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A new species of *Boyania* (Melastomataceae) from Guyana

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Abstract: *Boyania kenwurdackii* (Melastomataceae, Sonerileae) is described from moist forests in Guyana. It is the third species in the genus and most closely resembles the other species that occurs in Guyana, *B. ayangannae*, but differs on flower merosity, indumentum, petal and anther size and morphology. The new species is illustrated and scanning electron microscopy photographs of the seeds are provided, as well as a distribution map for both species present in Guyana.

Keywords: Neotropics, Sonerileae, Taxonomy.

Introduction

Melastomataceae, with close to 5900 accepted species is an important component of most tropical floras (Ulloa Ulloa *et al*., 2022). Our understanding of the relationships within the family have greatly changed over the past 20 years based on molecular data (*e.g.* Clausing & Renner 2001; Michelangeli *et al*., 2011; Rocha *et al*., 2016; Bacci *et al*., 2019; Kartonegoro *et al*., 2021), which recently yielded a greatly revised taxonomy at the tribal level (Penneys *et al*., 2022). These studies have also shown that there is remarkable geographical structure across clades (Reginato *et al*., 2020, 2022), with no genus found both in the Americas and in Asia and/or Africa (Ulloa Ulloa *et al*., 2022). At the tribal level there is also a great amount of geographical compartmentalization, with most tribes found only in either the New or the Old World. The Astronieae, Melastomateae, and Sonerileae are exceptions to this rule (Ulloa Ulloa *et al*., 2022).

Sonerileae are a group of 44 genera and *c*. 1100 species mostly from the Asian tropics, but with some species present in Africa and South America (Liu *et al*., 2022). In South America the tribe is represented by only 12 species from six genera: *Boyania* Wurdack (2 spp.), *Neblinanthera* Wurdack (1 sp.), *Opisthocentra* Hook.f. (1 sp.), *Phainantha* Gleason (5 spp.), *Tateanthus* Gleason (1 sp.) and *Tryssophyton* Wurdack (2 spp.). For the three neotropical genera with more than one species *Boyania* has one present in Guyana and one in the foothills of the Andes in Colombia, *Phainantha* has four in the Guayana Shield in Guyana and Venezuela and one in southern Ecuador, and both species of *Tryssophyton* occur in Guyana (Ulloa Ulloa & Neill, 2006; Wurdack & Michelangeli, 2019; Liu *et al*., 2022). There are three monotypic genera, two from the Guayana Highlands in Venezuela (*Neblinanthera* and *Tateanthus*) and one from the lowlands in the basins of the rivers Vaupes, Rio Negro and Atabapo in Brazil, Colombia and Venezuela respectively (Berry *et al*., 2001). While most of the neotropical species are clustered early diverging lineages of Sonerileae, different analyses have yielded slightly different results with *Boyania*, *Opisthocentra* or *Phainantha* as sister to the remaining members of the tribe (Bacci *et al*., 2019; Wurdack & Michelangeli, 2019; Maurin *et al*., 2021; van der Burgt *et al*., 2022; Zhou *et al*., 2022).

While reviewing herbarium material and some recent collections from Guyana it became obvious that the plants that had been identified as *Boyania ayangannae* Wurdack contained two different and easily identifiable species, one indeed corresponding to *B. ayangannae* and one new. The new species is described here, along with an illustration, and a distribution map to both known species of *Boyania* in Guyana. A list of specimens confirmed to belong to *B. ayangannae* is also provided.

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Materials and Methods

Measurements for vegetative parts were taken from herbarium dried specimens, while measurements for floral parts were obtained from rehydrated or alcohol-preserved material. Seeds for scanning electron microscopy studies were mounted on aluminum stubs and coated with gold-palladium in a DSK00V-0016 sputter coater (Denton, Moorestown, NJ, USA) at 15 kv for 4.5 min. Scanning electron microscopy was performed on a SU3500-VP (Hitachi, Tokyo, Japan) and images taken with the SE detector with accelerating voltages ranging from 5 to 15 kv and working distances ranging from 6 to 12 mm.

All specimens at CAS, FLAS, K, NY, US, VEN, were seen in person; images for those at INPA and U were seen on the SpeciesLink portal (https://splink.cria.org.br) maintained by the Centro de Referência em Informação Ambiental, CRIA. Images for specimens at B and G were seen on the JSTOR Global Plants portal (https://plants.jstor.org) (acronyms follow Thiers, 2022 updated continuously).

