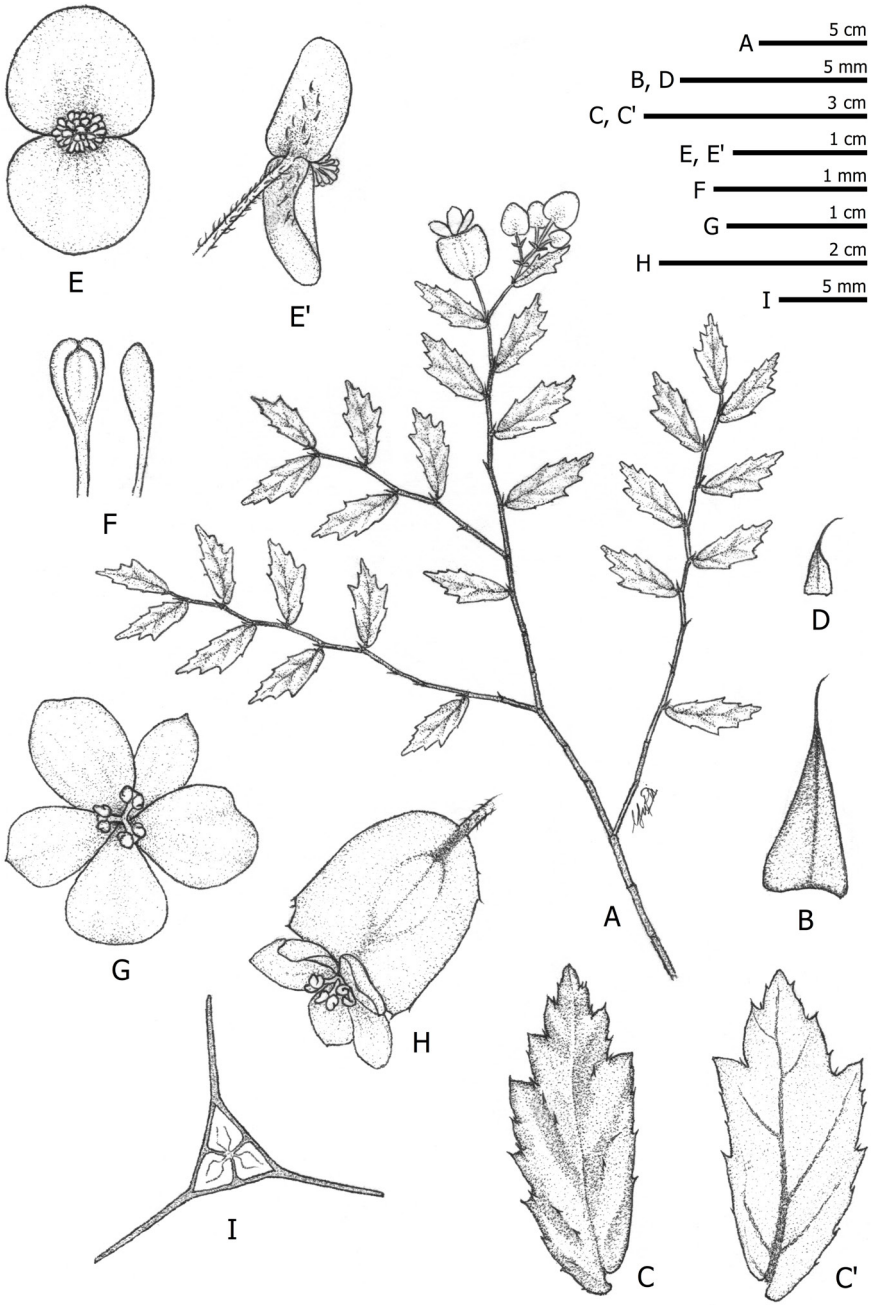

Figure 1. *Begonia naemma* Y.P.Ang, Aumentado & Magtoto, sp. nov. A, Habit; B, stipule; C and C', leaf (adaxial and abaxial surface, respectively); D, bract; E and E', staminate flower (face view and side view, respectively); F, stamen; G, pistillate flower (face view); H, pistillate flower (side view, showing ovary); I, ovary (cross-section). Drawn from the type collection (*PTI-PCWFR1-0021*) by Y. P. Ang.

