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# Flora of Singapore precursors, 49: *Phyllodon lingulatus* (Symphyodontaceae) new to Singapore with a new synonym

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ABSTRACT. The discovery of *Phyllodon lingulatus* (Cardot) W.R.Buck among several existing herbarium specimens collected from Singapore represents a new species record for the country. Additionally, the genus *Phyllodon* and the family Symphyodontaceae are both new records for Singapore. *Phyllodon bilobatus* (Dixon) P.E.A.S.Câmara is treated as a new synonym for *P. lingulatus*.

***Keywords.*** Bryophyte, *Glossadelphus*, new record

## Introduction

While sorting the bryophyte specimens deposited in the herbarium of the Singapore Botanic Gardens (SING) for the work on the *Flora of Singapore*, the project coordinator, Boon Chuan Ho, found a few mixed specimens containing material that should belong to the moss genus traditionally recognised as *Glossadelphus* M.Fleisch. These samples were segregated out as separate vouchers and sent to the author for further examination and determination resulting in the present report of *Phyllodon* species to be treated in the *Flora of Singapore*.

### *Taxonomic, nomenclature and familial placement of Glossadelphus*

Buck (1987), in his study of Asian Hypnaceae and related taxa, questioned the traditional concept of *Glossadelphus* and indicated that the genus as previously used is probably best ousted, partly because it was highly heterogeneous with obscure delineation since its inception. He further concluded that *Glossadelphus* is a nomenclatural synonym of *Phyllodon* Schimp., an overlooked and forgotten name; therefore, he reinstated *Phyllodon* to contain many names formerly placed under *Glossadelphus*. In addition, Buck (1987) suggested that most of the species currently placed within *Glossadelphus* should be transferred to *Taxiphyllum* M.Fleisch. Tixier (1988), in his revisionary study of *Glossadelphus*, however, continued to follow the traditional concept, perhaps unaware of its reduction to synonymy under *Phyllodon* by Buck (1987). Moreover, Tixier (1988) proposed an infrageneric classification for *Glossadelphus* with three subgenera and five sections. However, his classification system has not been followed

by anyone (Kim et al., 2020; Yi et al., 2022). Since Buck's work (1987), no one has taxonomically addressed the genus in its entirety by transferring the remaining species in *Glossadelphus* to *Phyllodon* or other genera. More than a dozen Asian and Pacific species remain classified under *Glossadelphus*. In a molecular phylogenetic reassessment of Hawaiian *Glossadelphus* by Kim et al. (2020), a handful of rheophytic *Glossadelphus* species have been shown to form a clade nested within the genus *Ectropothecium* Mitt. However, the taxonomy of *Ectropothecium* is still in flux and no new nomenclatural change was formally proposed.

Although *Glossadelphus* was traditionally placed in the Sematophyllaceae, Buck (1987) placed *Phyllodon* in the Hypnaceae. Recent molecular phylogenetic analyses demonstrated that *Phyllodon* and *Bryocrumia* L.E.Anderson (also formerly in the Hypnaceae) form a clade with *Chaetomitriopsis* M.Flesich., *Chaetomitrium* Dozy & Molk., *Dimorphocladon* Dixon, and *Symphyodon* Mont. in the Symphyodontaceae (Cox et al., 2010). A more recent study by Ma et al. (2018) further confirmed the close systematic positions of the above-mentioned genera with the inclusion of an additional new genus *Rheoshevockia* Ignatov et al. Most recently, Myotoishi et al. (2024) transferred another monotypic genus, *Pseudohypnella* (Broth.) M.Fleisch., from the Hypnaceae to the Symphyodontaceae. Hence, the Symphyodontaceae has now grown from being monogeneric to a family of nine genera.

## Materials and methods

All available specimens of Symphyodontaceae from Singapore deposited in the herbaria BM and SING were examined. Herbarium acronyms follow Thiers (continuously updated). Accepted names were determined by comparing them with the type specimens, images, original drawings, and protologue descriptions of the relevant names. All specimens have been seen by the author unless otherwise indicated; specimens examined via digital images are indicated with an asterisk (*).

Descriptions are provided following the *Flora of Singapore* format and they are based solely on the specimens collected within Singapore. Provisional IUCN conservation status for Singapore is assessed using the criteria outlined in Davison (2024).

