

***Begonia fritschiana* (Begoniaceae, *Begonia* section *Baryandra*), a new species from Quezon, Bukidnon, Philippines**

VICTOR B. AMOROSO^{1,3*}, RICA JOY V. LAMPARAS^{1,4}, NOEL E. LAGUNDAY^{1,5}, MARK LLYOD G. DAPAR^{1,6} & ROSARIO R. RUBITE^{2,7}

¹ Center for Biodiversity Research and Extension in Mindanao (CEBREM) and Department of Biology, Central Mindanao University, Musuan, Bukidnon 8710, Philippines

² Department of Biology, College of Arts and Sciences, University of the Philippines Manila, Padre Faura, Manila, Philippines.

³  victorbamoroso@gmail.com;  <https://orcid.org/0000-0001-8865-5551>

⁴  lamparasrica@gmail.com;  <https://orcid.org/0000-0001-6110-3044>

⁵  lagundaynoel@gmail.com;  <https://orcid.org/0000-0003-1880-4851>

⁶  f.marklloyd.dapar@cmu.edu.ph;  <https://orcid.org/0000-0002-1906-1191>

⁷  rrrubite@up.edu.ph;  <https://orcid.org/0000-0002-1704-1533>

*Corresponding author

Abstract

Begonia fritschiana from Mindanao Island is described as a new species endemic to the Philippines. This is the latest addition to the species-rich *Begonia* section *Baryandra*. It resembles *Begonia caramoanensis* but is distinguished by the consistent obliquely ovate leaves with shorter petioles, lamina glaucous abaxially and with marginal hairs, mostly solitary to singly-branched inflorescences with shorter white-glandular hairs on the pedicels and peduncle, one of the outer tepals pink, and glabrous ovary and ovary wings. *Begonia fritschiana* is known only from the type locality with one population and less than 100 individuals. The area is not currently protected under the country's National Integrated Protected Areas System by the Department of Environment and Natural Resources. Because of ongoing threats such as illegal logging, poaching, and over collection of biological resources, the single area of occurrence with estimated extent < 10 km², and the small number of < 100 individuals, we recommend a classification of *B. fritschiana* as Critically Endangered.

Keywords: *Begonia caramoanensis*, endemic, lithophyte, lower montane forest, Mt. Tangkulan Range, taxonomy

Introduction

Begonia L. (1753: 1056) with about 2110 species classified in 70 sections, is considered the sixth largest genus of angiosperms (Moonlight *et al.* 2018). In the Philippines, 160 species are recognized (Ang *et al.* 2022, Blasco *et al.* 2022, Dela Cruz *et al.* 2022, Delos Angeles *et al.* 2022, Hughes *et al.* 2015–, Mazo and Rubite 2022, Mazo *et al.* 2022 and Rubite *et al.* 2022), 79 of which are classified under *B.* sect. *Petermannia* (Klotzsch 1854: 124, de Candolle (1859: 128), 80 under *B.* sect. *Baryandra* A. de Candolle (1859: 122) and one under *B.* sect. *Platycentrum* (Klotzsch 1855: 243) de Candolle (1859: 134).

Botanists continue to explore the forest in Mindanao and discover species new to science and new records in the Philippines (Lagunday *et al.*, 2022, Coritico and Fleischmann, 2016, Coritico *et al.*, 2017, Amoroso *et al.*, 2020, Amoroso *et al.*, 2020). Recently, scientists from Central Mindanao University (CMU) and members of the Kulamanon-Manobo tribe conducted botanical exploration in the montane forest of Mt. Pinamantawan. This mountain, part of Mt. Tangkulan Range in Bukidnon on the island of Mindanao (Fig. 1), is considered botanically underexplored (Lagunday *et al.*, 2017; *et al.*, 2019). In one of the field trips, an interesting *Begonia* was found. The plant exhibits rhizomatous stems, axillary and cymose inflorescences, 4-tepaled male flowers that are basal and open first whereas the female flowers are distal, and a 3-locular ovary with bifid placentae. All these characters indicate a placement in sect. *Baryandra*. No record of *Begonia* sect. *Baryandra* exists from the province of Bukidnon. Further morphological studies based on the literature, herbarium specimens, and living plants confirmed that this plant is distinct from the 10 *Begonia* records of sect. *Baryandra* from Mindanao Island: *B. acuminatissima* Merr. (1911:395); *B. amparoae* Blasco,