Distribution maps were then made in ArcGIS Desktop 10.6 (ESRI 2018). The conservation status of each species was evaluated according to the Categories and Criteria of the IUCN (2012) as well as the guidelines for IUCN Standards and Petitions Committee (2022). The extent of occurrence (EOO) and area of occupancy (AOO) were calculated as recommended by the IUCN (2022) using the Geospatial Conservation Assessment Tool GeoCAT (Bachman *et al*., 2011).

Taxonomic Treatment

Boyania kenwurdackii Michelang. **sp. nov.** Figs. 1 & 2

Differs from *Boyania ayangannae* Wurdack by the 4-merous (*vs*. 5-merous) flowers, hypanthia sparsely covered by minute sessile glands (*vs.* densely to sparsely glandular pubescent), smaller petals (up to 3.24 mm long *vs*. 8–13 mm long), and anthers with a bilobed ventral appendage 0.15 mm long (*vs*. a single dorsal appendage 0.6 mm long), and the larger dorsal appendage (1.4–2.2 mm *vs*. 0.8–1.2 mm long).

Type: GUYANA, **Cuyuni-Marazuni**, 2nd and 3rd escarpments (of four) of Kamakusa Mt., upper west-facing slopes below summit, 1330 m, N 5°52'55.2", W 60°06'34.6", 08.06.2012 (fl), *K. J. Wurdack, E. A. Tripp, A. Radosavljevic & J. Ralph* 5869 (holo NY [NY04239396!]; iso K [K000370697], P [P00950851!], US [*n.v.*]).

Creeping to climbing herbs to small shrub, terrestrial or growing on fallen trunks or rocks, adventitious roots occasionally present. Stems obscurely quadrangular to flattened when young, glabrescent to pubescent, the trichomes mostly eglandular, but mixed with some glandular, 0.7–1.1 mm long, appressed, the older stems glabrescent and terete, nodes with a membranous, irregular flap *c*. 1.3 mm wide. Leaves opposite, usually isophyllous, occasionally anisophyllous, then the smaller leaf 1/3-1/5 the size of the larger one; petioles in isophyllous nodes or large leaves 3–8 cm long and up to 3.5 mm across., in smaller anisophyllous leaves 5–12 mm long, in all cases densely pubescent, trichomes simple, up to 2.5 mm long, appressed; leaf blades ovate to elliptic, 6.5–13 × 3.8–8.5 cm, chartaceous, base obtuse to broadly acute, apex acute to acuminate, margins serrulate and sparsely ciliate, the trichomes simple, up to 1 mm long; abaxial surface with sparse minute sessile glands, the primary and secondary veins pubescent, trichomes up to 0.8 mm long, appressed, mostly eglandular, but with some glandular trichomes, higher order veins with mixed minute sessile glands and simple trichomes up to 0.2 mm long; adaxial surface with sparse minute sessile glands, otherwise glabrescent or dense to sparsely strigulose with smooth trichomes up to 0.8 mm long; venation acrodromous with 2–3 pairs of secondaries basal, the outer pair considerably thinner, tertiary veins straight, spaced every 3–5 mm, higher order veins forming areolae 2–4 mm wide. Inflorescence terminal, with a 4–9 cm long peduncle, with a pair of bracts near the middle, glabrous, with 3–4 verticillate branches, each of them a scorpiod cyme; bracteoles lanceolate, 2–3 mm long, margins ciliate at the apex, persistent in flower, but late caducous; pedicels 3–4.5 mm long at anthesis, up to 13 mm long in fruit. Flowers 4–merous; hypanthium campanulate, 2.5–3 mm long, 2.1–2.3 mm wide at the torus, sparsely covered by minute sessile glands. Calyx 1.6–1.8 mm long; tube *c*. 8 mm long, lobes broadly deltoid with a blunt slightly cucullate apex, 0.8–1 mm long, the outer tooth reduced to a stubby round bump, the outer surface with glands similar to the hypanthium. Petals 3–3.2 mm

