EDINBURGH JOURNAL OF BOTANY 81, Article 2027: 1–19 (2024). https://doi.org/10.24823/EJB.2024.2027

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

TWO NEW SPECIES OF *SYZYGIUM* (MYRTACEAE) FROM ULTRAMAFIC SOILS IN NORTHEASTERN MINDANAO, PHILIPPINES, WITH NOTES ON THREE OTHER RARE SPECIES

E. S. Fernando [1,2,3]*, M. O. Quimado [1] & J. A. Mansibang [3]

Two new species of *Syzygium* (Myrtaceae), *S. omissum* Mansibang & Fernando and *S. parvipomum* Fernando & Mansibang from the ultramafic forests of Surigao del Norte, Mindanao Island, Philippines, are formally described. The subgeneric placement of the species is discussed, and an identification key for species of the subgenus *Perikion* with an axillary to ramiflorous inflorescence is presented. Notes on three 'lost' *Syzygium* species, namely *S. filipes* Merr., *S. siderocolum* (Merr.) Merr. and *S. surigaense* (Merr.) Merr., are provided, and lectotypes are assigned for *Eugenia siderocola* (basionym of *S. siderocolum*) and *E. surigaensis* (basionym of *S. surigaense*).

Keywords. Malesia, *Perikion*, taxonomy, ultramafic.
Received 1 February 2024 Accepted 14 August 2024 Published 26 November 2024

Introduction

The genus *Syzygium* P.Browne ex Gaertn. (Myrtaceae) is the world's most species-rich genus of trees (Low *et al.*, 2022), having 1236 currently recognised species (POWO, 2024). In the Philippines there are 194 native species, of which 149 are endemic (Pelser *et al.*, 2011 onwards). *Syzygium* is the third largest genus among Philippine angiosperms, after *Hoya* R.Br. (Apocynaceae) and *Bulbophyllum* Thouars (Orchidaceae), which have 204 and 209 species, respectively (Pelser *et al.*, 2011 onwards). Earlier studies attempted to circumscribe *Acmena* DC. (Merrill & Perry, 1938a) and *Cleistocalyx* Blume (Merrill & Perry, 1937) as genera separate from *Syzygium*. However, the phylogenetic work of Craven & Biffin (2010) led them to propose six subgenera that subsumed *Acmena* and *Cleistocalyx* back into *Syzygium*. Useful morphological characters used in this subgeneric classification are the orientation of the main inflorescence axis, perianth persistence, presence or absence of fibre bundles in the hypanthium, anther sac shape, placentation, ovule orientation, and cotyledon characters. *Syzygium* subg. *Perikion* (*sensu* Craven & Biffin, 2010), in which our new species is placed, has fibre bundles in the hypanthium.

[1] Department of Forest Biological Sciences, College of Forestry and Natural Resources, The University of the Philippines – Los Baños, College, 4031 Laguna, Philippines.
[2] Forestry Herbarium, Museum of Natural History, The University of the Philippines – Los Baños, College, 4031 Laguna, Philippines.
[3] Institute of Biology, College of Science, The University of the Philippines – Diliman, 1101 Quezon City, Philippines.
* Author for correspondence. E-mail: esfernando@up.edu.ph.

The vegetation found on ultramafic soils is unique and has high levels of plant endemism (Galey *et al.*, 2017). These soils are generally nutrient-deficient, with high concentrations of heavy metals. In the Philippines, ultramafic areas occur in at least six ophiolite belts, based on geographical distribution (Balce *et al.*, 1976), or four based on age and geochemical data (Tamayo *et al.*, 2004), or age and lithospheric sources (Yumul, 2007; Yumul *et al.*, 2008). Many areas along these ophiolite belts contain nickel and other mineral deposits (Yumul *et al.*, 2003).

Ecologically, most *Syzygium* species are woody shrubs or small to large trees, some reaching the forest canopy. The genus occurs in various habitats, from coastal areas to lowland evergreen to upper montane rain forests, growing on limestone, peatland and ultramafic soils. Brambach *et al.* (2020) has shown that during the great floristic interchange in the Malesian region, arborescent lineages, including Myrtaceae, migrated from Australia and then colonised areas of high elevation and ultramafic sites.

Field surveys of the plant diversity in several ultramafic sites in the Philippines have revealed new species of Apocynaceae (Fernando & Rodda, 2013), Ericaceae (Tamayo *et al.*, 2023), Melastomataceae (Fernando *et al.*, 2018) and Myrtaceae (Fernando & Wilson, 2021), with several other species recognised as nickel hyperaccumulators (Fernando *et al.*, 2014; Quimado *et al.*, 2015; Fernando *et al.*, 2020). In the present paper, two new species of *Syzygium* are described and notes on three rare, previously described *Syzygium* species from this same area provided. Additionally, lectotypes for *Eugenia siderocola* Merr. (basionym of *Syzygium siderocolum* (Merr.) Merr.) and *E. surigaensis* Merr. (basionym of *S. surigaense* (Merr.) Merr.) are designated.

Materials and methods

The new species of *Syzygium* described here were discovered while carrying out field surveys of the ultramafic flora of Surigao del Norte, Mindanao Island, Philippines. Photographs were taken and voucher herbarium specimens collected. The morphological descriptions of the species are based on vegetative and reproductive characters from herbarium specimens, unless otherwise indicated. Field characters and the ecology of the species were recorded on site; species descriptions were supplemented with observations from fresh field material and from material preserved in 70% ethanol. To characterise the seedlings, seeds were sown either in a commercial mixture of garden soil, carbonised rice husk and compost, or in ultramafic soil from the type locality. Morphological terminology used in the descriptions follows Beentje (2016).

In the process of diagnosis, the key from the Philippine revision of Myrtaceae by Robinson (1909) was used and supplemented with a thorough review of protologues and papers relevant to Philippine *Syzygium* species (i.e. Elmer, 1912, 1914; Merrill, 1915; Merrill & Perry, 1938a, 1939; Merrill, 1950; Pelser *et al.*, 2021; Mansibang *et al.*, 2024). Taxonomic treatments, including keys, from adjacent regions, namely Australia, China, Indochina,

Indonesia and Malaysian Borneo–Brunei Darrusalam (Merrill & Perry, 1938b, 1938c, 1938d; Hyland, 1983; Ashton, 2006; Chen & Craven, 2007; Ashton, 2011; Soh & Parnell, 2015; Brambach *et al.*, 2017) were also consulted.

All morphological measurements were made using digital calipers and a calibrated eyepiece under a dissecting microscope (Olympus SZ51; Olympus, Tokyo, Japan). Herbarium specimens from CAHUP, LBC, PNH and PUH were examined, and images of type specimens of Philippine *Syzygium* available online from A, BISH, BO, E, GH, K, L, LY, MICH, NY, P, U, US and V were consulted (see **Appendix**) (herbarium codes follow Thiers, continuously updated). In the process of lectotypification, a syntype was chosen that was in the best condition and had intact diagnostic characters. All photographs, except where indicated, were taken in the field in the natural habitat of the species.