Alejandro, Tandang & Rubite (2022:137); *B. anisoptera* Merr. (1911:398); *B. camiguinensis* Elmer (1915:2553); *B. copelandii* Merr. (1911:401); *B. elmeri* Merr. (1918:39); *B. longiscapa* Warb. (1904:52); *B. makuruyot* M.G.Rule, Y.P.Ang, Rubite, Docot, R.Bustam., & A.S.Rob. (2020:227); *B. mindorensis* Merr. (1911:396) and *B. nigritarum* (Kamel) Steud. (1821:104). Therefore, here we describe this plant as a species of *Begonia* new to science.

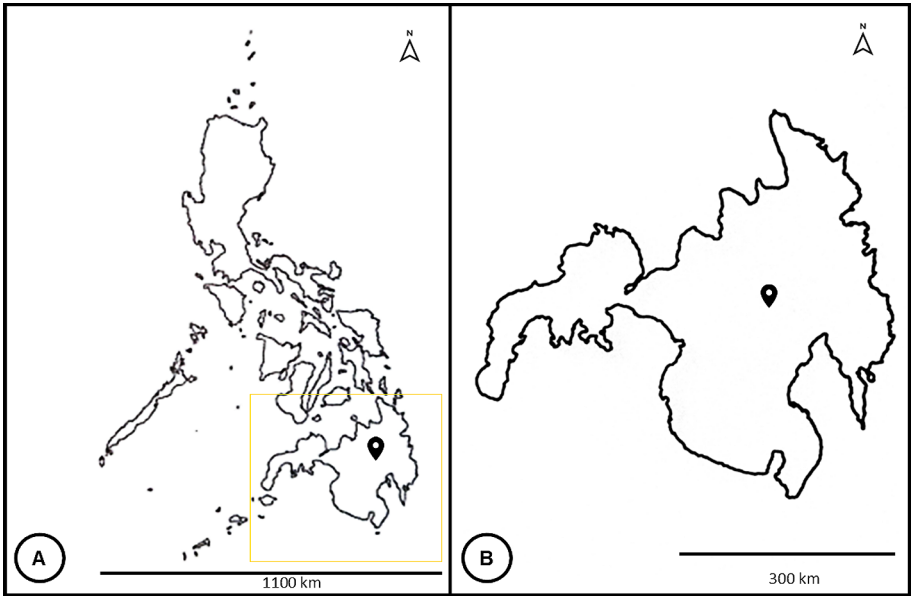


FIGURE 1. Distribution of *Begonia fritschiana*. A. Map of the Philippines; B. Mindanao Island showing the the type locality.

Materials and methods

Morphological examination was conducted with the *in situ* plants, herbarium specimens, and living plants in the V.B. Amoroso’s Garden. The new species was compared with *B. caramoanensis* Rubite, Irabagon, Palacio, Y.P.Ang, & R.Bustam. (2020:291), a similar species (Table 1).

TABLE 1. Comparison of the morphological characters of *Begonia fritschiana* and *B. caramoanensis*.

Characters	<i>Begonia fritschiana</i>	<i>Begonia caramoanensis</i>
rhizome color	light green	dark green to brown
rhizome length (cm)	3.5–5.4	4–16
stipules (mm)	8–10 × 3–5	7–19 × 5–14
arista (mm)	4–7	0
petiole	White non-glandular, 6-9 cm long	Tomentose, 12-26 cm long
lamina (cm)	5–6 × 4–5	8–11 × 8–12
lamina margin	Subentire	shallow undulate or subentire
lamina apex	mucronate	obliquely rounded to slightly acute
peduncle length (cm)	9–11	10–25
inflorescence branches	mostly solitary, rarely singly branched	dichotomously branched c.a. five times
inflorescence bract size (mm)	4–8 × 4–5, cuspidate	4–5 × 5–6, aristate
hairs of staminate flower	white	pinkish to green
outer tepals of staminate flower (mm)	9–11 × 6–9	7–9 × 7–8
outer tepal color of staminate flower	one outer tepal is pink, others white	uniformly pinkish
pedicel of pistillate flower (mm)	10–20	9–10
vestiture of pistillate flower	strictly white glandular hairs	white to green to brown glandular hairs
capsule size (mm)	13–15 × 10–15	6–12 × 14–22
capsule vestiture	Sparse on margins only	Dense throughout

Results and Discussion

Significant differences between *Begonia fritschiana* (Figs. 2 & 3) and *B. caramoanensis* were observed in the rhizome, stipule, petiole hirsuteness, lamina size, shape, margin and apex, inflorescence, vestiture of pedicel and capsule size (Table 1).