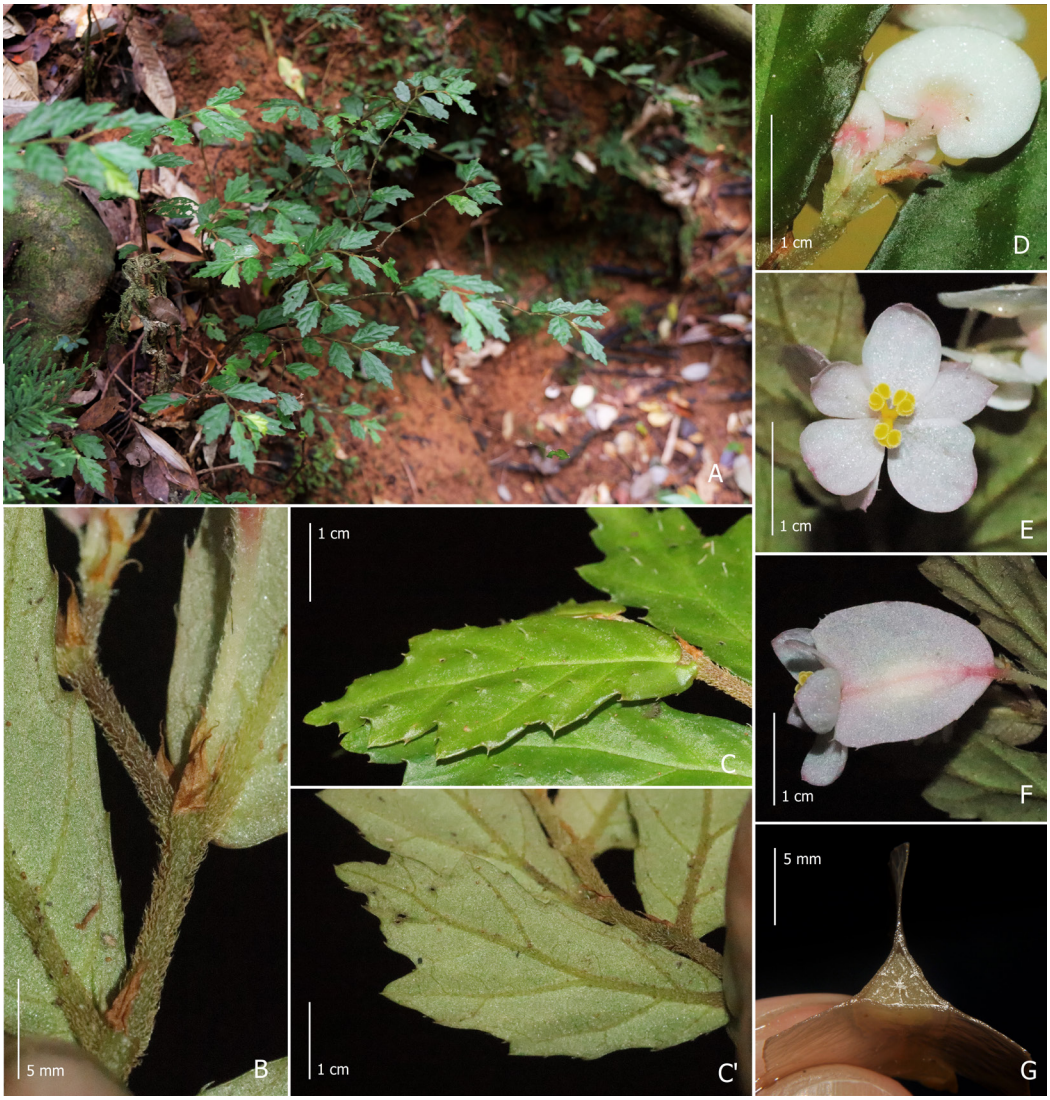

Figure 2. *Begonia naemma* Y.P.Ang, Aumentado & Magtoto, sp. nov. A, Habitat and habit; B, stem vestiture and stipules; C and C', leaf (adaxial and abaxial surface, respectively); D, immature staminate flower and bracts; E, pistillate flower (face view); F, pistillate flower (side view, showing ovary); G, ovary (cross-section). All photographs of the type collection (*PTI-PCWFR1-0021*), taken by M. N. Tamayo (A), R. A. A. Bustamante (B–F) and L. M. Magtoto (G).