Species descriptions

Syzygium omissum Mansibang & Fernando, **sp. nov.**

This species is most similar to the Bornean species *Syzygium silamense* P.S.Ashton in its nearly sessile leaves with cordate base, ovate-oblong lamina and terminal inflorescence. However, *Syzygium omissum* differs in its consistently shorter stature 3–5 m (vs taller, c.10 m), rigidly coriaceous leaf texture (vs membranous), petiole and midrib deep black (vs petiole dark olive brown, midrib paler olive brown), epunctulate leaf surface (vs adaxially pitted, abaxially minutely punctulate), hypanthium black (vs dark olive brown), distal hypanthium limb 1.8–3.0 mm (vs c.5 mm), hypanthium limb ovary-to-length ratio 1:1 (vs 2–3:1), and fruit style not persistent or c.2 mm (vs 4 mm). *Syzygium omissum* is also similar to the Philippine species *S. bernardoi* (Merr.) Merr.; however, it differs by having distinctly 4-winged young twigs and inflorescence axes (vs terete-sulcate); leaf apex bluntly obtuse to rounded (vs acuminate); fruits 7–8(–9) × 6–8(–12) mm (vs 20–25 × 18–20 mm), obovoid or cup-shaped (vs ovoid), glossy purplish black when ripe (vs pink); and styles not persistent or c.2 mm (vs 4 mm). – Type: Philippines, Mindanao Island, Surigao del Norte Prov., Claver, in forests on ultramafic soils, c.50 m elevation, 3 vii 2010 (fl), *E.S. Fernando* 2279 (holotype PNH!; isotypes LBC!, PUH!, SING!). **Figures 1, 2.**

Small, glabrous tree, 3–5 m tall; stem 6–10 cm in diameter, branches spreading above. *Twigs* 4-winged when young, turning quadrangular with age; resinous, reddish brown. *Leaves* opposite, subsessile, deep red when young. *Petiole* slightly swollen, drying deep black, 1–2 mm long. *Lamina* ovate-oblong, rigidly and thickly coriaceous, base cordate, apex bluntly obtuse to rounded, margins entire, both surfaces epunctulate, 9.3–13.0 × 5.6–8.1 cm; secondary veins 15–18 pairs, thin, (9.0–)10.7–11.4 mm apart, innermost intramarginal vein thin, (2.3–)2.7–3.5 mm from the margin, outermost intramarginal vein 0.7–0.9 mm from the margin, very faint; both surfaces of the midrib deep black. *Inflorescence* (axillary–) terminal, (4.0–)6.0–7.6 cm long, 4-winged. *Ultimate branchlets* in triads, flowers sessile. *Flower buds*

Figure 1. *Syzygium omissum* Mansibang & Fernando, sp. nov. (holotype, *E.S. Fernando* 2279, PNH). Photograph: E. S. Fernando and J. J. B. Latayan.

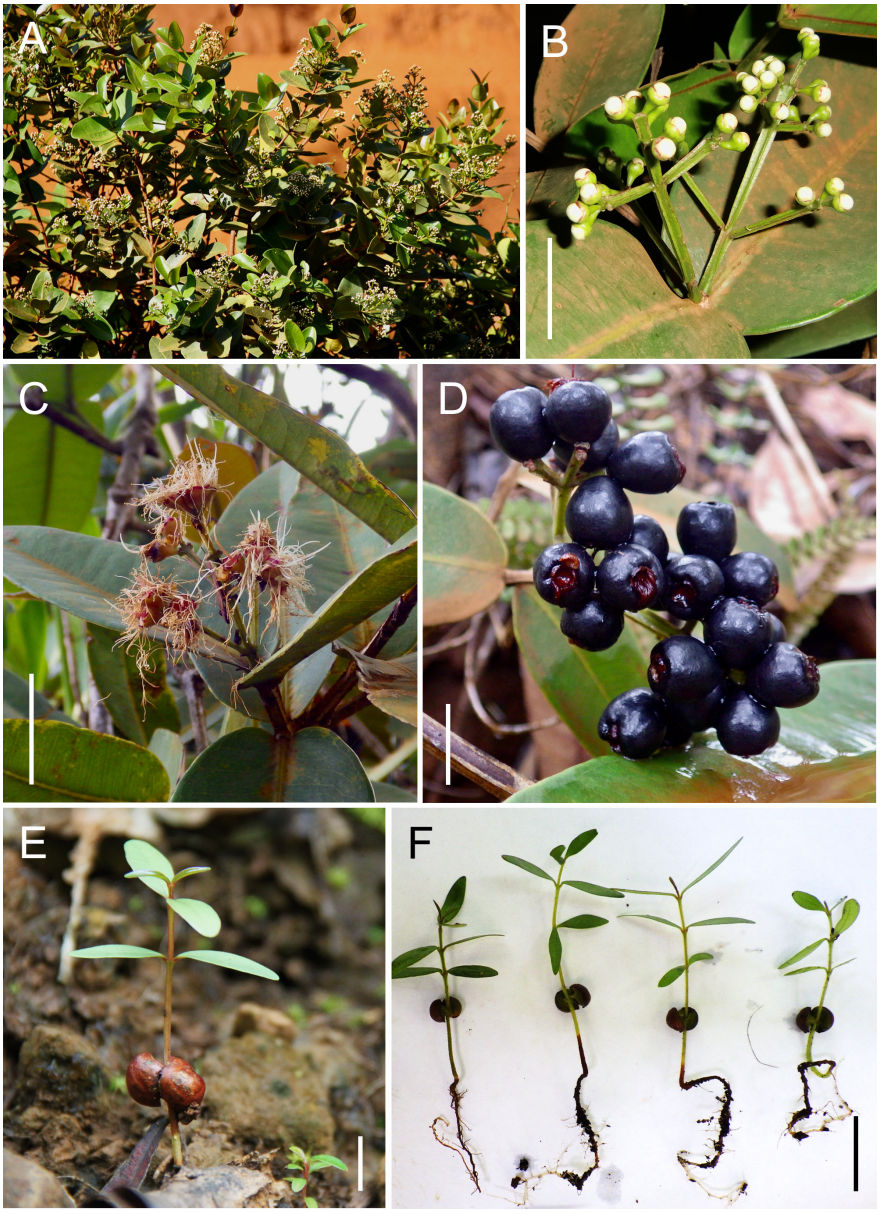

Figure 2. *Syzygium omissum* Mansibang & Fernando, sp. nov. A, Part of the tree crown, with young inflorescences; B, inflorescence, showing 4-winged branchlets and goblet-shaped hypanthium of flower buds; C, flowers with the stamens that have started to shed off; D, mature fruits; E, seedling in the wild, showing epigeal germination type with bulky cotyledons and the first three pairs of leaves; F, seedlings from seed of *E.S. Fernando* 5394 germinated in the nursery. Specimens: A and B, *E.S. Fernando* 2279; C, *E.S. Fernando* 5224; D, *E.S. Fernando* 4968; E, *E.S. Fernando* 3224. Scale bars: B, C and F, 20 mm; D and E, 10 mm. Photographs: E. S. Fernando.

