

THE GENUS *TRACHYPHYLLUM* (SEMATOPHYLLACEAE S.L., BRYOPHYTA)  
IN THE PHILIPPINES, WITH A NEW SPECIES RECORD FOR MALESIA

РОД *TRACHYPHYLLUM* (SEMATOPHYLLACEAE S.L., BRYOPHYTA)  
НА ФИЛИППИНАХ И НАХОДКА НОВОГО ДЛЯ МАЛЕЗИИ ВИДА

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Abstract

A taxonomic study of the genus *Trachyphyllum* (Sematophyllaceae s.l.) in the Philippines is presented. Two species are recognized to occur in the country: *Trachyphyllum dusenii* and *T. inflexum*. The discovery of *T. dusenii* in the Cordillera Central of Luzon Island represents the first record of this species in both the Philippines and the broader Malesian phytogeographic region. A key to the species, descriptions, illustrations, and notes on the distribution and ecology for both species are provided and discussed.

Резюме

Приводится таксономическая ревизия рода *Trachyphyllum* (Sematophyllaceae s.l.) на Филиппинах. Два вида встречаются на территории страны: *Trachyphyllum dusenii* и *T. inflexum*. Указание на находку *T. dusenii* в горах Центральные Кордильеры на острове Лузон является первой находкой для Филиппин, равно как и вообще для региона Малазии. Ключ для определения видов, описания и иллюстрации, а также заметки о распространении и экологии и карта распространения даны для обоих видов.

KEYWORDS: bryophytes, Malesian flora, mosses, new records, *Trachyphyllum*

INTRODUCTION

The moss genus *Trachyphyllum* A. Gepp (Sematophyllaceae s.l. sensu Han & Jia, 2021) consists of about seven species worldwide (Buck, 1979; Brinda & Atwood, 03 September 2024). Members of this genus are mainly found in the Paleotropics, with only one species reported in the Neotropics (Buck & Griffin, 1984). Previously, only one species of *Trachyphyllum*—*T. inflexum* (Harv.) A. Gepp—had been documented in the Philippines, specifically in Luzon and Mindoro (Tan & Iwatsuki, 1991; Linis, 2009, 2019). However, a recent examination of an unidentified moss collection from the Cordillera Central of Luzon Island revealed an additional *Trachyphyllum* species for the country. This, along with other collections primarily from the authors' field expeditions now housed at PNH and those archived at CAHUP, provided new insights into the distribution of the genus in the region. The present work provides an account of the genus in the Philippines, with one species—*Trachyphyllum dusenii* (Müll. Hal. ex Broth.) Broth.—newly reported for the country and the Malesian phytogeographic region.

MATERIALS AND METHODS

Herbarium specimens kept in PNH and CAHUP as well as recent field collections by the authors were ex-

amined. Morphological and anatomical features were studied using dissecting and compound microscopes. Photomicrographs were then taken using Amscope MU500 5MP USB Microscope Camera. Pertinent information for each species was compiled from relevant references, including Buck (1979, 1980), Buck & Griffin (1984), Kariyappa & Daniels (2010), and Norris & Koponen (1990).

TAXONOMIC TREATMENT

***Trachyphyllum*** A. Gepp, Cat. Afr. Pl. 2(2): 298. 1901.

**Type species:** *Trachyphyllum gastrodes* (Welw. & Duby) A. Gepp designated by Buck (1979); *Trachyphyllum inflexum* (Harv.) A. Gepp designated by Chen (1978) (Tropicos, Missouri Botanical Garden. 03 September 2024. *Trachyphyllum* A. Gepp. Available at <https://tropicos.org/name/35001313>).

