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A new species of *Pinalia* (Orchidaceae) with bell-shaped flowers from the mossy forest of southern Mindanao, Philippines

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Abstract

We present the first orchid species described from the Mount Busa Key Biodiversity Area (KBA 196) in southern Mindanao, Philippines. The new species was discovered growing on moss-covered tree trunks in the upper montane forest. It is primarily distinguished among the genus *Pinalia* by its very short inflorescence that bears few, closely spaced and relatively large campanulate flowers with trilobed, weakly keeled labellum and a dentate callus on disc. The discovery of this species brings the total number of *Pinalia* in the Philippines to 39. More importantly, it highlights the need for more field-based research on the flora of southern Mindanao to alleviate knowledge shortfalls that continue to limit our understanding of the region's biodiversity.

Key words: Allah Valley Protected Landscape, Philippine biodiversity, Orchids, Malesia, Mount Busa

Introduction

The complex geological history of insular Southeast Asia contributed to the rapid diversification of orchid flora within the Indo-Malayan region (Givnish *et al.* 2016). In the Philippines, Orchidaceae is the most speciose plant family with about 1,330 species from 155 genera, of which ca. 63% are country endemic (Pelser *et al.* 2011 onwards). This estimate is expected to increase with more fieldwork, especially in the least botanically explored regions in the country, including southern Mindanao. Preliminary work on the orchid flora of this region showed potential for further scientific study, as evinced by several species discoveries awaiting taxonomic work (Saavedra & Pitogo 2021). Thus, we have continued documenting the orchid flora of the Mount Busa Key Biodiversity Area (KBA 196), which hosts one of the last remaining primary forests in southern Mindanao, to help ameliorate this knowledge shortfall that limits our understanding of Philippine plant diversity. Our ongoing efforts have uncovered a new species of orchid from the genus *Pinalia* Lindl that we described herein.

The genus *Pinalia* was formerly under the broadly defined *Eria* until phylogenetic studies determined its placement and recognized it at the generic rank (Pridgeon *et al.* 2005). It is now the most speciose genus in the subtribe Eriinae, comprising about 178 accepted species from tropical and subtropical Asia to the southwest Pacific, with its center of diversity in Indonesia (O'Byrne *et al.* 2018; POWO 2022). The Philippines harbors 38 species with confirmed occurrences, 84.2% of which are found nowhere else in the world (Pelser *et al.* 2011 onwards).

The genus is morphologically closely related to *Bryobium* Lindl. Although both are not sister groups, the characters that distinguish between these genera are not direct and clear (see Ng *et al.* 2018). *Pinalia* is generally characterized by having ovoid to slender pseudobulbs bearing two to six linear-lanceolate leaves at or near the apex, small to medium-sized flowers (sepals 1.5–12.0 mm long) of various colors, lateral sepals broad ventrally to form a mentum with the column foot, the labellum usually adorned with keels and calli of various forms and sizes, and column bearing 8 pollinia (Chen *et al.* 2009; Ormerod & Kurzweil 2020; Teoh 2021).

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During our regular biodiversity monitoring in the mossy forest (upper montane forest) of the Busa Mountain Range (BMR) in Lake Sebu in South Cotabato Province, we found an unidentified *Pinalia* species with distinctive bell-shaped flowers growing on a moss-covered tree trunk. Upon detailed examination of its vegetative features and comparison with closely related species, we concluded that it is a species not currently known to science. Therefore, we take this opportunity to describe and illustrate herein a new species of *Pinalia* from southern Mindanao, which further highlights the region's understudied plant diversity. This discovery brings the total number of confirmed *Pinalia* species in the Philippines to 39.

Materials and Methods

The KBA 196 is an extremely high conservation priority site in the southern Mindanao region, comprised of the Busa Mountain Range and Mount Melibengoy (Ong *et al.* 2002; Saavedra & Pitogo 2021). The BMR straddles the provinces of South Cotabato and Sarangani. The northern slope of the BMR and portions of Mt. Melibengoy are within the Allah Valley Protected Landscape (AVPL), an initial component of the National Integrated Protected Areas System (NIPAS) in the Philippines. Our comprehensive inventory of orchid flora in the KBA 196 since 2019 resulted in the identification of more than 200 species, of which several species are putatively new to science. Among these is this unique *Pinalia* described in this paper.