goblet-shaped. *Hypanthium* goblet-shaped, greenish proximally, black (reddish distally when fresh), 3.8–6.0 × 2.0–4.5 mm (hypanthium limb 2–3 mm, ovary portion 2–3 mm), rim with 4 rounded lobes, one pair larger than the other, 1.3–1.5 × 0.5–0.7 mm, pseudo-pedicel slender, 1.1–1.3 mm long. *Corolla* pseudo-calyptrate, white, 4-merous, irregular rounded. *Stamens* many, filaments slender, white, 8–10 mm long, anthers basifixed, broadly oblong-suborbicular, parallel, (yellow when fresh), 0.2–0.3 × 0.3–0.5 mm. *Style* 1, 7–10 mm long. *Ovary* bilocular, axile placentation; ovules c.15 per locule. *Infructescence* terminal. *Fruits* obovoid or cup-shaped, 7–8(–9) × 6–8(–12) mm, the surface smooth, hard, black (ripening glossy purplish black when fresh); distally ± flat with circular calyx rim (2.5–)3.0–4.0 mm wide, calyx lobes shallow, fleshy, weakly incurved, c.1 mm long, style not persistent or when persistent c.2 mm long. *Seed* 1, globose, testa smooth, 5–7 mm wide, (white to pinkish red when fresh), surface of the opposite facing cotyledons slightly undulate.

Seedling germination (fresh material): epigeal, phanerocotylar; hypocotyl c.18–22 mm long, 1.0–1.5 mm thick; epicotyl 8–21 mm long, 4-angular, the edges sometimes reddish; cotyledons of bulky or reserve type, planoconvex, smooth and rounded on the outside and covered with the brown testa; the exposed inner cotyledon green as is the emerging seedling axis, c.2–3 mm thick, cotyledon stalk c.1 mm long; first two eophylls opposite, lamina narrowly elliptic, 10–24 × 2–5 mm, base attenuate, apex acute; subsessile.

Distribution. This species is, thus far, restricted to the islands of Mindanao and Hinatuan. In Mindanao, it is known to occur only in Surigao del Norte Province.

Habitat and ecology. The type population of this species was found along a stream at 55–60 m elevation on ultramafic soils, although some individuals were also recorded at higher elevations reaching to 260 m. Other plant species in the type locality include *Alyxia obovatifolia* Merrill (Apocynaceae), *Bikkia philippinensis* Valeton (Rubiaceae), *Buchanania insignis* Blume (Anacardiaceae) and *Rhodomyrtus surigaoensis* Elmer (Myrtaceae).

Etymology. The epithet *omissum* (Latin for 'neglected, disregarded') alludes to the fact that although first encountered several years ago, this species has only recently been given attention.

Proposed IUCN conservation category. Using GeoCAT (Bachman *et al*., 2011; https://www.geocat.kew.org), an extent of occurrence (EOO) of 196.5 km^2 was calculated, which is within the threshold for an Endangered category. The AOO was estimated at 32 km^2, which is also within the threshold for an Endangered category (IUCN, 2012). This species has a severely fragmented population; known populations occur in small patches comprising a few individuals. After more than a decade of field visits to the area, we have observed a steady decline in the: (i) EOO; (ii) area of occupancy (AOO); and (iii) area, extent and quality of the habitat, and number of locations. All known localities of this species, including that on the small adjacent Hinatuan Island, are within areas subject to surface mining for nickel. Using

the *IUCN Red List Categories and Criteria* (IUCN, 2012) and the *Guidelines for Using the IUCN Red List Categories and Criteria* (IUCN Standards and Petitions Subcommittee, 2022), we preliminarily assess *Syzygium omissum* as Endangered [EN B1+B2ab(i,ii,iii,iv,v)].

Notes. The combination of characters for this species is unique among all Philippine *Syzygium*. When Robinson's (1909) key to Philippine species was used, the leaf characters and inflorescence position were found to closely resemble those of *Syzygium bernardoi*, but the stems and reproductive parts are very different (see diagnosis). *Syzygium bernardoi* was observed to have similarities to the *Antisepticum* group, whereas *S. omissum* is perhaps truly related to the *Myrtifolium* group of Robinson (1909), considering their small turbinate flowers, inconspicuous and small calyx lobes (i.e. hypanthium rim subtruncate), pseudo-calyptrate corolla, and ripe pericarp fleshy and purplish black. *Syzygium silamense* is not assigned to a group in Ashton (2006, 2011), and the holotype does not contain the material needed to enable this. The term 'bulky or reserve type' in *Syzygium omissum* refers to exposed cotyledons that are thick and 'food-storing', as opposed to foliaceous or leaf-like (Ng, 1978; De Vogel, 1981) (see **Figure 2E,F**).

Additional specimens examined (paratypes). PHILIPPINES. **Mindanao Island**: Surigao del Norte Prov., Claver, along river, 53 m elevation, 8 viii 2013 (fr, seedling, + spirit), *E.S. Fernando* 3224 (LBC!); ibid., along small, rocky stream, 55 m elevation, 23 iv 2015 (fl buds), *E.S. Fernando* 3759 (CAHUP!, LBC!, PNH!); ibid., 260 m elevation, 7 vi 2019 (fl, fr), *E.S. Fernando* 4781 (LBC!, PNH!, PUH!); ibid., 55 m elevation, 16 xii 2020 (fl buds, fr juvenile, fr, seedlings), *E.S. Fernando* 4968 (LBC!); ibid., near nursery area, on gentle slope, 210 m elevation, 6 xi 2022 (fl, + spirit), *E.S. Fernando* 5224 (LBC!); ibid., 114 m elevation, 20 vi 2023 (fr, seedling, + spirit), *E.S. Fernando* 5394 (LBC!). **Hinatuan Island**: 95 m elevation, 4 xii 2023 (st), *E.S. Fernando* 5670 (LBC!).