**Descriptions:** Gepp (1901), Buck (1979; 1980).

**Notes:** Historically, Gepp (1901) initially classified *Trachyphyllum* within the Entodontaceae—citing the numerous alar cells in its leaves and its morphological similarities to *Erythrodontium* Hampe. However, Buck (1979) proposed reclassifying the genus as part of the Thuidiaceae, based on both gametophytic and sporophytic characteristics; aligning it more closely with *Heterocla-*

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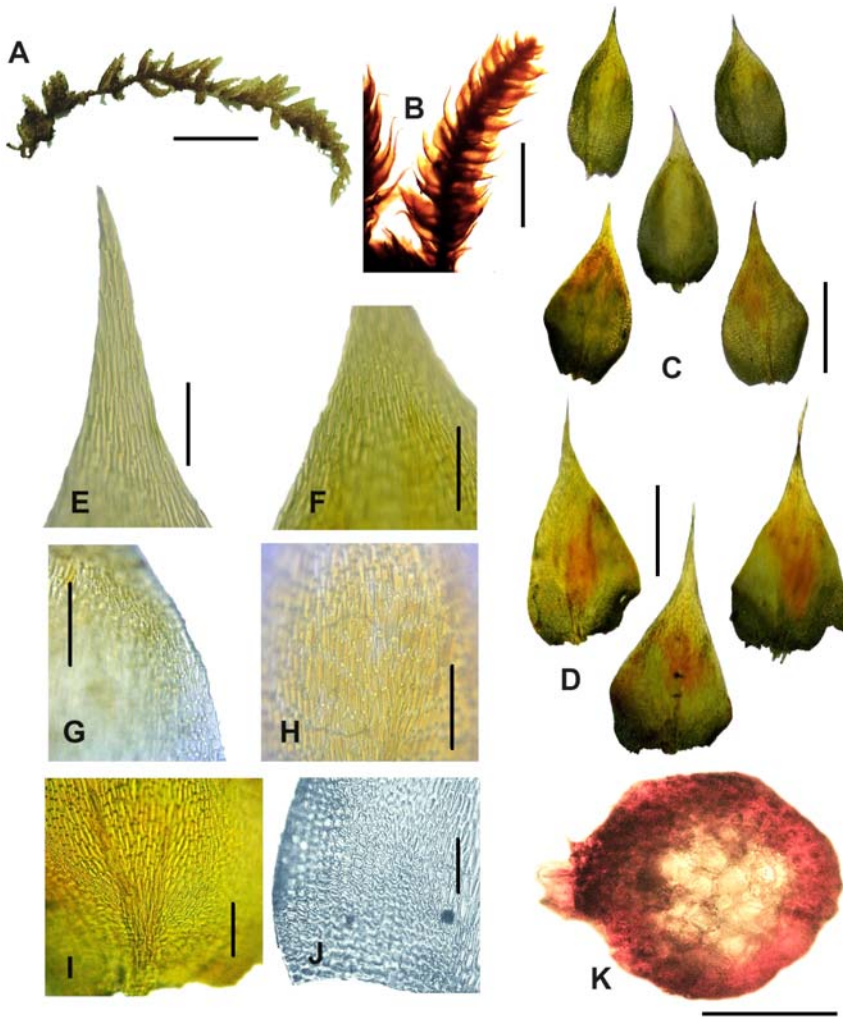


Fig. 1. *Trachyphyllum dusenii* (Müll. Hal. ex Broth.) Broth. (A) The habit of the plant, moist. (B) Detail of the plant's branch. (C) Branch leaves, adaxial view. (D) Stem leaves, adaxial view. (E) Leaf apex, adaxial view. (F) Upper laminal cells. (G) Upper marginal lamina cells. (H) Median laminal cells. (I) The base of the branch leaf showing the costa. (J) Basal laminal cells. (K) Cross-section of the stem. All from V.C. Linis 2015-18 (CAHUP). Scale bars: A = 5 mm; B = 1 mm; C, D = 0.25 mm; E, F, G, H, I, J = 50 µm; K = 25 µm.

*dium* Bruch & Schimp. Spence (1997) later reassigned the genus to the Pteryginandraceae, a change that was reflected in the classification system proposed by Goffinet, Buck, & Shaw (2008). In 2014, Carvalho-Silva *et al.* further reclassified *Trachyphyllum* into the Pylaisiadelphaceae. Subsequently, Han & Jia (2021) placed the genus under the Sematophyllaceae *sensu lato*, temporarily within the subfamily Platygryioideae which included taxa with unstable phylogenetic positions. Most recently, Akiyama *et al.* (2024) resolved that the genus nested within the Pylaisiadelphaceae—noting, however, the need for further taxon sampling in order to clarify the backbone phylogeny of the family. In light of the unstable systematic position of *Trachyphyllum*, we opted to follow Han & Jia (2021) and thus treat the genus as a member of the Sematophyllaceae s.l.