This new species was first observed flowering in August 2021 on the northern slope of the BMR in Lake Sebu and in April 2022 on the southern slope near Kiamba, Sarangani (Figure 1). During our recent fieldwork in Lake Sebu, fresh materials were closely examined, dried, and pressed as vouchered specimens for further examination of floral morphology. The collection was covered by the Gratuitous Permit No. RXII-2022-13 issued by the Department of Environment and Natural Resources (DENR) RXII. Also, the Protected Area Management Board of AVPL issued Resolution No. 35 Series of 2021 further supporting our extensive floristics study in the protected area.

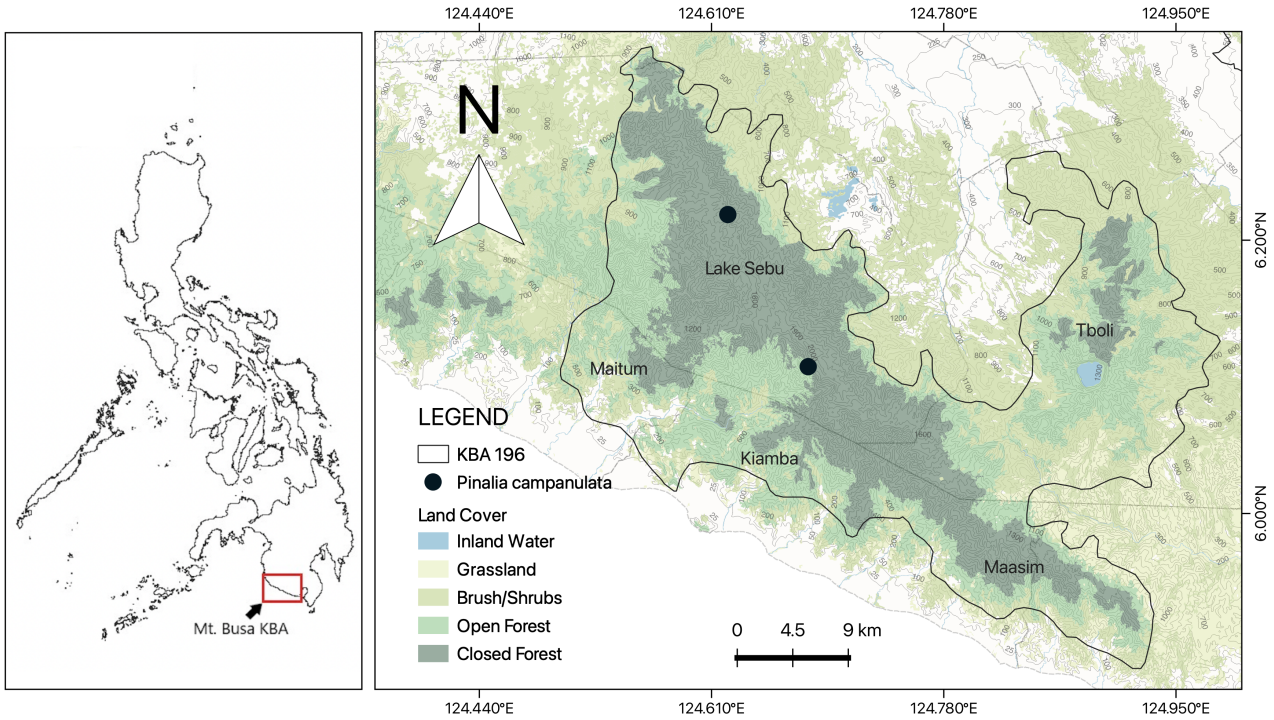

FIGURE 1. Land cover map showing the known occurrences of *Pinalia campanulata* Saavedra & Pitogo in the Mt. Busa Key Biodiversity Area (KBA 196) in Southern Mindanao, Philippines.

