

9. DIPHYSCIACEAE M. Fleischer

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Plants perennial, medium-sized, 0.5–1 cm, forming dense turf, rhizoids often firmly compacting the mineral substratum, dark to dull green; protonema producing funnel-like flaps (rarely discernible in most specimens). **Stems** short, erect, usually simple, 0.5–2 mm. **Leaves** proximally reduced, crowded, often crisped when dry, sometimes radially inrolled, spreading when moist, lingulate or lingulate-subulate, rounded-obtuse to acute, mainly entire; costa single, strong, lamina usually 2(–3)-stratose from costa to near margins, cells rounded-quadrate to rounded-hexagonal, thick-walled, plane, mammillose or papillose on one or both surfaces; cells at or near base 1-stratose, hyaline, smooth, rectangular or oblong-hexagonal. **Sexual condition** autoicous or dioicous; perigonal shoots with few, short-lingulate leaves enclosing paraphyses and few antheridia; paraphyses filamentous; interior perichaetial leaves usually longer than exterior leaves, erect, often scarious, ovate-lanceolate, lance-subulate to linear, generally lacerate or ciliate at apex, awned by long-excurrent costa, brown and mainly without chlorophyll when mature. **Seta** very short, smooth, central strand absent. **Capsule** obliquely oriented, nearly completely enveloped by perichaetial leaves, asymmetric, ovoid, at the base often strongly bulging on upper side, narrowed to a conic operculum and narrow mouth, annulus present, neck absent, stomata phaneropore in 2 rows near base or absent; peristome double or sometimes absent, with a white densely papillose endostome of 16 pleats, somewhat twisted when dry and toothed at apex of each of the keels, exostomial teeth rudimentary, fewer in number than the pleats. **Calyptra** smooth, covering operculum.

Genera 3, species 15 (1 genus, 2 species in the flora): North America, Mexico, West Indies, Central America, South America, Europe, Asia, Atlantic Islands, Pacific Islands, Australia.

Diphysciaceae's three genera are *Diphyscium* with ca. 12 species, *Theriotia* Cardot with two species in Southeast Asia, and *Muscoflorschuetzia* Crosby with one species in Chile. The three were recently merged (Z. L. K. Magombo 2003) into a single genus, *Diphyscium*, with 15 species.

SELECTED REFERENCE Magombo, Z. L. K. 2003. Taxonomic revision of the moss family Diphysciaceae M. Fleisch. (Musci). J. Hattori Bot. Lab. 94: 1–86.

1. DIPHYSCIUM D. Mohr, *Observ. Bot.*, 34. 1803 • [Greek *di-*, two, and *physkion*, little gut, alluding to double bladder of spore sac and capsule wall]

Plants gregarious, forming compact short turf. **Leaves** lingulate, costate, 1–2-stratose, distal cells chlorophyllose, quadrate to isodiametric, thick-walled and papillose or mammillose or smooth, proximal cells rectangular, hyaline, smooth. **Perigonial leaves** similar to vegetative leaves, except that interior are reduced and enclose paraphyses, axillary hairs, elongate antheridia. **Perichaetial leaves** long-awned with awn smooth or spinulose, awn often longer than lamina, with laminal apex lacerate and ciliate, when without sporangium strongly imbricate and penicellate, enclosing paraphyses, axillary hairs, few archegonia. **Calyptra** conic, barely covering operculum.

Species 12 (2 in the flora): North America, Mexico, West Indies, Central America, s South America, Europe, Asia, Atlantic Islands (Azores, Madeira), Pacific Islands, Australia.

Diphyscium is the most widespread genus in the family and is mainly temperate to subtropical. It is sufficiently distinctive and unlikely to be confused with any other genus in North America if perichaetia or sporophytes are present. Vegetative material is superficially similar to that of the Pottiaceae, especially in leaf form and papillosity. Fortunately, perichaetia and sporophytes are frequent in the eastern range of the genus, while turf firmly cemented by rhizoids is a trait not shared by Pottiaceae in the same range.

- 1. Vegetative leaves blunt, leaf cells mammillose or papillose; awn of perichaetial leaves spinulose; soil 1. *Diphyscium foliosum*
- 1. Vegetative leaves acute, leaf cells smooth; awn of perichaetial leaves smooth; rock 2. *Diphyscium mucronifolium*

1. **Diphyscium foliosum** (Hedwig) D. Mohr, *Observ. Bot.*, 35. 1803 [F]



Buxbaumia foliosa Hedwig, *Sp. Musc. Frond.*, 166. 1801

Plants dark green to brownish, dull, forming hard tufts. **Stems** unbranched, erect, 0.5–1 mm, strongly radiculose. **Leaves** 0.5–4 mm, crisped and imbricate when dry, margins entire or weakly toothed with papillae, apex blunt,

the most proximal leaves shorter than the most distal, laminal cells mammillose or papillose through most of lamina. **Perichaetial leaves** brownish when mature, with spinulose awn, lamina at awn base lacerate and membranaceous. **Capsule** broadly ovoid, (2–)3–4 mm, stomata phaneropore near capsule base; mature sporangium emergent from spreading perichaetium. **Spores** 6–8 μm.

Capsules mature early summer. Soil banks and soil of forest floors, also in tundras; low to moderate elevations (50–1000 m); B.C., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que.; Ala., Alaska, Ark., Conn., Del., Ga., Ill., Ind., Kans., Ky., La., Maine, Md., Mass., Mo., N.H., N.J., N.Y., N.C., Ohio, Okla., Pa., S.C., Vt., Va., W.Va.,

Wis.; Mexico; Central America (Guatemala); Europe; Asia; Atlantic Islands (Azores, Iceland, Madeira).

