

Calicium Pers.
(CALICIALES: CALICIACEAE)

After Tibell, and others

Rev. 4/96

Thallus verruculose-granular or immersed (usually not on other lichens), gray to gray-green, pale yellow-green or dark green. Photobiont Trebouxia.

Apothecia usually with long or short stalk, rarely sessile, blackish brown to greenish black, the head globose to lens-shaped; often with pruina on various parts; stalk of sclerotized, blackish brown to greenish black, irregularly interwoven hyphae. True exciple well developed, supporting the dry spore mass. Asci cylindrical to clavate, formed singly from ascogenous hyphae with croziers, dissolving at an early age. Spores 1-septate, forming a well developed, black, dry spore mass (mazaedium),; wall thick, dark brown, often with a distinctive ornamentation, without gelatinous coat.

Pycnidia sessile or slightly immersed, simple, globose; ostiole punctiform; conidiophores branched; conidogenous cells subcylindrical, enteroblastic; conidia broadly ellipsoid to short-cylindrical, colorless, non-septate. β -orcinol depsidone and para-depside, xanthonones, and pulvinic acid (tetronic acid) derivatives may be present. Usually on dry bark and wood, or some species on siliceous rocks, in rather humid and sheltered situations.

Resembles Cyphelium in thallus morphology, apothecial anatomy, chemistry and ecology but differs in the apothecia being stalked or rarely, sessile but never immersed.

1. On siliceous rock underhangs in very humid habitats; parasitic? on Lepraria spp. Canada.C. corynellum (Ach.) Ach.

1. On bark or wood.2

2. Thallus \pm yellow (to green or yellow-grayish). Apothecia \pm red-brown pruinose below. Stalk l-.3

2. Thallus \pm gray or white, sometimes greenish or brownish, without yellow tinge, or not evident. Mostly boreal. 6

3. Boreal-temperate. 4

3. Subtropical. Spores 10-14 μ m long. Stalk black.5

4. Thallus K-, C-, KC-, P-, UV+ yellow, containing rhizocarpic acid and epanorin. Underside of capitulum often with a brown pruina. Asci clavate, the spores not uniseriate. On bark or twigs, or wood (acidic, usually conifers). Common in

West.C. viride Pers.

4. Thallus K+ dull yellow, C+ orange, KC+ orange to red, P-, UV+ dark orange, containing xanthonenes (arthothelin, thuringione and thiophanic acid). Underside of the capitulum black or sometimes with a faint grayish pruina. Ripe asci cylindric, the spores uniseriate. On bark. C. hyperelloides Nyl.

5. Thallus straw yellow, K+ dull yellow, C+ orange, UV+ dark orange (xanthonenes). On old wood, Florida. C. leucochlorum Tuck.

5. Thallus pale yellow-green, K+ yellow then dull red, C-, UV-. On wood, Florida. C. chlorosporum F. Wilson

6. Stalk and excipulum I+ strongly blue. 7

6. Stalk and excipulum I- or the outermost hyaline envelope of the stalk only rather faint reddish blue in I. 8

7. Stalk pale olive-brown or white to buff, epruinose, 1-29-50 times as tall as width of capitulum. Mature spores with distinct, striated ornamentation, 7-14 x 4-7 μ m, \pm constricted. Capitulum top-shaped to lenticular, or globular to dome-shaped. C. adaequatum Nyl.

7. Stalk black or very dark reddish brown, 0.6-1.5 mm high. Mature spores 8-11 x 4-6 μ m, not constricted, with minutely pustulate (minutely verrucose to areolate) ornamentation, smooth when young, remaining non-septate while in the asci, then 1-septate. Capitulum 0.2-0.55 mm wide, obconical, top-shaped to lenticular. On bark or wood, often decaying stumps, especially of oaks, in humid areas. Maine; elsewhere. C. lenticulare Ach.

8. Apothecia with a yellow pruina. 9

8. Apothecia with whitish or red-brown pruina, or not pruinose. 10

9. Thallus usually immersed in substrate, rarely episubstratic, dark grayish-green, verrucose, very thin. Apothecia with a yellow pruina on lower side of capitulum, and sometimes a little on the mazedium, 0.5-1 mm high, usually definitely stalked; capitulum top-shaped or obovoid to lenticular, 0.17-0.26(-0.5) mm wide; stalk to 0.2 mm thick, with hyaline mantle. Spores 7-12(-14) x 4-6 μ m, the surface with irregular sulcate-cracked pattern. Mature asci cylindrical. On wood, e.g., old fence posts. Maine; elsewhere. C. trabinellum (Ach.) Ach.