This new species is described following the terminologies from the Kew Plant Glossary (Beentje 2016). Descriptive features were based on close examinations of the species *in situ,* voucher specimens, and high-resolution images of the flower's macromorphological features taken by a digital camera (Canon EOS 850D, 100 mm macro lens). Important floral and vegetative measurements were taken from freshly collected materials using a digital caliper (Mitutoyo 500-

196-30, Japan) and supplemented by measurements from images using the ImageJ Software (Rueden *et al.* 2017). The collected materials were also compared with digitized specimens in different herbaria through high-resolution images accessed at the Global Biodiversity Information Facility (gbif.org). Herbarium acronyms follow Thiers (2022). The elevations at which the species were observed were determined using a Global Positioning System (Garmin 64s, USA). Lastly, the provisional conservation status of this new species is proposed following the IUCN Red List Categories and Criteria Version 3.1 (IUCN 2012).

Taxonomic Treatment

***Pinalia campanulata* Saavedra & Pitogo *sp. nov.* (Figures 2 & 3)**

Type:—PHILIPPINES. Mindanao island: South Cotabato Province, Municipality of Lake Sebu, Allah Valley Protected Landscape, 1720 m elevation, 6.2179° N 124.6235°E, 19 August 2022. *AJ Saavedra AJS 0001* (Holotype: PNH!)

Diagnosis:—The new species is related to *Pinalia polyura* (Lindl.) Kuntze in Ames (1905: 95) but with a much shorter inflorescence (1–4 vs. 10–14 cm) bearing fewer flowers (10–18 vs. up to 40), oblong-elliptic sepals and petals (vs. ovate- to triangular-lanceolate lateral sepals and cordate petals), trilobed labellum (*vs.* unlobed) that is weakly keeled (vs. bicarinate) and having a deltate callus on disc (vs. purple tubercle). The new species is also distinguished by its prominently campanulate flowers.

Description:—Epiphytic, semi-pendulous herb up to 50 cm long. *Pseudobulbs* branching, laterally flattened, 50–60 mm long, 11.4 mm wide above the middle, fleshy, partly covered with appressed sheaths up to 25 mm long, bearing 2–3 leaves. *Roots* long, slender, to 0.5 mm thick. *Stems* terete, covered with laxly spaced sheaths up to 20 mm long, internodes 40–70 mm long, getting longer distally. *Leaves* lanceolate, apex obliquely acute or subacute, glabrous, entire, 7–10 × 2.5–3 cm. *Inflorescence* 1 or 2, lateral near or at the apex of the pseudobulb, raceme, glabrescent, 10–40 mm long, dense bearing 10–18 closely-spaced flowers, peduncle 3–9 mm long; floral bracts ovate, acute, reflexed, 3.8 × 3.1 mm, greenish cream; *Ovary with pedicel* terete, glabrous, 3.4 mm long; *Flowers* resupinate, campanulate, not widely open, glabrous, crystal white, 6.8 mm long, labellum white with a shade of burgundy in basal half. *Sepals* oblong-elliptic, apex obtuse, 3-veined. *Dorsal sepal* 5–5.3 mm long, 2.4 mm wide. *Lateral sepals* 5–6 mm long, 2.6–2.7 mm wide, mentum less prominent. *Petals* oblong, subacute, 3-veined, 6–6.2 mm long, 2–2.1 mm wide. *Labellum* slightly decurved, trilobed, 4 mm long, 3 mm wide between the apices of lateral lobes when flattened, single fleshy dentate callus on the disc, weakly keeled; lateral lobes prominent, erect, curving inwards to partly embrace column, ovate, rounded, outer margin slightly sinuate; mid-lobe porrect, 1.2 m wide, ovate, apex acute, margins erose. *Column* terete, partly curved, up to 2.1 mm long, burgundy; column foot 1.1 mm long, pale pink, with a burgundy warty protrusion at the base. *Anther* orbicular in front. *Pollinia* 8, obovoid, yellow, very small.