## Results

All specimens studied could be attributed to *Phyllodon lingulatus* (Cardot) W.R.Buck. The species also commonly occurs in the neighbouring Peninsular Malaysia where *Phyllodon glossoides* (Bosch & Sande Lac.) P.E.A.S.Câmara and *P. similans* (Bosch & Sande Lac.) S.He are also recorded (Yong et al., 2013). Upon examining the type specimen images, original drawings, and protologue descriptions of both *Taxithelium bilobatum* Dixon and *T. lingulatum* Cardot, I concluded that these two species fall well within variation boundary of a single species. The conduplicate lateral leaves

in the type specimens of both taxa resemble each other. Several specimens named as *Glossadelphus bilobatus* (Dixon) Broth. and *G. lingulatus* (Cardot) M.Fleisch. deposited at the Missouri Botanical Garden Herbarium (MO) also suggest that the two names belong to one species. Some studies, such as Jia et al. (2005: 33–35), used a 'double toothed' upper leaf margin to distinguish *Glossadelphus bilobatus* from *G. lingulatus*. However, this distinction does not hold, as *Glossadelphus lingulatus* clearly exhibits bifid marginal teeth at the upper leaf margin shown here in Fig. 1 E–H and the same feature is also shown by Noguchi et al. (1994: 1090, fig. 480) and Yi et al. (2022: 226, fig. 1). Having nomenclatural priority, the correct name for this taxon is *Phyllodon lingulatus*. Not only does this species represent a new species record for Singapore but *Phyllodon* and Symphyodontaceae are also new generic and family records, respectively, for the country.

## Taxonomic treatment

***Phyllodon lingulatus*** (Cardot) W.R.Buck, Mem. New York Bot. Gard. 45: 521 (1987); Kis, Cryptog. Bryol. 23: 163, fig. 2 (2002); Yi et al., Phytotaxa 541: 226, fig. 1 (2022). – *Taxithelium lingulatum* Cardot, Beih. Bot. Centralbl., Abt. 2, 19(2): 136, fig. 27 (1905). – *Glossadelphus lingulatus* (Cardot) M.Fleisch., Musci Buitenzorg 4: 1352 (1923 ['1915–1922']); Noguchi et al., Ill. Moss Fl. Japan 5: 1090, fig. 480 (1994); Jia et al., Moss Fl. China 8: 35 (2005). – TYPE: China, Taiwan (Formosa), Kelung, *U.J. Faurie 179* (holotype PC [PC0097061*]; isotypes BM [BM000919391] n.v., H n.v.). (Fig. 2A)

*Taxithelium bilobatum* Dixon, Bull. Torrey Bot. Club 51: 244, pl. 3: fig. 2 (1924), **syn. nov.** – *Glossadelphus bilobatus* (Dixon) Broth. in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 11: 535 (1925); Gangulee, Mosses E. India 3, fasc. 8: 1928, fig. 988 (1980); Tixier, Nova Hedwigia 46: 332, fig. 7 (1988); Jia et al., Moss Fl. China 8: 33 (2005). – *Phyllodon bilobatus* (Dixon) P.E.A.S.Câmara, Novon 20(2): 140 (2010). – TYPE: Malaysia, Perak, Bujong Malacca, 1907, *H.N. Ridley 739* (holotype NY [NY01086759*]; isotypes BM [BM000850526, BM000850534] n.v., SING [SING0165916]).

*Glossadelphus baldwinii* Broth., Bishop Mus. Bull. 40: 31, pl. 7: fig. 26 (1927). – TYPE: USA, Hawaii, Olowalu, Insul. Maui occid., 1875, *Baldwin 49* (lectotype H [H1811049], designated by Kis (2002: 163); isolectotype NY [NY01028880]).

Plants medium-sized, 2–3 cm long, forming thin mats, yellowish green, somewhat glossy. ***Stems*** loosely spreading, irregularly pinnately branched; stem in cross section with thick-walled epidermal cells and outer cortical cells in 2 rows, inner cortical cells thin-walled, enlarged; central strand not or faintly developed; pseudoparaphyllia foliose. ***Leaves*** usually complanate, spreading, differentiated into more or less similar ventral/dorsal leaves and broadly concave to conduplicate, asymmetric lateral leaves, oblong-ovate to lingulate, 0.7–1 × 0.3–0.4 mm, apex obtuse to truncate; margins plane

or recurved on one side below, one side narrowly folded, coarsely serrate in distal 2/3; costae short and double, 1/5–1/4 lamina length, or absent; leaf base not decurrent; apical and distal marginal cells short, with bifid papillose marginal cells; median cells oblong-linear, 65–75 × 4–5 μm, papillosely projecting at cell angles; alar region somewhat differentiated into short-rectangular cells, smooth. ***Dioicous?*** Perichaetia and perigonia not seen. ***Sporophyte*** not seen.

