

CALOPLACA SECTION 3. ON ROCK

Rev. 1/94

The saxicolous species are a real mess [I could amplify on that, but I won't bother at present].

1. Thallus \pm distinctly radiately lobed, or dwarf fruticose. (SECTION 2. Subg. Gasparrinia lato and subg. Polycauliona, together in separate document CALOPLAC.LOB)

1. Thallus, if evident, not distinctly lobed, but sometimes (e.g., C. squamosa group squamulose (to somewhat lobed)). 2

2. Thallus \pm distinct yellow, orange, or red, K+ strong red to violet. 2

2. Thallus pale or dark, only weakly yellowish or orangish, K \pm reddish or K-, or immersed. 6

3. Thallus isidiate or sorediate. Apothecia often absent. KEY 3-A-1 C. citrina group

3. Thallus not isidiate or sorediate. Apothecia usually present. 4

4. Growing on the seashore, often near high tide line. KEY 3-A-2 C. marina group

4. Growing inland or at least not directly on the seashore. 5

5. Thallus \pm scattered to imbricate, areolate, verrucose, or squamulose. KEY 3-A-3 C. squamosa group

5. Thallus continuous to rimose-areolate. KEY 3-A-4 C. aurantiaca group

6. Thallus some shade of buff, yellow, or yellow that has darkened, K \pm weakly reddish, thin but distinct, \pm rimose-areolate, not squamulose or lobed. (if thallus distinctly lobed, see C. teicholyta/C. modesta group in subg. Gasparrinia) KEY 3-B C. rimosa, etc. group

6. Thallus whitish to grayish, brownish, greenish, or blackish, K-, or immersed. (if parasitic on other lichens, see key to parasitic species under terricolous species). 7

7. Apothecia black. KEY 3-C C. variabilis group

7. Apothecia at least partly yellow to orange, red, brown, or olive. 8

8. Discs \pm rusty colored (to brownish or blackish), K+ or K-. 9

8. Discs yellow, orange or red, sometimes brownish but never dark, and always K+ strong red to violet. 10

9. Thallus well developed, often \pm squamulose. KEY 3-D-1 C. sideritis group (If thallus distinctly lobed, see C. teichophylla/C. modesta group in subg. Gasparrinia)

9. Thallus in general poorly developed and often \pm immersed. KEY 3-D-2 C. ferruginea group

**10. Amphithecium (thalline margin of apothecia) \pm gray (whitish to blackish),
K-. KEY 3-E-1 C. cerina group**

10. Amphithecium, if present, \pm yellow, orange, or reddish, K+ red-violet.
KEY 3-E-2 C. pyracea group

3-A On rock;
Thallus ± well developed, yellow to orange or red, K+;
C. aurantiaca Group s. lato
(Pyrenodesmia sect. Citrinae; Blastenia pr. p.)

3-A-1 On rock;
Thallus well developed, yellow to red, K+ red or purple;
non-lobed; isidiate or sorediate;
C. citrina Group

1. Thallus densely isidiate. [Check thallus color; it may be grayish instead of yellow to red!]. 2

1. Thallus sorediate, yellow to orange. (If areoles 0.5 mm diam., flat, not lobed, and soredia on most of the margins, growing in Utah, see C. sp. 94 of Wetmore). 4

2. Growing in Texas. C. subnitida

2. Growing in Baja California or Arizona. 3

3. Isidia granular globose. Thallus with small lobes. Baja California. C. sp. 29 (Wetmore)

3. Isidia cylindrical. Thallus areolate. Arizona. C. sp. 30 (Wetmore)

4. Thallus orange to brownish orange, areolate; areoles contiguous or ± scattered, to 0.3 mm wide, often elongate-irregular and somewhat sparingly branched, very closely adpressed, flat to ± convex; prothallus sometimes present, pale, occasionally fimbriate. Soralia few and scattered to numerous and ± continuous, ± punctate or irregular in shape; soredia small-granular. Apothecia rare, to 0.5 mm diam., becoming convex. Spores ca. 14 x 6 µm; septum ca. 1/3 length of spore. On ± basic to acidic, ± deeply shaded rocks, chiefly on cliffs. C. obliterans