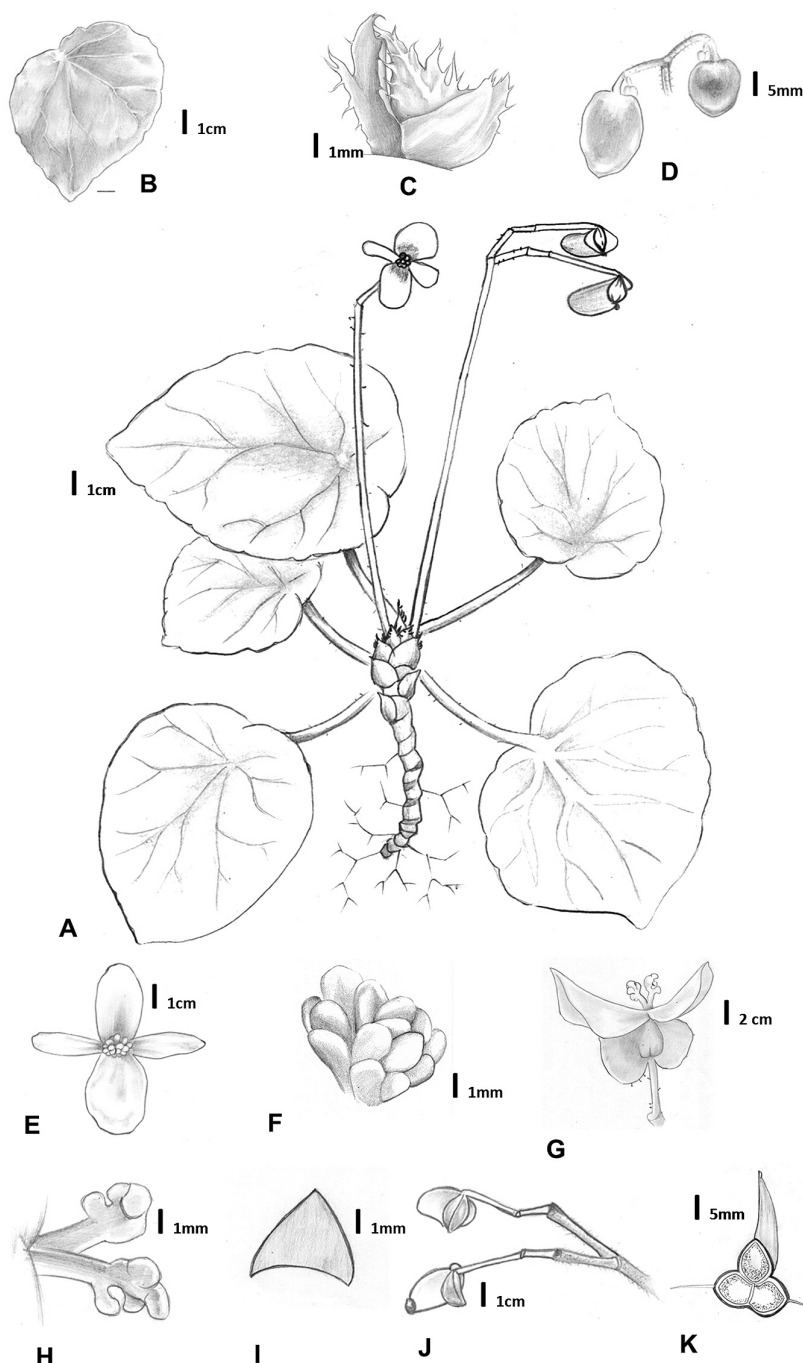


FIGURE 2. Illustration of *Begonia fritschiana*. A. Habitat; B. Lamina adaxial view; C. Stipules; D. Unopened staminate flower; E. Staminate flower; F. Stamens; G. Pistillate flower lateral view; H. Pistil; I. Bracts; J. Unopened staminate flower; K. Cross section of the ovary (Illustration by R.J. Lamparas based on V.B. Amoroso 31059)