*Distribution.* India, Sri Lanka, China (including Taiwan), Japan, Thailand, Vietnam, Peninsular Malaysia, Borneo, the Philippines, Vanuatu, Hawaii, and Africa (DR Congo). New to Singapore.

*Ecology.* On rocks by stream in jungle. Specimens in Singapore were collected in mixture with other humid-loving species, such as *Distichophyllum schmidtii* Broth. and *Callicostella papillata* (Mont.) Mitt. var. *prabaktiana* (Müll.Hal.) Streimann.

*Provisional IUCN conservation assessment.* Globally not assessed. In Singapore assessed here as presumably Nationally Extinct (NEx) because it has not been recollected for over 60 years since 1960 despite several attempts to relocate it in its known locality.

*Additional specimens examined.* SINGAPORE: **Bukit Timah:** Fern Valley, 5 Apr. 1926, *Holttum SFN 18315b* (SING [SING0248659]); ibidem, 30 May 1928, *Holttum SFN 19328b* (SING [SING0248658]); ibidem, 29 Apr. 1960, *Unknown collector 2088 [B0815]* (KLU [KLU B790]).

*Taxonomy.* The species of *Phyllodon* in Singapore and Peninsular Malaysia region often have oblong-ovate to lingulate leaves that are complanately arranged, with leaf apices broadly obtuse to truncate. The leaf cells have projecting distal ends or both ends, and the alar cells are weakly differentiated. *Phyllodon lingulatus* typically exhibits divergent lateral leaves that are distinctly concave to conduplicate, sometimes deeply bi-lobed near the apex. The leaf apex is often truncate and emarginate, with swollen bifid teeth along the upper margin. The combination of truncate dorsal/ventral leaves and the deeply bi-lobed apex with a coarsely serrate margin distinguishes *Phyllodon lingulatus* from *P. glossoides* and *P. similans* found in Peninsular Malaysia. *Phyllodon lingulatus* also differs from *P. truncatulus* (Müll.Hal.) W.R. Buck, the type species of the genus, by the absence of seriate pluripapillae over the cell lumen.

When *Phyllodon bilobatus* was first described as *Taxithelium bilobatum*, it was characterised by the distinctly bi-lobed lateral leaves, which were considered different from any other known species in the genus *Taxithelium* by Dixon at the time (Dixon, 1924). This species is most closely allied with *Phyllodon glossoides*, which shares similar dorsal and ventral leaves, but differs entirely in the lateral leaves. Earlier, *Phyllodon lingulatus* was described as *Taxithelium lingulatum* characterised by having conduplicate lateral leaves (Cardot, 1905). The latter was also compared to *Taxithelium glossoides* and *T. similans*, as they share similarities in their dorsal and