Distribution:—Philippines. Provinces of Sarangani and South Cotabato (Allah Valley Protected Landscape), southern Mindanao.

Habitat and Ecology:—*Pinalia campanulata* is known only from the mossy forest of the Busa Mountain Range between 1,550 and 1,750 m elevation in southern Mindanao. This small epiphytic herb often grows on moss-covered tree trunks at about 1.5–2.5 m above the forest floor, lower than most congeners growing in the area. During our three-year extensive fieldwork, only five (5) individuals were recorded on the northern slope in South Cotabato (within the AVPL) and only one (1) individual on the southern slope in Sarangani. The flowers are often visited by leaf beetles (*Chrysomelidae*), which may be potential pollinators or predators of this new species.

Phenology:—Plants were observed flowering in April and August–September.

Etymology:—The specific epithet, campanulata, is reminiscent of the prominently bell-shaped flowers of this species that do not open widely. To our knowledge, the shape of *P. campanulata* flowers is quite unique among *Pinalia* species.

Conservation Status:—*Pinalia campanulata* is known only at two (2) sites in the Busa mountain range and is restricted so far to higher elevations (> 1,500 meters) despite our continued, extensive orchid surveys within the KBA 196 and neighboring Mount Matutum since 2019. Its habitat in Lake Sebu is within the AVPL, an initial component of the NIPAS and legally protected under the Philippine Republic Act No. 11038. However, legal protection of its habitat does not guarantee protection from the illicit collection of wild orchid populations, which have been documented within the mountain range (Saavedra & Pitogo 2021; DENR 2022). Besides, the IUCN (2012) clearly states that the criteria are to be applied regardless of the level of conservation action done for the species. Since epiphytic

orchids less likely exhibit microendemism in Philippine mountains, we expect new records of this species will likely come out from the relatively intact and unsurveyed montane forests of the neighboring mountain ranges of Kidapong, Daguma, Malibato, and Tampakan Highlands (ca. >20,000 km^2). In view of this information, we proposed to have *P. campanulata* provisionally classified as Near Threatened following the IUCN Categories and Criteria version 3.1 (IUCN, 2012) until more empirical field data is available.

