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***Begonia bangsamoro* (Begoniaceae, section *Petermannia*), a new species from Mindanao Island, the Philippines**

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Abstract

Begonia bangsamoro, a new Philippine *Begonia* species from the section *Petermannia* is described and illustrated. The new species was discovered in the fragmented riparian forest of Lanao del Sur, along the Ginapukan river in Wao, Mindanao island, Philippines. The previous collections also revealed that it occurs in the nearby province of Bukidnon. *Begonia bangsamoro* is distinguished from other Philippine *Begonia* by its lacerate leaf margins, terminal inflorescences, 4-tepaled staminate flowers, and sparsely hirsute ovaries. The new species is compared with the phenetically similar *B. quercifolia*. Based on IUCN Red List criteria, *B. bangsamoro* is designated as Endangered (EN).

Keywords: endemic, *Begonia quercifolia*, eudicots, Cucurbitales, Lanao del Sur, Malesia, taxonomy

Introduction

Established by Plumier in 1700 with six species (Dryander 1791; Doorenbos *et al.* 1998), *Begonia* Linnaeus (1753: 1056) is now a remarkable genus comprised of 2,001 species making it the sixth-largest genus amongst angiosperms (Moonlight *et al.* 2018; Hughes *et al.* 2015). This number, however, is expected to increase as hundreds of possibly undescribed species are likely to be discovered particularly in Southeast Asia—the centre of *Begonia* diversity (Moonlight *et al.* 2018; Thomas *et al.* 2012; Tian *et al.* 2018). *Begonia* section *Petermannia* (Klotzsch 1854: 194) de Candolle (1859: 128), in particular, has the highest species richness in Asia with more than 200 species (Peng *et al.* 2017). Yet, the same region is also a hotspot of tropical deforestation driven by the expanding plantation economy (Kenney-Lazar & Ishikawa 2019; Zeng *et al.* 2018). With approximately 82 billion m² of the area being converted into croplands (Zeng *et al.* 2018) and 500 times faster than the expected extinction rate for plants (Humphreys *et al.* 2019), documenting and conserving the region's flora is a race against time, especially in the remaining ecologically intact landscapes and other little-known biocultural territories.

The Bangsamoro Region on the island of Mindanao, Philippines is one of the botanically unexplored areas of Southeast Asia. Established in 2019, the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) is a newly recognised region that gained its autonomy after decades of armed conflict between the government of the Philippines and the Bangsamoro people whose historical assertion of self-governance and statehood date back to the middle of 15th-century Sultanates (Abubakar 2019; Abuza & Lischin 2020; Lingga 2004). The decades of socio-political conflict, violence, and insurgency hampered all fieldwork in the region and many of its mountain flora (i.e., Mount Ragang and Mount Makaturing in Lanao del Sur, BARMM) remain poorly known.

To fill this gap, the field surveys were carried out within the province of Lanao del Sur in the Bangsamoro region. With the photo-documentation of the local flora in the forest patches of Sitio Trese, Barangay Banga, Wao, Lanao del Sur, BARMM (Figure 1), an unidentified *Begonia* was hypothesised to be an undescribed species. This was validated and confirmed through morphological comparisons of the herbarium specimens with the protologues, digitally available type specimens, and botanical descriptions from relevant literature. As such, with a window of opportunity to botanically explore the Municipality of Wao in the Bangsamoro region, we are delighted to present the discovery of a new species of *Begonia* from section *Petermannia*.