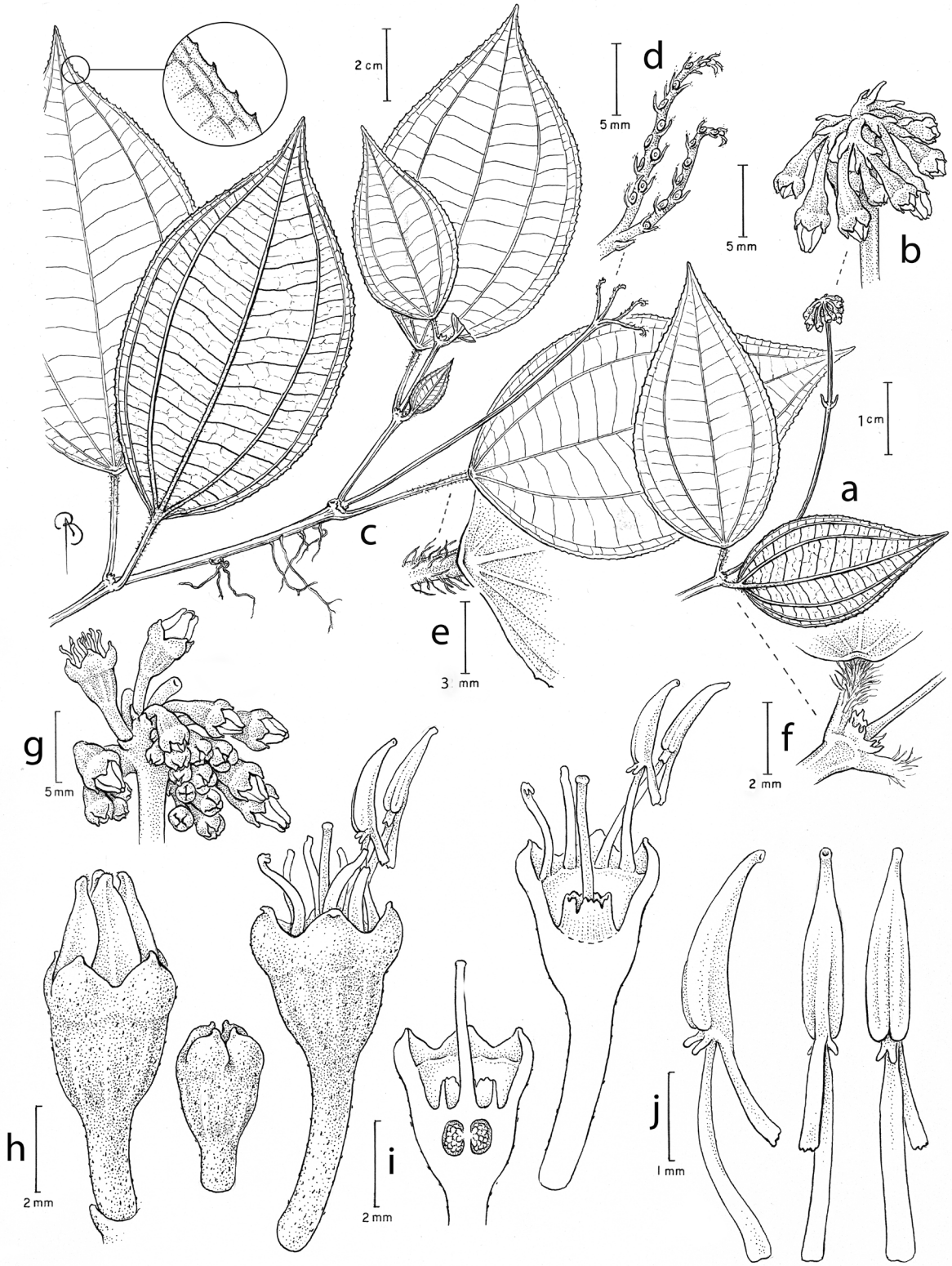

Fig. 1. *Boyania kenwurdackii* Michelang.: **a**. Flowering stem with distal leaves and inflorescences, with close up of stem node; **b**. Young inflorescence; **c**. Branch with old inflorescence remnant; **d**. Inflorescence remnant with persistent bracteoles; **e**. Petiole apex and leaf base; **f**. Stem node and flap. **g**. Young inflorescence; **h**. Flowers and bud in lateral view, mature flower (right) with petals removed; **i**. Flower in longitudinal section (left) through the ovary and with petals and stamens removed, (right) through the hypanthium with petals and some stamens removed; **j**. Antesepalous stamens in lateral (left), dorsal (middle) and frontal (right) views (a–f from *Michelangeli* 2489; g–j from *K.J. Wurdack, E.A. Tripp, A. Radosavljevic & J. Ralph* 5869; drawn by Bobbi Angell).