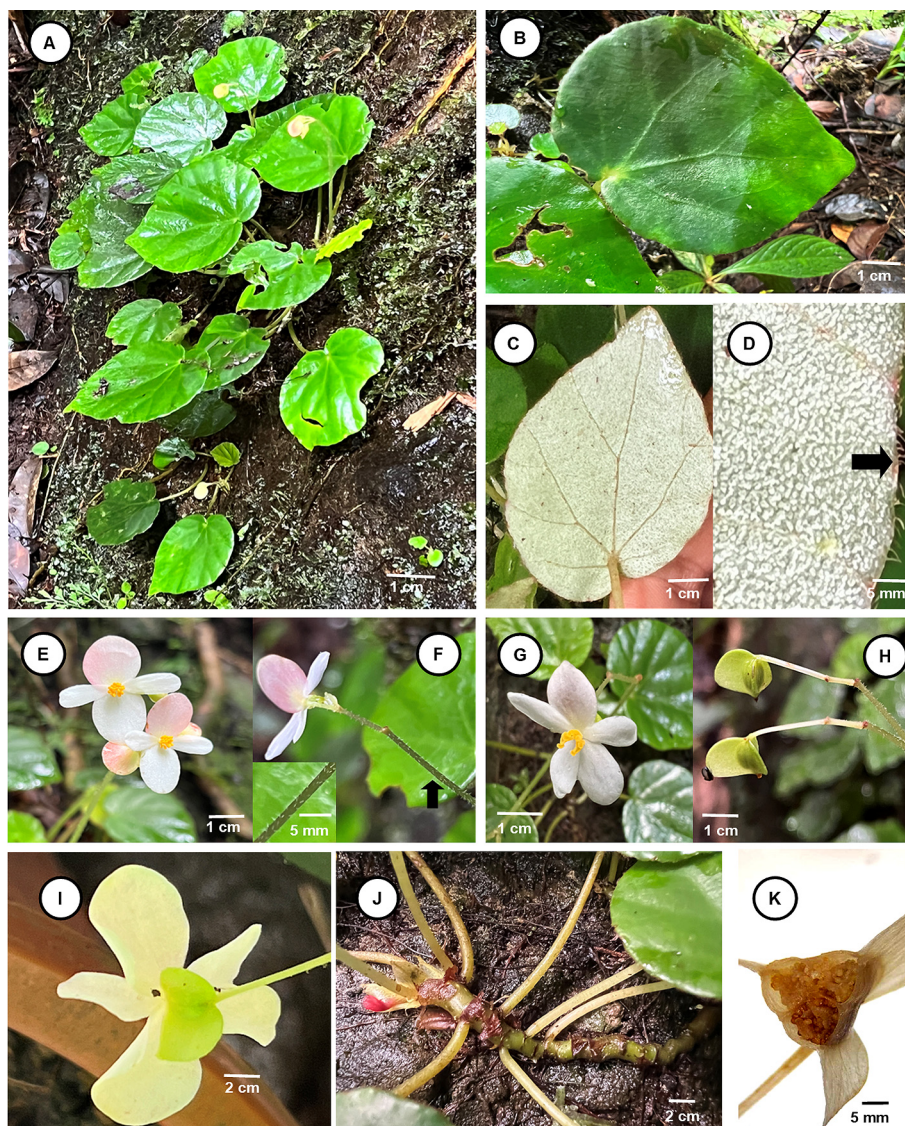


FIGURE 3. *Begonia fritschiana*. A. Habit; B. Leaf adaxial surface; C. Leaf abaxial surface; D. Close-up view of abaxial leaf surface with marginal hairs (arrow); E. Inflorescence; F. Staminate flower lateral view with hairy pedicel and peduncle (inset); G. Pistillate flower front view with 5 tepals; H. Mature fruits with hairy pedicels; I. Uniformly white tepals of pistillate flower with green glabrous capsule; J. Creeping rhizome with persistent stipules; K. Transverse section of ovary with unequal wings (All from V.B. Amoroso 31059)

Taxonomy

Begonia fritschiana Amoroso & Rubite, *sp. nov.* § *Baryandra* (Figs. 2–4)

Type:—PHILIPPINES: Mindanao, Sto. Domingo, Quezon, Bukidnon, Mt. Pinamantawan, 1112–1130 m, on mossy rocks in shaded forest, 28 August 2022, V.B. Amoroso 31059 (holotype PNH!, isotype CMUH!).