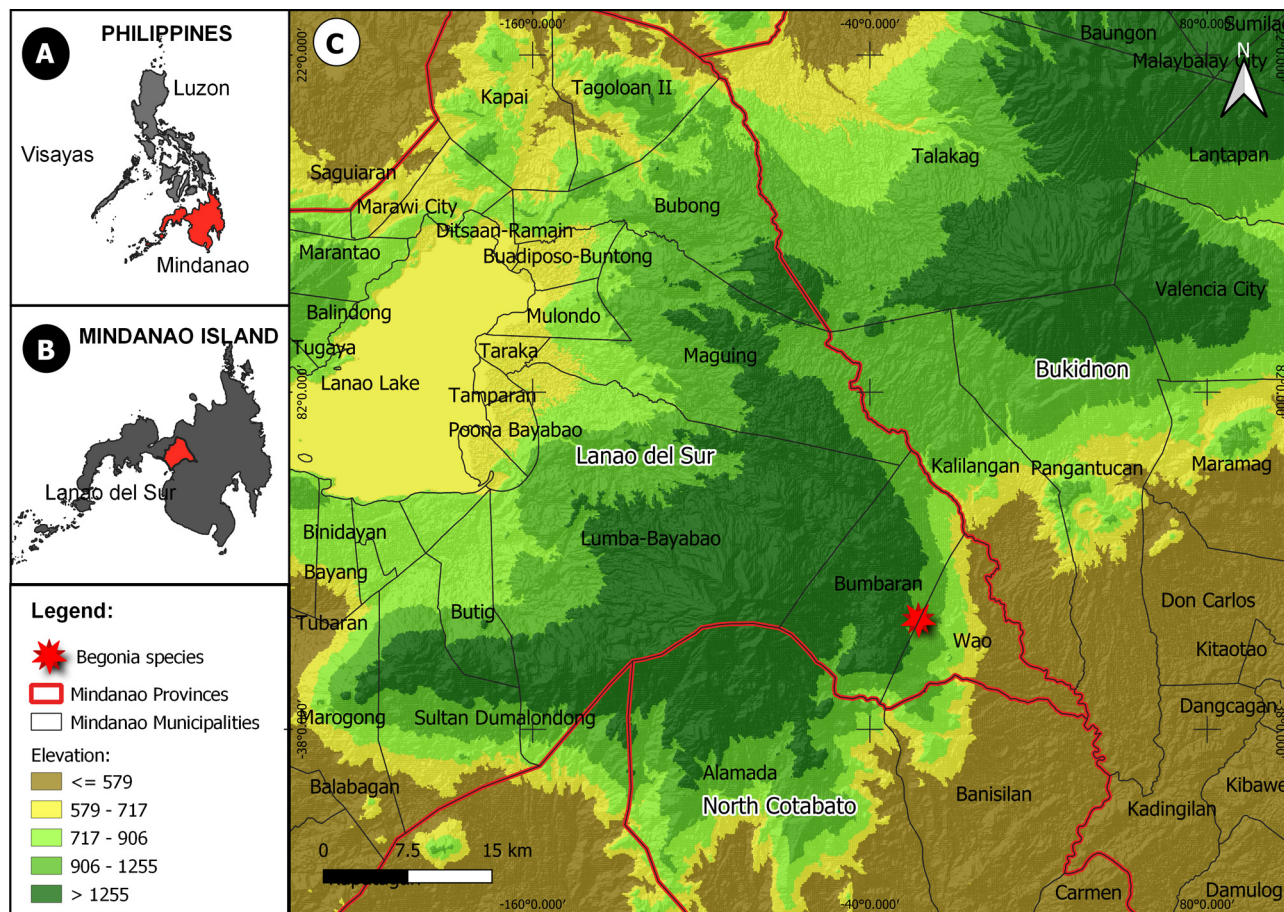


FIGURE 1. Map indicating the type locality of *B. bangsamoro* in the Municipality of Wao (C), province of Lanao del Sur, Mindanao island (B), Philippines (A). Illustrated by D.S. Salas