9. Thallus epiphloedal or epixylic, granular-squamulose, grayish-whitish. Apothecia with faint to strong yellow pruina on mazaedium

(especially when young) and exciple margin but not on lower side of capitulum (?--can be on lower side according to Galloway), 0.6-1(-2) mm high, usually definitely stalked; capitulum top-shaped to lenticular, 0.3-1 or more mm wide; stalk 0.1-0.34 mm thick. Spores (10-)13-16(-19) x 5-6.5(-9) um, constricted, with very distinct ornamentation of spirally arranged ridges. Mature asci clavate to cylindrical.C. adspersum Pers.

10. Lower side of capitulum with brown pruina. On dry, acid bark and wood, especially on dry sides of old oaks. Maine; elsewhere (also known from tropical or subtropical areas, e.g. southern Mexico).C. salicinum Pers.

10. Lower side of the capitulum with or without a whitish pruina, but not brown.11

11. Spores 5-6(-8) x 2.5(-3.5) um. ...(Chaenothecopsis pusilla)

11. Spores over 8 um long. 12

12. Thallus clearly superficial, Half-ripe spores with regular screw-like (spiralled) patterns. On bark of Quercus and on wood. C. quercinum Pers.

12. Thallus immersed, inapparent or thinly superficial. Spore surface warted or cracked-areolate. 13

13. Asci clavate; spores narrowly ellipsoid, 8-11 x 3.5-4.5 um, when mature very slightly ornamented with ± polygonal warts On wood and park, mostly of pines. Maine; elsewhere.C. parvum Tibell

13. Asci cylindrical. Spores larger, with rather coarse ornamentation.14

14. Apothecia not pruinose. Semi-mature spores without ornamentation; mature spores 11-15 x 5-7 um, with irregular ornamentation of small pustules (minutely warted to minutely cracked-areolate) giving rise to dotted appearance in light microscope. Asci 44-52 um long, 4-5 um wide, cylindrical. Apothecia 0.6-0.9 mm tall, 6-11 x as high as wide; stalk often with brownish or olivaceous tinge, or shiny black, 0.08-0.13 mm wide. C. abietinum

14. Apothecia usually with a faint white pruina at least at edge (upper part) of excipulum and below the head. Semi-mature spores with a very irregular sulcate pattern; mature spores 9-13 x 4-6.5 um, with coarse irregular ornamentation of cracks and ridge fragments. Asci 34-41 um long, 3.5-4.5 um wide, cylindrical. Apothecia 0.5-0.9 mm tall, 4-8 x as high as wide; stalk shiny black, 0.11-0.17 mm wide. C. glaucellum

Descriptions of species

C. abietinum Pers.

Apothecia not pruinose. Semi-mature spores without ornamentation; mature spores 11-15 x 5-7 μm , with irregular ornamentation of small pustules (minutely warted to minutely cracked-areolate) giving rise to dotted appearance in light microscope. Asci 44-52 μm long, 4-5 μm wide, cylindrical. Apothecia 0.6-0.9 mm tall, 6-11 x as high as wide; stalk often with brownish or olivaceous tinge, or shiny black, 0.08-0.13 mm wide. Capitulum 0.21-0.28 mm diam., lens- or slightly bell-shaped. Upper part of excipulum often slightly translucent, pale; excipulum formed as a continuation of stalk tissue, with isodiametric to slightly elongated and anticlinally arranged, heavily sclerotized cells. Hypothecium flat or slightly convex. Stalk in longitudinal section dark brown, consisting of densely intertwined, sclerotized hyphae; outermost part of stalk \pm hyaline, of pale hyphae and with a thin sheet of gelatinous material at the surface. Apothecia l-. Thallus immersed. No substances. On wood, especially conifers and oaks, also decaying stumps and logs. Maine; elsewhere.

C. adaequatum

Stalk pale olive-brown or white to buff, epruinose, 1-29-50 times as tall as width of capitulum, stalk and excipulum l+ dark blue. Mature spores with distinct, striated ornamentation, 7-14 x 4-7 μm , \pm constricted. Capitulum top-shaped to lenticular, or globular to dome-shaped.

Thallus immersed.

Apothecia without pruina, with dark capitulum and olive brown stalk, 0.6-0.8 mm high. Stalk and excipulum l+ dark blue (watermount of sections or squash preparations). Capitulum cylindrical to distinctly bell-shaped, 0.1-0.2 mm diam. Excipulum 20-35 μm thick, with a distinct thickening in the upper part; outermost part brown, consisting of isodiametric, medium brown cells, 3-5 μm diam., inner part 10-17 μm thick, consisting of intertwined hyphae with strongly thickened walls. Outermost layer of stalk 5-10 μm thick, medium brown, consisting of periclinally arranged, brown hyphae. Apothecia 8-10 times as high as diam. of stalk. Asci cylindrical, 31-39 x 3-4 μm with uniseriately or sometimes biseriately arranged spores. Spores 9.0-11.0 x 4.5-5.5 μm , with a distinctive ornamentation of spirally arranged ridges.

