

Dermatocarpon Eschw.
(VERRUCARIALES: VERRUCARIACEAE)

After Thomson (1984), Degelius (1934), Poelt (1969),
and Coppins & Fox (1992)

Rev. 5/94

Thallus foliose, single-lobed and attached to substratum by a usually central holdfast (peltate or umbilicate), or multi-lobed (appearing squamulose but \pm loosely attached by several, scattered holdfasts), or (especially in vagrant modifications) subfruticose, with lobes inrolled with corniculate tips. Upper surface gray to dark brown, often \pm whitish pruinose, when epruinose and aquatic often green when wet; mostly smooth but with slightly raised, punctiform spots of the ostioles of ascomata or conidiomata. Lower surface pale to dark brown or black, smooth, verrucose, papillate, granular or wrinkles to at least partly with reticulate veins; rhizines absent or occasionally present; tomentum absent. Upper cortex pseudoparenchymatous, formed of adhering, vertically oriented hyphae with \pm globose cells; lower cortex of several rows of rounded to usually almost cuboid, vertically aligned, thick-walled cells. Photobiont chlorococcoid (*Myrmecia*, *Hyalococcus*, or other genera, not trebouxiioid). Medulla of thin, filamentous hyphae. Thallospores, soredia and isidia absent; trabeculae absent.

Perithecia uniloculate, immersed, globose; involucrellum absent. True exciple colorless, reaching the surface by a short to rather long ostiolar neck, the neck often slightly protruding and brown pigmented. Periphyses numerous; paraphyses deliquescing; hymenial gel I+ reddish or blue. Asci cylindrical-clavate to saccate, thick-walled, K/I-, *Verrucaria*-type; apical dome distinct in young asci and with an ocular chamber, but becoming reduced and almost absent as the ascus matures. Spores 8, simple or rarely a few thinly 1-3-septate, globose to narrowly ellipsoid or ovoid, colorless, smooth, without a conspicuous perispore.

Pycnidia immersed, similar in size to perithecia, wall colorless, internally pseudoparenchymatous with irregular locules lined with poorly differentiated conidiogenous cells; conidia bacilliform, simple, colorless.

No substances. On hard acid or calcareous rocks, often by or in rivers or lakes or in seepage tracks, or growing loose on gravelly or rocky soil in dry areas but often associated with intermittent stream beds where attached forms grow; mainly in cool (to warm) temperate regions, to \pm arctic-alpine.

Care must be taken to distinguish a true pruina, which is not water-soluble, from clusters of water-soluble crystals often formed on the thallus surface in the herbarium. The color change in the thallus when wet does not seem to be a very reliable character.

Catapyrenium differs mainly in having a squamulose to almost areolate thallus.

1. With rhizines below. 2
1. Underside smooth to rugose or papillate, without rhizines. 3
2. Rhizines mostly simple, often sparse. Underside orangish brown to dark brown.

Spores 12-15 x 7-8 um. Rhizines short, light to dark brown. Apparently rather uncommon. Attached to dry, calcareous rocks, in scattered localities in the west (including the Pacific NW); full distribution not well known. D. moulinsii

2. Rhizines coralloid branched, abundant, forming a thick mat. Underside black.

Spores 8.5-10 x 6 um. Rhizines ca. 0.1 mm long. Thallus leathery, thickish, to well over 10 cm wide, grayish pruinose, usually completely monophyllous. On steep faces of lime-free rock. D. vellereum

3. Growing loose on soil; thallus foliose-fruticose, deeply laciniate, convoluted; lobes inrolled; upper side pruinose, date brown. Usually on thin soil, in flat, rocky sites with poor drainage. Locally very abundant in scattered localities in the northern intermontane West. See article by Rosentreter & McCune for more details]. "D. vagans" 4

3. Growing ± firmly attached to rock. 5

4. Lower side blackish, strongly and finely granular-papillose, without prominent rugae; spores 11-15.5 x 6-7.5 um. British Columbia and Alberta; E. Washington; Idaho; SW Oregon; NW Wyoming. (D. vagans Imshaug s. str.) vagrant modification of D. reticulatum.