Materials and methods

For the authorized collection of plant samples, we were granted Prior Informed Consent (PIC), and Municipal Wildlife Permit on the 13th of July 2020 through the Office of the Municipal Mayor Elvino B. Balicao Jr. and the Municipal Environment and Natural Resources Office (MENRO) of Wao, respectively. The site was revisited for the field documentation and collection of herbarium specimens on the 9th of August 2020. The inflorescence of both staminate and pistillate flowers was preserved in spirit whilst plant samples for type specimens were pressed and dried for herbarium collections. For morphological examinations, quantitative characters were taken using a ruler, digital caliper, and dissecting microscope with a graduated eyepiece for the microscopic structures like the hairs. The hypothesis that the *Begonia* from Lanao del Sur represents a new and distinct taxon was then tested by morphological comparison with the phenetically similar *Begonia* species in the section *Petermannia* from the Philippines. Typifications were made in following the provisions of the Shenzhen Code otherwise known as the International Code of Nomenclature for Algae, Fungi, and Plants (Turland *et al.* 2018). The holotype and isotype were deposited in the Botany and National Herbarium Division of the National Museum of the Philippines, Manila. The conservation status of the new species was assessed according to the provisions of IUCN Categories and Criteria Version 14 (IUCN Standards and Petitions Committee, 2019).

Taxonomic Treatment

***Begonia bangsamoro* D.P.Buenavista, Pranada & Y.P.Ang sp. nov. § *Petermannia* (Fig. 2, 3)**

Type:—PHILIPPINES. Mindanao Island, Province of Lanao del Sur, Municipality of Wao, Barangay Banga, Sitio Trese, 1197 m elevation, 9 August 2020, D.P. Buenavista: DPB 001; PNH 258465 (holotype: PNH!); DPB 002; PNH 258466 (isotype: PNH!).

