

SECTION 0--PARASITIC ON OTHER LICHENS ON ROCK.

Rev. 1/94

1. **Spores 13-16 um long.** 2

1. **Spores mostly under 13 um long.** 3

2. Spore septum (2.5-)3(-5) um. Apothecia yellow to red-orange with a somewhat lighter, thick margin; spores 13-16 x 8-10 um. Thallus yellowish-ashy, irregularly chinky-areolate; areolae flat, dull, epruinose, soft; hypothallus lacking. Apothecia dispersed or grouped, round, to 1 mm broad but usually less, adnate; margin thick, waxy, shining, paler than disk and more yellow; disk flat to slightly convex, dark yellowish-rusty red, epruinose, smooth; hypothecium hyaline, dense; epihymenium brownish, granular-inspersed; hymenium 65-70 um, hyaline; paraphyses free, slender, sometimes constrictedly septate above, sometimes slightly thickened to 4-5 um, branching. Typically on Aspicilia or Lecanora, Arctic. C. invadens

2. Spore septum very thin. Apothecia red-orange, K+ red, 0.3-0.4(-0.5) mm wide, mostly dispersed, concave then plane; margin concolorous, thin, entire; epithecium granulose; hypothecium hyaline; paraphyses free, septate, narrow, simple or furcate towards tips; asci clavate-inflated, thick-walled at top; spores 8, 13-16 x 7-9 um, polarilocular. Thallus black, visible only under apothecia. Similar to C. festiva. On other lichens on rock, New Mexico. C. dispersa

3. Amphithecium brown, K-. Thallus reduced to a rim around the apothecia; prothallu absent. Apothecia round to angular, sessile or immersed in the host, 0.3-0.7(-1.0) mm diam., scattered; disk brownish red to reddish orange; thalline margin brown, flush to slightly raised. Epihymenium dark golden; hymenium (56-)70-84 um; hypothecium hyaline; parathecium with radiating elongated cells or hyphae; upper amphithecium with algae. Paraphyses with some branches, tips with 1-2 slightly swollen cells. Spores (10.0-)11.0-14.0 x 5.5-7.0 um, isthmus 2.0-4.0 um. Pycnidia not seen. Epihymenium K+ red, H-, C-; thalline margin K-, C+ red brown, cN-. On Candelariella. C. grimmiae (Nyl.) Oliv.

3. Amphithecium usually reddish or orangish, K+ red. 4

4. Apothecia dark reddish; spores 8-13 x 5-7.5 um; isthmus 2-2.5 um; amphithecium dark reddish, grayish to black, or disappearing. Thallus not evident. Apothecia in small groups, 0.35-0.5(-1) mm broad, sessile with constricted base; margin dark rust-red becoming black, entire and persistent, concolorous with disk, containing abundant algae, hyphae anticlinally radiate, the outer part with rusty granules; disk flat, epruinose, rust-red or rust-orange to rusty brown; hypothecium hyaline; epihymenium very inspersed with reddish brown granules over the paraphysal tips; hymenium 70-75 um, hyaline; paraphyses free, abundantly branched, tips only slightly thickened but covered with the granules; spores 8, ellipsoid, 10-13 x 6.5-8 um, septum 2-2.5 um. On wide variety of lichens, widespread. Greenland and southern Canada, south to Colorado. C. epithallina

4. Amphithecium orange-ochraceous, thick. Thallus indistinct. Apothecia sessile to ± stipitate; disc plane, darker; paraphyses not capitate; spores 11-14 x 5.5-8 um; septum 2.5-3.5 um thick. Parasitic on Aspicilia on rocks. C. insularis

ADD:

Thallus not evident, immersed in host thallus, indicated by orange coloration of host, prothallus not evident. Apothecia sessile, grouped in orange areas, round, flat, 0.1-0.3 mm diam., disk and margin orange like thallus areas, margin flush, no thalline margin, no algae in upper margin. Epihymenium dark golden, hymenium 50-55 um, parathecium with oval to elongate cells, hypothecium without distinct cells. Paraphyses tips not swollen, frequently branched. Spores 10-12.5(-14) x 5.5-7.0 um, isthmus 3(-4) um. Pycnidia not seen. Thallus areas and epihymenium K+ red. Parasitic on thallus of Heterodermia at base of shady side of rock cliffs. Central Baja California. C. endodermia Wetmore

Thallus parasitic on crustose lichens on calcareous rocks. Thallus yellow orange, conspicuous; discs and margins orange. Rare, Ontario. C. cf. inconnexa

C. wetmorei Nimis, Poelt & Tretiach

SECTION 1--ON MOSS, SOIL, ETC.