Syzygium parvipomum Fernando & Mansibang, **sp. nov.** [subg. *Perikion*]

Compared with all Philippine *Syzygium* subg. *Perikion* with axillary-ramiflorous inflorescence, *S. parvipomum* is most similar to *S. iwahigense* (Elmer) Merr. in its oblanceolate-obovate lamina shape, revolute margins, and rigid coriaceous texture but differs by its quadrangular twigs (vs terete), smaller lamina 3.2–4.5 × 0.8–1.3 cm (vs 6 × 3 cm), adaxially punctate leaf surface (vs adaxially epunctulate), fewer secondary veins (7–)8–9 pairs (vs 10–15), and fewer flowered inflorescence 1–3(–4) flowers (vs 5–12(–15)). – Type: Philippines, Mindanao Island, Surigao del Norte Prov., Claver, in forests on ultramafic soils, on steep slope, c.320 m elevation, 6 vi 2019 (fl), *E.S. Fernando* 4765 (holotype PNH; isotypes LBC, SING). **Figures 3, 4.**

Small glabrous tree 4–6 m tall; stem 10–15 cm in diameter, trunk and branches tending to be upright, erect. *Twigs* quadrangular, seldom laterally flattened. *Leaves* opposite, young leaves purple when fresh. *Petiole* 1.3–2.0(–2.2) mm long. *Lamina* oblanceolate, rigidly coriaceous, base attenuate, apex bluntly obtuse to rounded, margins revolute, entire, sparsely punctate adaxially, epunctulate abaxially, 3.2–4.5 × 0.8–1.3 cm; secondary veins (7–)8–9 pairs, thin, 3.0–4.0(–4.8) mm apart, intramarginal vein thin, 0.6–1.0 mm from the margin; pale olive

Figure 3. *Syzygium parvipomum* Fernando & Mansibang (holotype, *E.S. Fernando* 4765, PNH). Photograph: E. S. Fernando and J. J. B. Latayan.

Figure 4. *Syzygium parvipomum* Fernando & Mansibang, sp. nov. A, Tree in the type locality, showing growth habit with narrow crown and mostly upright branches; B, inflorescence; C, part of crown, with infructescences; D, mature fruits; E, newly germinated seedlings showing remains of fibrous seeds and their newly emerged radicles; F, seedlings with newly emerged shoot and angular epicotyl with scale-like cataphylls; G, seedling showing hypogeal and cryptocotylar germination with first two pairs of opposite leaves. Specimens: A and B, *E.S. Fernando* 4765; C, D, F and G, *E.S. Fernando* 5408; E, *E.S. Fernando* 5407. Scale bars: B, 5 mm; D, E and F, 10 mm; G, 20 mm. Photographs: E. S. Fernando.

brown when dry. *Inflorescence* (pseudoterminal–) axillary, solitary (–simple cyme), 1–3(–4) flowers, sessile (or 12 mm long when present, slender, quadrangular). *Flower buds* clavate. *Hypanthium* claviform, white, with dense fibre bundles, 12 × 2.7–3.3 mm, rim subtruncate in outline, obscurely 4-lobed, rounded, 0.5–0.6 × 0.7–0.8 mm, pseudo-pedicel slender, 1.7–4.1 mm. *Corolla* pseudo-calyptrate, white, 4-merous, irregular rounded. *Stamens* many, filaments slender, white, 2.8–4.7 mm, anthers basifixed, oblong, parallel, yellowish brown (yellow when fresh), c.0.3 × 0.2 mm. *Style* 1, 6–8 mm long. *Ovary* bilocular, axile placentation; ovules c.6 per locule. *Fruits* solitary on axils (or rarely in very short axis, 12 mm long), broadly obovoid, 11–12 × 10.0–11.5 mm, surface smooth, ripening dull, waxy red when fresh, brown when dry; pericarp fleshy, with longitudinally striated fibres covering the testa.

Seedling germination hypogeal, cotyledons remain inside the testa, unexposed; epicotyl angular, with alternate cataphylls preceding the eophylls; first two eophylls opposite, narrowly elliptic, 1.2–3.4 × 1.5–2.0 mm.

Distribution. Endemic to the Philippines. This species is, thus far, known only from Surigao del Norte Province on Mindanao Island, Philippines.

Habitat and ecology. This species occurs on steep ultramafic hill slopes at 320 m elevation. Associated species include two Myrtaceae, namely the common *Leptospermum amboinense* Blume and saplings of *Xanthostemon verdugonianus* Náves ex Fern.-Vill., *Gymnostoma rumphianum* (Miq.) L.A.S.Johnson (Casuarinaceae), *Norrisia malaccensis* Gardner (Loganiaceae) and *Scaevola micrantha* C.Presl (Goodeniaceae).

Etymology. The epithet *parvipomum* (Latin: *parvi*, 'small'; *pomum*, 'apple') refers to the similarity of the ripe fruits to small, red apples.

Notes. Floral characters suggest that this species belongs to *Syzygium* subg. *Perikion sensu* Hatt *et al.* (2023) with a claviform hypanthium and the presence of fibre bundles in the hypanthium wall. The results of a thorough review of Philippine *Syzygium* (see methodology) suggest that there are c.12 species (including *S. parvipomum*) that belong to subg. *Perikion*, of which seven have consistent terminal inflorescence. Meanwhile, representatives of the subgenus with axillary to ramiflorous inflorescence are unique to only five of species in the Philippines so far. An identification key for the Philippine representatives of this group is presented below.

Proposed IUCN conservation category. Only two adjacent populations, each consisting of fewer than 15 mature individuals of *Syzygium parvipomum*, have been observed in the type locality. A continuing decline in the number of mature individuals in each population is probable, as all populations are within an area subject to surface mining. Following the *IUCN Red List Categories and Criteria* (IUCN, 2012) and *Guidelines for Using the IUCN Red List Categories and Criteria* (IUCN Standards and Petitions Subcommittee, 2022), we preliminarily assess *Syzygium parvipomum* as Critically Endangered [CR C+C2a(i)].

Additional specimens examined (paratypes). PHILIPPINES. **Mindanao Island**: Surigao del Norte Prov., Claver, in forests on ultramafic soils, on steep slope, c.370 m elevation, 22 vi 2023 (fr., + spirit), *E.S. Fernando* 5407 (CAHP, LBC, PNH, PUH); ibid. (+ spirit), *E.S. Fernando* 5408 (K, LBC, PNH, PUH, SING); ibid., (seedling, + spirit), *E.S. Fernando* 5408A (LBC).

Key to Philippine *Syzygium* subg. *Perikion* with axillary to ramiflorous inflorescences

1a. Leaf apex bluntly acute to shortly acuminate, lamina elliptic to oblong, texture chartaceous to coriaceous (never rigid) _____ 2
1b. Leaf apex obtuse to rounded, lamina oblanceolate to obovate, texture rigidly coriaceous _____ 4

2a. Inflorescence subumbellate, flowers many (4–)5–10(–12), inflorescence axes conspicuous (geographically widespread) _____ *S. claviflorum* (Roxb.) Wall. ex Steud.
2b. Inflorescence mostly solitary (rarely in 3's) and flowers sessile (–subsessile) _____ 3

3a. Leaves 6–10 × 2.5–4 cm, hypanthium 15–17 mm long (Samar and Leyte Islands) *S. subsessiliflorum* (Merr.) Merr.
3b. Leaves 2–4 × 1–2 cm, hypanthium c.8 mm long (young fruits) (Luzon: Rizal Prov.) *S. rizalense* (Merr.) Merr.