4. Thallus mostly greenish yellow to yellow-orange (to occasionally bright orange in C. citrina). 5

5. Prothallus mostly present and prominent yellow; areoles ± convex, incised at base; granules often present, coarse; soredia 36-46.8 µm diam., concolorous with thallus. Apothecia fairly common, 0.5-1.5 mm diam.; thalline margin often present, crenulate; spores 11.7-14.3 x 4.9-6.8 µm (L:W = 1.86-2.72); septum 3.1-4.7 µm thick (1/4-1/3 of spore length). Growing in mesic supralittoral or upper supralittoral fringe zone on the seashore. Thallus 1-3 cm across, sometimes coalescing, consisting of scattered to clustered areoles, crenate lobes or squamules, verruculose, coarsely granular or sorediate, occasionally slightly cracked to cracked-areolate; areoles 0.05-0.4 mm wide; lobes 0.2-0.6 mm long, 0.1-0.4 mm thick, convex and mostly incised at base. Soralia usually common, discrete to continuous, first appearing at edge of areoles or lobes. Apothecia zeorine, few to abundant, scattered or sometimes crowded, mostly raised and constricted at base except in heavily sorediate parts, round to irregular; disk ± plane, concolorous with or mostly somewhat darker than thallus; proper margin rather thin. On acidic, calcareous or ultramafic rocks, occasionally on driftwood, usually on sun-exposed, horizontal or somewhat sloping surface, occasionally on vertical or more protected parts,

Southern Alaska to northern California. [= Caloplaca sp. 3 of Ryan, 1988). C. flavogranulosa Arup.

5. Prothallus very rare, scanty, gray; areoles slightly convex to plane, not incised; granules absent; soredia 24.4-34.4 μ m diam., concolorous with thallus or lighter and often more intense than thallus. Apothecia rare, 0.3-0.7 mm diam.; thalline margin rarely present, not crenulate; spores 10.7-16.4 x 5.0-6.1 μ m (L:W = 1.84-2.68); septum 3.9-4.5 μ m (1/4 to almost 1/2 spore length). Growing inland, or occasionally in xeric supralittoral on the seashore. Thallus becoming completely sorediate or a somewhat areolate crust, yellowish green to yellow or yellow-orange or bright orange; of very small, subsquamulose areoles or minutely scattered or continuously granular or \pm immersed in substrate and inconspicuous, diffuse. Soredia diffuse, not in discrete soralia, thin to thick, when thick broken up into irregular coarse areoles, usually yellow but sometimes orange, yellowish gray in shade, farinose. Apothecia lacking or frequent, to 1.0 mm diam., scattered, immersed then \pm sessile, flat, somewhat swollen when mature; thalline margin usually persistent, even, smooth or almost completely sorediate, yellowish; disc orange. Paraphyses partly with narrow tips, partly \pm clavate to 3 μ m wide at tips. Asci often long and narrow. Spores 10-15 x 5-6 μ m, broadly ellipsoid; septum ca. 3 μ m thick, ca. 1/3 length of spore. Chem.: emodin, paritein, xanthorin, fallacinal. Often on calcareous substrates (limestone, mortar, etc.), usually in sunny situations, at times overgrowing mosses and dead plants; occasionally on acidic or ultramafic rocks. Widespread throughout much of N. America, at least in the north and west, S to S. Carolina in the east. (if thallus completely sorediate, also see Leproplaca) C. citrina

3-A-2.
On rock;
Thallus yellow, orange, or red, K+;
Non-lobed; Not sorediate or isidiate;
Growing on the seashore
C. marina group