4. Lower surface ± pale, not finely papillose, smooth to rugulose. British Columbia, E. Washington; S-central Oregon; most frequent in SW Idaho. Often associated with Artemisia rigida. vagrant modification of D. miniatum s. lato, possibly a distinct taxon

5. Thallus of densely aggregated squamules 1-3 mm broad, almost areolate; upper surface grayish pruinose, matt; squamules umbilicate, flat or slightly convex, round to weakly lobate, somewhat deformed by mutual pressure; edges mostly down-curved; underside brown to blackish; squamules in central parts to 0.8 mm thick; upper cortex thin (10-20 um), of roundish-angular cells 4-6 um diam., covered by thin granular pruina; algae 6-9 um diam., in distinct vertical columns forming a ± compact layer of varied thickness; medulla thick, prosoplectenchymatous, of densely interwoven hyphae with some interspersed algal cells; lower cortex sharply delimited, paraplectenchymatous, of anticlinally arranged, strongly conglutinated hyphae, 40-100 um thick, hyaline or slightly brownish; cells 6-10 um diam., in distinct vertical columns, the outermost ones darker pigmented; umbilicus to 1 mm thick, the central part consisting of medullary tissue, covered by lower cortex. Perithecia fully immersed few to many per squamule, pear-shaped, to 250 um broad; wall pale except near ostiole; periphyses short; asci clavate; spores 8, biseriate, ellipsoid to elongate, 13-22 x 5-7 um. Pycnidia laminal, immersed; spermatia short-cylindrical, 4-5 x 1-1.3 um. Medulla I-. California, Idaho. The species resembles a Catapyrenium, but is umbilicate and has a prosoplectenchymatous medulla and a different structure of the lower cortex. D. leptophyllodes (Nyl.) Zahlbr. (syn. D. lorenzianum Anders)

5. Thallus foliose or cushion-forming squamulose, the squamules or individuals generally over 3 mm broad. 6

6. Upper side some shade of brown, usually (but by no means always!) epruinose and turning green when wet (forms from more exposed sites can be pruinose and

unchanged when wet); usually growing in running water; underside usually not papillate.7

6. Upper side gray, ± pruinose, not green when wet; often growing in seepage water, but not in streams. (if aquatic and thallus imbricate to tangled, forming extensive clumps to over 1 cm thick and easily detached, see D. luridum v. decipiens). 10

7. Underside usually with distinct veins, rugae, or ridges; thallus usually monophyllous, with a single holdfast. 8

7. Underside mostly smooth, without distinct veins, rugae, or ridges, or if wrinkled, then wrinkles weak and seldom covering entire surface; sometimes pimpled/papillate; thallus strongly polyphyllous (repeatedly lobed, with scattered holdfasts), flabby (especially when wet), mat-forming; lobes mostly 5-15 mm wide, often very convex (especially in center of the mat), about 0.15-0.4 mm thick; underside ± pale, or dark brown with paler patches; upper side grayish brown to dark brown, bright green when wet, not pruinose but often developing clusters of white crystals in herbarium. Perithecia 0.2-0.3 mm diam. Asci clavate. Spores (10-)12-19(-23) x 5-8 um, ellipsoid to usually narrowly ellipsoid. Upper cortex 25 um thick, cortical cells 4-6 um wide. Medulla I+ red (brown-red in Meltzer's Iodine). On rocks (usually siliceous?), growing in or next to water, at times immersed (often for much of the year) on stream and lake edges (confined to ± continuously inundated sites according to Goward, et al., 1994). Common, boreal-temperate, common in eastern N. America, uncommon in the west, California to British Columbia, and the Rockies, with rare disjuncts in north-central arctic. Because of the green color when wet, the species might be mistaken for a thalloid liverwort. According to Nimis (unpublished notes on lichens from Santa Rosa Is., Calif.), some forms can be large and monophyllous, and can have a light gray upper surface, as in D. miniatum, but can be distinguished from that species by the lack of pruinosity on the upper side, dark brown lower surface, and occurrence on siliceous rocks (Nimis claims D. miniatum is strictly calcicolous, which means the common D. miniatum-like things on siliceous rocks in N. America would have to be other species!--perhaps some are D. luridum) always in creeks. D. luridum