4a. Twigs terete, leaf surface adaxially epunctulate, inflorescence with more flowers (5–12(–15)) (Palawan Island) _____ *S. iwahigense* (Elmer) Merr.
4b. Twigs quadrangular, leaf surface adaxially punctate, inflorescence with fewer flowers (1–3(–4)) (Mindanao: Surigao del Norte Prov.) __ **S. parvipomum** Fernando & Mansibang

Notes on three 'lost' species of *Syzygium*

The ultramafic northeastern area of Mindanao, Philippines, including Surigao del Norte, was often referred to by Merrill (1920, 1921) as "low altitudes at the iron deposit on the northeast coast". Under the Bureau of Science number series, many new species in various genera were collected by Maximo Ramos, accompanied by either Gregorio Edaño or Juan Pascasio, between April and June 1919 (Merrill, 1920). These were subsequently described by him in the following years, and until relatively recently, many, including several species of *Syzygium*, were still known only from their types.

Recent fieldwork in Surigao del Norte enabled rediscovery of some of these poorly known *Syzygium* species, namely *S. filipes* Merr., *S. siderocolum* and *S. surigaense*. They had been considered 'lost' (i.e. "species that have not been reliably observed in > 50 years, yet are not declared extinct"; Martin *et al.*, 2022) until recent collections in the area. Here we provide additional notes on these species and designate lectotypes for *Eugenia siderocola* (basionym of *Syzygium siderocolum*) and *E. surigaensis* (basionym

of *S. surigaense*), following Articles 8.1 and 9.3 of the Shenzhen Code (Turland *et al.*, 2018).

Syzygium filipes Merr., Philipp. J. Sci. 79 (1950) 390. – Type: Philippines, Mindanao Island, Surigao Province, vi 1919, *M. Ramos & G. Edaño* BS 34723 (holotype A [A00071505], designated by Merrill (1950); isotypes K [K000800266], US [US1263737]). **Figure 5.**

Distribution. Endemic to the Philippines. Mindanao Island, Surigao del Norte Province.

Proposed IUCN conservation category. Using GeoCAT (Bachman *et al.*, 2011; http://www.geocat.kew.org), an EOO of less than 100 km^2, which is within the threshold for the Critically Endangered category, was calculated, in addition to an AOO of 12 km^2, which is within the threshold for an Endangered category. The known localities of this species are all within a mining area. Following the *IUCN Red List Categories* (IUCN, 2012) and the recommendation to use a precautionary approach in conservation assessments (IUCN Standards and Petitions Subcommittee, 2022), we assess this species as Endangered [EN B1+B2b(i,ii,iii,iv,v)].

Notes. This species falls under the *Myrtifolium* group of Robinson (1909). Vegetatively, this group consist of species with a generally elliptic-oblong lamina, acute-obtuse leaf base,

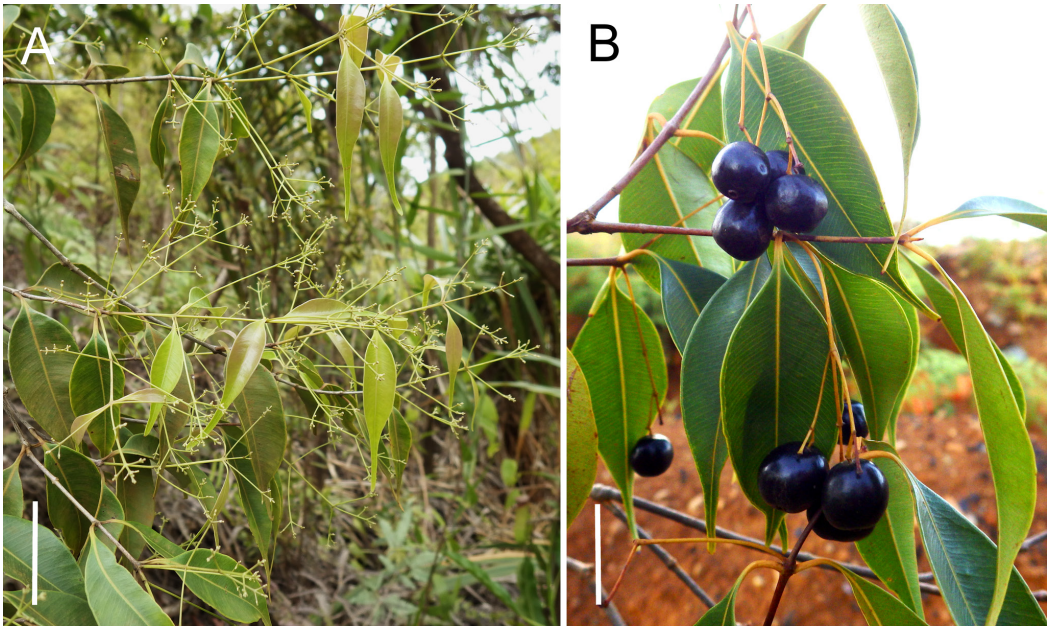

Figure 5. *Syzygium filipes* Merr. A, Branch with young flower buds; B, branch with ripe fruits. Specimens: A, *E.S. Fernando* 5409; B, *E.S. Fernando* 5223. Scale bars: A, 30 mm; B, 25 mm. Photographs: E. S. Fernando.

acute-acuminate apex, and thin secondary venation, but most importantly for inclusion in the *Myrtifolium* group, the possession of small turbinate flowers, inconspicuous and small calyx lobes (i.e. hypanthium rim subtruncate), pseudo-calyptrate corolla, small fruits, pericarp ripening to fleshy texture and purplish-black colour.

Information from the late Leonard L. Co (Pelser *et al.*, 2011 onwards) includes a note of the similarity of *Syzygium filipes* to *S. rostratum* (Blume) De Candolle from Sumatra, Java, and Borneo. However, *Syzygium filipes* is readily distinguished by its elongated, gracile inflorescence/infructescence axes.

Additional specimens examined. PHILIPPINES. **Mindanao Island**: Surigao del Norte, Claver, 170 m elevation, 6 xi 2022 (fr), *E.S. Fernando* 5223 (LBC, PNH); ibid., 210 m elevation, 22 vi 2023 (fl buds), *E.S. Fernando* 5409 (LBC, PNH, PUH, SING).