Distribution and ecology. *Begonia naemma* is narrowly distributed and currently known only from its type locality in the PCWFR (**Figure 3**). It is found growing on soil slopes or lithophytically at least 1200 m a.s.l., along with *Elatostema* Wight and *Selaginella* P.Beauv. species. It occurs in two localities: one at c.1200 m a.s.l. and another at 1500 m a.s.l.

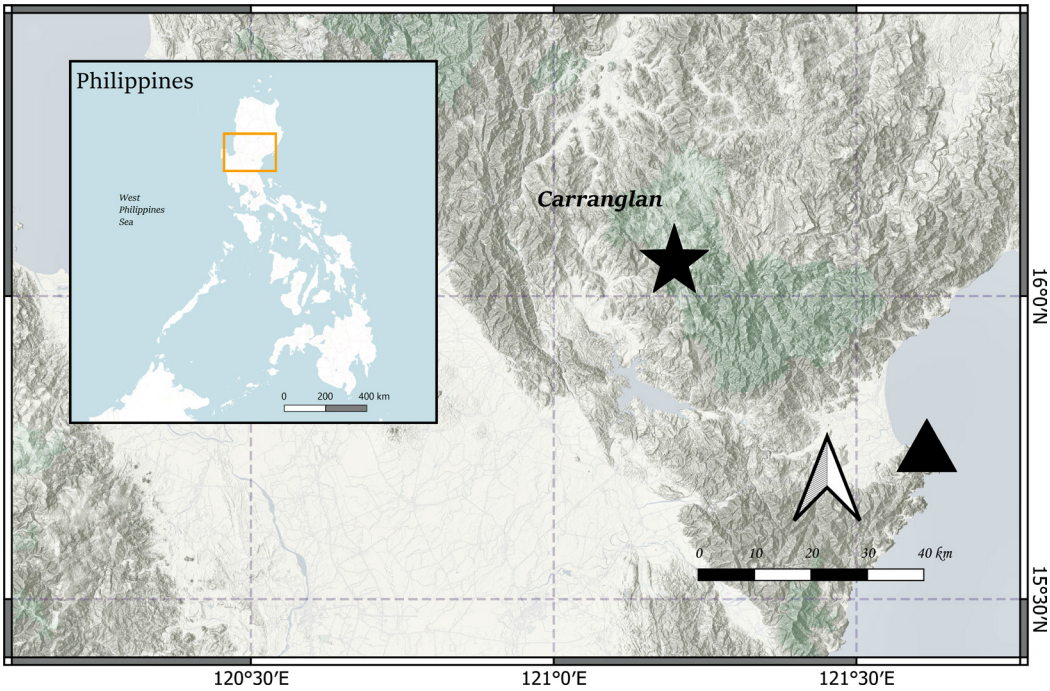

Figure 3. Distribution map for *Begonia naemma* (star) and *B. polyclada* (triangle).

Proposed IUCN conservation category. *Begonia naemma* has a restricted distribution and a relatively small number of mature individuals (only two localities [one location sensu IUCN] were observed with fewer than 100 mature plants per locality). It has an EOO and AOO of 4 km^2. Moreover, a potential threat of land conversion is noted, because economic crops are introduced in the lower slopes of the mountain. Presently, pockets of illegal logging have been observed in the area by locals, and this activity has shown no sign of stopping despite the locality being designated as a protected area. Because the survival of *Begonia naemma* is strongly tied to the overall health of the ecosystem, any forest disturbances are likely to affect this species negatively. Following the IUCN criterion B, *Begonia naemma* is hereby assessed as Critically Endangered CR B1ab(iii)+2ab(iii) (IUCN Standards and Petitions Committee, 2019).

