

**Diploschistes** Norman  
(THELOTREMATACEAE)

After Lumbsch

Rev. 5/94

Thallus crustose, continuous to cracked-areolate, whitish, grayish, yellowish or brownish, often thick, smooth and uniform to verrucose, often pruinose, ecorticate or with a corticiform layer; medulla I+ bluish; medullary hyphae thick-walled. Photobiont Trebouxia.

Apothecia at first usually  $\pm$  perithecioid, often immersed in thallus, later urceolate, immersed to adnate, with open disc, or persistently opening only by a pore; disc black, or gray pruinose. Thalline exciple present, sometimes scarcely distinguished from the thallus, or thick and pruinose; [often?] separated [or at least clearly distinct] from proper exciple by circular fissure (according to Poelt, and my own observations, but proper exciple united with the thalline exciple according to Hawksworth); receptacle (true exciple) deeply cupulate, dark brown to black, pseudoparenchymatous, of interwoven, not radiating, thick-walled, swollen to  $\pm$  globose hyphae immersed in a matrix below; periphysoids arising from innermost layer, pale brownish, on upper inside margin, remotely septate, not swollen apically, often appearing as a fringe in surface view, and presumed to close the ascomatal opening under xeric conditions; hypothecium dark brown to olive-brown (colorless according to Awasthi), 30-60(-100)  $\mu$ m tall. Hymenium colorless, I-, not inspersed; epihymenium  $\pm$  colorless to black, sometimes with crystal inclusions. Paraphyses simple or apically  $\pm$  branched, flexuous, remotely septate, 1-1.5  $\mu$ m thick, the apices not or slightly swollen, sometimes brownish or yellowish. Asci elongate-clavate to subcylindrical, the wall thin, then  $\pm$  thickened when mature, with a somewhat abrupt apical thickening within a thin, internal apical beak or a downward, convex swelling when young, lacking any apical apparatus, the contents I+ orange-red, the walls I-, not fissitunicate. Spores (1-)2-4-8 per ascus, at first colorless and only transversely septate, progressively becoming brown to dark brown or purplish black and few to many-celled muriform, broadly ellipsoid, lacking a distinct perispore or gelatinous sheath, I- or I+ bluish.

Pycnidia in slightly raised warts, black; conidiogenous cells simple or branched at the base, elongate-ampulliform; pycnosporos short, bacilliform to elongate-ellipsoid, straight, truncated to apiculate at the base, simple, colorless, arising apically (fulcrum exobasidial). Thallus usually C+ red, containing para-depsides (e.g. lecanoric and diploschistes acids), or gyrophoric acid; some species with norstictic or constictic acids. On soil, rock, moss, or other lichens, mostly in xeric situations, coastal, desert, grassland, forest, or alpine habitats,  $\pm$  temperate.

Usually easily recognized by the immersed, punctiform to urceolate apothecia with distinctly double margins,  $\pm$  muriform spores, and thickish, usually pale thallus usually on rock or soil.

**1. Ascocarps immersed, perithecioid, opening only by a narrow pore 0.2.-0.6(-0.8) mm (D. actinostomus group). Spores brown. .... 2**

**1. Ascocarps semi-immersed to adnate, urceolate (D. scruposus group) or lecanoroid (D. ocellatus group), at least the older ones opening broadly, the disc to 2 mm wide. Spores brown or (Ingvarella bispora) hyaline to brownish. .... 5**

**2. Thallus gray to gray-white**, uniform, firmly attached, finely to coarsely rimose-areolate, matt to shiny, not pruinose; areoles 0.5-1.5 mm diam., to 1.5 mm thick, irregularly polygonal, flat or slightly convex. Apothecia blackish, immersed in warts to 3 mm diam. and 2 mm high; proper exciple blackish, to 70 µm thick, pseudoparenchymatous; hymenium 120-160 µm; hypothecium hyaline, 10-15 µm thick; paraphyses simple, flaccid, 1-1.5 µm thick; asci cylindrical to subclavate, 110-150 x 15-40 µm; spores 4-6(-8) per ascus, broadly ellipsoid, 4-6-septate transversely, 1-3-septate longitudinally, 16-32 x 10-32 x 10-20 µm. Pycnidia immersed, cerebriform; conidia bacilliform, 4-7 x 1 µm. Thallus K-, C+ red, P-, UV- (lecanoric acid in TLC; with traces of diploschistic acid in HPLC). On rock (usually siliceous), Great Lakes area (Minnesota) and southward (North Carolina). ..... D. actinostomus

