

Catapyrenium Flotow
(VERRUCARIALES: VERRUCARIACEAE)

After Thomson, 1987, 1989, Breuss & Fox, 1992, and Breuss, 1996

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Description below may need to be modified slightly to apply only to Catapyrenium s. stricto.

Thallus squamulose, attached to substrate by intricate, colorless or brownish rhizoidal hyphae. Upper cortex paraplectenchymatous, small-celled, thin, indistinctly delimited; lower cortex composed of rounded to angular cells, or absent. Photobiont chlorococcoid, cells to 10 μ m diam. Perithecia immersed in thallus; involucrellum absent; true exciple composed of tangentially arranged, \pm elongated cells, pigmented around the ostiole, lower part pale or \pm darkened. Periphyses present; paraphyses absent. Asci thin walled, clavate. Spores 8, uniseriate or biseriate, colorless, simple, ellipsoid or \pm ovoid-clavate in some species. Pycnidia absent. No substances. Mostly on soil or over decaying bryophytes and plant debris, or rock, some species preferring calcareous substrata, one species on bark.

This genus is a segregate of Dermatocarpon, consisting of the squamulose species. The boundary between it and Verrucaria can be rather fuzzy among some of the saxicolous species. Some of the species, especially C. lachneum, appear to be frequently sterile, in which case they are difficult to recognize as belonging to this genus.

The recent division of the genus into segregate genera may be controversial.

I. On trees, or old logs.

1. Squamules with spotted pruina; upper cortex cinereum-type (small-celled, thin, indistinctly delimited); lower cortex lacking; medullary hyphae merging into the blackish brown hypothallus; asci clavate; spores biseriate. California. C. psoromoides

1. Squamules epruinose; upper cortex thick, distinctly delimited; lower cortex paraplectenchymatous; rhizohyphae entangled in \pm distinct fascicles; asci cylindrical; spores uniseriate. Squamules pale below; spores ellipsoid or elongate-ellipsoid, 10-15 x 4-6 μ m. Eastern U.S., southeastern Arizona, central California. Placidium tuckermanni

II. On soil or rocks.

Placocarpus schaereri (Fr.) Breuss [syn. Catapyrenium schaereri]

Thallus very thick (to 2.5 mm) due to an excessively developed medulla, cracky areolate in central parts and \pm distinctly effigurate at circumference. giving the species an almost lobate appearance when well developed. The thick medulla composed of interwoven hyphae is densely inspersed with minute colorless crystals or granules (thus comparable with the medulla in Squamaria), and slowly turns blue with iodine. The spores are _____.

Very similar to Verrucaria in some respects, but differs not only in its larger size but also in a number of taxonomically important characters such as anatomical features and spores. The areolate appearance deriving from the cracking of a primarily continuous crust distinguishes it from Catapyrenium, in which the thallus consists of squamules developing individually from the prothallus.

Key to segregate genera

1. Thallus with an areolate appearance deriving from the cracking of a primarily continuous crust. Medulla densely inspersed, I+ slowly blue. Spores (18-)20-28(-32) x 8-10(-12) μ m halonate, the gelatinous sheet being best developed in premature spores and then about 2.5 μ m thick. Thallus rimose-areolate in center, the margins sublobate. Areoles fastened to substrate by a short stalk of densely packed perpendicularly arranged hyphae originating from the medulla, the outermost ones with a great part of the underside free from the substrate with a blackening paraplectenchymatous lower cortex. Asci oblong-clavate.

Placocarpus schaereri (Fr.) Breuss

1. Thallus composed of squamules developing individually from the prothallus. 2

2. Perithecia sessile between the squamules, with involucrellum. Squamules very small (< 1.5 mm) and thin (mostly 100-200, rarely -300 μ m), often appearing crustlike. Involucropyrenium (waltheri)

2. Perithecia immersed in the squamules, without involucrellum (but partly with black or carbonaceous wall). Upper cortex of thin-walled cells, paraplectenchymatous. 3