The dainty morphology of *Begonia naemma*, with its numerous small, horizontally held leaves, is seen in only one other Philippine *Begonia* species: *B. polyclada*. Such adaptation could potentially help the species avoid herbivory by blending in with the surrounding vegetation; in this case, looking like *Elatostema pilosum* by having a much-branched lignified habit, oblong leaves with few marginal teeth, narrowed to the base, acuminate-caudate leaf apex, antrorse pilose stem, and sessile inflorescence. As observed, *Begonia naemma* and *Elatostema pilosum* are growing sympatrically (**Figure 4**).

The characters of *Begonia naemma* and *B. polyclada* are compared in the **Table**.

Figure 4. Sympatric relationship of *Begonia naemma* and *Elatostema pilosum*. A, *Begonia naemma* (top arrow) *in situ*, growing sympatrically with *Elatostema pilosum* (bottom arrow); B, *E. pilosum* (close-up). All photographs taken at the type locality by M. N. Tamayo.

Table. Comparison of the characters of *Begonia naemma* and *B. polyclada*

Character	*B. naemma*	*B. polyclada*
Stem internode length (mm)	7–15	2–10
Leaf		
Shape	Oblong-lanceolate-ovate	Ovate to ovate-lanceolate
Dimensions (mm)	20–45 × 6–19	7–16 × 3.5–8
Adaxial vestiture	Sparsely hirsute between veins	Glabrous
Inflorescence		
Peduncle length (mm)	3–11	1–3.5
Staminate flowers		
Number	3–5	Up to 3
Stamen number	c.25	c.15
Pistillate flower		
Pedicel length (mm)	c.12	4–5
Shape of tepals	Elliptic to obovate	Narrowly elliptic to ovate
Ovary wing shape	Ovate-oblong, rounded proximally and truncated distally	Rounded triangle
Ovary wing dimension (mm)	c.18 × 5–7	c.10 × 3.5–5.5

Acknowledgements

Morphological and ecological studies, including the vouchering of *Begonia naemma* specimens, were conducted under Gratuitous Permit III-2020-005, issued by the Department of Environment and Natural Resources (DENR) Region 3 in December 2020. The completion of this study would not have been possible without the invaluable assistance of Joselito M. Blanco (Protected Area Superintendent, PCWFR), Alfredo C. Kimayong (Assistant Protected Area Superintendent, PCWFR), Florencio J. Lalu (City Environment and Natural Resources Office–DENR Muñoz), Eng. Paquito T. Moreno (Regional Executive Director, DENR Region 3) and members of the Protected Area Management Board of PCWFR, who issued the Gratuitous Wildlife Collection Permit that allowed us to conduct our research. We also acknowledge the support and assistance of Ms Jenny Raisa Lico (Section Chief, Conservation Development Division). Moreover, we express our deepest gratitude to our fieldwork team, Prof. Marjorie delos Angeles, Mr Rene Alfred Anton Bustamante, Mr Maverick Tamayo, Mr John Charles Altomonte, Mr Leonardo Udasco and Mr Marlon Bagiw, for their substantial help and assistance during the fieldwork.

We also want to express our appreciation for the significant financial support provided by Ms Isen Alejo and the following members of the Ayala Alabang Village Biophiles Group: Ms Jenna Genio, Ms Sylvia Ramos, Mr Tonji Ramos, Ms Edwina Dominguez, Ms Cacay Moras, Atty Gil Roberto Zerrudo, Mr Jaime Iñigo, Ms Catha Server, Ms Tina Mallari, Mr Wency Mallari, Ms Michelline Suarez, Ms Lestie Fronteras, Ms Ian Luciano-Ramos, Ms Hazel Caballero Scott and the Philippine Taxonomic Initiative, Inc.

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Appendix

Begonia specimens examined for morphological comparison

Begonia naemma. Philippines. **Luzon**: Nueva Ecija, Pantabangan–Carranglan Watershed Forest Reserve, elevation c.1200 m a.s.l., 16°00'27.2"N, 121°11'03.3"E, 12 iii 2021, *PTI-PCWFR1-0021* (CAHUP, PNH).

Begonia polyclada. Philippines. **Luzon**: Aurora, Baler, elevation c.600 m, 121°36'35"E, 15°43'48"N, 25 x 2012, *Peng C.I.* 23553 (HAST, PNH).