Rev. 1/94

1. Thallus isidiate or sorediate. Apothecia (if present) yellow, orange, red, or rusty, K+ red or purple..... 2

1. Thallus not isidiate or sorediate, but sometimes granular, of various colors or thallus not apparent. Apothecia usually present, variously colored, K+ or K-. 4

2. Thallus (at least the soredia or isidia) yellow to orange or reddish, K+ reddish to purple. KEY 1-A (*C. citrina* group)

2. Thallus entirely whitish to blackish, K-, or almost absent. 3

3. Apothecia brown to dark brown, K-. On *Selaginella*. (see corticolous species in the *C. camptidia* group: *C. obscurella*)

3. Apothecia yellow, orange or red, K+ purple. (*C. herbidella*/*C. chlorina* group; no primarily terricolous species known in N. America, but for this and other such groups, need to check saxicolous and corticolous keys)

4. Thallus at least partly \pm distinctly yellowish to orangish (sometimes pale or spotty), K+ reddish to purple. (If thallus squamulose or subsquamulose-areolate and growing on soil in Baja California, see *C.* sp. 104 of Wetmore if apothecia absent, and *C.* sp. 100 of Wetmore if apothecia dark orange, with spores 16-18.2 x 4.2-5.6 μ m and septum 0.5 μ m; if thallus of distinct, convex areoles, growing on moss or dead plants, see *C. bolacina*; if thallus distinctly lobed, red-orange, and corticate below, see *Xanthoria*) (*C. aurantiaca* group; no primarily terricolous species known in N. America)

4. Thallus immersed, or \pm grayish (whitish to blackish or tinged with other colors but not yellowish or orangish), K-. 5

5. Spores 24-30(-38) x (3-)5-7 μ m, very narrow relative to length, simple, or pseudoseptum occasionally present, very thin; thallus pale to black-gray (or orange?--due to pycnidia or apothecial primordia?), sometimes \pm lobate; apothecia to 0.7(-2) mm wide; disc orange to rust-colored or blackish orange, pruinose. Thallus crustose, spreading over mosses, thin, skin-like or \pm coarsely crowded-granular; prothallus conspicuous. Apothecia numerous, crowded, \pm contiguous, rounded, \pm sessile, somewhat concave then flat or \pm convex; thalline margin pale to dark gray; proper margin \pm orange, persistent or \pm excluded; disc roughened. Paraphyses 1-3 μ m wide, lax, simple to sparsely branched, of chains of obovate cells, submoniliform, apical cell slightly enlarged. Spores subcylindrical, sometimes with a median indentation and then slipper-shaped, straight to \pm curved. Thallus K-. On mosses (apparently parasitic on *Andreaea* and *Grimmia*) on acidic rocks, alpine. May not belong in *Caloplaca*. *C. nivalis*

5. Spores shorter, relatively broad in relationship to length, usually distinctly septate and polarilocular. 6

6. Apothecia brown, K-. (*C. camptidia* group; no non-sorediate, primarily

terricolous species known in N. America)

- 6. Apothecia yellow, orange, red, or black, or \pm brown, but always with at least the disc K+ reddish or purplish. 7**
- 7. Apothecia \pm rusty colored to brown, or black (variously tinged). 8**
- 7. Apothecia (at least the discs) yellow, orange, red, sometimes brownish but not rusty nor blackening. 9**
- 8. Apothecia \pm black (variously tinged). KEY 1-B (C. pollinii group)**
- 8. Apothecia \pm rusty colored (with yellowish to orangish or reddish tinges, but often brownish or blackening). Key 1-C (C. ferruginea group)**
- 9. Apothecial margin (at least outer part) some shade of white, gray, brown, or black, K-. KEY 1-D (C. cerina group)**
- 9. Apothecial margin concolorous with disk or somewhat lighter or darker, but K+ reddish to purple and not gray to black. Key 1-E (C. pyracea group)**