Thallus K-, C-, KC-, P-, no substances.

On bark.

C. adspersum Pers. (syn. C. roscidum)

Thallus epiphloedal or epixylic, granular-squamulose, grayish-whitish. Apothecia with faint to strong yellow pruina on mazaedium (especially when young) and exciple margin but not on lower side of capitulum (?--can be on lower side according to Galloway), 0.6-1(-2) mm high, usually definitely

stalked; capitulum top-shaped to lenticular, 0.3-1 or more mm wide; stalk 0.1-0.34 mm thick. Spores (10-)13-16(-19) x 5-6.5(-9) μ m, constricted, with very distinct ornamentation of spirally arranged ridges. Mature asci clavate to cylindrical. Stalk generally 3-5 x as high as wide. Stalk I-, the very thin, outermost translucent gelatinous part I+ blue. Capitulum broadly lenticular. Excipulum of weakly anticlinally arranged, slightly elongated, heavily sclerotized hyphae. Hypothecium dark brown, convex. Stalk of densely intertwined, dark brown, sclerotized hyphae or with a pale, not sclerotized central and outer part. Asci 34-37 x 3.5-4.5 μ m. Spores uniseriate or biseriate. Thallus P+ yellow-red, K+ red (norstictic acid). Pruina contains vulpinic acid. On dry, old bark of oaks.

C. chlorosporum

Thallus verrucose, pale yellowish green, K+ dull yellow then dull red, C-, P-.

Apothecia 0.7-1.3 mm high; stalk black, with reddish brown pruina in the upper part; capitulum broadly obconical-lenticular with reddish brown pruina below, the pruina K+ violet-red (often with plate-like violet crystals); mazaedium black but with a faint yellow pruina (probably crystals of a tetronic acid derivative), particularly in young apothecia; asci cylindrical; spores uniseriate to almost biseriate, when mature 10-14 x 5.5-7 μ m, with distinct ornamentation of spirally arranged ridges and a few irregular cracks. Conidia cylindrical, 5-7 x 1 μ m. On decorticate trunk in subtropical, swampy forest, Florida.

C. corynellum (Ach.) Ach.

On siliceous rock underhangs in very humid habitats; parasitic? on Lepraria spp. Thallus often well developed, thick, farinose-granular, soorediose, yellowish or greenish, P-, K- (rhizocarpic and ?usnic acids). Apothecia \pm sessile or short-stalked, 0.2-1.2 mm high, 3-5 x as high as width of central part of stalk, black, slightly pruinose on lower part of exciple; stalk I-; capitulum to 2.5 mm diam. in sessile fruits; pruina white, faint, on lower side of exciple. Asci clavate. Spores 12-16 x 4-6 μ m, with spirally arranged ridges within young, later becoming cracked. Canada.

C. glaucellum Ach.

Apothecia usually with a faint white pruina at least at edge (upper part) of excipulum and below the head. Semi-mature spores with a very irregular sulcate pattern; mature spores 9-13 x 4-6.5 μ m, with coarse irregular ornamentation of cracks and ridge fragments. Asci 34-41 μ m long, 3.5-4.5 μ m wide, cylindrical. Apothecia 0.5-0.9 mm tall, 4-8 x as high as wide; stalk shiny black, 0.11-0.17 mm wide, consisting of blackish brown to dark aeruginose, irregularly interwoven and strongly sclerotized hyphae, becoming pale towards surface; outermost layer gelatinous.. Apothecia I-. Capitulum 0.23-0.34 mm diam., obovoid to lenticular. Spores uniseriate. Pycnidia frequent; conidia 4-5 x 0.8 μ m, narrowly cylindrical. Excipulum dark

brown to aeruginose, of elongated to almost isodiametric sclerotized hyphae, paler in outer part and \pm distinctly anticlinally arranged. Hypothecium dark brown, flat or slightly convex upper surface. Thallus immersed or rarely superficial with an indistinct, dark grayish green granular thallus, K \pm dull yellow (unknowns). On old stumps or standing or fallen wood of coniferous and deciduous trees, more rarely on bark. Maine; elsewhere.