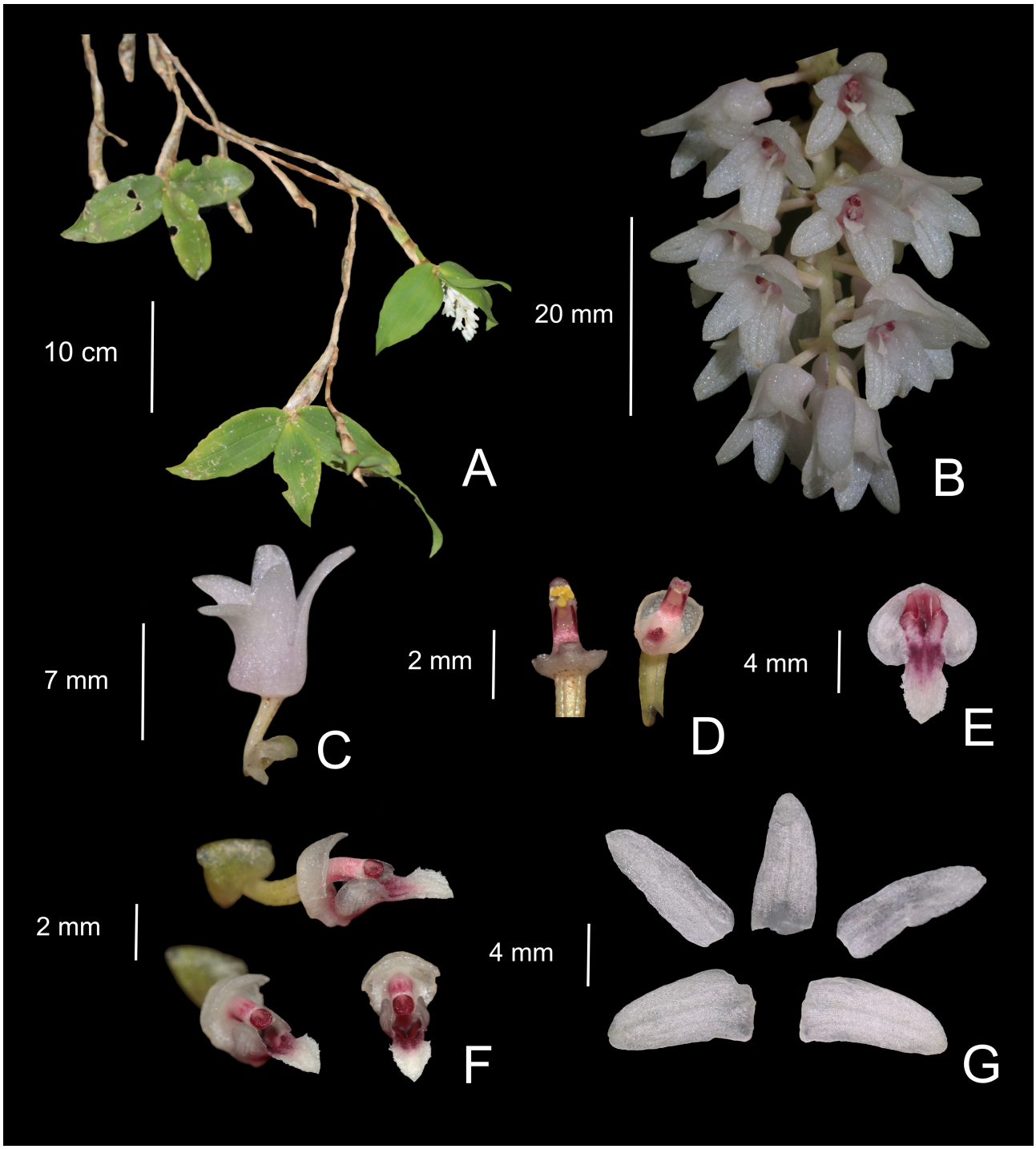

FIGURE 2. Colored photos of *Pinalia campanulata* Saavedra & Pitogo. A. Flowering plant. B. Inflorescence. C. Lateral view of the flower showing its campanulate shape. D. Column (with the pollinia, left). E. Labellum (flattened). F. Labellum with column (natural form). G. petals and sepals.

Discussion:—We assign *P. campanulata* to the section *Polyura* for having branching pseudobulbs and a shorter labellum than sepals, which is adorned with a dentate fleshy callus (Ormerod *et al.* 2019). The new species superficially resembles the flowers of *P. polyura* but differs in many floral aspects, most notably the floral measurements and shape of the labellum. This new species is distinguished among the Philippine species of *Pinalia* sect. *Polyura* by its relatively

much shorter inflorescence (1–4 cm vs. 3–17 cm in other species), larger flowers relative to inflorescence length (petal length/inflorescence length 0.15 vs. 0.01–0.11), and trilobed labellum with prominent lateral lobes that partly embrace the column. Floral measurements closely approach *P. tomentosiflora* Hayata (1912:137) but *P. campanulata* is easily distinguished by its glabrescent inflorescence and outside surface of sepals (vs. tomentose) and longer lip (3.8 mm vs. 2.5 mm) with a single deltoid callus on disc (vs. four linear discs). This new species is also distinguished by its prominently campanulate flowers.

Our discovery of *P. campanulata* underpins the importance of continuously doing field-based research in southern Mindanao. It is among the least biologically explored regions in the Philippines, owing to logistical difficulty, security issues, and bureaucracy that impede fieldwork in the area (Pitogo & Saavedra 2021). These challenges are exacerbated by the general lack of expertise (e.g., field biologists, biodiversity scientists, and taxonomists) in the region. Despite these limitations, recent botanical studies in southern Mindanao have shown significant levels of diversity that need immediate scientific and conservation attention (Saavedra & Pitogo 2021; Obemio 2022). Thus, we recommend more extensive surveys in the mountains/mountain ranges of Busa, Malibato, Daguma, Kidapong, Matutum, Tampakan Highlands, and Latian to address the knowledge shortfalls that limit our understanding of southern Mindanao's biodiversity.