Syzygium siderocolum (Merr.) Merr., Philipp. J. Sci. 79 (1950) 414, excl. syn. '*Eugenia similis*' (which is the printer's error for '*Eugenia sidericola*'). *Eugenia siderocola* Merr., Philipp. J. Sci. 18 (1921) 303. – Type: Philippines, Mindanao Island, Surigao Province, on ridges and along streams at the iron deposit on the northeast coast, extending from low elevations to at least 650 m, 4 vi 1919, *M. Ramos & J. Pascasio* BS 34521 (lectotype A [A00069783] designated here!; isolectotypes K [K000800306], P [P05229088], US [US00118159]); paratype: Philippines, Mindanao Island, Surigao Province, on ridges and along streams at the iron deposit on the northeast coast, extending from low altitudes to at least 650 m, 4 vi 1919, *M. Ramos & J. Pascasio* BS 34722 (not found). **Figure 6.**

Distribution. Endemic to the Philippines. Mindanao Island, Surigao del Norte Province.

Proposed IUCN conservation category. Using GeoCAT (Bachman *et al.*, 2011; https://www.geocat.kew.org), an EOO of less than 100 km^2, which is within the threshold for the Critically Endangered category, was calculated, in addition to an AOO of 12 km^2, which is within the threshold for the Endangered category. The known localities of this species are all within a mining area. Following the *IUCN Red List Categories* (IUCN, 2012) and the recommendation to use a precautionary approach in conservation assessments (IUCN Standards and Petitions Subcommittee, 2022), we assess this species as Endangered [EN B1+B2b(i,ii,iii,iv,v)].

Notes. This species grows on ridges and along streams at low elevations. According to L. L. Co (Pelser *et al.*, 2011 onwards), it is known only from the original two collections. In the protologue, *Syzygium siderocolum* was compared with *S. cagayanense* (Merr.) Merr. It can be distinguished from all other species of Philippine *Syzygium* by its strikingly small growth habit, flexuous twig, small and oblong lamina, obtuse-rounded apex, terminal inflorescence, and most importantly, an inconspicuous secondary venation.

Additional specimens examined. PHILIPPINES. **Mindanao Island**: Surigao del Norte, Claver, along a streambank, 35 m elevation, 5 ix 2022 (fr young), *E.S. Fernando* 5180 (LBC, PNH); ibid., 114 m elevation, 20 vi 2023 (fl buds), *E.S. Fernando* 5396 (K, LBC, PNH, PUH, SING).

Figure 6. *Syzygium siderocolum* (Merr.) Merr. A, Branch with flower buds; B, branch with very young developing fruits. Specimens: A, *E.S. Fernando* 5396; B, *E.S. Fernando* 5180. Scale bars: A, 20 mm; B, 25 mm. Photographs: E. S. Fernando.

Syzygium surigaense (Merr.) Merr., Philipp. J. Sci. 79 (1950) 417. – *Eugenia surigaensis* Merr., Philipp. J. Sci. 18 (1921) 297. – Type: Philippines, Mindanao Island, Surigao Province, along streams at low altitudes at the iron deposit on the northeast coast, 14 vi 1919, *M. Ramos & J. Pascasio* BS 34686 (lectotype A [A00069806], designated here!; isolectotypes K [K000800349], P [P05229209], US [US00118184]). Figure 7.

Distribution. Endemic to the Philippines. Mindanao Island, Surigao del Norte Province.

Proposed IUCN conservation category. This species has a small population size, with only a single mature fruiting individual recorded. This plant was about 7 m tall with a 10 cm stem diameter (Figure 7**A**) and was seen in April 2019 at low elevation along a stream, from which area herbarium specimens were collected. The species may occur in similar habitats elsewhere in the vicinity. However, given that the whole area is part of a surface mining project, the remaining individuals of this species, if any, face real threat to their survival from habitat loss. Considering its EOO, AOO and area, extent and/or quality of habitat; the number of mature individuals; and a projected continuing decline in habitat quality and quantity, *Syzygium surigaense* is assessed as Critically Endangered [CR) C+C2a(i)].

Notes. According to L. L. Co (Pelser *et al.*, 2011 onwards), this species is, thus far, known only from the type specimen. It was compared with *Syzygium megalanthum* (C.B.Rob.) Merr. because of its solitary- to few-flowered inflorescence, turbinate hypanthium, rim 2–3 cm in diameter, and large, persistent calyx lobes, but strongly differs from that species by its thick and corky petioles, fewer secondary veins, eglandular lamina, and broader leaf base.

Figure 7. *Syzygium surigaense* (Merr.) Merr. A, Growth habit along stream bank; B, branch with flower buds and young fruit. Specimens: A and B, *E.S. Fernando* 4714. Scale bar: B, 30 mm. Photographs: E. S. Fernando.

Additional specimen examined. PHILIPPINES. **Mindanao Island**: Surigao del Norte, Claver, along a stream, 37 m elevation, 26 iv 2019 (fr), *E.S. Fernando* 4714 (LBC, PNH, PUH).

Acknowledgements

We are grateful to Taganito Mining Corporation and Hinatuan Mining Corporation for allowing E.S.F. and M.O.Q. access to their mining tenements. Permission to collect plant specimens from Surigao del Norte for scientific study was covered by Gratuitous Permits Nos. 199, 211 and 231, issued by the Biodiversity Management Bureau, Department of Environment and Natural Resources (DENR) of the Philippines; and Gratuitous Permits R13-2021-10 and R13-2022-26, issued by the Department of Environment and Natural Resources (DENR), Region 13, CARAGA Regional Office, Butuan City, Philippines. We thank Jay E. Matute and Edwin O. Breganza for assistance with field collection and processing of herbarium specimens, and Jay S. Fidelino for help with preparing the figures.

ORCID iDs

E. S. Fernando https://orcid.org/0000-0001-9422-5451
M. O. Quimado https://orcid.org/0000-0002-5236-0097
J. A. Mansibang https://orcid.org/0000-0003-1470-2380

References

Ashton PS. 2006. New *Syzygium* (Myrtaceae) from northern Borneo. Kew Bulletin. 61:107–144. https://www.jstor.org/stable/20443251.

Ashton PS. 2011. Myrtaceae, 10. *Syzygium*. In: Soepadmo E, Saw LG, Chung RCK, Kiew R, editors. Tree Flora of Sarawak. Vol. 7. Kepong: Forest Research Institute Malaysia. pp. 122–170.

Bachman S, Moat J, Hill A, de la Torre J, Scott B. 2011. Supporting Red List threat assessment with GeoCAT: geospatial conservation assessment tool. Zookeys. 150:117–126. https://doi.org/10.3897/zookeys.150.2109.

Balce GR, Alcantara PH, Morante EM, Almogela DH. 1976. Tectonic Framework of the Philippine Archipelago (A Review). Philippine Bureau of Mines Report. Manila: Philippine Bureau of Mines. 59 pp.

Beentje H. 2016. The Kew Plant Glossary, 2nd edition. Richmond: Kew Publishing. 186 pp.

Brambach F, Byng JQ, Culmsee H. 2017. Five new species of *Syzygium* (Myrtaceae) from Sulawesi, Indonesia. PhytoKeys. 81:47–78. https://doi.org/10.3897/phytokeys.81.13488.