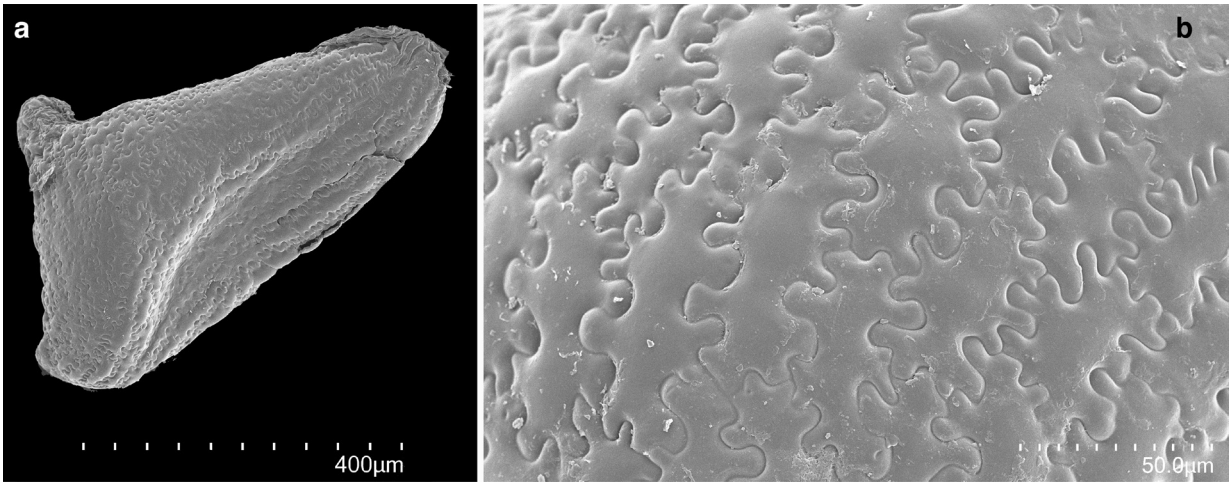

Fig. 2. Scanning electron microscopy images of seeds of *Boyania kenwurdackii* Michelang.: **a**. Entire seed; **b**. Detail of testa (both from *C.E. Zartman, M.M. Pombo, Y.H. Glen & C. Perry* 9387).

long, thin and translucid when dry. Stamens 8, isomorphic; filaments 2.5–2.8 mm long, glabrous; anthers subulate and slightly arcuate, 2.1–2.2 mm long, opening by a minute pore, upright to slightly dorsally oriented, connective not prolonged belong the thecae, but with a dorsal flattened appendage 1.4–2.2 mm long, and two ventral appendages *c*. 0.15 mm long. Ovary fully to ½ inferior, 4–locular, with a collar *c*. 0.9 mm tall around the style, glabrous; style straight, projecting 2.5–2.8 mm above the collar; stigma punctiform. Fruit capsular, terete but with 8 prominent ridges; seeds numerous (>50) per fruit, long pyramidal, 0.6–0.7 long, testa cells flat and with the anticlinal walls puzzle-shaped.

Flowering & fruiting: Flowering and fruiting plants have been collected in both in March and June, but there are no collections outside of these months.

Habitat: *Boyania kenwurdackii* grow in the understory of moist forests in the foothills and mid elevations of the Pakaraima mountains of the Guayana Shield in central Guyana at elevations between 225 m and 1330 m (Fig. 3).

Distribution: Endemic to Guyana.

Etymology: The specific epithet honors Ken Wurdack, Curator at the National Museum of Natural History of the Smithsonian Institution, who has collected in some of the most remotes corners of Guyana, including the type of this new species.