In the Philippines, species of *Trachyphyllum* appear similar to the more widespread *Erythrodonium julaceum* (Schwägr.) Paris (Entodontaceae) but the papillose laminal cells readily distinguishes the former from the latter. Similarly, plants of *Macgregorella indica* (Broth.) W.R. Buck (Myriniaceae) may resemble a minute form of *Trachyphyllum* in the field but the single costa, short

and prorate laminal cells, and the marginal cells of the alar region having thin lateral walls and distinctly thick transverse walls differentiates the former from members of the latter (Norris & Koponen, 1990). The combination of 1) julaceous habit, 2) characteristic laminal cells papillose at both ends, 3) a well-developed double costa, and 4) numerous quadrate alar cells readily distinguishes *Trachyphyllum* from genera in the Entodontaceae and Sematophyllaceae s.l. found in the Philippines.

Buck (1979) recognised two subgenera within *Trachyphyllum*: subg. *Trachyphyllum* and subg. *Carinatum*. To date, only members of *Trachyphyllum* subg. *Trachyphyllum* have been reported in the Philippines.

Key to species of *Trachyphyllum* in the Philippines

1. Branch leaves ovate-lanceolate with a long, gradually tapered apex; alar cells extending up the margin less than 1/3 the leaf length ..... *T. dusenii*
- Branch leaves ovate to broadly ovate with a more abruptly tapered apex; alar cells extending (1/3) 1/2 the leaf length ..... *T. inflexum*

1. **Trachyphyllum dusenii** (Müll. Hal. ex Broth.) Broth., Nat. Pflanzenfam. I(3): 890. 1907. — *Pylaisia dusenii* Müll. Hal. ex Broth., Bot. Jahrb. Syst. 24: 261. 1897. (Fig. 1)

**Description:** Plants yellow-green to dull golden brown, in dense mats. *Stems* creeping, 2.5–3.0 cm long, 60–90 µm by 50–75 µm in cross-section, ovoid, without central strand; cortical cells 2- or 3-layered, 4.5–8 µm by 4–6 µm, rounded-quadrate, thick-walled; medullary cells 8–22 µm by 6–16 µm, rounded-quadrate to rounded or hexagonal, thin-walled; rhizoids emerging from the ventral side. *Branches* 2.5–4.5 mm long, slightly curved when dry, straight when moist. *Stem leaves* broadly ovate, long acuminate, 0.65–0.75 mm long by 0.25–0.40 mm wide, similar in areolation with branch leaves. *Branch leaves* ovate-lanceolate to broadly lanceolate, plane to faintly concave, imbricate, erecto-patent, 0.45–0.55 mm long by 0.19–0.25 mm wide; margins entire to faintly toothed; apices acuminate, wide-spreading to recurved; costa double, extending to about 1/4–1/3 of the leaf's length. *Upper leaf cells* linear, 30–51 µm long by 4–6 µm wide in distal portions, 20–30.5 µm long by 4–6.5 µm wide near the alar region, papillose at both ends, sometimes epapillate at the apex. *Alar cells* differentiated, quadrate to quadrate-rectangular, 8–10 µm long by 4–6.5 µm wide, epapillate, forming a distinct region extending less than 1/3 the leaf length. *Sporophyte* not observed.

**Additional descriptions and illustrations:** Buck (1979: 387; 388, figs. 14 & 15), Buck & Griffin (1984: 63).

**Specimen examined:** LUZON ISLAND: Ilocos Norte Province, Solsona Municipality, on the bank of Padsan River, on the lower part of Mt. Sicapoo, Cordillera Central, 18.009861°N, 120.852314°E, ca. 413 m elev., corticolous on the stem of a small riparian tree, 26.XII.2018, V.C. Linis 2015-18 (CAHUP, PNH, VBG1).