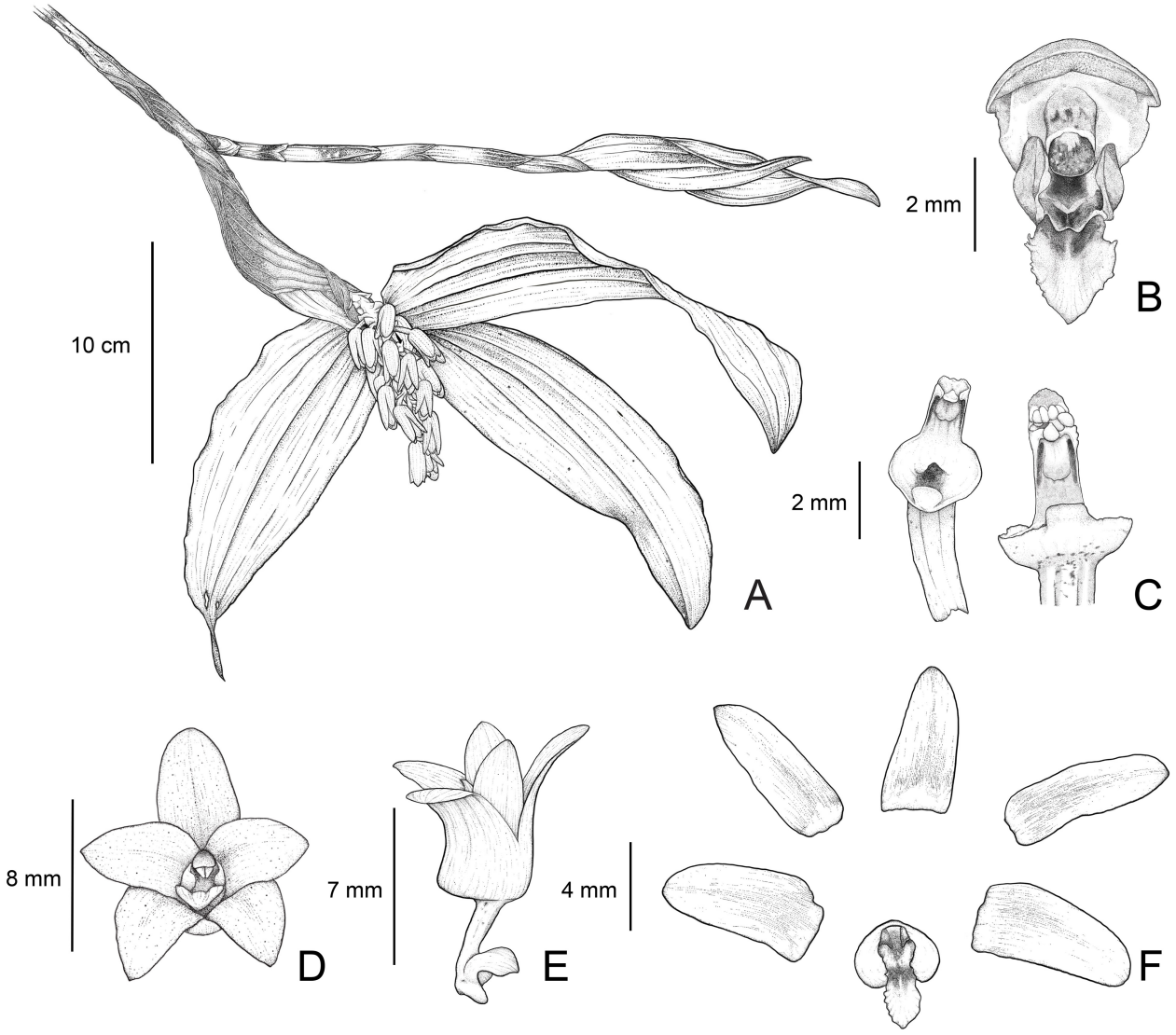

FIGURE 3. *Pinalia campanulata* Saavedra & Pitogo. A. Underside view of a flowering plant. B. Top view of labellum. C. Column (with the pollinia, left). D. Front view of flower. E. Lateral view of flower. F. Petals, sepals, and labellum (flattened). Illustrated by Larie Dianco.

Acknowledgments

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References

Ames, O. (1905) *Orchidaceae: illustrations and studies of the family Orchidaceae: Vol. fasc.1*. Boston, Houghton, Mifflin, 1905-22. Available from: https://www.biodiversitylibrary.org/item/52843 (accessed: 25 August 2022).

Beentje, H. (2016) *The Kew Plant Glossary: an illustrated dictionary of plant terms (2nd edition)*. Kew, Richmond: Kew Publishing, Royal Botanic Gardens, 184 pp.

DENR [Department of Environment and Natural Resources] (2022) *Biodiversity Monitoring System Annual Accomplishment Report for CY 2021.* Protected Area Management Office - Allah Valley Protected Landscape, DENR-PENRO South Cotabato. 31 pp.

Givnish, T.J., Spalink, D., Ames, M., Lyon, S.P., Hunter, S.J., Zuluaga, A., Doucette, A., Caro, G.G., McDaniel, J., Clements, M.A., Arroyo, M.T.K., Endara, L., Kriebel, R., Williams, N.H. & Cameron, K.M. (2016) Orchid historical biogeography, diversification, Antarctica and the paradox of orchid dispersal. *Journal of Biogeography* 43 (10): 1905–1916. https://doi.org/10.1111/jbi.12854

Hayata, B. (1912) *Icones plantarum formosanarum nec non et contributiones ad floram formosanam: or, Icones of the plants of Formosa, and materials for a flora of the island, based on a study of the collections of the Botanical survey of the Government of Formosa. Vol. 2.* Taihoku Bureau of Productive Industry, Government of Formosa 1911–1921. https://doi.org/10.5962/bhl.title.18786