Diagnosis:—*Begonia fritschiana* resembles *B. caramoanensis* in having male flowers with 4 tepals and female flowers with 5 tepals, glandular hairy pedicels and peduncles, a capsule that is pendent, recurved with unequal wings, but differs by having leaves that are ovate (vs. almost orbicular), with a petiole that is 5–9 cm long (vs. 12–26 cm), and with the abaxial surface of the lamina glaucous with marginal hairs (vs. not glaucous and absent marginal hairs) solitary to singly-branched inflorescence (vs. dichotomously branched, 5 times), a peduncle and pedicels with white glandular hairs (vs. white to green and brown glandular hairs), one of the outer tepals dark pink abaxially (vs. uniformly pinkish), and a glabrous ovary (vs. with glandular hairs).

Herbaceous, lithophytic, rhizomatous, perennial, monoecious, creeping. **Rhizome** light green, sometimes covered with liverworts, ca. 3.5–5.4 cm × 0.4–0.5 cm, glabrous, internodes 5 mm long. Stipules persistent, symmetric, yellow

turning dark brown when mature, ovate, $20\text{--}22 \times 3\text{--}5$ mm, abaxially with white hairs, margin entire with long distantly placed hairs, apex aristate, arista 4, up to 7 mm long. Leaves alternate, petiolate; petioles erect, yellowish-green, terete, with dense non-glandular hairs, becoming glabrous; lamina basifixed, thick and fleshy, obliquely ovate, $5\text{--}6 \times 4\text{--}5$ cm, adaxially dark green, abaxially glaucous, glabrous, base cordate, lobes not overlapping, margin subentire with white marginal hairs, apex mucronate, venation palmate-pinnate, primary veins 5–6, not prominent adaxially. Inflorescence axillary, arising directly from rhizome, mostly solitary and rarely branching singly, erect, 16–23 cm long, peduncle light green, 15–19 cm long, with dense white glandular hairs up to pedicels. Bracts caducous, usually sheathing developing buds, light green, broadly ovate, $4\text{--}8 \times 4\text{--}5$ mm, glabrous, margin entire, apex cuspidate. Staminate flower: actinomorphic, dark red when young, broadly ovate, pedicel 10–15 mm long, glandular-hairy, hairs white and profuse, tepals $2 + 2$, one outer tepal dark pink abaxially and light pink adaxially, other tepals white, outer tepals orbicular, $9\text{--}11 \times 6\text{--}9$ mm, inner tepals narrowly lanceolate, $4\text{--}7 \times 3\text{--}5$ mm, stamens 14–21, filaments ca. 1 mm long, united at base, anthers yellow, obovate, apex rounded, ca. 1 mm long. Pistillate flower: ascending early then later recurving downward, pedicel white to light green, tepals $2 + 3$, outer pair white, obovate, $10\text{--}12 \times 7\text{--}8$ mm, 3 inner tepals white, asymmetrical, $10\text{--}12 \times 5\text{--}6$ mm. Ovary inferior, green, 13×15 mm (wings included), 3-locular, glabrous, placentae bifid; wings 3, unequally surrounding ovary, light green; styles 2, 2–4 mm long, stigmas ca. 3 on each style, yellow. Fruiting pedicel 19–25 mm long, light green, glabrous to sparsely glandular-hairy, unequal. Capsule recurved, $13\text{--}15 \times 10\text{--}15$ mm (wings included), base rounded to cordate, apex obtuse, abaxial wing 10×8 mm, angular, lateral wings 7×5 mm, angular.



FIGURE 4. Habitat of *B. fritschiana* (encircled) among boulders with a thin layer of soil, liverworts, and some other herbaceous plants.

Phenology:—Observed flowering and fruiting *in situ* on August 28, 2022 and ex-situ on 2 September 2022–6 February 2023.