Brambach F, Leuschner C, Tjoa A, Culmsee H. 2020. Predominant colonization of Malesian mountains by Australian tree lineages. Journal of Biogeography. 47(2):355–370. https://doi.org/10.1111/jbi.13747.

Chen J, Craven LA. 2007. Myrtaceae. In: Wu ZY, Raven PH, Hong DY, editors. Flora of China. Vol. 13 (Clusiaceae through Araliaceae). Beijing: Science Press, and St Louis: Missouri Botanical Garden Press. pp. 335–359.

Craven LA, Biffin E. 2010. An infrageneric classification of *Syzygium* (Myrtaceae). Blumea. 55(1):94–99. https://doi.org/10.3767/000651910X499303.

De Vogel EF. 1981. Seedlings of Dicotyledons: Structure, Development, Types. Wageningen: Centre for Agricultural Publishing and Documentation. 465 pp.

Elmer ADE. 1912. Notes and descriptions of *Eugenia*. Leaflets of Philippine Botany. 4:1399–1444.

Elmer ADE. 1914. Myrtaceae from Mt Urdaneta. Leaflets of Philippine Botany. 7:2343–2358.

Fernando ES, Rodda M. 2013. *Marsdenia purpurella* (Apocynaceae: Asclepiadoideae), a new species from the Philippines. Gardens' Bulletin Singapore. 65(2):143–148. https://www.nparks.gov.sg/sbg/research/publications/gardens-bulletin-singapore/-/media/sbg/gardens-bulletin/gbs_65_02_y2013_v65_02/4-4-65-2-02-y2013-v65p2-gbs-pg-143.pdf.

Fernando ES, Wilson PG. 2021. *Tristaniopsis flexuosa* (Myrtaceae), a new species from ultramafic soils in the Philippines. Telopea. 24:345–349. https://doi.org/10.7751/telopea15588.

Fernando ES, Quimado MO, Doronila AI. 2014. *Rinorea niccolifera* (Violaceae), a new, nickel-hyperaccumulating species from Luzon Island, Philippines. PhytoKeys. 37:1–13. https://doi.org/10.3897/phytokeys.37.7136.

Fernando ES, Quakenbush JP, Lillo EP, Ong PS. 2018. *Medinilla theresae* (Melastomataceae), a new species from ultramafic soils in the Philippines. PhytoKeys. 113:145–155. https://doi.org/10.3897/phytokeys.113.30027.

Fernando ES, Celadiña DA, Tandang DN, Lillo EP, Quimado MO. 2020. *Brackenridgea* (Ochnaceae) in the

Philippines, with notes on foliar nickel hyperaccumulation in the genus. Gardens' Bulletin Singapore. 72(2):255–273. https://doi.org/10.26492/gbs72(2).2020-09.

Galey ML, van der Ent A, Iqbal MCM, Rajakaruna N. 2017. Ultramafic geology of South and Southeast Asia. Botanical Studies. 58:18. https://doi.org/10.1186/s40529-017-0167-9.

Hatt S, Low YW, Burslem DFRP, Middleton DJ, Biffin ED, Maurin O, Lucas EJ. 2023. A morphological analysis of *Syzygium*, with a focus on fibre bundles and description of a new subgenus. Botanical Journal of the Linnean Society. 202(1):93–109. https://doi.org/10.1093/botlinnean/boac065.

Hyland BPM. 1983. A revision of *Syzygium* and allied genera (Myrtaceae) in Australia. Australian Journal of Botany Supplementary Series. 13(9):1–164. https://doi.org/10.1071/BT8309001.

IUCN. 2012. IUCN Red List Categories and Criteria, version 3.1, 2nd edition. IUCN Species Survival Commission. Gland, Switzerland, and Cambridge: International Union for Conservation of Nature. 32 pp.

IUCN Standards and Petitions Subcommittee. 2022. Guidelines for Using the IUCN Red List Categories and Criteria, version 15.1. Prepared by the Standards and Petitions Committee https://www.iucnredlist.org/documents/RedListGuidelines.pdf.

Low YS, Rajaraman S, Tomlin CM, Ahmad JA, Ardi WH, Armstrong K, Athen P, Berhaman A, Bone RE, Cheek M, Cho NRW, Choo LM, Cowie ID, Crayn D, Fleck SJ, Ford AJ, Forster PJ, Girmansyah D, Goyder DJ, Gray B, Heatubun CD, Ibrahim A, Ibrahim B, Jayasinghe HD, Kalat MA, Kathriarachchi HS, Kintamani E, Koh SL, Lai JTK, Lee SML, Leong PKF, Lim WH, Lum SKY, Mahyuni R, McDonald WJF, Metali F, Mustaqim WA, Naiki A, Ngo KM, Niisalo M, Ranasinghe S, Repin R, Rustiami H, Simbiak VI, Sukri RS, Sunarti S, Trethowan LA, Trias-Blasi A, Vasconcelos TNC, Wanna JF, Widodo P, Wijesundara DSA, Worboys S, Yap JW, Yong KT, Khew GSW, Salojärvi J, Michael TP, Middleton DJ, Burslem DFRP, Lindqvist C, Lucas EJ, Albert VA. 2022. Genomic insights into rapid speciation within the world's largest tree genus *Syzygium*. Nature Communications. 13:5031. https://doi.org/10.1038/s41467-022-32637-x.

Mansibang JA, Udasco LC, Garrino AL, Aumentado JAM, Rule MGQ, Patykowski J. 2024. *Syzygium crystalliferum* (Myrtaceae), a new tree species from Carranglan, Nueva Ecija, Philippines and lectotypification of *Eugenia purpuriflora* Elmer. Nordic Journal of Botany. 2024(6):e04227. https://doi.org/10.1111/njb.04227.

Martin TE, Bennett GC, Fairbairn A, Mooers AO. 2022. 'Lost' taxa and their conservation implications. Animal Conservation. 26(1):14–24. https://doi.org/10.1111/acv.12788.

Merrill ED. 1915. New species of *Eugenia*. Philippine Journal of Science, section C, Botany. 10:207–225.

Merrill ED. 1920. New or noteworthy Philippine plants, XVI. Philippine Journal of Science. 17:239–323.

Merrill ED. 1921. New Philippine Myrtaceae. Philippine Journal of Science. 18:289–308.

Merrill ED. 1950. Readjustments on the nomenclature of Philippine *Eugenia* species. Philippine Journal of Science. 79:351–430.

Merrill ED, Perry LM. 1937. Reinstatement and revision of *Cleistocalyx* Blume (including *Acicalyptus* A. Gray), a valid genus of the Myrtaceae. Journal of the Arnold Arboretum. 18(4):322–343. https://www.jstor.org/stable/43780839.

Merrill ED, Perry LM. 1938a. A synopsis of *Acmena* DC., a valid genus of the Myrtaceae. Journal of the Arnold Arboretum. 19(1):1–20. https://www.biodiversitylibrary.org/page/8102683#page/6/mode/1up.