8. Spores spherical or subspherical, 10-17 x 8-10 um. Thallus weakly pruinose. Greenland. [D. lyngei]

8. Spores elliptical or elongate elliptical.9

9. Thallus (when wet) 0.1-0.3 mm thick; underside dark gray-brown to brownish black, showing slightly to distinctly conspicuous ridges or raised veins, ± rugose throughout; upper cortical cells 6.5 um diam.; spores (13-)15-21.5(-24) x (6-)6.5-8.5(-9) um. Thallus 15-35(-50) mm diam.; upper surface light to dark brown or dark gray-brown, turning olive-dark brownish when wet, pruina absent or very thin, local and inconspicuous. Lower surface light to dark brown, often darker than the upper surface, almost smooth to strongly wrinkled, variable in a single collection. Thallus 100-380 um (sections measured between wrinkles and perithecia), to 580 um thick measured at wrinkles or perithecia. Thallus usually monophyllous, attached by a single holdfast, sparingly lobed, but often massed together; lobes not strongly convex. Upper cortex 13-21 um; cells 4-6 um wide. Perithecia 0.2-0.35 mm diam. Asci subcylindrical. Medulla I-. On siliceous rocks and boulders, in drainage areas where snow melt provides moisture for some time in the spring, or in occasionally flooded areas beside brooks or in cold canyon-bottom

streams. Arctic-alpine, to subalpine, Alaska and NW arctic, Greenland, British Columbia to California, and Rocky Mountains to Colorado. D. rivulorum

9. Thallus (when wet) 0.4-0.7 mm thick; underside pale, little-veined but often folded; upper cortical cells 8.5 μ m diam.; spores 13-15 x 4.5-6.5 μ m. Thallus to ca. 50 mm diam., often irregularly incised, rigid; upper surface grayish brown, green when wet. Perithecia 0.25-0.45 mm diam. Asci subcylindrical. On rocks overflowed by snow meltwater, or on seminundated boulders in streams and at margins of lakes, arctic-alpine, Alaska. Similar to D. miniatum but with epruinose upper surface and veined lower surface. D. arnoldianum

10. Underside finely papillose (furfuraceous-granulose, the papillae usually ca. 25-30 μ m wide, 10-20 μ m high, carbonaceous, giving a fine uniform granular texture under 10x lens; coarse warty or bumpy structures may also occur), usually with \pm distinct veins or rugae, especially near margins, often forming a reticulate pattern, dark brown to black; upper side pale, \pm yellowish gray; spores 12-15 x 5-7 μ m.

Common on dry siliceous rocks in various areas and habitats (occasionally on streamside rocks) in the West, including the Pacific NW and California (full distribution not well known). Not always easily distinguished from D. miniatum, and there may be several undescribed or unreported taxa that do not fit well into either (e.g., specimens with pale, verrucose, strongly veined undersides, and material with smooth, black, non-veined undersides). D. reticulatum

10. Underside smooth to coarsely warty or bumpy (warts ca. 0.2-1.0 mm diam.) or wrinkled, but without fine granular papillae, and without a reticulated pattern of plicate veins, usually pale to dark reddish brown. 11

11. Spores 15-20 x 6-8 μ m; underside black; thallus monophyllous, 0.3 mm thick, dark gray to brown above, becoming imbricate, the margins incised, ascending;
["Entosthelium saxicola"]