Mostly after Arup

- 1. Growing near the high tide line. 2**
- 1. Usually higher above the water line, sometimes somewhat inland.** Thallus verrucose to subsquamulose. [Mostly?] west coast. 3
 - 2. Thallus without cracks or weakly to irregularly cracked-areolate, uneven to verruculose or rough. West coast.** Apothecia concave to \pm plane, often aggregate with a flexuose disk; proper margin moderately thick to thick; thalline margin thick, prominent and persistent to thin or lacking. Thallus usually areolate to squamulose, the squamules with effigurate margins; marginal lobes almost always absent. Areoles 0.5 mm or more across. Apothecia usually numerous, to 1 mm wide; discs concave; proper margin thickish; hymenium (60-)70-90 μ m high; subhymenium 70-340 μ m; spores (9-)10.5-15.0(-19.5) x (3.7-)4.5-6.5 μ m; septum (1.8-)2.5-4.5(-5.2) μ m. Submesic to mesic supralittoral zone, often on bird rocks, especially on vertical surfaces, central California to British Columbia. [C. sp. 54 of Wetmore, with elongate cells or hyphae in the apothecial margins, seems to key out here]. (C. marina subsp. americana)
 - 2. Thallus of contiguous or often \pm scattered, small, individual microsquamules, rounded or \pm elongate, 0.5-2 mm wide, convex, yellowish orange. East coast.** Apothecia to 1 mm diam., scattered, sometimes isolated; flat but becoming convex; true excipiel conspicuous, yellow orange at first, reduced or \pm crenulate when mature; disc orange. Paraphyses often with apical cell swollen, to 7 μ m diam. spores 12-15 x 6-8 μ m, ellipsoid; septum (1-)3 μ m wide, ca. 1/4 length of spore. On seashore rocks. Maine, Nova Scotia and Newfoundland. (reports of C. marina from the east coast of N. America are based on this taxon or a similar one; description is based on British material; need to compare with description of "C. marina" by Taylor). C. microthallina
- 3. Growing on the Atlantic coast.** Thallus gray or yellow, mostly not conspicuous; apothecia dominating. 4
- 3. Growing on the Pacific coast. 5**
 - 4. Thallus gray; apothecia dark brownish red, 0.5-2.0 mm diam., initially with thick, raised margins conspicuously lighter than disk; disk often umbonate. C. fraudans**
 - 4. Thallus mostly yellow; apothecia yellow to red-orange, 0.2-0.7 mm diam; margins rather thin, \pm concolorous with disk; disk never umbonate. C. lithophila**
- 5. Thallus \pm continuous, regularly cracked-areolate, even to slightly uneven; apothecia plane to convex; proper margin often thin; thalline margin mostly thin and restricted to base of**

apothecia. Spores 12-16 x 4-8 μm . Sometimes overgrown by C. marina, with the thallus rougher and paler around small groups of apothecia of that species. On calcareous and siliceous rocks, often bird manured, on vertical and horizontal surfaces, mostly in the supralittoral zone (rarely the supralittoral fringe, occasionally to 150 m above the sea), Baja California to British Columbia. C. rosei Hasse

5. Thallus mostly discontinuous or verrucose to subsquamulose. 6

6. Spores 12-13 x 5.5-8.5 μm ; septum 3.5-5 μm thick. Thallus usually grayish but sometimes with scattered, orange-yellow, to 0.2 mm across squamules, which can become rather effigurate. Apothecia zeorine, numerous, dispersed or very crowded, sometimes forming raised conglomerates, 0.5(-0.9) mm diam.; disc flat to slightly convex, orange; margin prominent, rather thick (60 μm), persistent; proper margin slightly paler than disc; thalline margin somewhat paler than proper margin, irregular, On strongly eutrophicated substrates (rock or wood), not far from the sea. Eastern Canadian Arctic. (C. alcarum)

6. Spores mostly longer than 13 μm . Thallus with abundant well developed orange or yellow areoles or squamules; cortex and excipulum consisting of anticlinally to irregularly arranged hyphae composed of oblong, thick-walled cells; apothecia usually more than 0.8 mm wide; lobes convex to inflated; 7

7. Thallus areoles and squamules \pm inflated, incised at base, tawny yellow to reddish orange; apothecia disk tawny yellow to reddish; medulla without crystals; hypothecium occasionally with scattered oil droplets; spore septum longer than 3 μm . On acid rocks in California, particularly on cliffs near the ocean but sometimes also in more inland locations, Baja California to British Columbia. C. bolacina

7. Thallus areoles convex but not inflated, mostly verruculose, dirty yellow to brownish yellow; apothecial discs ferruginous to brownish; medulla with abundant crystals; hypothecium and lower part of hymenium heavily inspersed with oil droplets; spore septum shorter than 2.5 μm . On vertical or horizontal surfaces, often on poorly consolidated and crumbling rocks, on the seashore or at low elevations (below 70 m) in the coastal mountains, California to Oregon. C. stantonii W. Weber ex Arup

ADD:

Thallus to 3 cm, lacking or mostly present but poorly developed, consisting of scattered to contiguous, convex or occasionally uneven areoles 0.05-0.2 mm wide, to 0.1 mm thick, with smooth surface; margin indistinct, consisting of scattered areoles; surface mostly bright yellow, occasionally with orange tinge or fading toward grayish yellow; prothallus occasionally present, very thin and yellow. Apothecia always present and often rather abundant, mostly scattered or occasionally more crowded, zeorine, initiating in strongly convex to subglobular areoles, initially sessile but soon raised, 0.3-1.1 mm, round to somewhat irregular; disk slightly concave to somewhat convex, bright yellow to orange-yellow; proper margin fairly thin, 25-75(-100) μm , slightly raised or not, concolorous with or slightly lighter than disk. Spores narrowly to broadly ellipsoid, (9.6-)10.2-13.6(-14.0) x (3.2-)3.7-7.2(-7.8) μm ; septum (2.5-)3.0-4.7(-5.1) μm . On rock, coastal. California to British Columbia. C. inconspicua Arup