**Distribution and ecology:** This species has previously been recorded in various localities across Africa (Buck, 1979), the Indian subcontinent (Kariyappa & Daniels, 2010), and South America (Buck & Griffin, 1984; Carvalho-Silva *et al.*, 2014). It is now reported here as a new record for the Philippines and the Malesian phytogeographic region, known thus far from a single locality in the northern part of the Cordillera Central on northern Luzon Island (Fig. 3). Throughout its range, the species appears to be either epilithic or epiphytic, typically found in areas with a relatively drier climate at elevations ranging from 400 to 1400 meters.

**Notes:** In the field, plants of *Trachyphyllum dusenii* can be distinguished from the similar-looking *T. inflexum* by its wide-spreading to recurved branch leaves when dry, which are narrower than those of other species in the genus (Buck, 1979). The Philippine material, despite being sterile, is attributable to this species as it exhibits ovate-lanceolate branch leaves with gradually tapered apices and an alar region that extends up the margin

only less than 1/3 the leaf length typical of *T. dusenii*. This contrasts with the ovate branch leaves of *T. inflexum*, which have stout, abruptly tapering apices and an alar region extending to approximately half the leaf length—features consistently observed in all examined Philippine specimens of this species. Additionally, plants of *T. inflexum* have more conspicuously papillose upper leaf cells whereas those of *T. dusenii* tend to have less conspicuous papillae and, as in the Philippine material, sometimes lack papillae altogether.

2. **Trachyphyllum inflexum** (Harv.) A. Gepp, Cat. Afr. Pl. 2(2): 299. 1901. — *Hypnum inflexum* Harv., Icon. Pl. [Hooker] 1: pl. 24. 1836. (Fig. 2)

*Trachyphyllum papuanum* (Broth.) Broth., Nat. Pflanzenfam. I(3): 890. 1907. — *Leptohyemium papuanum* Broth., Öfvers. Finska Vetensk.-Soc. Förh. 40: 183. 1898. Synonymized by Buck (1979).

**Description:** Plants green to golden brown, in dense mats. *Stems* creeping, 3.0–3.5 cm long, 78–110 µm by 70–84 µm in cross-section, ovoid, without central strand; cortical cells 2- to 4-layered, 4–7.5 µm by 4–6.5 µm, rounded-quadrate, thick-walled; medullary cells 7.5–22 µm by 6–15.5 µm, rounded-quadrate to hexagonal, thin-walled; rhizoids emerging from the ventral side. *Branches* 2.5–4.5 mm long, curled when dry, straight when moist, prostrate. *Stem leaves* broadly ovate, long acuminate, 0.75–1.00 mm long by 0.50–0.65 mm wide, similar in areolation with branch leaves. *Branch leaves* predominantly ovate, slightly concave, imbricate, 0.40–0.50 mm long by 0.20–0.50 mm wide; margins entire, becoming serrulate towards the upper half; apices stout, abruptly tapered at tips; costa double, extending to about 1/3–1/2 of the leaf's length. *Upper leaf cells* strongly papillose at both ends, long-rhomboidal and 30–52 µm long by 4.5–6.5 µm wide in distal portions, long-linear and 21–31 µm long by 4–6 µm wide near the alar region. *Alar cells* differentiated, quadrate to quadrate-rectangular, 8–10 µm long by 4–6 µm wide, epapillate, forming a distinct region extending 1/3–1/2 leaf length. *Perichaetial leaves* ovate-lanceolate, long acuminate, 1.50–1.80 mm long; ecostate; cells long-rhomboidal. *Setae* 8.0–10.0 mm long, smooth, reddish. *Capsules* exserted, inclined, asymmetrically ellipsoidal, 0.8–1.0 mm long; exothecial cells quadrate to rectangular, thin-walled, not collenchymatous; peristome double, exostome and endostome characteristic of the genus. *Spores* spherical to ovoid, up to 25 µm, finely papillose. *Calyptra* cucullate, smooth, naked.