11. Spores under 15 μ m long. Underside pale or dark. 12

12. Thallus polyphyllous (attached by several lobes), with secondary holdfasts, cartilaginous, rigid; lobe margin at first ascending but later becoming recurved or more often inflexed (downrolled or inrolled), giving the thallus a contorted, intestine-like appearance. Cells of upper cortex ca. 6.5 μ m. Lobes mostly 3-10 mm wide, 0.15-0.3(-0.4) mm thick; upper surface gray-brown to dark brown, at least the young lobes usually thinly blue-white pruinose. Lower surface smooth, pale to more usually dark brown, often extending to give the margin of erect lobes a blackish rim; holdfasts scattered, in the middle of the lobes or frequently close to the margins. Perithecia 0.2-0.25 mm diam. Asci clavate. Spores spheroidal to short-ellipsoid, ellipsoid, or ovoid, 9-12(-15) x (4.5-)6-7(-9) μ m. Medulla I- (negative in Meltzer's Iodine). Usually on calcareous or \pm basic, steeply sloping rocks (occasional on siliceous rock according to McCune & Goward, 1995), especially in dry habitats, but also often in seepage tracks or on rocks in the splash zone of lake shores (above the level of D. luridum), arctic-alpine, south to British Columbia, Montana and Washington, apparently rather rare. Extremely variable. [the taxon referred to by Rosentreter & McCune as "D. miniatum cf. var. complicatum on calcareous rocks" may be this species, since they state that the thallus is "often with

numerous points of attachment". D. intestiniforme

12. Thallus monophyllous, attached by a solitary, central holdfast, mostly single-lobed, or sometimes (var. complicatum (Lightf.) Hellbom), with secondary lobes which are not attached to the substratum directly (appearing polyphyllous, but the clusters of lobes always attached by a solitary holdfast), 1-7 cm diam., (0.2)0.3-0.5(-0.7) mm thick, the edges usually not curved downward; upper surface pale gray to dark brown, reddish brown to gray-brown, epruinose (on pale gray thalli in shade, and on dark brown thalli on exposed lake shores) to thickly gray-white pruinose; underside usually pale, tan-brown, sometimes with dark gray-brown blotches, smooth or sometimes warty, often rugose but very rarely ridged or reticulately veined. Cells of upper cortex ca. 8.5 um. Thallus 300-600(-700) um thick when moist (measured between perithecia). Perithecia 0.2-0.3 mm diam.; asci cylindrical; spores ellipsoid to elongate-ellipsoid or ovoid-ellipsoid, (8-)9-12(-15) x (4.5-)5-6(-7) um. Medulla I-. On rocks often containing or exposed to calcium, often in very dry habitats with much sunlight, but also on shaded cliffs or boulder faces exposed to occasional seepage or runoff, on \pm vertical surfaces, over much of North America, common and variable. Specimens with epruinose upper surface and somewhat veined undersides have been named as D. arnoldianum, which may not be a distinct species. D. miniatum (L.) Mann

Preliminary Key to Variations in "D. miniatum"

1. **Thallus two-dimensional, clearly monophyllous.** 2

1. **Thallus becoming \pm three-dimensional, with secondary lobes which are not attached to the substratum directly (appearing polyphyllous, but the clusters of lobes always attached by a solitary holdfast).** 3

2. **Underside smooth to wrinkled, without bumps.** D. miniatum var. miniatum f. miniatum

2. **Underside with coarse bumps or "papillae".** D. miniatum var. miniatum f. papillosum (Anzi) Oxn.

3. **Lobes relatively broad, not tubular, with entire to weakly crisped margins. Lower surface smooth to weakly rugose, tan, brown or orangish brown.** Thallus becoming somewhat three-dimensional, but not fruticose. [Usually?] on calcareous rocks.

Widespread. D. miniatum var. complicatum (Lightf.) Hellbom

3. **Lobes relatively narrow, tubular, with strongly crisped margins at the lobe tips. Lower surface deeply, strongly, and broadly rugose, dark brown to black.** Thallus becoming strongly three-dimensional (essentially fruticose) and attached by a single holdfast). On basalt or other base-ppor rocks. Frequent in SW Idaho; also found in s-central Oregon, eastern Washington, and British Columbia. Treated by Rosentreter & McCune as an undescribed taxon related to D. miniatum. D. sp.

Additional morphs of uncertain status include monophyllous ones with black, entirely smooth undersides, and ones with pale but strongly veined-ridged and coarsely papillose undersides.