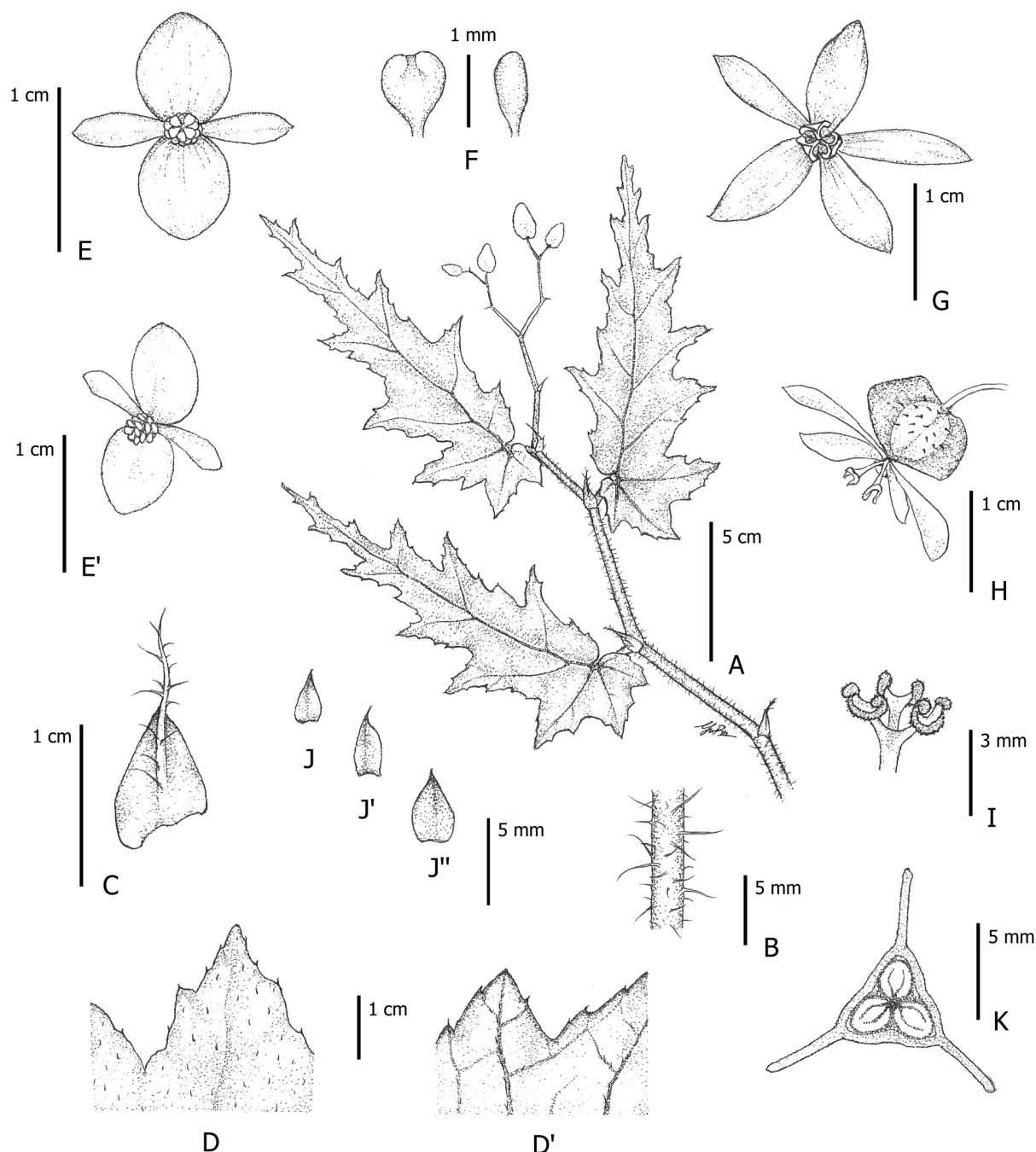


FIGURE 2. *B. bangsamoro*. **A.** Habit; **B.** Stem; **C.** Stipule; **D, D'** Leaf adaxial and abaxial surfaces; **E, E'**. Staminate flower face and angled view; **F.** Stamen top and side view; **G.** Pistillate flower face view; **H.** Pistillate flower side view, showing ovary; **I.** style; **J, J', J''.** Bracts; **K.** Ovary cross-section. Line drawing by Y.P. Ang.

Diagnosis:—*Begonia bangsamoro* is most similar to *B. quercifolia* DC. among the species of *Begonia* section *Petermannia* of the Philippines in having upright stem and lacerate or incised leaf. However, it differs in having pilose (vs. glabrous) stems and rachis, lance-ovate (vs. oblong) leaves, ovate (vs. oblong) stipules, 4 (vs. 2) staminate tepals, caducous (vs. persistent) bracts and terminal (vs. axillary) staminate inflorescences.



FIGURE 3. *B. bangsamoro*. **A.** Habitat and habit; **B.** Stem; **C.** Stipule; **D.** Bract; **E, E'.** Leaf adaxial and abaxial surface respectively; **F.** Inflorescence; **G.** Staminate flower face view; **H.** Pistillate flower face view; **I.** Pistillate flower side view, showing ovary; **J.** Capsule; **K.** Ovary cross-section. *Photos all by DP Buenavista.*

Monoecious, terrestrial, perennial herb, up to 55 cm tall. **Stem** terete, brown to red, 2–3 mm thick, red to white pilose (ca. 2 mm long), internodes 3.3–6.6 cm long, nodes slightly swollen. **Stipules** persistent, ovate, red, keeled, adaxially glabrous, abaxially sparsely hairy on the upper half of keel, margins entire, 6–10 × 7–7.5 mm, apex aristate, arista extended for an addition ca. 3.5 mm long. **Leaves** alternate; petiole terete, red, 1.5–2.1 × 2.0–6.5 mm long, red pilose (ca. 2 mm long); lamina asymmetric, basifixed, lance-ovate, 7.6–10.8 × 3.1–4.1 cm, margins lacerate, serrated