I-A. On soil, etc.
Sorediate or Isidiate;
Thallus at least partly yellow, orange or red, K+ red/purple
Apothecia often absent
C. citrina group

1. Thallus of small, often coalescing crustose-squamulose rosettes; often erupting into soralia from lower side of margins; apothecia uncommon, the margin sorediate and concolorous with the thallus; spores 16-17 x 8-9 um. Thallus brownish or light yellow, K+ purple, of small areolae appressed to the substratum, 0.5-1.5 mm broad, sometimes with short marginal lobes but usually these lacking; soralia on raised margins or on surface, the soredia light yellow. Apothecia very rare, with margins sorediate, disk 0.5-1 mm broad, reddish brown. On loess and silt soils, alpine to desert shrublands and plains grasslands. Arctic, south to Utah.C. tominii

1. Thallus finely granular, forming a crust, not squamulose, erupting into irregular soralia that eventually coalesce into a homogeneous sorediate to sorediate-isidiate crust; apothecia rare, constricted at the base to substipitate. Thallus lemon-yellow to orange, at first of small areolae 0.1-0.2 mm across, the areolae soon verruculose-granulose with tiny granules, but sometimes environmental forces strip the granules and leave only a yellowish white thallus remnant. On plant detritus and in crevices in calcareous rock, alpine. Greenland; Colorado. C. epiphyta (synonym: C. bryochryson)

I-B. On soil, etc.
Apothecia black.
C. pollinii group

1. Apothecia flat to convex. Arctic. Not yet reported from N. America [but treated by Rudolph?](C. friesii)

1. Apothecia concave then flat. Thallus very thin, of dispersed verrucules, ashy gray or obsolete. Apothecia few, to 0.7 mm across, crowded; disc black, somewhat pruinose; margin thick, prominent, gray, persistent. Hypothecium colorless; paraphyses free, branched at tips, capitate; tips pale grayish violet, K+ intensified violet, not red; asci inflated-clavate; spores 8, ellipsoid or ovoid, 10-13 x 5-7 um. Arctic. Not mentioned by Wetmore (1994). C. celata

I-C. On soil, etc.
Thallus immersed or ± grayish, K-.
Apothecia ± rusty colored, K+ reddish to purple
C. ferruginea group

1. Disc yellowish to rusty brown or brownish to olive-blackish, usually soon convex to subspherical; spores 12-22 x 6-12 µm; septum thick; thallus gray-whitish to dark gray, granulose. Apothecia 0.1-0.7 mm across; adnate; margin thin, concolorous with disc, soon disappearing. On mosses and lichens, esp. on calcareous soil, boreal-montane to arctic-alpine. Colorado.C. sinapisperma

1. Disc dark rusty red to blackening, plane. 8

2. Thallus dark gray with bluish tinge, arachnoid, scarcely to indistinctly granular, 1-2 cm across. Apothecia frequent, 0.2-0.4 mm diam., sessile, constricted at base; disc dark rusty red to blackening; margin thin, prominent, black (contrasting with paler disc), persistent; without algae; exciple with upper part in section green-blue. Hypothecium 25-35 µm; hymenium 70-80 µm; paraphyses contiguous, 1.7 µm wide, slightly thickened above. Asci ca. 50 x 15-17 µm; spores 8, ellipsoid, 17-19 x 7.5-8.5 µm; septum 2-2.5 µm (mixed with narrower spores, probably young, 6-7 µm wide, with 4-5 µm septum and indistinct isthmus). On dying moss among rocks. Arctic. C. tornoensis

2. Thallus white to gray, thin, uneven or granular. Spores (12-)15-18 x (6-)6.5-7.5(-8) µm, 8/ascus; apothecial discs dark rusty red to red-brown, brownish orange or blackish red; hypothecium about 35 µm. Apothecia to 1.5 mm diam., crowded, ± contiguous, rounded or somewhat angular or flexuose, flat then ± convex, sessile; proper margin rust-red to brownish orange, irregular, somewhat swollen, ± uneven, ± grayish below, becoming excluded when old. Paraphyses flexuose, simple to forked, gradually broadening towards tips. Chem.: emodin, parietin, xanthorin, fallacinal, chloremodin, fragilin. Usually on moss and plant detritus, occasionally on wood, arctic alpine. [C. cinnamomea is accepted as distinct from C. amniospila by many recent authors] C. amniospila (syn.: C. cinnamomea)

I-D. On soil, etc.
Thallus immersed or ± grayish, K-
Apothecial margin whitish to black at least towards outside
Disc yellow to orange (or greenish or olive).
C. cerina group

Arctic-alpine to boreal and montane.