Specimens examined: **Boyania kenwurdackii** Michelang: GUYANA, **Potaro-Siparuni**. Kaieteur National Park, upper Mure Mure basin, 480–490 m, N 5°16'19.56", W 59°30'53.28", 25.03.2014 (fl.), *F.A. Michelangeli & N. Zarine* 2486 (BRG, NY, US); Marina Falls, 449 m, N 5°22'43.2", W 59°29'33.3", 28.03.2011 (fl.), *C.E. Zartman, M.M. Pombo, Y.H. Glen & C. Perry* 9356 (INPA); Amalia Falls to V4, 225 m, N 5°20'40", W 59°32'06", 30.03.2011 (veg.), *C. E. Zartman, M.M.*

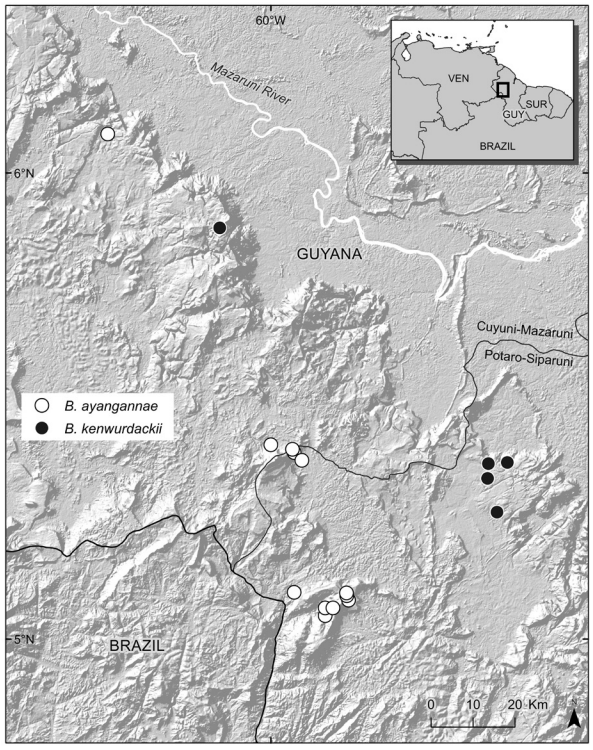

Fig. 3. Arc Gis map with distribution points of *Boyania kenwurdackii* Michelang. and *Boyania ayangannae* Wurdack in Guyana.

Pombo, Y.H. Glen & C. Perry 9368 (INPA, US); *Ibid*., 30.03.2011 (fl.), *C.E. Zartman, M.M. Pombo, Y.H. Glen & C. Perry* 9387 (INPA, US); V4, N 5°22'40", W 59°32'00" , 31.03.2011 (fl.), *C.E. Zartman, M.M. Pombo, Y.H. Glen & C. Perry* 9404 (INPA, US). **Boyania ayangannae** Wurdack: GUYANA, **Cuyuni-Mazaruni**, Pakaraima Mts, ascent and transect 4 km along NE plateau of Mt. Ayanganna, 1100–1500 m, N 5°24', W 59°57', 06.11.1992 (fl buds), *T.W. Henkel* 147 (BRG, NY, US); Pakaraima Mountains, Kumarau Falls on Kurupung River, 0.5–1.5 km SW on forest trails, 350 m, N 6°05', W 60°21', 31.07.1992 (veg), *B. Hoffman* 2237 (NY, US); Pakaraima Mountains; ascent and transect 4 km along NE plateau of Mt. Ayanganna, 1100–1500 m, N 5°24'25", W 59°57'13", 06.11.1992 (fr), *B. Hoffman* 3236 (NY, US); Pakaraima Mountains; 1–4 km NW of Mt. Ayanganna on outer toe slopes of mountain, 800–1100 m, N 5°25', W 60°0', 09.11.1992 (fr), *B. Hoffman* 3308 (BRG, NY, U, US); Membaru-Kurupung Trail, Pakaraima Mts., 1000 m, 29.10- 04.11.1951 (veg), *B. Maguire* 32405 (B, NY, US, VEN [paratypes]); Mt. Ayanganna, NE side of, upper Mazaruni River basin, 800–915 m, N 5°23', W 59°57", 14.08.1960 (fl.), *S.S. Tillet* 45000 (K, NY, US[paratypes]); *Ibid* 16.08.1960 (fl.), *S.S. Tillet* 45151 (NY[paratype]); 16.08.1960 (fl.), *S.S. Tillet* 45152 (G[isotype], K[isotype], NY[isotype], US[holotype]). **Potaro-Siparuni**, Wokomung, base camp & vic., upper Potaro River region, 1070–1160 m, N 5°5', W 59°50', 30.06.1989 (fl.), *B.M. Boom* 8993 (NY, US); Mt. Wokomung, easternmost pinnacle of massif, 1524 m, N 5°05'34.4", W 59°50'13.3", 30.06.2003 (fl.), *H.D. Clarke* 10344 (BRG, NY[2], US); Mt. Wokomung, NE facing slopes above second of four escarpments, 1400 m, N 5°5'56", W 59°50'16", 01.07.2003 (fl.), *H.D. Clarke* 10389 (NY[2], US); Pakaraima Mts, Mt. Wokomung, Wusupubaru Creek, 2 km from juncture with Suruwabaru Creek, 975–1125 m, N 5°03', W 59°53', 13.02.1993 (fr), *T.W. Henkel* 1340 (BRG, NY, US); Pakaraima Mts, Mt. Wokomung. W slope on sub-plateau near head of Mo-toy-mabaru Creek, 1150–1200 m, N 5°04', W 59°53', 11.11.1993 (fr), *T.W. Henkel* 4286 (BRG, CAS, FLAS, NY, U, US); *Ibid*, 11.11.1993 (fl bud, fr), *T.W. Henkel* 4291 (BRG, CAS, FLAS, INPA, NY, U, US); Pakaraima Mts-Mt. Wokomung, summit ridge of Ka-mie-wah pinnacle NE to S pinnacle, "Little Ayanganna", 1550–1650, N 5°04', W 59°52', 17.11.1993 (fl.), *T.W. Henkel* 4436 (BRG, CAS, FLAS, NY, US); Pakaraima Mtns; upper Ireng watershed, Sukabi River, Kurdah Falls, lower E branch, 685 m, N 5°06', W 59°97', 20.10.1994 (fl.), *P.A. Mutchnick* 129 (US).