IUCN [International Union for Conservation of Nature] (2012) *IUCN Red List Categories and Criteria: Version 3.1 (2nd edition)*. IUCN, Gland, Switzerland and Cambridge, United Kingdom, 32 pp.

Ng, Y.P., Schuiteman, A., Pedersen, H.Æ., Petersen, G., Watthana, S., Seberg, O., Pridgeon, A.M., Cribb, P.J. & Chase, M.W. (2018) Phylogenetics and systematics of *Eria* and related genera (Orchidaceae: Podochileae). *Botanical Journal of the Linnean Society* 186 (2): 179–201. https://doi.org/10.1093/botlinnean/box088

Ong, P.S., Afuang, L.E. & Rosell-Ambal, R.G. (2002) *Philippine Biodiversity Conservation Priorities: A Second Iteration of the National Biodiversity Strategy and Action Plan*. Quezon City, Philippines: Department of Environment and Natural Resources-Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program-University of the Philippines Center for Integrative and Development Studies, and Foundation for the Philippine Environment, 113 pp.

Ormerod, P. & Kurzweil, H. (2020) *Pinalia taunggyiensis* (Orchidaceae), a New Species from Myanmar. *Harvard Papers in Botany* 25 (1): 123–124. https://doi.org/10.3100/hpib.v25iss1.2020.n15

Pelser, P.B., Barcelona, J.F. & Nickrent, D.L. (2011 onwards) Co's Digital Flora of the Philippines. Available from: http://www.philippineplants.org (Accessed 25 Aug. 2022)

Pitogo, K.M. & Saavedra, A.J.L. (2021) Rediscovery of Guttman's Stream Frog, *Pulchrana guttmani* (Brown, 2015) from the mountains of southern Mindanao, Philippines. *Herpetology Notes* 14: 163–167.