**2. Thallus brown, uniform.** ..... 3

**3. Thallus C-, without substances.** ..... (see D. arabiensis)

**3. Thallus C+ rose or red, with gyrophoric or lecanoric acids.** [Need to see Lumbsch's key again to see what the diagnostic differences between the next two species are; they seem to differ slightly in a number of small ways but not in any big ways]. ..... 4

**4. Ascocarps to 0.8 mm wide; Thallus K-, C+ rose, P-, UV- (gyrophoric acid major, lecanoric acid minor).** Spores 21-28 x 10-13 µm, broadly ellipsoid, 4-6 septate transversely, 1-2 septate longitudinally. Thallus adnate, rimose-areolate, reddish brown to brown; areoles 0.6-2 mm diam., to 2.4 mm thick, irregularly angular. Proper exciple gray black, to 65 µm thick, pseudoparenchymatous; hymenium 120-140 µm; hypothecium hyaline, 10-15 µm; paraphyses simple, 1-1.5 µm thick; asci cylindrical, 110-130 x 15-25 µm, 6-8-spored, I-. Pycnidia unknown. On rock, SE Arizona, and Costa Rica. .... D. badius Lumbsch & Elix

**4. Apothecia immersed in warts to 2.5 mm diam.; Thallus K-, C+ red, P-, UV- (lecanoric acid).** Spores 16-26 x 8-18 µm, broadly ellipsoid, 4-6-septate transversely, 1-3-septate longitudinally. Thallus tightly attached, rimose to warty areolate, matt to shiny, red-brown to dark-brown, not pruinose; areoles 0.4-1.8 mm diam., to 1.8 mm thick, irregularly polygonal, flat to convex. Proper exciple blackish, to 70 µm thick, pseudoparenchymatous; hymenium 100-130 µm; hypothecium hyaline, 10-15 µm high; paraphyses simple, flaccid, 1-2 µm thick; asci cylindrical, 90-120 µm, 4-6-spored. On non-calcareous rock. California, Mexico (Sonora), South Carolina, West Indies. .... D. aeneus (Müll. Arg.) Lumbsch

**5. Spores 1-2 per ascus, hyaline to brownish. Apothecia without true exciple.** On siliceous rocks, montane to alpine in arid or semi-arid areas. Wyoming, British Columbia, possibly Washington. .... (Ingvariella bispora)

**5. Spores 4 or more per ascus, brown. Apothecia with true exciple.** ..... 6

**6. Thallus rusty brown, whitish mainly around apothecia, C-(no substances).** uniform, rimose-areolate, thick; areoles 0.5-1 mm across, 0.5-0.7 mm thick, irregularly angular. Photobiont chlorococcoid. Apothecia immersed; without ridges; disc urceolate, punctiform or expanded; excipulum brown; hypothecium 10 µm high, hyaline; hymenium 120-140 µm high, hyaline. Paraphyses simple, lax. Asci cylindrico-clavate, unitunicate, 120 x 20-25 µm, 6(-8)-spored. Spores broadly ellipsoid, brown, muriform; 5(-6)-septate

transversely, 2-3-septate longitudinally, 23-29 x 15-19 um. Cortex and medulla K-, P-. Medulla I+ blue. On siliceous rock. Arizona, Colorado, Utah. .... D. arabiensis  
Lumbsch in Abu-zinda, et al.

**6. Thallus grayish or whitish, or at most yellowish or yellowish brown, not rusty colored; C+ rose or red (gyrophoric or lecanoric acids).** ..... 7

**7. Thallus firmly attached to rock, thick, areolate, ± pure gray, rarely yellowish.** ..... 8

**7. Thallus on soil, moss or other lichens, or forming very loosely appressed, often only marginally attached delicate "skin" on shaded rock. Apothecia deeply sunken.** ..... 9

**8. Thallus K+ yellow then ± red-brownish to blackish-violet-red, I+ violet-blue, C+ red to violet-blue.** ..... D. scruposus var. violarius