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 siliceous rocks, coastal, Baja California to Oregon. C. ludificans Arup

C. flavogranulosa (see sorediate species)

Thallus orange, with elongated lobes, closely appressed; without cortex. Apothecia orange. No cells under hypothecium, irregular hyphae in apothecial margin. Spores 11.2 \times 4.2-5.6 μ m; septum narrow (2-2.8 μ m). On rock. California. C. brattiae (See Weber, 1989. Graphis Scripta 2: 168-170)

3-A-3. On rock;
Thallus yellow, orange or red, K+ purple,
mostly discontinuous or areolate or verrucose to squamulose.
Apothecial discs yellow, orange or red, K+ purple.
C. squamosa Group

After Arup, and others

1. Spores mostly to 13(-14) μ m long. Thallus cortex and excipulum paraplectenchymatous, consisting of rather thin-walled, rounded to very short rectanuglar cells (or cortex and excipulum indistinct or apparently amorphous, in the case of C. novomexicana); apothecia usually less than 0.8 mm wide; areoles and lobes \pm flat. C. squamosa group. 2

1. Spores mostly over 14 μ m long. Thallus cortex and excipulum consisting of anticlinally to irregularly arranged hyphae composed of oblong, thick-walled cells; apothecia usually more than 0.8 mm wide; lobes convex to inflated. (If growing in \pm coastal areas, see KEY 3-a-2: C. bolacina and C. stantoni; if growing in inland mountain areas, see Subg. Polycauliona: C. cladodes, a typically dwarf fruticose species that sometimes can be poorly developed and appear to be only verrucose).

2. Thallus of short, overlapping squamulose lobes uplifted from the substrate.

Apothecial cortex and subhymenium paraplectenchymatous. Thallus orange, epruinose. Apothecia with thalloid margin, epruinose. Spores 11.2-14 x 5.6-7 μ m; isthmus 2.8-4.2 μ m. On non-calcareous rocks. Texas, New Mexico, Arizona, California. [I can't find what I did with the type description--possibly in Xanthoria notebook]. C. squamosa (B. de Lesd.) Zahlbr.

2. Thallus \pm areolate-squamulose or of \pm scattered squamules. Spore septum under 4 μ m. 3

3. Thallus becoming crenately lobed at margin, lemon yellow to cadmium orange or orange buffous. Thallus K+ purple; squamules \pm scattered, ca. 1 mm across. Cortex paraplectenchymatous. Apothecia numerous, 0.2-0.6(-1.0) mm diam., adnate to soon sessile, becoming angular by compression; disk flat to slightly convex, margin orange to rusty brown; thalline margin yellow to orange, entire, sometimes raised, becoming thinner or disappearing with age. Hymenium 70-90 μ m. Hypothecium hyaline, to 50-120 μ m in center, with algal layer below. Paraphyses 3 μ m thick according to Rudolph, septate, branching above the asci; tips very slightly enlarged, encrusted; asci clavate, 38.3-48.7 x 11.3-13.9 μ m, 8-spored. Spores biserial, ellipsoid, 10-13 x 5-8 μ m, polarilocular; septum 2.5-3.5 μ m. On basalt or other rocks, Arizona, New Mexico; Maryland and Rhode Island [a highly unlikely apparent disjunction!]. [Steiner & Poelt, 1982 argue that this species should be in Caloplaca (subg. Gasparrinia), since it lacks a lower cortex and rhizines]. ("Xanthoria lobulata"; Syn. C. spaldingii sensu Fink, according to Rudolph)