Conservation status: It is known from only six collections made in the last 12 years, only one of which is inside a national park. Moreover, four of the paratypes have been collected in areas that have been identified as future dam sites for hydroelectric power. The Extent of Occurrence (EOO) is 474.3 km^2 and the Area of Occupancy (AOO) is 20 km^2 with a total of 4 locations. Based on the low number of locations, the EOO and AOO and the fact that some of the areas are likely to be developed in the near future, it is recommended that *Boyania kenwurdackii* be considered Endangered under criteria B1ab(iii)+ B2ab(iii) (IUCN, 2022).

Notes: Superficially, *Boyania kenwurdackii* closely resembles *B. ayangannae*, and indeed all the specimens assigned here to the new species had been initially determined as the latter. However, the two species differ by the number of petals, hypanthium indumentum, the size of the petals, and the size and morphology of the anther appendages (see diagnosis). Additionally, the ovary in *B. kenwurdackii* seems to range from ½ to fully inferior and it is 4-locular, while it is superior and 3-locular in *B. ayangannae*; however, these characters are based on limited dissections for both species. Furthermore, *B. kenwurdackii* is easily distinguished from *B. colombiana*, the third species in the genus, by the leaf bases (obtuse to broadly acute *vs*. cordate), and the anthers dorsal connective appendages (present *vs*. absent). Although *B. kenwurdackii* and *B. ayangannae* both grow in central Guyana, and relatively close to each other, they have not been collected in the same locality. *Boyania ayagannae* has been mostly collected around Mount Ayanganna and Mount Wokomung at 800–1400 m, and once farther west along the Kurupung River at 350 m (Fig. 4). *Boyania kenwurdackii* has been mostly collected at 225–480 m on tributaries of the Potaro River farther north of Mount Ayanganna, and once (the type), at 1300 m in Kamakusa Mountain.

When Wurdack (1964) described *Boyania* he placed it in the expanded Sonerileae and noted that among neotropical members of the tribe it most closely resembled *Diplarpea* Triana or *Monolena*

Triana ex Benth. & Hook.f. However, it is notable that he also remarked that it actually shared more characters with Old World Sonerileae. *Diplarpea* has now been synonymized under *Triolena* Naudin, and both *Triolena* and *Monolena* form the tribe Trioleneae, an exclusively neotropical group not part or sister to the Sonerileae as currently defined (Bacci *et al*., 2020).

It should be noted that the collection cited as *B. ayangannae* in recent phylogenetic analyses (Bacci *et al*., 2019; Wurdack & Michelangeli, 2019; Maurin *et al*., 2021; Penneys *et al*., 2022) is actually one of the paratypes of *B. kenwurdackii.* Moreover, when more than one species of *Boyania* have been included in phylogenetic studies the genus is not recovered as monophyletic, with both terminals close to the base of the tribe, although most of the branches in between these taxa have low or moderate support.

Acknowledgements

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