**Additional descriptions and illustrations:** Bartram (1939: 305; pl. 23, fig. 389), Buck (1979: 384; 383, figs. 1–7), Norris & Koponen (1990: 8).

**Specimens examined:** LUZON ISLAND: Pangasinan Province, Mangatarem Municipality, Barangay Malabobo, on the bank of Baracbac River, north of Manleluag Spring Protected Landscape on the lower part of Zambales Mountain Range, 15.683253°N, 120.264969°E, ca. 510 m elev., corticolous on decortivating log in a secondary lowland forest, 29.X.2016,



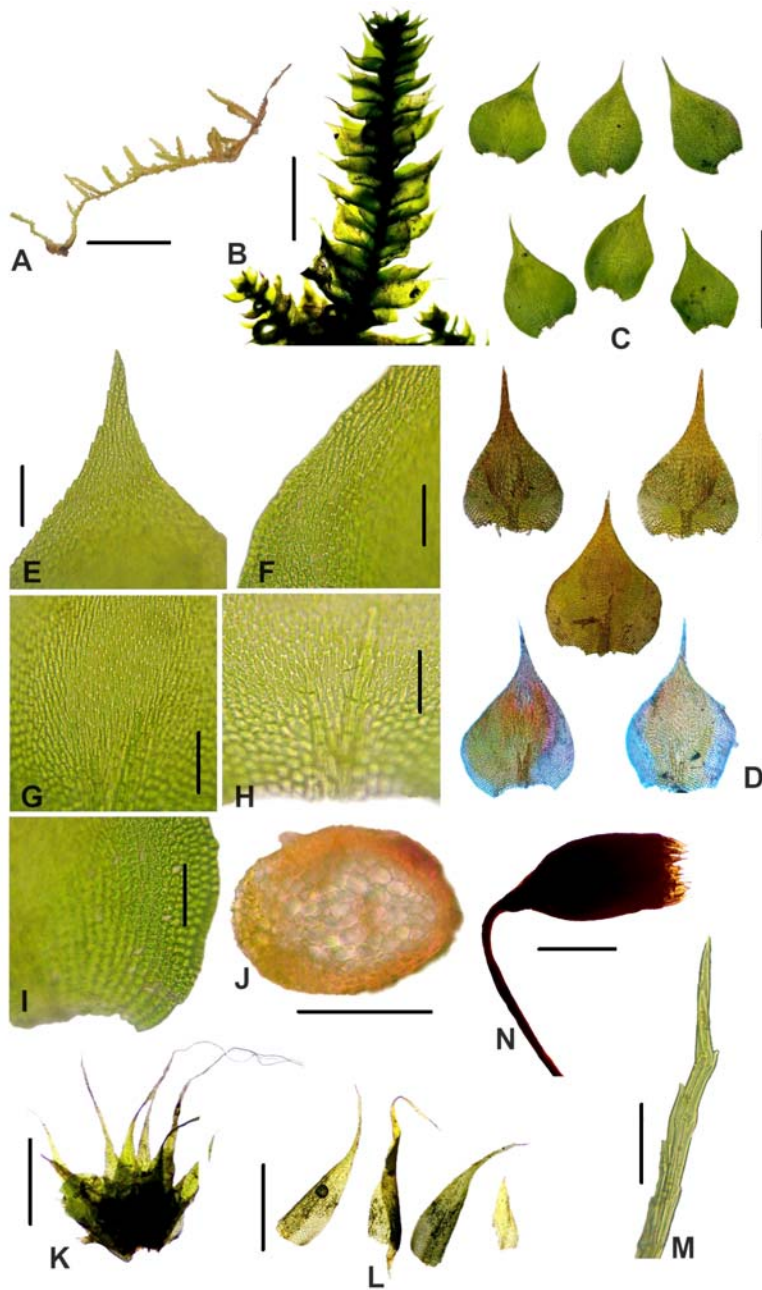


Fig. 2. *Trachyphyllum inflexum* (Harv.) A. Gepp. (A) The habit of the plant, moist. (B) Detail of the plant's branch. (C) Branch leaves, adaxial view. (D) Stem leaves, adaxial view. (E) Leaf apex, adaxial view. (F) Upper marginal lamina cells. (G) Median laminal cells. (H) The base of the branch leaf showing the costa. (I) Alar region of the branch leaf. (J) Cross-section of the stem. (K) Perichaetium. (L) Perichaetial leaves. (M) Leaf apex of a perichaetial leaf. (N) Capsule. All from V.C. *Linis* 5400-17 (PNH). Scale bars: A = 1 cm; B = 10 mm; N = 5 mm; C, D, K, L = 0.5 mm; E = 80  $\mu$ m; F, G, H, I, J = 50  $\mu$ m; M = 10  $\mu$ m.

V.C. *Linis* 5116-16 (PNH); Nueva Ecija Province, Cuyapo Municipality, Mount Bangcay, 15.778333°N, 120.733611°E, ca. 360 m elev., corticolous on *Samanea saman* in a mixed secondary lowland forest and agricultural plot, 11.XII.2017, V.C. *Linis* 5400-17 (PNH); Pampanga Province, Arayat Municipality, Barangay Baño, adjacent