3. Lichenicolous on Staurothele spp. 4

3. Not lichenicolous. 5

4. Pycnidia of Dermatocarpon-type (plurilocular, with conidiogenous cells similar to

- the surrounding tissue), thallus up to 1 mm thick, areoles fastened to the substratum by distinct corticated stipes, spores 14-19 x 8-10 μm Placopyrenium (noxium)
4. Pycnidia of **Staurothele**-type (unilocular, with flask-shaped conidiogenous cells), thallus thinner, areoles fastened to the substratum by central hyphal fascicles. Verrucaria (V. lesdainii and V. inficiens)
5. Upper cortex of **cinereum**-type (small-celled, thin and indistinctly delimited). Catpyrenium s.str.
5. Upper cortex not of **cinereum**-type, thicker and distinctly delimited. 6
6. Rhizohyphal web absent or reduced and not penetrating the substrate. Attachment only through rhizines. Squamules in loose, flat masses, not forming cushions, directly on rock. Rhizines short and plump. Medulla cellular. Heteroplacidium (podolepis)
6. Rhizohyphal web well developed and penetrating the substrate, partly also with rhizines. Excipulum hyaline to brownish black but not carbonaceous. Pycnidia of Xanthoria-type. 7
7. Asci at least when young distinctly cylindrical. Spores uniseriate. Photobiont cells 7-16 μm diam. Pycnidia laminal or marginal. Upper cortex of **lachneum**-type. Placidium
7. Asci even when young distinctly clavate. Spores (sub)biseriate. Photobiont cells smaller (5-13 μm). Pycnidia laminal. 8
8. Squamules 2-5 mm across, with distinctly differentiated medulla and mostly well delimited basal zone (however, without true paraplectenchymatous lower cortex). medulla prosoplectenchymatous or of mixed type. Clavascidium (umbrinum)
8. Squamules smaller (0.3-3 mm), mostly cellular throughout. Heteroplacidium

Key to species of Catapyrenium s. str.

1. Rhizohyphae very thin (c. 2.5 μm), brownish, in part bundled into "rhizopts". Squamules 1-2 mm across, appressed to marginally ascending. Excipulum pale. Spores narrowly ellipsoid, 15-22 x 4.5-6 μm . On rock. California. C. squamellum
1. Rhizohyphae thicker (> 3 μm), dark brown to brownish black. Excipulum dark in age. 2
2. Squamules small (0.5-3 mm), finely crenate to deeply incised crenate-lobed, appressed, \pm pruinose, mostly dark bordered, with blackish paraplectenchymatous lower cortex. Spores oblong-ovoid to clavate, 17-23 x 6.5-8.5 μm . On rock. Arctic-alpine. Reported by Thomson from scattered localities in western and northern N. America, south to New England, Colorado and Nebraska, and California; however, his concept included Involucropyrenium waltheri. C. cinereum
2. Squamules larger, more coarsely lobed, not finely crenate, not dark bordered, without lower cortex, the medullary hyphae becoming brown in the lower part, blending in with the rhizohyphal web. 3
3. On soil and over terricolous mosses. Thallus often rosetted. Marginal lobes broadly rounded and thickish, epruinose. Pruina, when present, diffuse on the central thallus parts. Asci 75-85 x 17-20 μm . Spores 17-22 x 6-8 μm , mostly oblong-ovoid to clavate. Arctic-

alpine. C. daedaleum

3. Usually on bark; occasionally on moss over rock. Pruina mostly restricted to the lobe tips, spotty. Asci 55-65 x 13-16 um. Spores 13-17 x 5.5-7 um, ellipsoid to fusiform.

Temperate. Arizona, California. C. psoromoides (Borrer) R. Sant.

Detailed Descriptions

C. cinereum (Pers.) Körber (Syn. Dermatocarpon cinereum)

Thallus of small, \pm densely aggregated squamules, 0.1-0.3 mm thick, 0.5-3 mm across, closely appressed throughout, mostly confluent to form an almost continuous crust, rarely scattered, margins finely notched-incised, especially at the periphery, sometimes subgranular in central parts of thallus; upper surface usually slightly to heavily whitish pruinose, rarely almost naked and then greenish gray to pale brown or even dark brown, often with a darker, epruinose rim along the margin; lower surface black; hypothallus blackish, spongy, of densely intricate, dark brown rhizohyphae ca. 3.5-4 um diam; thallus sections \pm cellular throughout; upper cortex 10-30 um, composed of small roundish-angular cells 5-8 um diam.; algal cells filling most of the thallus, 5-12 um diam., only in a thick squamules an alga-free and more loosely organized tissue developed; lower cortex paraplectenchymatous, of isodiametric, angular cells 8-11 um diam., blackish.

Perithecia numerous, immersed in the squamules or slightly protruding, almost spherical, to 300 um wide, the ostioles sometimes slightly elevated; true exciple pale when young, soon becoming brown or blackish throughout; periphyses 20-30 x 2.5-3.5 um, apical cells often swollen, to 5 um. Asci clavate, c. 65-70 x 16-22 um. Spores 17-23 x 6-8.5 um, \pm oblong-ovoid (clavate), biseriate.