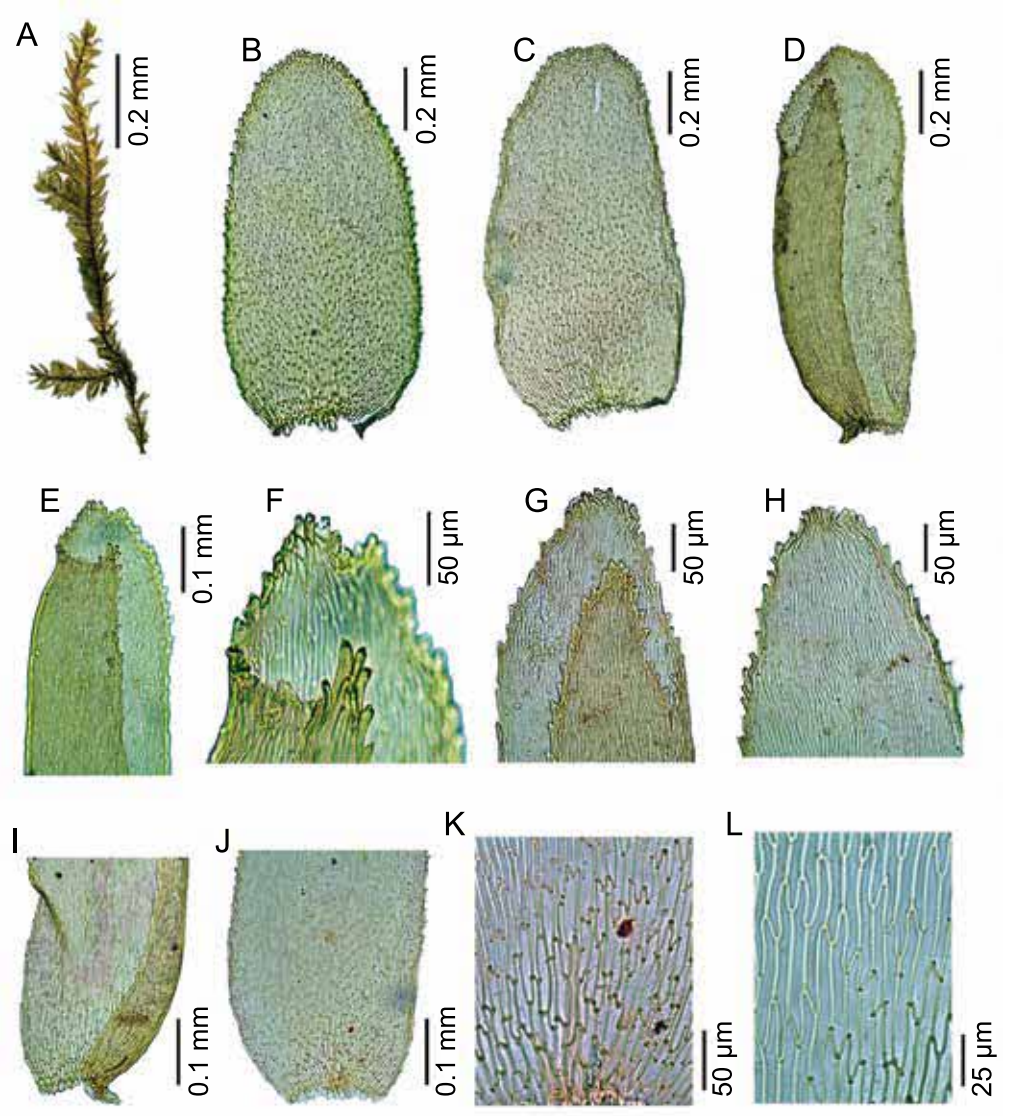


**Fig. 1.** *Phyllodon lingulatus* (Cardot) W.R.Buck. **A.** Habit. **B, C.** Dorsal/ventral leaves. **D.** Lateral leaf. **E–G.** Leaf apices of lateral leaves. **H.** Leaf apex of dorsal/ventral leaf. **I.** Leaf base of lateral leaf. **J.** Leaf base of dorsal/ventral leaf. **K.** Basal juxtacostal leaf cells. **L.** Median leaf cells. All from Singapore, Bukit Timah, *Holttum SFN 19328b* (SING). (Photos: S. He)

ventral leaves. The distribution ranges of the two names overlap in East and Southeast Asia, with *Glossadelphus bilobatus* being better known in Southeast Asia, while *G. lingulatus* is more frequently reported in East Asia.

Tixier (1988: 334) treated *Glossadelphus lingulatus* as a synonym of *G. laevifolius* (Mitt.) E.B.Bartram; however, the latter does not show bi-lobed or conduplicate leaves. Furthermore, Tixier's synonymy has never been accepted in any recent literature.


**Fig. 2. A.** Type images of *Taxithelium lingulatum* Cardot, *U.J. Faurie 179* (holotype PC [PC0097061]). **B.** Type images and drawings of *Taxithelium bilobatum* Dixon, *H.N. Ridley 739* (holotype NY [NY01086759]).

*Notes.* Câmara (2010: 140) cited the types of *Taxithelium bilobatum* as 'holotype BM; isotype NY'. However, the protologue clearly states that the species was described based on *Ridley 739* from Herb. Mitten, which is now housed at NY (Fig. 2B). An image of the NY specimen also bears an annotation from H.N. Dixon dated 16 October 1920, with sketches of leaves that match those illustrated in the protologue. Hence, the NY specimen is without doubt the holotype. BM does seem to have an isotype identified by Câmara (J. Wilbraham, pers. comm.) and the so-called 'holotype' on the annotation of *Taxithelium bilobatum* should also be treated as an isotype.

## Doubtful and excluded species of Symphyodontaceae in Singapore

*Symphyodon perrottetii* Mont. was first recorded in Singapore by He & Snider (2000: 73). Although the record has already been excluded for Singapore by Tan & Ho (2008: 139), it was propagated recently by Akiyama et al. (2021: 75). The record was, without doubt, based on the correctly identified voucher *St. V. Down 28* (H [H-BR3909006]) collected in 1897. However, the species occurrence elsewhere is above 1000 m elevation, whereas Singapore is no more than an elevation of 164 m. This is very likely a case of mislabelling of a specimen that may have been collected from elsewhere at high elevation in the region instead.

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