D. intestiniforme

THALLUS polyphyllous (attached by several lobes), repeatedly lobed, to 7 cm diam., cartilaginous, rigid; young thallus with a central holdfast, secondary holdfasts soon developing, becoming numerous, scattered, sometimes marginal; primary holdfast becoming lost or unidentifiable; lobe margins at first ascending but later becoming recurved or more often inflexed (downrolled or inrolled), giving the thallus a contorted, intestine-like appearance. Cells of upper cortex ca. 6.5 μ m. **Lobes** mostly 3-20 mm wide, numerous, often crowded, overlapping or mutually compressed, often concave when young, when lacking perithecia 0.15-0.3(-0.4) mm thick, when with perithecia 0.18-0.6 μ m (between perithecia); **upper surface** pale gray to gray-brown to dark brown, at least the young lobes usually blue-white pruinose, pruina thin and inconspicuous to well developed and conspicuous, especially on young lobes. **Lower surface** smooth, rarely wrinkled, pale to more usually dark brown, either paler or darker than upper surface, often extending to give the margin of erect lobes a blackish rim; holdfasts scattered, in the middle of the lobes or frequently close to the margins. **Medulla** hyphae 2.5-3.5 μ m wide.

PERITHECIA present or not, 0.2-0.25 mm diam. Asci clavate. Spores spheroidal to short-ellipsoid, ellipsoid, or ovoid, (8.0-)8.5-15(-16) x (4.5-)5.5-7.5(-9) μ m, L:W = (1.2-)1.3-2.5(-3.0)..

CHEMISTRY: Medulla I-, Meltzer's-.

ECOLOGY AND DISTRIBUTION: Usually on calcareous or \pm basic, steeply sloping rocks (occasional on siliceous rock according to McCune & Goward, 1995), especially in dry

habitats, but also often in seepage tracks or on rocks in the splash zone of lake shores (above the level of D. luridum), arctic-alpine, south to British Columbia, Montana and Washington, apparently rather rare.

Extremely variable. The presence of secondary holdfasts distinguishes the species from D. miniatum, but young thalli may not be identifiable.

D. leptophyllodes (Nyl.) Zahlbr.

THALLUS 2-7 mm diam., attached by a single ceentral holdfast, secondary holdfasts absent or rare; thalli usually crowded, often interlocking and difficult to distinguish from each other, forming colonies up to 3 cm or more diam.; lobes 0.4-3.0(-5.0) mm wide, in central parts 0.17-0.34 mm thick in areas \pm distant from perithecia, to 0.5(-0.8) mm thick in regions with perithecia; flat or slightly convex, round to weakly lobate, somewhat deformed by mutual pressure; edges sometimes slightly raised when young, mostly slightly down-curved when older; thalli or clusters of thalli occasionally separated from adjacent clusters to give an areolate appearance to the colony; **underside** pale to dark brown to blackish, smooth; **upper surface** pale gray to dark brown, epruinose or with a fine whitish pruina on some lobes, matt, extreme margin (c. 60 μ m wide) of lobe slightly darker, slightly glossy; **prothallus** brown, rimose, often extensive and locally continuous between the thalli; **thallus sections** with combined upper cortex and algal layer 60-145 μ m thick (30-55% of thallus thickness); **upper cortex** thin (10-20 μ m), composed of cells in irregular vertical columns, not sharply delimited from algal layer, of roundish-angular cells (3-)4-6(-7) μ m diam. near surface, pigmented or not, walls not or scarcely thickened; very young ocrtex at margin with smooth unbroken surface with slightly thickened, otuer wall, immediately behind young margin upper cortex covered by an epinecral layer 1-20 μ m thick, composed of dead, air-filled, often broken cells, or rpresented merely by the broken lower parts of dead superficial cells; **algal layer** with algae 6-9 μ m diam., in distinct vertical columns forming a \pm compact layer of varied thickness; **medulla** 25-155 μ m thick (15-45% of thallus thickness), prosoplectenchymatous, of densely interwoven hyphae with some interspersed algal cells, sometimes poorly defined above or mixed with isodiametric cells; **lower cortex** sharply delimited, paraplectenchymatous, of anticlinally arranged, strongly conglutinated hyphae, 40-100 μ m thick (25-35% of thallus thickness), hyaline or slightly brownish; inner cells 5-14 μ m wide, walls thickened to 1.5-4 μ m, outer cells 4-8 μ m wide, with walls to 1-2(-3) μ m thick, outermost cells with brown walls, cells in distinct vertical columns; **umbilicus** to 1 mm thick, the central part consisting of medullary tissue, covered by lower cortex.