C. hyperelloides Nyl.

Thallus K+ dull yellow, C+ orange, KC+ orange to red, P-, UV+ dark orange, containing xanthenes (arthothelin, thuringione and thiophanic acid). Underside of the capitulum black or sometimes with a faint grayish pruina. Ripe asci cylindric, the spores uniseriate. Thallus usually episubstratic, \pm well developed, verrucose, yellowish green to pale straw yellow. Half-ripe spores smooth; ripe spores with a fine ribbing to strongly areolate (minutely uneven and cracked) ornamentation, 10.5-14 x 4-5(-7.5) μ m. All parts of apothecia l-. Apothecia distinctly stalked, 0.4-0.9 mm high, 3-7 x as high as width of stalk; capitulum obovoid to lenticular, 0.10-0.15 mm diam. Excipulum of dark brown, elongate to almost isodiametric interwoven hyphae with thickened walls. Hypothecium dark brown, convex. Inner surface of excipulum sometimes lined by a layer of minute crystals that appear at the edge as a narrow yellow zone surrounding the mazaedium. Stalk 0.10-0.15 mm diam., shining, black, epruinose, consisting of dark brown, periclinally arranged, intricately branched hyphae; outermost layer pale, consisting of unsclerotized, irregularly arranged hyphae; surface of stalk covered by a very thin gelatinous layer. Asci 40-51 x 4.5-7.5 μ m. On bark.

C. lenticulare Ach. (synonym: C. subquercinum, C. lentigerellum; however, C. lenticulare sensu Nád. = C. adpersum)

Stalk black or very dark reddish brown, 0.6-1.5 mm high. Mature spores 8-11 x 4-6 μ m, not constricted, with minutely pustulate (minutely verrucose to areolate) ornamentation, smooth when young, remaining non-septate while in the asci, then 1-septate. Capitulum 0.2-0.55 mm wide, obconical, top-shaped to lenticular, black to faintly or distinctly white pruinose below. Stalk 4-8 x as high as wide. Stalk and exciple l+ dark blue (in squash). Asci narrowly clavate to \pm cylindrical, 21-32 x 4-5.5 μ m. Spores broadly ellipsoid, in part biserial and overlapping. Excipulum of densely intertwined, sclerotized hyphae with slightly elongated cells, laterally not reaching far above surface of hypothecium. Hypothecium blackish brown with convex upper surface. Stalk consisting of densely intertwined, sclerotized hyphae and sometimes with strands of interhyphal, granular crystals; outer part slightly paler and with a thin gelatinous coat. Thallus greenish to yellowish gray or with a bluish tinge, thin, finely granular to verrucose or almost immersed, K-, C-, KC-, P-, UV- (no substances). On bark or wood, often decaying stumps, especially of oaks, in humid areas. Maine; elsewhere.

C. leucochlorum Tuck.

Thallus episubstratic, verrucose to areolate (granulose according to Fink), pale straw yellow (yellow to yellow-gray according to Fink), intersected by black hypothalline lines; granules subcontiguous, forming a thin, uneven crust.

Apothecia on moderately long, stout, epruinose, shining black stalks, 0.7-1.0-1.3 mm high, 0.1-0.2 mm wide (5-9 times as wide as high); capitulum (0.15-)0.26-0.4-0.54 mm across, broadly obovate (clavate-top-shaped according to Fink); mazaedium convex to flat, dark brown to blackish, the exciple with a brown (dark rust-colored according to Fink) pruina on lower side. All parts of the apothecia l-. Capitulum consisting of densely and irregularly interwoven, sclerotized hyphae. Excipulum laterally 35-50 µm thick, covered by a 5-14 µm thick layer of yellowish brown, amorphous crystals. Hypothecium blackish brown, with flat to convex upper surface, consisting of periclinally arranged hyphae. Stalks consisting of strongly sclerotized hyphae that are intertwined but mainly periclinally oriented; 3-14 µm thick hyaline layer present on the outside of the stalk. Asci cylindrical with uniseriately arranged spores, 49.0-50.8-52.0 x 5.2-5.9-6.6 µm. Spores brown, broadly ellipsoid (oblong according to Fink!), (10-)11.2-12.4-13.5(-14) x 6.3-6.9-7.5(-8.0) µm, with a very distinctive ornamentation of spirally arranged ridges.

Pycnidia semi-immersed, visible part blackish brown, 40-60 µm diam.; immersed parts of pycnidial wall pale; conidia formed apically and laterally on short, branched conidiophores; conidiophores ca. 2 µm diam.; conidogenous cells of varying shape, 3-5 x 2-4 µm; conidia ellipsoid, 5-7 x 2.5-3 µm, truncate at lower end.