Etymology:—This species is named in honor of Dr. Peter W. Fritsch, renowned botanist from the Botanical Research Institute of Texas and Fort Worth Botanic Garden, USA, for discovering novel species and in his unwavering support for and participation on botanical exploration and research in the Philippines.

Distribution and Ecology:—Endemic to the province of Bukidnon, Mindanao, Philippines. It grows in a narrow elevation range at ca. 1100 m on boulders with a thin layer of soil with liverworts and *Selaginella* spp. in the lower montane forest of Mt. Pinamantawan, Quezon, Bukidnon. Some planted abaca (*Musa textilis*) were observed among the boulders.

Proposed Conservation Status:—*Begonia fritschiana* is known only from the type locality, with one population and less than 100 individuals. The area is not currently protected under the country's National Integrated Protected Areas System by the Department of Environment and Natural Resources. Because of ongoing threats such as illegal logging, poaching, and over-collection of biological resources, the single area of occurrence with estimated extent of occurrence < 10 km², and the small number of individuals observed, we recommend a classification of *B. fritschiana* as Critically Endangered CR based on the criterion B1ab(i) of IUCN (2022).

Comparison to other similar species:—The species shares having glandular hairs on the peduncles with *B. droseriodes* but *B. fritschiana* differs in having a light green creeping rhizome (vs. crimson); long arista on the stipule (4–7 mm) (vs. 2 mm); petioles up to 9 cm long with white non-glandular hairs (vs. petioles up to 12 cm long with dense pale brown appressed sericeous hairs); lamina margin with white hairs (vs. lamina margin with puberulous red hairs); lamina apex mucronate (vs. obtuse to rounded); peduncle up to 11 cm long (vs. peduncle up to 19 cm long); inflorescence mostly solitary, rarely singly branched (vs. branched 2–3 times); and with one pink outer tepal of staminate flowers (vs. uniformly white).

Acknowledgements

We thank the National Research Council of the Philippines and U.S. National Science Foundation grants DEB-1754667 for funding this research; the Department of Environment and Natural Resources Region 10 for issuance of the Gratuitous Permit; and Earl Bryant P. Cordova, Kristana May Buenavista, Krishia Shelyn Blaire Guirigay, Catherine Gail Navacilla, Datu Rudy Panduma, Datu Alexander Dayon, Erinia G. Mailanyag and the teachers of the Sulads Comprehensive High School for the Lumads led by Mr. Solomon Olantao for logistical support.

References

- Amoroso, V.B., Coritico, F.P. & Fritsch, P.W. (2020) *Actinostachys minuta*, a new species of grass fern from Mindanao, Philippines. *PhytoKeys* 151: 59–66.
<https://doi.org/10.3897/phytokeys.151.53100>
- Ang, Y.P., Aumentado, J.A. & Magtoto L.M. (2022) *Begonia naemma* (sect. *Petermannia*), a new species from Nueva Ecija, Luzon Island, the Philippines. *Edinburgh Journal of Botany* 79, *Begonia* special issue, Article 390: 1–10.
<https://doi.org/10.24823/EJB.2022.390>
- Blasco, F.A., Alejandro, G.J., Tandang, D.N., Vales, M.B. & Rubite, R.R. (2022) *Begonia amparoi* (Begoniaceae, section *Baryandra*) a new species from Linungaw Twin Islands, Surigao del Sur, Mindanao, Philippines. *Phytotaxa* 549 (2): 136–140.
<https://doi.org/10.11646/phytotaxa.549.2.2>
- Coritico, F.P. & Fleischmann, A. (2016) The first record of the boreal bog species *Drosera rotundifolia* (Droseraceae) from the Philippines, and a key to the Philippine sundews. *Blumea* 61: 24–28.
<https://doi.org/10.3767/000651916X691330>
- Coritico, F.P., Amoroso, V.B. & Lehnert, M. (2017) New records, names, and combinations of scaly tree ferns (*Cyatheaceae*) in eastern Malesia. *Blumea* 62 (5): 92–96.
<https://doi.org/10.3767/blumea.2017.62.02.03>
- de Candolle, A. (1859) Meimorie sur la famille des Beigoniaceies. [ser. 4.] *Annales des Sciences Naturelles; Botanique* 11: 128–129.
- Dela Cruz, C.J.P., Concepcion S.R. & Ang Y.P. (2022) *Begonia francisabuidii*, (section *Baryandra*, Begoniaceae) a new species endemic