to doubly-serrated, shallowly undulating, ciliate (ca. 0.5 mm long), base cordate, apex caudate or attenuate; lamina chartaceous, adaxially green, veins reddish-brown, puberulent (ca. 1 mm long), glabrescent, abaxially pale green, intervein glabrous, veins reddish-brown, slightly raised, appressed puberulous; venation basally palmate, primary veins ca. 7, actinodromous, secondary veins craspedodromous. **Inflorescence** terminal, bisexual, protogynous, pistillate flower solitary, at base of staminate cymes, staminate inflorescences dichasial cymes, branching 3–4 times, peduncle pale red, 1.6–1.7 cm long, pilose. **Bracts** ovate, caducous, hyaline, glabrous, 3–5 × 1–2 mm, decreasing in size towards the summit of inflorescence nodes, margins entire, apex cuspidate. **Staminate flower** pedicel 4–5 mm long, glabrous, tepals 4, white suffused with pink, glabrous; outer tepals 2, ovate to widely elliptic, ca. 7 × 5 mm, margins entire, apex bluntly obtuse, base rounded; inner tepals 2, elliptic to lanceolate, 6–7 × 2 mm, margins entire, apex rounded to acute, base rounded; androecium actinomorphic, ca. 2 mm in diameter, stamens 20–25, yellow, crowded on elongated axis ca. 3 mm in length; anthers obovoid, ca. 1.2 mm long. **Pistillate flower** pedicel 4–5 mm long, sparsely puberulous, tepals 5, white suffused with pink, glabrous, margins entire; outer tepals 2, narrowly elliptic, 13 × 3 mm, apex rounded to acute; inner tepals 3, narrowly elliptic, 13–14 × 4–5 mm, apex acute; ovary pale green, sparsely minute hirsute, trigonous-ellipsoidal, 6–7 × 5 mm (wings excluded), wings 3, subequal, subrhomboid, widening towards the apex, proximally and distally truncated, 5 × 3–3.5 mm wide, locules 3, placentae axile, bilamellate; styles 3, yellow, bifid, ca. 3 mm long, stigma spirally twisted and papillose all around. **Capsule** similar in dimensions to the ovary, recurved when mature.

Etymology:—The specific epithet is named after the Bangsamoro people which refers to the thirteen ethnolinguistic groups native to the southern Philippines. The Bangsamoro people collectively include the Bajao, Iranun, Jama Mapun, Kalagan, Kalibugan, Maguindanao, Palawanon, Maranaw, Molbog, Sama, Sangil, Tausug, and Yakan. With livelihoods and culture intimately intertwined with nature, the Bangsamoro people living within the traditional territory safeguard a number of Key Biodiversity Areas (i.e., Lake Lanao, Mount Piagayungan, and Tawi-Tawi Island). These designated KBA's in the Bangsamoro region is of global importance to biodiversity conservation of terrestrial, freshwater, and marine ecosystems.

Distribution and ecology:—*Begonia bangsamoro* thrives within the riparian forest along the Ginapukan river in Sitio Trese, Barangay Banga, Wao, Lanao del Sur, BARMM. The population of this species is sparsely distributed on the forest floor and along the riverbanks with a closed canopy. Some individuals were observed to creep up and shallowly rooting into a wet substrate such as the roots of tree fern for support. This forest fragment, however, is surrounded by agricultural lands, in particular, vegetable and sugarcane plantations. To date, this species is observed in Lanao del Sur, but the full extent of the distribution is not known due to the inaccessibility of the terrain.

Conservation status:—With the expanding plantation of cash crops and continuous clearing of the forests, the population of this species within the fragmented forest is restricted and faces a potential decline in the near future. The entire population of *B. bangsamoro* composed of about 180 individuals occurs within one km². The nearest *B. bangsamoro* population is approximately 30 metres away from the forest edge surrounded by the aubergine and coffee plantations. However, the new species has also been documented in the nearby province of Bukidnon, Mindanao based on previous collection and photos. An unidentified collection by Ramos & Edaña (39103) from Tangculan, Bukidnon, which was then determined as *B. incisa*, appears to be of *B. bangsamoro* as seen from the degree of laceration of the lamina and the pilose stem. *B. bangsamoro* also occurs in the Mount Kitanglad Range Natural Park based on photographs by Pelser & Barcelona available at the Co's Digital Flora of the Philippines (Pelsner *et al.* 2011 onwards). The photos, which are labelled as *B. contracta* Warburg (1904: 54), show lacerate leaves, pilose stem, 4-tepal staminate flower and 5-tepal pistillate flower, characteristics that best describe *B. bangsamoro*. As such, following the IUCN Red List Version 14, we provisionally classified *B. bangsamoro* as endangered due to its severely fragmented geographical range and very small population within the province of Lanao de Sur.