to Baño Spring, near Mount Arayat National Park on the lower part of Mount Arayat, 15.183333°N, 120.799712°E, ca. 90 m elev., corticolous on a tree inside a reforestation site, 13.XII.2003, V.C. *Linis* 718-03 (PNH); Bulacan Province, San Rafael Municipality, on bark of mango tree, 5.IX.1960, N. *Veloiria* 230 (CAHUP); Rizal Province, Mount Susong Dalaga, VIII.1917, Ramos & *Edaño* 29443 (PNH); City of Manila, Luneta Park, VIII.1917, R.F. Ramos 44 (PNH); Laguna Province, Municipality of Los Baños, University of the Philippines Los Baños, 09.X.1987, M.D. *Avelino* 64 (PNH); Batangas Province, Talim Point, 18.XII.1984, M. *Onraedt* s.n. (CAHUP). MINDORO ISLAND:

Mindoro Occidental Province, Mamburao Municipality, Barangay Tangkalan, Sitio Biguhan, 13.316671°N, 120.616672°E, corticolous on a dead tree within agricultural land, on a tree trunk, 26.I.2006, V.C. *Linis* 1495-06 (PNH); *ibid.*, Rizal Municipality, Mayupan, 50 m elev., on tree trunk, 4.XI.1976, A.R. *Alvarez* 0-76 (CAHUP). PANAY ISLAND: Iloilo Province, Igrabas Municipality, Barangay Passi, Nasadjaan Falls, on calcareous rock along trail, 1.IV.1984, B.C. *Tan* 84-90 (CAHUP).

#### Distribution and ecology

*Trachyphyllum inflexum* is known to occur in periodically dry areas across Africa, Asia, Papua New Guinea, New Caledonia, and Australia (Buck, 1979; Norris & Koponen, 1990). In the Philippines, it has been reported on the islands of Luzon and Mindoro (Tan & Iwatsuki, 1991; *Linis*, 2009; 2019). This species is now reported