- to Albay, Luzon Island, Philippines. *Taiwania* 67 (2): 223–228.
<https://doi.org/10.6165/tai.2022.67.223>
- Delos Angeles M.D., Rubite R.R., Chung K.-F., Buot, Jr. I.E. & Tandang D.N. (2022) *Begonia normaaguilariae* (section *Baryandra*, Begoniaceae), a new species from the limestone forests of Samar Island, Philippines. *Phytotaxa* 541 (1): 49–56.
<https://doi.org/10.11646/phytotaxa.541.1.4>
- Elmer, A.D.E. (1915) Two Hundred Twenty Six New Species I. *Leaflets of Philippine Botany* 7: 2543–2700.
- Hughes, M., Moonlight, P.W., Jara-MunPoz, A., Tebbitt, M.C., Wilson, H.P. & Pullan, M. (2015–) *Begonia* Resource Centre. Online database available from [<http://padme.rbge.org.uk/begonia/>]
- IUCN Standards and Petitions Committee (2022) *Guidelines for Using the IUCN Red List Categories and Criteria. Version 15. Prepared by the Standards and Petitions Committee*. Available from: <https://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 5 February 2023)
- Klotzsch, J.F. (1854) *Begoniaceen-Gattungen und Arten. Monatsberichte der Königlich preussischen Akademie der Wissenschaften zu Berlin* 1854: 119–128.
- Klotzsch, J.F. (1855) *Begoniaceen-Gattungen und Arten. Abhandlungen der Könighchen Akademie der Wissenschaften zu Berlin* 1855: 121–25.
- Lagunday, N.E., Acma, F.M., Cabana, V.G., Sabas, N.M. & Amoroso, V.B. (2017) Two new *Nepenthes* species from the unexplored mountains of Central Mindanao, Philippines. *Philippine Journal of Science* 146 (2): 159–165.
- Lagunday N.E., Cabana, V.G., Armecein, H.C., Sabas, N.M., Escarlos, J.A. & Mohagan, A.B. (2019) Rodents and some non-rodent mammals of Mt. Tangkulan Range, Central Mindanao, Philippines. *Journal of Biodiversity and Environmental Sciences* 14 (1): 814–2019.
- Lagunday N.E., Dela Rosa S., Cleofei, C.M.B., Patanao, R. Jr., Coritico, F.P. & Amoroso, V.B. (2022) *Nepenthes candalaga* (Nepenthaceae), a new species from eastern Mindanao, Philippines. *Phytotaxa* 554 (3): 285–292.
<https://doi.org/10.11646/phytotaxa.554.3.7>
- Linnaeus, C. (1753) *Species plantarum*, vol. 1. Salvius, Stockholm, 1200 pp.
- Mazo, K.R.M. & Rubite, R.R. (2022) Two new species of *Begonia* (section *Petermannia*, Begoniaceae) from the Zamboanga Peninsula, Philippines and a redescription of *Begonia parvilimba*. *Phytotaxa* 538 (2): 163–171.
<https://doi.org/10.11646/phytotaxa.538.2.9>
- Mazo K.R.F., Salatan N.L., Santos I.E.A. & Rubite, R.R. (2022) Two new species of *Begonia* (section *Petermannia*, Begoniaceae) from Zamboanga Peninsula, Philippines with notes on an amended description of *B. elatostematoides*. *Taiwania* 67(3): 441–449.
<https://doi.org/10.6165/tai.2022.67.441>
- Merrill, E.D. (1912 [1911]) The Philippine species of *Begonia*. *Philippine Journal of Science, section C, Botany* 6: 369–406.
- Merrill, E.D. (1918) New or noteworthy Philippine plants. *The Philippine Journal of Science section C, Botany* 13: 1–66.
- Moonlight, P.W., Ardi, W.H., Padilla, L.A., Chung, K.-F., Fuller, D., Girmansyah, D., Hollands, R., Jara-MunPoz, A., Kiew, R., Leong, W.-C., Liu, Y., Mahardika, A., Marasinghe, L.D.K., O'Connor, M., Peng, C.-I., Peirez, A.J., Phutthai, T., Pullan, M., Rajbhandary, S., Reynel, C., Rubite, R.R., Sang, J., Scherberich, D., Shui, Y.-M., Tebbitt, M.C., Thomas, D.C., Wilson, H.P., Zaini, N.H. & Hughes, M. (2018) Dividing and conquering the fastest-growing genus: Towards a natural sectional classification of the mega-diverse genus *Begonia* (Begoniaceae). *Taxon* 67: 267–323.
<https://doi.org/10.12705/672.3>
- Rubite R.R., Ubaldo D.B.H., Salcedo J.C., Chung K.F., Evangelista L.T., Tandang D.N. & Hughes M. (2022) *Begonia hemicardia* (sect. *Petermannia*, Begoniaceae), a resurrected heterotypic synonym and *nomen nudum*. *Edinburgh Journal of Botany* 79, *Begonia* special issue, Article 403: 1–7.
<https://doi.org/10.24823/EJB.2022.403>
- Rubite, R.R., Irabagon, M.L., Palacio, D.J.E., Ang, Y.P. & Bustamante, R.A.A. (2020) *Begonia caramoanensis* (sect. *Baryandra*, Begoniaceae) a new species from Camarines Sur, Philippines. *Phytotaxa* 439 (3): 287–294.
<https://doi.org/10.11646/phytotaxa.439.3.10>
- Rule, M.G.Q., Ang, Y.P., Rubite, R.R., Docot, R.V.A., Bustamante, R.A.A. & Robinson, A.S. (2020) *Begonia makuruyot* (Begoniaceae section *Baryandra*), a new species from Surigao del Norte Province, Philippines. *Phytotaxa* 470: 226–234.
<https://doi.org/10.11646/phytotaxa.470.3.2>
- Steudel, E.G. von. (1821) *Nomenclator botanicus: enumerans ordine alphabetico nomina atque synonyma, tum generica tum specifica, et a linnaeo et recentioribus de re botanica scriptoribus plantis phanerogamis imposita*. Cottae, Stuttgartiae & Tubingae, 900 pp.
- Warburg, O. (1904) Begoniaceae. In: Perkins, J.R. (Ed.) *Fragmenta florum Philippinae: contributions to the flora of the Philippine Islands*. Leipzig, Germany, pp. 51–56.