Notes:—*Begonia bangsamoro* is distinctive in having a 4-tepal staminate flower, a character which is not commonly seen in section *Petermannia* since most species in the section are 2-tepal except for a few species which include *B. mindanaensis* Warburg (1904: 55), *B. longibractea* Merrill (1920: 293), and *B. affinis* Merrill (1912: 308). In gross morphology, *B. bangsamoro* resembles *B. quercifolia* De Candolle (1859: 129), a species known from the islands of Samar and Leyte in the Visayas, north of Mindanao (Fig. 5). They are most similar in their erect habit and lacerate leaf margin but *B. bangsamoro* can be easily distinguished by its pilose (vs. glabrous) stem and ovate (vs. oblong) stipules. *B. bangsamoro* is also evidently different by its shorter petioles (2–6.5 cm long) as compared to the petioles of *B. quercifolia* which measure from 7.5 mm to 61 mm long. In the reproductive structures, *B. bangsamoro* is different by its terminal, cymose inflorescence (vs. axillary, racemose) and shorter peduncles at 16–17 mm (vs. 26–32 mm), shorter ovary length at 6–7 mm (vs. 14–15.5 mm). Additionally, the type specimens of *B. quercifolia* (Cuming 1696) show that the bracts of the staminate inflorescence are persistent as opposed to the caducous bracts of

B. bangsamoro. The new species, *B. bangsamoro*, can be also readily distinguished from *B. quercifolia* by the number of their staminate tepals with 4 for the former and 2 for the latter. Detailed comparison is seen in Table 1.

TABLE 1. Morphological differences between *B. quercifolia* and *B. bangsamoro*.

Character	<i>B. bangsamoro</i> (Figs 2, 3)	<i>B. quercifolia</i> *
Stem		
vestiture	pilose (ca. 2mm long)	glabrous
internode length (cm)	3.3–6.6	2.1–3.2
Stipule		
shape	ovate	oblong
length (mm)	9–13	5–10
Petiole		
vestiture	pilose	sparsely pilose
length (mm)	2–6.5	7.5–61
Leaf		
shape	lance-ovate	oblong
dimension (cm)	7.6–10.8 × 3.1–4.1	9.5–14.4 × 2.8–5
adaxial vestiture	minutely puberulous	sparsely pilose
Staminate inflorescence		
position	terminal	axillary or terminal
type	dichasial cyme, branching 3–4 times	racemose, branching dichotomously once or none at base
peduncle length (mm)	16–17	26–32
Bract		
character	caducous	persistent
dimension (mm)	3–5 × 1–2	3–5 × 2–3
Staminate flower		
tepal count	4	2
Ovary		
vestiture	sparsely minute hirsute	glabrous
length (mm)	6–7	14–15.5
wing shape	subrhomboid, proximally and distally truncated	ovate

*Based from protologue and type specimens (*Cuming 1696*)