3. Thallus without distinct marginal lobes. 4

4. Thallus smooth, of scattered to contiguous squamules. Discs dirty orange to salmon orange (concolorous with thallus). Spores to 9 μ m wide. Thallus dirty orange or salmon orange. Thallus K+ red. Squamules and lobes \pm flat. Squamules scattered or

contiguous, thin, flat to slightly undulate, 0.5-0.7 mm broad, 0.2 mm thick, sublobate, incised. Cortex and excipulum paraplectenchymatous, of angular, thin-walled cells ca. 4-7 μ m diam. Apothecia sessile, round to angular by compression, to 0.5(-1.0) mm diam.; margin thin; discs plane to convex, orange (concolorous with thallus); margin concolorous with thallus or paler. Hypothecium 35-100 μ m, with algal layer below. Hymenium (50-)70-75(-90) μ m high; paraphyses 1.7 μ m thick (3 μ m according to Rudolph), the tips in KOH 3-4 μ m, often with 1-2 short branches and twice clavate; epihymenium greenish yellow; asci clavate, 31.3-59.2 x 8.7-14.8 μ m, 8-spored; spores biseriate, (8.7-)12-14.4 x (4.4-)7-8(-9) μ m, broadly ellipsoid, with apical wall thin, double; septum (1.5-)3-3.5 μ m thick. On non-calcareous rocks. Oregon; Arizona, Colorado, Minnesota. C. sipeana

4. Thallus somewhat granular, areolate to squamulose. Apothecia reddish. Spores to 7.5(-8) μ m wide. 5

5. Thallus dark olive orange, areolate, often partly subsquamulose. Apothecial margin like disk. Small rounded cells in margin. Spores 9.8-11.2 x 5.6-7 μ m. Arizona. C. sp. 55 (Wetmore)

5. Thallus red-orange, or greenish yellow to orange. 6

6. Thallus red-orange, squamulose without a black hypothallus. Apothecial margin thickish and persistent. Spores (13.9-)16-18(-19.1) x (5.2-)6-7(-8) μ m. Apothecia with algae (in thalline margin and below hypothecium). Thallus K+ red, composed of granules or minute squamules, dispersed; hypothallus indistinct. Apothecia numerous, usually dispersed, adnate, often constricted at base, to 0.4 mm wide, red-orange, K+ red; at first urceolate, with thalline margin concolorous with thallus, entire, thick becoming thin, persistent, then plane; disc red-orange, epruinose; epithecium orange-granular; hymenium ca. 90 μ m high; hypothecium ca. 100 μ m, with algal layer below; paraphyses thin, septate, ca. 3.5 μ m diam., branching above the asci; tips capitate, encrusted; asci clavate, 45.2-55.2 x 13-17.4 μ m, 8-spored; spores biserially arranged, polarilocular, isthmus thin, ca. 3(-3.5) μ m or less wide. On rocks. New Mexico. C. urceolata

6. Thallus greenish yellow to orange, areolate to squamulose with black hypothallus. Apothecial margin thin and often disappearing. Spores 10.4-12.2 x 5.2-6.1 μ m (according to Rudolph, who examined the type; 12-16 x 6-7.5 μ m according to Fink). Apothecia with algae below hypothecium. Thallus composed of minute to small, convex, granulose squamules, running together into a \pm continuous crust. Apothecia 0.3-0.6 mm across, subsessile; disc flat to slightly convex, vinaceous rufous (according to Rudolph, orange according to Fink); proper exciple thin, lighter or more rarely colored like disk; spores oblong-ellipsoid, becoming 1-septate and polarilocular, Spore septum ca. 3 μ m wide. On rocks, New Mexico. C. novomexicana (Fink) ined.

ADD:

Thallus ochre yellowish, yolk yellow when wet, K+ purple-red, composed of small granules or reduced to scattered 0.2-0.5 mm wide spots, \pm white-pruinose. Apothecia numerous, to over 0.3 mm wide; disc red-orange, finally somewhat convex; proper margin concolorous, almost entire, finally becoming excluded; paraphyses \pm simple, at the tips septate and swollen; spores as in "C. tegularis" (= C. saxicola), i.e., ca. 8-16 x 6-8 μ m?. On rock, New Mexico. C. discernenda (Ozenda & Clauzade include this under C. saxicola f. tegularis)

Poorly lobed specimens of various species of subg. Gasparrinia will also key out in this group

ADD?:

Growing on non-calcareous rocks in California and Utah. Spores (9.8-)11.2-2-12.6 x 7-8.4 μ m, isthmus 1.4-2.8 μ m, areoles stalked, convex, with microlobes, and apothecial margins flush with disk. C. sp. 52 of Wetmore

C. approximata sensu Wetmore [see "ADD" list at end of C. pyracea key]

(Poorly developed forms of C. cladodes--see fruticose species)

3-A-4. On rock;
Thallus \pm bright yellow, orange, or red, K+ red-violet;
well developed, continuous to rimose-areolate,
not lobed or squamulose; not sorediate or isidiate;
Growing inland.
C. aurantiaca Group