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

- B. acuminatissima* Mindanao: Balut Island, 8 Oct 1906, *ED Merrill* 5419
B. amparoe Mindanao: Surigao del Sur, Linungaw Twin islands, 30 May 2013, *FA Blasco* 13-945
B. anisoptera Mindanao: Zamboanga del Sur, 10 October 1906, *ED Merrill* 5482
B. camiguinensis Mindanao: Camiguin Island, Mambajao November 1912 *A.D.E. Elmer* 14222
B. caramoanensis. Luzon: Camarines Sur, Caramoan, 2 November, 2018, *R. Rubite* 988.
B. copelandii Mindanao: Davao, Todaya, April 1904, *E.B. Copeland* 1255
B. elmeri Mindanao: Agusan, Mt. Urdaneta, *A.D.E. Elmer* 14183
B. longiscapa Mindanao: Davao, Mt. Apo, Aug 1908, *ADE Elmer* 11787
B. makuruyot Mindanao: Surigao del Norte, Claver, Sapa, 11 July 2019 *C.B.M. Domingo, R.V.A. Docot, and M.G.Q. Rule* SDN19-006
B. mindorensis Mindanao: Agusan, Mt. Urdaneta, Aug 1912 *ADE Elmer* 13575
B. nigritarum Mindanao: Zamboanga, 1838-1840, *Guillou*
B. fritschiana Mindanao: Bukidnon, Quezon, Mt. Pinamantawan, 28 August 2022, *VB Amoroso* 31059
B. fritschiana Mindanao: Bukidnon, Quezon, Mt. Pinamantawan, 12 December 2021, *Lagunday NE, Dapar MG, Lamparas, RJ, Rosales, R, Sabas, S.M., VGC* 419
B. fritschiana Mindanao: Amoroso's Garden cultivated plants on 2 September 2022- 6 February 2023