1. Spore septum under 3 um. 2

1. Septum 4.2-5.6 um; spores (10-)14-16.8(18.2) x (5-)8.4-10 um, oblong-ellipsoid. Thallus thin, light gray, areolate, of convex areoles, or scurfy-granulose to subsquamulose, K-, becoming somewhat scattered. Apothecia 0.3-1.5 mm across, adnate to sessile; disc flat to convex or somewhat wavy, yellowish green to orangish yellow, dirty yellow-orange, or dark olive, often ± pruinose; exciple light gray or blue-gray pruinose, raised, entire to wavy, sometimes radiately striate. Epithecium K+ reddish. Paraphyses septate, branched at upper ends; tips capitate to 5 um. On soil and moss. Massachusetts; Minnesota; Pacific NW; Alaska; south to California and New Mexico; [If spores 11.2-12.6 x 5.6-7 um, and growing on HCl+ soil in Baja California, see C. sp. 101 of Wetmore] C. cerina (synonym: C. stillicidiorum)

2. Spores 15-17 x 7-8.5 um; septum 2-3 um; thallus thin, sordid whitish; apothecia orange to rusty or gray-brownish, to 0.5 mm, convex. Rare, British Columbia. ...C. livida

2. Spores 24-30(-38) x (3-)5-7 um, simple, or pseudoseptum occasionally present, very thin; thallus pale to black-gray (or orange?--due to pycnidia or apothecial primordia?), sometimes ± lobate; apothecia to 0.7(-2) mm wide; disc orange to rust-colored or blackish orange, pruinose. On mosses (apparently parasitic on Andreaea and Grimmia) on acidic rocks, alpine. May not belong in Caloplaca. (C. nivalis)

I-E. On soil, etc.
Thallus immersed or ± grayish, K-;
Disc yellow, orange or red;
Apothecial margin ± concolorous with disc
C. pyracea group

1. Apothecia ± red-orange. 2

1. Apothecia yellow to orange. 3

2. Spores (17-)22-28(-34) x 10-17 um, 4/ascus; apothecia red-orange, high-convex to spherical, margin thin to disappearing; hypothecium over 150 um. Thallus white to ashy, K-, thin, granulose to disappearing. Apothecia to 0.8 mm broad, at first with flat disk and a thin margin of same color as thallus, which soon disappears and the disk becomes very convex so that the apothecium appears like that of a Blastenia; disk red-rusty, rusty brown, or darkening; hypothecium hyaline; epihymenium golden-brownish, K+ reddish; hymenium 80-100 um, hyaline, upper part brownish; paraphyses free, septate, branched, tips capitate to 5 um; spores ellipsoid, septum 5-8 um. On moss and humus. Arctic-alpine, esp. calcareous sites, south to Washington in the west. C. tetraspora

2. Spores smaller, 4-12/ascus, 12-23 x 3.5-5 um; 4, 8, or 12 spores/ascus; apothecia orange to vermillion. Thallus thin, dirty whitish, squamulose; squamules strongly convex, passing into granulose conditions and disappearing. Apothecia 0.3-1 mm across, sessile; disc flat to slightly convex; proper exciple well developed, concolorous with disc, raised, entire to radially striate or rough and lumpy. Septum of spore usually thin (1.4-2.8 um) and indistinct. On soil in California. C. luteominia

3. On dead stems of saxifrages, arctic-alpine. Thallus very reduced or indistinct. Apothecia 0.3-0.7 mm diam., plane or slightly concave, very bright orange; margin rather thick, paler than disc. Spores 11-13 x 3-8 um. C. saxifragarum

3. Mostly on soil or moss. 4

4. Septum narrow, under 3.5 um. [Note: C. fulvolutea, known from Greenland, also keys out here; it has usually yolk-yellow discs, and spores 15.5-18.5 x 8-9 um; see Thomson 1997 for description]. 5