Merrill ED, Perry LM. 1938b. The Myrtaceous genus *Syzygium* Gaertner in Borneo. Memoirs of the American Academy of Arts and Sciences. 18(3):135–202. https://www.jstor.org/stable/25058505.

Merrill ED, Perry LM. 1938c. On the Indo-Chinese species of *Syzygium* Gaertner. Journal of the Arnold Arboretum. 19(2):99–116. https://www.jstor.org/stable/43782393.

Merrill ED, Perry LM. 1938d. The Myrtaceae of China. Journal of the Arnold Arboretum. 19(3):191–247. https://www.jstor.org/stable/43780867.

Merrill ED, Perry LM. 1939. The Myrtaceous genus *Syzygium* Gaertner in Borneo. Memoirs of the American Academy of Arts and Sciences. 18(3):135–202. https://doi.org/10.2307/25058505.

Ng FSP. 1978. Strategies of establishment in Malayan forest trees. In: Tomlinson PB, Zimmerman MH, editors. Tropical Trees as Living Systems. Cambridge: Cambridge University Press; pp. 129–162.

Pelser PB, Barcelona JF, Nickrent DL, editors. 2011 onwards. Co's Digital Flora of the Philippines. https://www.philippineplants.org. [Accessed 8 July 2024.]

Pelser PB, Brambach F, Mansibang J, Schaefer H, Kiew R, Barcelona JF. 2021. New combinations and names for some Philippine vascular plants. Blumea. 66:96–100. https://repository.naturalis.nl/pub/800133/BLUM2021066001006.pdf.

POWO. 2024. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet. https://powo.science.kew.org. [Retrieved 8 July 2024.]

Quimado MO, Fernando ES, Trinidad LC, Doronila AI. 2015. Nickel hyperaccumulation in species of *Phyllanthus* (Phyllanthaceae) from the Philippines. Australian Journal of Botany. 63(2):103–110. https://doi.org/10.1071/BT14284.

Robinson CB. 1909. A preliminary revision of Philippine Myrtaceae. Philippine Journal of Science. 4:331–407. https://www.biodiversitylibrary.org/item/209842#page/7/mode/1up.

Soh WK, Parnell J. 2015. A revision of *Syzygium* Gaertn. (Myrtaceae) in Indochina (Cambodia, Laos and Vietnam). Adansonia. 37(2):179–275. https://doi.org/10.5252/a2015n2a1.

Tamayo MN, Fernando ES, Fritsch PW. 2023. *Vaccinium coarctatum* (Ericaceae), an ultramafic-obligate new species from the dwarf forest of Mt Redondo, Dinagat Island, Philippines. Edinburgh Journal of Botany. 80:1960. https://doi.org/10.24823/EJB.2023.1960.

Tamayo RA Jr, Maury RC, Yumul GP Jr, Polvé M, Cotton J, Dimalanta CB, Olaguera FO. 2004. Subduction-related magmatic imprint of most Philippine ophiolites: implications on the early geodynamic evolution of the Philippine archipelago. Bulletin de la Société Géologique de France. 175(5):443–460. https://doi.org/10.2113/175.5.443.

Thiers B. 2024. Continuously updated. Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/science/ih/. [Accessed 26 January 2024.]

Turland NJ, Wiersema JH, Barrie FR, Greuter W, Hawksworth DL, Herendeen PS, Knapp S, Kusber WH, Li DZ, Marhold K, May TW, McNeill J, Monro AM, Prado J, Price MJ, Smith GF, editors. 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code), adopted by the

Nineteenth International Botanical Congress, Shenzhen, China, July 2017. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books. https://doi.org/10.12705/Code.2018.

Yumul GP Jr. 2007. Westward younging disposition of Philippine ophiolites and its implication for arc evolution. Island Arc. 16(2):306–317. https://doi.org/10.1111/j.1440-1738.2007.00573.x.

Yumul GP Jr, Dimalanta CB, Maglambayan VB, Tamayo RA Jr. 2003. Mineralization controls in island arc settings: insights from Philippine metallic deposits. Gondwana Research. 6(4):767–776. https://doi.org/10.1016/S1342-937X(05)71023-6.

Yumul GP Jr, Dimalanta CB, Maglambayan VB, Marquez EJ. 2008. Tectonic setting of a composite terrane: a review of the Philippine Island arc system. Geosciences Journal. 12(1):7–17. https://doi.org/10.1007/s12303-008-0002-0.

Appendix

Herbarium specimens examined for comparison

Syzygium bernardoi (Merr.) Merr.: Luzon: **Cagayan Province**, Aparri, in dense forest, elevation about 15 m, 16 x 1917, *A. Bernardo* FB 27074 (syntypes K [K000800237-image!], US [US1375115-image!]).

Syzygium cagayanense (Merr.) Merr.: Luzon: **Cagayan Province**, 300 m, 8 v 1914, *V. Velasco* FB 21785 (syntype US [US00117908-image!]).

Syzygium claviflorum (Roxb.) Wall. ex Steud.: Palawan: Puerto Princesa, Mt Pulgar, *A.D.E. Elmer* 12975 (BISH [BISH559435-image!], GH [GH69823-image!], NY [NY405266-image!], US [US118214-image!]).

Syzygium iwahigense (Elmer) Merr.: Palawan: Puerto Princesa, Mt Pulgar, iii 1911, *A.D.E. Elmer* 12743 (A [A00069714-image!], BO [BO0030870-image!], E [E00504495-image!], GH [GH00069715-image!], L [L.2513480-image!], LY [LY0233489-image!], MICH [MICH1109690-image!], NY [NY405162-image!], P [P05229637-image!], U [U0180468-image!], US [US917901-image!], V [V0065374F-image!]).

Syzygium rizalense (Merr.) Merr.: Luzon: **Rizal Province**, Mt Susong Dalaga, viii 1917, *M. Ramos & G. Edaño* BS 29280 (syntypes A [A00069773-image!], K [K000800320-image!], P [P05229334-image!], US [US1294661-image!]).

Syzygium megalanthum (C.B.Rob.) Merr.: Palawan: Puerto Princesa, Iwahig River, iii–iv 1906, *F.W. Foxworthy* BS 784 (syntypes NY [NY00405190-image!], US [US00118048-image!]).

Syzygium subsessiliflorum (Merr.) Merr.: Luzon: **Cagayan Province**, May 1917, *Peña FB 26681* (P [P05229213]). **Negros**: 29 iii 1915, *N. Roque* FB 2358 (K [K00800350-image!]). **Samar**: iv 1914, *M. Ramos* Philippine Plants 1679 (syntypes BO [BO1282484-image!], GH [00069798-image!], L [L.2515588-image!], NY [NY0405247-image!], P [P05229214-image!], US [US00118177-image!]).