In western North America, *Diphyscium foliosum* is terrestrial in tundra sites, often in blowouts; it is also found as humid perpendicular sods pendent from ledges and on rock in canyon walls; in eastern North America it is found on banks and horizontal surfaces in forests. The unique golf-tee-like protonemal flaps, which can be excavated from the rhizoids, are a distinctive family trait.

SELECTED REFERENCE Shaw, A. J., L. E. Anderson, and B. D. Mishler. 1987. Peristome development in mosses in relation to systematics and evolution. I. *Diphyscium foliosum* (Buxbaumiaceae). *Mem. New York Bot. Gard.* 45: 55–70.

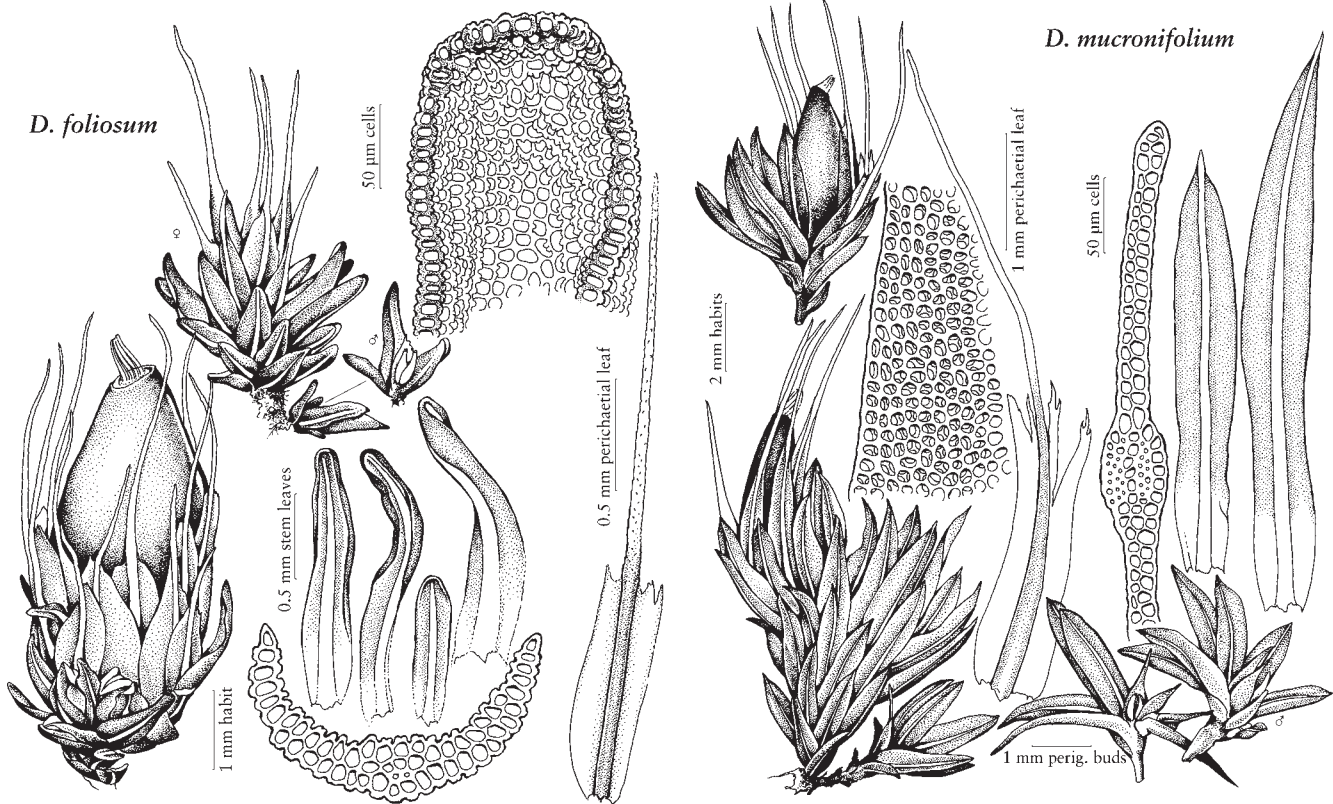
2. **Diphyscium mucronifolium** Mitten in F. Dozy and J. H. Molkenboer, *Bryol. Jav.* 1: 35, plate 26. 1855 [F]



Diphyscium cumberlandianum Harvill; *D. involutum* Mitten

Plants dark green to brownish, somewhat glossy, tightly affixed to substratum. **Stems** 0.5–1 mm, erect, strongly radiculose. **Leaves** 0.5–5 mm, and somewhat crisped when dry, apex acute, the most proximal leaves reduced, laminal cells smooth, margins entire. **Perichaetial leaves** with smooth awn, 9–12 mm, lamina at awn base lacerate but

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not membranaceous. **Capsule** narrowly ovoid, 2–3 mm, stomata absent, mature capsules sheathed in penicellate perichaetium, awns extending more than twice the length of the immersed capsule. **Spores** 9–12 µm.

Sporophytes infrequent, capsules mature summer. Always on somewhat shaded humid rock surfaces, especially sandstones, conglomerate, and schist; moderate elevations (900–1000 m); Ala., Ga., Ky., N.C., Tenn., Va; Asia (China, India, Japan, Philippines, Sri Lanka).

Diphyscium mucronifolium is an example of an east Asian disjunctive species, and is found only as local, small populations.

SELECTED REFERENCE Harvill, A. M. 1950. *Diphyscium cumberlandianum*, a pre-Pliocene relic with palaeotropical affinities. *Bryologist* 53: 277–282.