POWO [Plants of the World Online] (2022) Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet. Available from: http://www.plantsoftheworldonline.org/ (Accessed 28 Aug. 2022)

Pridgeon, A.M., Cribb, P., Chase, M.W. & Rasmussen, F.N. (Eds.) (2005) *Genera Orchidacearum. Volume 4: Epidendroideae (Part one).* Oxford University Press, Oxford, UK. https://doi.org/10.1093/oso/9780198507123.001.0001

Saavedra, A.J.L. & Pitogo, K.M.E. (2021) Richness and distribution of orchids (Orchidaceae) in the forests of Mount Busa, Sarangani, Southern Mindanao, Philippines. *Philippine Journal of Science* 150 (S1): 151–163. https://doi.org/10.56899/150.S1.10

Teoh, E.S. (2021) *Pinalia* Lindl. *In: Orchid Species from Himalaya and Southeast Asia Vol. 2 (G-P)*. Springer, Cham. pp. 311–321. https://doi.org/10.1007/978-3-030-80428-2_35

Chen, X., Luo, Y-B. & Wood, J.J. (2009) *Pinalia* Lindl. *In:* Wu, Z.-Y & P.H. Raven, (Eds.) *Flora of China. Vol. 25.* Science Press, Beijing and Missouri Botanical Garden Press, St. Louis, pp. 352–357.

O'Byrne, P., Teck, O.P., Gokusing, L. (2018) *Pinalia* in Malesia: Two New Species and Some Allies. *Malesian Orchid Journal* 21: 5–29.

Obemio, C.D.G. (2022) *Floristics and dynamics of Pteridophytes in Mount Matutum Protected Landscape (MMPL), South Central Mindanao, Philippines.* Unpublished M.Sc. Thesis, University of the Philippines Los Baños.

Thiers, B. (2022) Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Available from: http://sweetgum.nybg.org/science/ih/ (Accessed on 28 Aug 2022)

Ormerod, P., Naive, M.A. & Cootes, J. (2019) Notes on Some Malesian Orchidaceae. *Harvard Papers in Botany* 24 (2): 281–290. https://doi.org/10.3100/hpib.v24iss2.2019.n15

Rueden, C.T., Schindelin, J., Hiner, M.C., DeZonia, B.E., Walter, A.E., Arena, E.T. & Eliceiri, K.W. (2017) ImageJ2: ImageJ for the next generation of scientific image data. *BMC Bioinformatics* 18 (1): 1–26. https://doi.org/10.1186/s12859-017-1934-z

APPENDIX 1. Herbarium specimens examined for morphological analysis.

Pinalia polyura Lindl. PHILIPPINES. Luzon island: Mariveles (Mt. Mariveles), Bataan Province. 1 January 1904, *E.D. Merrill 3733* (AMES 6005!). Visayas: Magallanes (Mt. Giting-giting), Capiz province. May 1910, *A.D.E. Elmer 12502* (AMES 12880!).

Pinalia campanulata Saavedra & Pitogo. PHILIPPINES. Mindanao island: South Cotabato Province, Municipality of Lake Sebu, Allah Valley Protected Landscape, 1720 m elevation, 6.2179° N 124.6235°E, 19 August 2022. *AJ Saavedra AJS 0002* (Isotype PNH!)

Pinalia campanulata Saavedra & Pitogo. PHILIPPINES. Mindanao island: South Cotabato Province, Municipality of Lake Sebu, Allah Valley Protected Landscape, 1720 m elevation, 6.2179° N 124.6235°E, 19 August 2022. *AJ Saavedra AJS 0003* (Isotype CEBU!)

Pinalia campanulata Saavedra & Pitogo. PHILIPPINES. Mindanao island: South Cotabato Province, Municipality of Lake Sebu, Allah Valley Protected Landscape, 1720 m elevation, 6.2179° N 124.6235°E, 19 August 2022. *AJ Saavedra AJS 0004* (Isotype CEBU!)