4. Septum broader, over 3.5 um. 6

5. Spores 12-20 x 6-8 um. Disk pale yellow-orange to rusty yellow, proper margin yellow or pale orange, brighter than the disk, thin, persistent, entire. Hymenium 72-80 um high; paraphyses not well separated, with globular heads, some furcate below the tips; asci oblong-tubular. Spores oblong-ellipsoid; isthmus narrow. Thallus clay color, quite thin, obscure or absent. Apothecia sessile, 0.25-0.75 mm diam.; disk flat to planoconvex. On soil or crumbling rock (sandstone), foothills in southern California. C. subpyracea

5. Spores 11.2-14 x 5.6 um. Disk orange. Oval cells in apothecial margin; apothecia 0.3-0.6 mm diam.; isthmus 2.8 um. Apothecial margin moderately thick, flush with disk. Baja California. C. sp. 103 (Wetmore)

6. Growing directly on soil, in Baja California. Indefinite cells in apothecial margin.

Disk yellow-orange; apothecia 0.5-1.5 mm diam.; spores 14-15.4 x 5.6-7 um; isthmus 3.5-4.2 um. C. sp. 102 (Wetmore)

6. Growing on moss or plant debris, in arctic-alpine areas. 7

7. Thallus absent. Apothecia dirty yellow orange to bluish yellow orange, with not gray on outside of apothecial margin. Asci with 8 spores. Epithecium K+ red-violet. Spores 12.6-14 x 7-9.8 um; isthmus 3-4.2 um. On plants. Colorado. C. sp. 114 (Wetmore)

7. Thallus obvious, gray. [Note: Brigantiaea spp., with huge muriform spores, will also key out here]. 8

8. Thallus coralloid-granular areolate. Discs bluish- greenish orange; inner margin yellow-orange; outer surface color of thallus. Spores 12.6-14 x 8.4-9.8 um; isthmus 2.8-4.2 um. On moss. Colorado, California, Wyoming. C. sp. 115 (Wetmore)

8. Thallus thin, minutely granulose to subsquamulose. Discs without bluish-greenish tinge (but may be olive); margin concolorous with disc. 9

9. Disk waxy yellowish to yellow-orange to olive-blackish; spores 11-16 x 6-9 um, septum 4-5 um; apothecia to 0.5 mm. Thallus very thin, subgranulose to squamulose, whitish, K-. Apothecia adnate, flat; margin thin, concolorous with disc; hypothecium over 60 um thick; hymenium hyaline, 30 um; paraphyses slender, not capitate. Spores 8/ascus, ellipsoid. On mosses, plant debris, and soil, occ. on bark; arctic-alpine. C. tirolensis

9. Disk orange or darkening; spores 16-23 x 7-13 um; septum 3.5-4 um; apothecia to 1.5 mm. Thallus thin, minutely granulose to subsquamulose, ashy or whitish. Disc flat to slightly convex; exciple thick, swollen, concolorous with disc, becoming flexuous and finely disappearing; spores oblong-ellipsoid. Wide ranging, common in northern Rockies, esp. in alpine areas. Colorado, Montana, California and Pacific NW.....C. jungermanniae

ADD:

Thallus 0.5-2(-3) cm, sometimes coalescing, crustose, discontinuous to continuous, consisting of scattered to clustered areoles, cracked areolate or poorly developed; areoles 0.3-0.5(-1.0) mm wide, 0.05-0.2(-0.35) mm thick, fairly even to slightly convex or verruculose; surface mostly very smooth, giving a waxy appearance; margin mostly indistinct, fading or of scattered areoles; color mostly some shade of pale yellow, occasionally orange-yellow or beige; prothallus occasionally present but mostly poorly developed, yellow to orange. Apothecia mostly present and abundant, scattered to aggregate, zeorine, sessile when young but soon raised, 0.4-1.2(-1.6) mm, round to irregular; disk slightly concave to rather strongly convex, sometimes flexuose, yellow, golden yellow, yellowish orange or sometimes orange; proper margin initially rather thick but becoming thinner with age, (10-)50-100(-150) μ m, initially raised, later almost level with disk, mostly slightly lighter than disk, often with a slightly waxy appearance. Spores ellipsoid, (11.2-)13.0-17.4(-19.7) \times (4.6-)5.2-7.3(-10.3) μ m; septum (1.8-)2.5-4.3(-5.2) μ m. On soil or mud, coastal, Baja California to Oregon. C. ludificans Arup