PERITHECIA always present, fully immersed few to many per squamule, pear-shaped, to 250-320 μ m broad; wall pale except near ostiole; periphyses hsort; asci clavate; spores 8, biseriate, ellipsoid to elongate (L:W = (1.8-)2.3-3.2(-3.8), (12-)15-22 x 5-7.5 μ m, some of the larger spores becoming 1-septate when old.

PYCNIDIA frequent, laminal, immersed; spermatia short-cylindrical, 4-6 x 1-1.3 μ m.

ECOLOGY AND DISTRIBUTION: On periodically inundated, unshaded or lightly shaded, siliceous rocks at the margins of unpolluted rivers and lakes, apparently avoiding very acid waters. California, Idaho.

NOTES: The species resembles a Catapyrenium, but is umbilicate and has a prosoplectenchymatous medulla and a different structure of the lower cortex.

D. vellereum Zschacke

Thallus foliose, umbilicate, usuallly mono-lobed, but frequently composed of up to

several lobes, 1-7 cm diam. Lobes almost entire to irregularly and sparsely dissected; upper surface brownish or grayish, dull, slightly and finely scabrose, or nearly smooth, epruinose, concave in the central part; lower surface black or dark brown, dull, with or without ridges, with a central umbilicus, with rhizinomorphs. Rhizinomorphs dense, completely or partly covering the lower surface, repeatedly branched, \pm swollen at tips of branchlets, almost botryoid, usually 1-2 mm long, to 0.15 mm thick at base, black to dark brown. Thallus 130-660 μ m thick or more. Upper cortex 5-50 μ m thick, brown in uppermost part, hyaline in the remainder, lower cortex (25-)50-110 μ m thick.

Perithecia laminal, common, scattered, completely immersed, almost plane, dark brown around ostioles, pyriform to almost spheric, 280-510 μ m high, 200-550 μ m wide; exciple hyaline (brown at the outermost), 20-110 μ m thick; asci clavate, 55-80 \times 12-15 μ m; spores 8, ellipsoid, 10.5-17.5 \times 5-7 μ m.

Pycnidia laminal, common, scattered, immersed, dark brown around the ostioles; conidia 4-5 \times ca. 1 μ m.

On rocks, especially serpentine and rhyolite, in \pm exposed sites.

ADD?

Thallus with single holdfast, 130-300 μ m thick, upper surface pruinose; spores broadly ellipsoid, 6-12 \times (4-)6-7(-8) μ m. On calcareous rock. Arizona. D. leptophyllum

Literature

- Breuss, O. and B. McCune. 1994. Additions to the pyrenolichen flora of North America. The Bryologist 97(4): 365-370.
- Coppins, B. J. and B. W. Fox. 1992. Dermatocarpon. In: Purvis, O. W., et al., The Lichen Flora of Great Britain and Ireland. British Museum (Natural History), London.
- Degelius, G. 1934. Über Dermatocarpon rivulorum (Arn.) DT. & Saroth. und D. arnoldianum Degel. n. sp. Nyt Mag. Naturvid. 75: 151-161.
- Galloway, D. 1985. Flora of New Zealand Lichens.
- Goward, T., B. McCune and D. Meidinger. 1994. The Lichens of British Columbia. 1.
- Harada, H. 1993. A taxonomic study on Dermatocarpon and its allied genera (Lichenes, Verrucariaceae) in Japan. Natural History Research 2: 113-152.
- McCune, B. and T. Goward. 1995. Macrolichens of the Northern Rocky Mountains. Mad River Press, Eureka, California.
- Orange, A. 1998. Dermatocarpon leptophyllodes and related species in the British Isles. Lichenologist 30: 1-20.
- Poelt, J. 1969. Bestimmungsschlüssel europäischen Flechten. Cramer, Vaduz.
- Rosentreter, R. and B. McCune. 1992. Vagrant Dermatocarpon in western North America. The Bryologist 95(1): 15-19.
- Thomson, J. W. 1984. American Arctic Lichens. I. The Macrolichens. Columbia University Press, New York.