Thallus K+ dull yellow, C+ orange, KC+ orange-red, P-, UV+ dark orange. Pruina (especially in young apothecia) K+ red, dissolving then precipitating violet-red, feather-, plate-, needle-like or irregular crystals. Thallus with thiophanic acid and two additional substances, probably xanthones.

On old wood, Florida.

C. parvum Tibell

Asci clavate; spores narrowly ellipsoid, 8-11 x 3.5-4.5 µm, when mature very slightly ornamented with ± polygonal warts and usually constricted. Apothecia 0.5-0.9 mm high, 6-8 x as high as wide; stalk black, shiny, 0.08-0.12 mm; capitulum 0.12-0.4 mm diam., lens shaped; exciple sometimes with slight whitish pruina at edge. Apothecia l-. Thallus usually superficial, gray to green-gray, thin, verrucose. Pycnidia frequent; conidia 2-3 x 1-1.5 µm, ellipsoid. Thallus K+ dull yellow, P+ pale yellow, C- (diffractaic acid). On wood and bark, mostly of pines. Maine; elsewhere.

C. quercinum Pers.

Thallus clearly superficial, Half-ripe spores with regular screw-like (spiralled) patterns. Thallus gray and finely granular. Ripe spores clearly

constricted at septum. Thallus P+ yellow, K+ yellow then red. Apothecia 0.7-1 mm high, 5-7 times as long as diameter of the dull black stalks; at least the edge of excipulum often whitish pruinose; underside of capitulum black, with or without white pruinosity. Ripe spores 9-11 x 4-5 μ m, with an ornamentation of spiral ribs and irregular ribs. All parts of apothecia l-. Ripe asci cylindric. On bark of Quercus and on wood.

C. salicinum Pers.

Lower side of capitulum with brown pruina. Thallus endoxylic or endophloedal, gray, P-, K- or \pm P+ yellow-orange, K+ yellow-red (norstictic acid). Mature spores 8-11 x 4-5 μ m, with regular ornamentation of spirally arranged ridges, uniseriately arranged, ellipsoid. Asci cylindrical. Apothecia stalks 0.4-1.5(-4) x 0.05-0.12(-0.4) mm, 10-15 x as high as wide, dark red-brown to black, with colorless mantle; capitulum subglobose to lenticular, 0.18-0.4(-0.8) mm wide, with brown pruina (K+ purple-red crystals) on lower side of exciple and sometimes upper part of stalk. Apothecia l-. On dry, acid bark and wood, especially on dry sides of old oaks. Maine; elsewhere (also known from tropical or subtropical areas, e.g. southern Mexico).

C. trabinellum (Ach.) Ach.

Thallus usually immersed in substrate, rarely episubstratic, dark grayish-green, verrucose, very thin. Apothecia with a yellow pruina on lower side of capitulum, and sometimes a little on the mazedium, 0.5-1 mm high, usually definitely stalked; capitulum top-shaped or obovoid to lenticular, 0.17-0.26(-0.5) mm wide; stalk to 0.2 mm thick, with hyaline mantle. Spores 7-12(-14) x 4-6 μ m, the surface with irregular sulcate-cracked pattern. Mature asci cylindrical. Stalk 5-9 x as high as wide, 0.07-0.11 mm diam., the central part dark brown or with an aeruginose tinge, of intricately interwoven and heavily sclerotized hyphae; outer part hyaline to brownish, 22-27 μ m thick, of strongly gelatinized cells arranged as in the central part, with a thin gelatinous coat. Apothecia l-. Excipulum of isodiametric to slightly elongated cells; cells of outer part pale, of inner part sclerotized and dark brown; outer surface with granular, yellow pruina. Asci cylindrical, 30-37 x 3.5-4.5 μ m. Pruina contains vulpinic acid. On wood, e.g., old fence posts. Maine; elsewhere.

C. viride Pers.

Thallus K-, C-, KC-, P-, UV+ yellow, containing rhizocarpic acid and epanorin. Underside of capitulum often with a brown pruina. Asci clavate, the spores not uniseriate. Spores (9-)11-13(-16) x 4-5(-6) μ m, commonly incised at septum, with deep, irregular cracks. Stalk mostly 9-16 x as tall as wide, (1-)2(-6?) x 0.04-0.16(-0.3) mm; capitulum (0.15-)0.3-0.7 mm wide. Apothecia l-. Thallus rather bright green to yellow-gray, usually well developed and thick, sometimes immersed; sometimes sorediate. On bark or twigs, or wood (acidic, usually conifers). Common in West.

See Tibell 1998 for fuller description

C. minutissimum = Stenocybe minutissimum

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