Pycnidia unknown.

On soil, humus or mosses, especially on calcareous ground, in upland areas, also on consolidated soil on or near the coast, mainly boreal to alpine.

C. daedaleum (Krempelh.) B. Stein in Kohn (Syn. Dermatocarpon daedaleum)

Thallus slightly foliose, squamulose, margins adnate or slightly raised; squamules dispersed to crowded and often confluent to slightly overlapping and then thalli often almost rosette-like with somewhat enlarged marginal lobes; squamules thickish, rounded or slightly elongate at the periphery; squamules 1-4 mm wide, lobate early stages with lobes 0.7-1.5 mm wide, 3-7 mm long, becoming a broad crust; upper side gray brown, often with a greenish gray tinge, matt, \pm scabrid, thinly or rarely thickly pruinose at first, becoming bare and brown, matt; underside dark felted (pale or whitish over a black hypothallus?); thallus sections c. 200-400 um thick; upper cortex paraplectenchymatous, ca. 60 um, cells 3-5 um; algal layer of various thickness, algal cells 5-12 um diam.; medullary tissue \pm cellular or more loosely organized, the hyphae grading into brown in the lower part, gradually merging into the hypothallus of dark intricately rhizohyphae; lower cortex not developed.

Perithecia usually abundant, immersed, becoming slightly projecting in black warts, to 300 um wide, walls pale or slightly brown, darker around ostioles, with brown-red ostioles; periphyses 20-25 x 2-3 um; hymenial gel I+ reddish; exciple pale below, reddish around ostiole, or becoming brownish throughout; asci clavate or clavate-saccate; spores 8, biseriate, ellipsoid or elongate-ovoid with blunt ends, or drop-shaped or more rarely fusiform-ellipsoid, (12-)17-22 x 6-8(-9) um.

Pycnidia unknown.

On soil, moss and humus, especially over calcareous soils. Colorado, Wyoming; S. Dakota.

C. psoromoides (Borrer) R. Sant.

Squamules to 4 mm across, dispersed to contiguous or partly imbricate, \pm divided, often somewhat elongated, especially at the periphery, loosely attached or slightly ascending at the apices; upper surface dull grayish- or greenish-brown or fawn, often with gray-violet pruina in defined patches mostly on distal parts of lobes; lower cortex lacking; squamules fastened to substrate by a prominent dark-brown hypothallus of densely interwoven rhizohyphae gradually emerging from the medullary tissue. Perithecia moderately frequent, fully immersed; true exciple pale or slightly brownish; asci clavate; spores 14-18 x 5-7 μ m, ellipsoid or \pm attenuated at the apices, biseriate, sometimes pseudoseptate. On bark of Quercus douglasii and Q. lobata, California.

C. squamellum (Nyl.) Thoms. (Syn. Dermatocarpon squamellum)

Thallus of very small lobulate squamules, 1-2 mm broad, giving a dissected appearance and ascending from the substratum, or crenate-edged, olive green or darkening; underside pale, attached by numerous dark rhizoidal hyphae. Perithecia immersed; exciple pale to darkening in its outer layers, ostiole darkening and visible in thallus surface; hymenial gel I+ blue (fleeting); spores ellipsoid to oblong, 12-24 x 2.5-8 μ m. On moss over rock or possibly moss over soil. California.

ADD? (not mentioned by Breuss, 1996):

Thallus squamulose

"C." heppioides (Zahlbr.) Thoms. (syn. Dermatocarpon heppioides)

Thallus greenish gray to ashy gray or ashy, matt, sometimes slightly pruinose, brownish olive when wet; squamules flat to slightly convex, to 4 mm broad, the margins slightly lobate or incised; lower side black, attached by rhizoidal hyphae. Perithecia immersed, spherical, "35-40 um" diam. [this sounds much too small!], scattered; ostioles conspicuous and either reddish or small and dark brown, 0.1-0.2 mm broad [this doesn't make sense that the ostioles would be almost 10x as large as the immersed part of the perithecia!]; exciple pale; hymenial gel I+ blue; spores uniseriate to biseriate, oblong-ellipsoid to oval, biguttulate, 16-28 x 6-10 um. On acidic rocks (coarse, hard sandstone) in crevices. Southern California; known only from the type locality and possibly extinct.

Thallus "areolate" (= ? Verrucaria spp.):

"C." caeruleopulvinum Thoms.