**8. Thallus K- or slightly yellowish-brownish, I-, C+ fleeting reddish.** ..... D. scruposus var. scruposus

**9. On hard calcareous or gypsaceous rocks.** Thallus ca. 1-3 mm thick, loosely appressed, very fragile, frequently bulging/folded, to rimose-areolate, forming a chalky "skin" over the substrate, gray-yellowish to white, usually densely grayish white pruinose (granular-mealy) at least when old. Epinecral layer present. Thallus K- or slightly yellowish, C+ red, P- (lecanoric acid). Apothecia urceolate, to 5 mm diam.; proper excipulum pseudoparenchymatous, brown, with periphysoids; hypothecium hyaline, ca. 15 um thick; hymenium 120-190 um, I-; paraphyses simple, 1-2 um broad; asci I-, subclavate to cylindrical, 90-130 x 20-30 um, 4-spored; spores brown, muriform, 25-40 x 10-17 um. On often vertical surfaces, especially limestones, in somewhat shaded and damp situations. U.S. (Montana?). ..... D. gypsaceus

**9. On soil, moss or plant remains, loosely to firmly attached, gray; areoles to 0.5 mm wide.** ..... 10

**10. Thallus K+ yellow to red or red-brownish, P-, C+ red (chem.: lecanoric and diploschisteric acids).** Widely distributed and common. .... 9

**10. Thallus K-, C+ rosy, P-, UV- (chem.: gyrophoric acid plus small amount of lecanoric acid), I+ reddish violet (or I-?).** Thallus unifrom, tightly attached, continuous to finely rimose-areolate, shiny, yellowish brown to yellowish green or sometimes pale straw color to ochraceous-white, not pruinose, to 1 mm thick, flat. Apothecia immersed, apothecia-like, often coalescing; disc blackish, weakly pruinose, to 5 mm diam; proper exciple blackish, to 60 um thick, pseudoparenchymatous; hymenium 125-150 um; hypothecium hyaline, 10-20 um; paraphyses simple, flaccid, 1-2 um thick; asci cylindrical to subclavate, 100-140 x 15-30 um; spores (4-)6-8/ascus, 20-28 x 8-14 um, broadly ellipsoid, 4-6-septate transversely, 1-2-septate longitudinally. On soil, tropical-subtropical. Florida. .... D. hypoleucus Zahlbr. (synonym: D. stramineus)

**11. Growing on mosses or Cladonia, at least initially.** Thallus UV-, C+ red, K- or K+ yellowish then usually red-brownish, or ("D. canadensis") K+ red-violet to blackish purple; containing lecanoric and diploschisteric acids (or ? in "D. canadensis"). Spores 4/ascus, (18-)25-32(-40) x (6-)12-15(-18) um, with 5 transverse and 1-2 longitudinal septa. Thallus whitish to dark gray, creamish-fawn, or grayish brown, uneven, ± continuous, not areolate, the surface uneven, ± coarsely warted or hummocky, 1-4 cm diam., [usually?] not whitish pruinose. Apothecia urceolate, common, crowded; disc 0.2-0.8(-2) mm diam., black, ± pruinose; margins swollen, inflexed, not or slightly raised above thallus, concolorous with thallus, often rugose-plicate. Hymenium 75-120 um tall; hypothecium dark brown. Asci 65-80 x 12-15(-20) um. On calcareous ground, wall tops or base-rich dunes, rarely trees. Widespread, eastern and

western. .... D. muscorum (Scop.) R. Sant.

**11. Growing on soil, usually calcareous or gypsaceous**, in exposed habitats. Spores 4-8/ascus, 20-40 x 9-17 um, brown, muriform, with 3-6 transverse and 1-2 longitudinal septa. Thallus K+ yellow to red. Thallus crustose, rimosely to verrucosely areolate, with grayish white to grayish pruina, ca. 1-3 mm thick, covered by epinecral layer. Apothecia urceolate to lecanorine, to 2.5 mm diam.; proper exciple pseudoparenchymatous, brown, with periphysoids. Hypothecium hyaline, ca. 15 um thick; hymenium 110-180 um, I-; paraphyses simple, 1-2 um broad; asci I-, subclavate to cylindrical, 100-140 x 20-28 um. Pycnidia immersed in thallus, hyaline to brownish, cerebriform; conidia ellipsoid, 4-6 x 1-1.5 um. United States (CA, UT, TX; probably common throughout much of the arid or semi-arid west, into Washington or British Columbia) and Mexico (Puebla and Jalisco). .... D. diacapsis (Ach.) Lumbsch (synonym: D. albissimus)

ADD:

Texas (Worthington collection in ASU, det. Lumbsch)..... D. candissimus (Kremph.) Zahlbr.

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