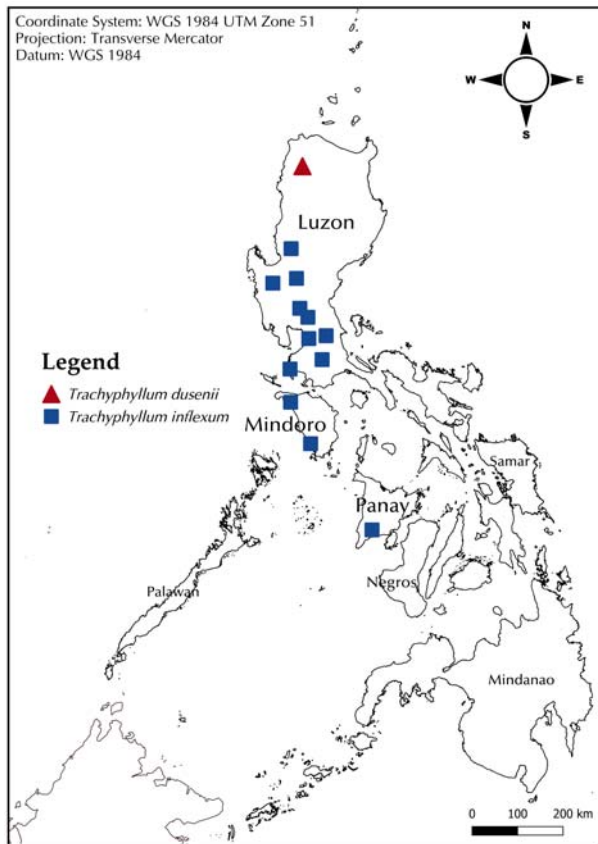


Fig. 3. Distribution of *Trachyphyllum* species in the Philippines, based on studied specimens. Longitude and latitude data for historical collections were approximated. Map generated using QGIS 3.34.10 (QGIS, 2024). *QGIS Geographic Information System. Open Source Geospatial Foundation Project.* Available at <https://qgis.org>.

here for the first time on Panay Island (Fig. 3), based on a specimen collected by B.C. Tan in 1984 (*B.C. Tan 84-90*, CAHUP). In the Philippines, *T. inflexum* occurs on rocks, logs, or as an epiphyte at elevations ranging from near sea level to 1300 meters.

#### DISCUSSION

In recent years, the importance of extensive field surveys in overlooked or under-explored areas and habitats in the Philippines, as well as the examination of historical collections in local herbaria, has been underscored by the discovery of new and notable species in the country (e.g. Tan *et al.*, 2019; Linis, 2019, 2021; Linis & Logatoc, 2023b). The identification of *Trachyphyllum dusenii* in the northern part of Luzon's Cordillera Central significantly extends its known range into the Malayan phytogeographic region. This discovery raises further questions about the historical biogeography of Luzon Island (see Vallejo, 2011), whose moss floras appear to be an aggregate of species with various affinities (Linis & Tan, 2008; Linis, 2019; Linis & Logatoc, 2023a).

*Trachyphyllum dusenii* was initially believed to have an Afrotropical distribution (Buck, 1979) until Buck & Griffin (1984) reported its occurrence in South America.

In addition to the initial record in central Brazil, the species has also been documented in several localities in Panama, Guyana, Brazil, and Bolivia (Carvalho-Silva *et al.*, 2014; Gudiño Ledezma & Salazar Allen, 2017). The species was long known to have an African-South American disjunct distribution, but it was later found in the Indian subcontinent (Kariyappa & Daniels, 2010). These findings—along with the discovery of its presence in Malesia—provide valuable insights and raise further questions about the biogeography of the genus *Trachyphyllum*. Specifically, they prompt inquiry into whether the presence of *T. dusenii* in Southeast Asia represents a relatively recent dispersal event, a long-overlooked disjunct population, or a relic of under-collection.

Throughout their known range, members of *Trachyphyllum* tend to occur in regions with semi-arid to mesic environments (Buck, 1979; Norris & Koponen, 1990; Gudiño Ledezma & Salazar Allen, 2017). In the Philippines, the distribution of *Trachyphyllum dusenii* and *T. inflexum* appears to be restricted to areas characterised by tropical savannah (Aw) or tropical monsoon (Am) climates (Fig. 3; Linis, 2009, 2019; see also Beck *et al.*, 2023). These areas are primarily found along the western seaboard of the islands of Luzon, Mindoro, and Panay, which experience a pronounced dry season from November to April and a wet season for the remainder of the year (Philippine Atmospheric, Geophysical and Astronomical Services Administration, 03 September 2024. *Climate of the Philippines*. Available at <https://www.pagasa.dost.gov.ph/information/climate-philippines>). To date, these species have not been reported in regions with wetter climates, such as the Bicol Peninsula (Linis, 2014), Camiguin (Linis, 2010), and southern Mindanao (Linis & Schwartz, 2023)—unless new data become available as more areas in the country open up for botanical explorations.

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