Thallus light bluish gray to medium gray, pruinose, areolate, the areoles rounded to angular, 1-4 mm broad, the upper surface very rounded convex, almost bullate; cortices and medulla paraplectenchymatous; upper cortex to ca. 25 um thick; algal layer appearing as columns of algae; lower cortex thick, purplish brown; lower side black, attached to substratum for greater part of each areole by dark hyphae, not rhizoids, not umbilicate. Perithecia numerous in each areole, the mouth inconspicuous and showing in the upper surface only as a very minute, deeply embedded, dark dot; exciple pale except near ostiole where its cells darken; spores uniseriate to usually biseriate, ellipsoid to elongate ellipsoid, 10-20 x 6-8 um. On rocky soils. Arizona, California.

"C." radiatum Thomson

Thallus effigurate at margin; marginal areoles radiating, to 3 mm long, 0.5-0.75 mm wide, those towards center angular, 1-1.5 mm broad, areoles flat to slightly convex, bluish gray above, black bordered, with thick black hypothallus which is also on the edges of areoles. Perithecia sunken deeply in areoles, 1-3 per areole, 270 um wide; ostiole red-brown; exciple pale down to lower layers of hypothallus; hymenial gel I-; spores biseriate or slanting uniseriate, ellipsoid or narrowly ellipsoid, 10-18 x 5-7 um. On HCL+ rock, Mexico (Yucatan).

"C." globosum Thomson

Thallus gray, densely pruinose, areolate; areoles 1-4 mm broad, slightly convex, angular, partly subdivided, surface cracked; underside dark brown to black. Perithecia 1-several per areole; upper 1/5-1/4 partly projecting; ca. 0.25-0.35 mm diam.; inner 35-40 um of exciple brown, outer ca. 50 um dark brown-black entirely around perithecium; hymenial gel I-; spores biseriate, broadly ellipsoid to mostly globose, 12.5-18 x 7-7.5 um ellipsoid or 7-12 um when globose. On steeply sloping irrigated granite, Colorado.

"C." granulosum (B. de Lesd.) Thoms. (Syn. Endopyrenium granulosum, and

[presumably; type not found] E. crustaceum)

Thallus areolate; areoles to 0.5 mm broad, flat, irregular, the edges granular, becoming larger and more granular to 3 mm broad and 0.5 mm thick, \pm angular; upper side ashy brown to blackish, the granules grayer; underside dark. Perithecia immersed, the mouth showing as a dark spot; exciple dark; hymenial gel I \pm wine red; spores ellipsoid to oblong, 24-28 x 7-9 μ m (15-16 x 6-8 μ m in "Endopyrenium crustaceum", type not seen but treated by Thomson as a synonym). On HCl+ rock, New Mexico.

"C." zahlbruckneri (Hasse) Thoms. (Syn. Dermatocarpon zahlbruckneri)

Thallus squamulose-areolate; areoles 0.5-1 mm broad, convex above, round to more usually angular, gray; upper cortex paraplectenchymatous with vertically arranged cells; lower cortex thin, attached by rhizoidal hyphae. Perithecia 130 μ m diam., immersed, 1 to few per areole; ostiole dark, rest of exciple pale; hymenial gel I-; asci becoming saccate or ventricose (according to Fink; if correct, that's closer to clavate than to cylindrical). spores uniseriate to biseriate, ellipsoid, 17-24 x 4-7 μ m. Pycnidia immersed; pycnosporangia ellipsoid-fusiform, 12 x 2 μ m. On calcareous or acidic rocks, California (?), Arizona, NW Mexico. According to Breuss & McCune, the species belongs neither to Catapyrenium nor Dermatocarpon.

Excluded

Verrucaria compacta (Massal.) ____

(Syn. Catapyrenium compactum (Massal.) R. Sant., Dermatocarpon compactum, and [presumably; types not found] Endopyrenium rupicola and E. americanum)

Thallus a thick black or dull brownish black crust of tough umbonate or reflexed, granular, areolate squamules, over a black hypothallus but may be attached by a thick layer of white hyphae; squamules 0.4-0.8 mm broad, with black borders; in very dry habitats sometimes gray from calcium oxalate pruina. Perithecia 0.25-0.33 μ m diam., embedded in the squamules, only the ostiole projecting; exciple entirely black or with basal portion a little paler; hymenial gel I+ blue; spores ovate or ellipsoid, 12-17 x 6-9 μ m. On calcareous rocks in the open, Utah, New Mexico, Colorado, Wyoming; Alberta.

Verrucaria lesdainii Breuss

(Syn. Catapyrenium plumbeum)

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