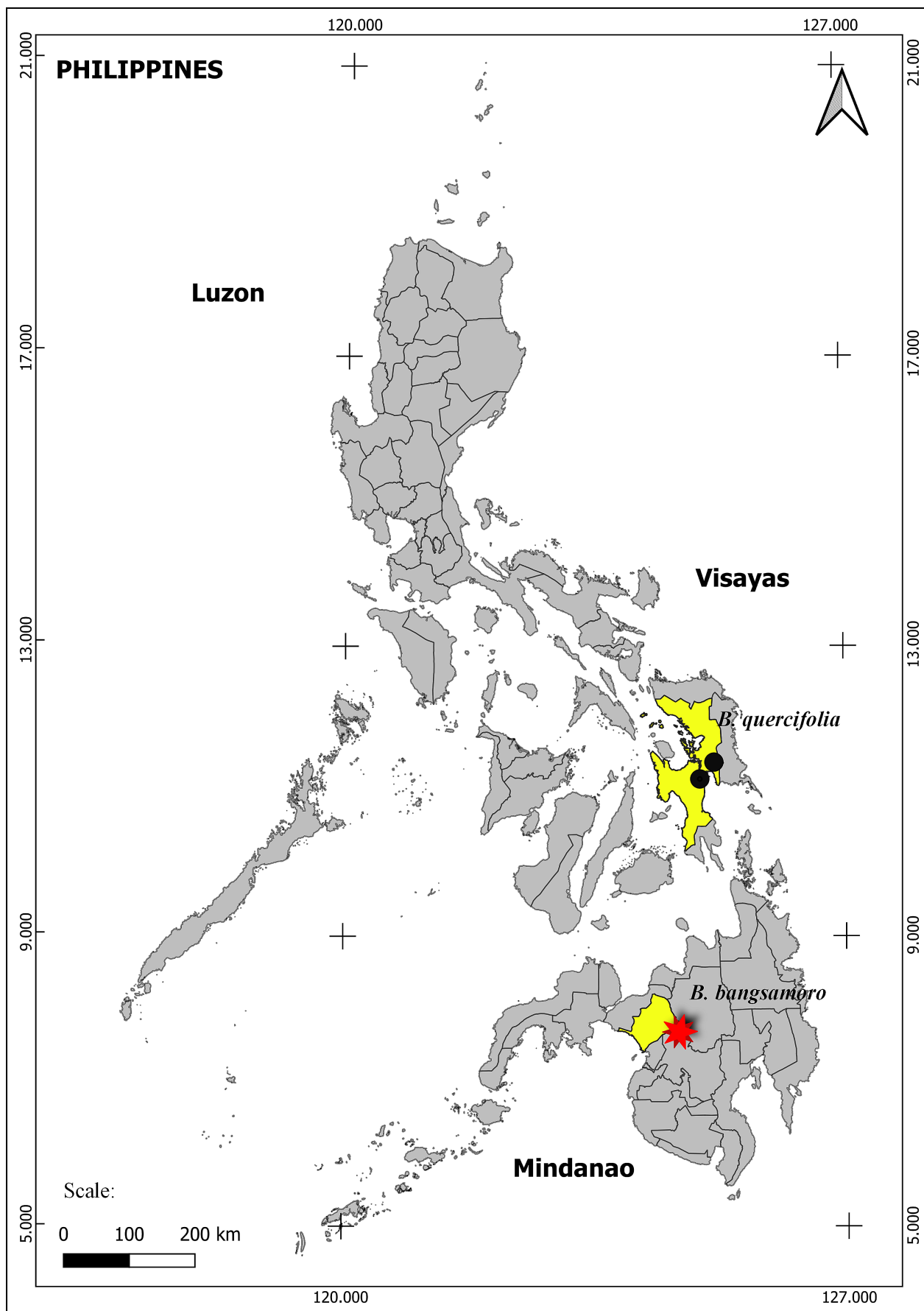


FIGURE 4. Map of type locality of *B. bangsamoro* (Star) vs *B. quercifolia* (Circle).

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Appendix 1. *Begonia* specimens examined for morphological comparison.

***Begonia bangsamoro* D.P. Buenavista, Pranada & Y.P.Ang.** PHILIPPINES. Mindanao Island, Province of Lanao del Sur, Municipality of Wao, Barangay Banga, Sitio Trese, 1197 m elevation, 9 August 2020, *D.P. Buenavista*: *DPB 001*; *PNH 258465* (holotype: PNH!); *DPB 002*; *PNH 258466* (isotype: PNH!).

***Begonia incisa* DC.** PHILIPPINES. Mindanao Island, Bukidnon, Tangculan, June–July 1920, *Ramos & Edaño 39103* (B 100238279, K).

***Begonia quercifolia* DC.** PHILIPPINES. Samar Island, 1841, *Cuming, H. 1696* (K 000761016, K 000761017, P 01900786, F I004388).