After various authors

1. Thallus mostly discontinuous or verrucose to subsquamulose. Thallus cortex and excipulum paraplectenchymatous, consisting of rather thin-walled, rounded to very short rectanuglar cells; apothecia usually less than 0.8 mm wide; areoles and lobes \pm flat; spores mostly shorter than 13 μ m. [*C. modesta* sensu Nash, Wetmore, etc. may also key out here--see lobate species; Wetmore's concept is as follows: Thallus yellow or orange; areoles contiguous, large, undulate, thick, not stalked; discs orange; spores 12.6-14 x 4.2-5.6 μ m; isthmus 2.8-3.5 μ m; thick layer below hymenium. On non-calcareous rock, Utah] (see KEY 3-A-3. C. squamosa group).

1. Thallus \pm continuous, regularly cracked-areolate, even to slightly uneven. 2

2. Spores mostly over 14 μ m long. 3

2. Spores mostly to 13(-14) μ m long. (Also see C. rosei and C. brattiae among the seashore species, and C. sp. 55 of Wetmore, keyed out under C. squamosa group; if growing on calcareous rock in California, with apothecial margins thick, flush, areoles contiguous, simple, spores 12.6-14 x 5.6 μ m and septum 2.8-3.5 μ m, see C. sp. 88 of Wetmore; if growing on non-calcareous rocks in California and Utah, with spores (9.8-)11.2-2-12.6 x 7-8.4 μ m, isthmus 1.4-2.8 μ m, areoles stalked, convex, with microlobes, and apothecial margins flush with disk, see C. sp. 52 of Wetmore). 4

3. Spores 11-15 x 5-7 μ m; apothecia dingy orange (yellowish according to Rudolph).

According to the protologue the thallus is absent, but according to Rudolph the thallus is "not very thin", continuous, areolate to granulose-diffuse". (C. fraudans may also key out here). (C. feracissima)

3. Spores 14-17 x 5-7 μ m; apothecia light orange. [see "ADD" list at end, for comparison of N. American and European material under this name]. (C. approximata, at least sensu Wetmore, Black Hills)

4. Discs vitelline (yolk) yellow. Spores 9-14 x 4-7 μ m, polarilocular; septum 4-6 μ m. Thallus yellowish or vitelline, K+ purple-red, very weakly developed, often almost absent or reduced to scattered granules. Apothecia scattered or numerous and aggregated, becoming angular, 0.3-0.5 mm diam.; discs plane to somewhat convex; margin somewhat pale, entire, thin, the lower part with algae. Paraphyses simple or branched, at the tips with 2-3 short, unevenly swollen cells. Asci ellipsoid, 8-spored. Especially on vertical surfaces and beneath overhangs. (C. vitellinula)

4. Discs orange to red or brownish or ochraceous. 5

5. Discs dingy orange, orange-brown, or ochraceous orange. Thallus yellow (to brownish orange). On calcareous rocks, eastern. 6

5. Apothecia \pm bright orange to red. Thallus \pm bright orange or red-orange. Rock type and distribution various. 8

8. Apothecia 0.1-0.3 mm diam., without algae. Spore septum ca. 3 μ m. Thallus yellow, thin, smooth, K+ red. Apothecia sessile, K+ red; disc ochraceous orange; margin persistent, lighter yellowish, without algae; hypothecium hyaline, to 100 μ m in center; hymenium ca. 70 μ m; paraphyses ca. 1.5 μ m thick, coherent, branched above asci, capitate; asci 48.7-55.7 x 13.9-19.1 μ m, clavate; spores 8, biseriate, 13.1-13.9 x 6.1-7.0 μ m, polarilocular; locules rounded; walls thick. On calcareous rocks. Maine.

Blastenia sulphurea Rud. ined.

8. Apothecia over 0.5 mm diam., with algae. Spore septum (-3)4-5(-7) μ m. (also see C. feracissima). 9

9. Apothecia superficial from the first. Apothecia to 1.1 mm diam., with algae. Spore septum (2.8-)4-5.6(-7) μ m. Discs dingy orange or orange-brown. Thallus greenish yellow to whitish yellow. Spores (9.8-)11-14(-15.4) x 5-8(-9.8) μ m. Hypothallus gray or black when visible. Discs contrasting with a yellow thallus. Thallus rimose-areolate, often occurring as large, conspicuous single patches. Apothecia discs often convex. Round cells under hymenium and elongate cells in margin. Typically on \pm calcareous rocks, or on acid rocks in close proximity to basic rocks or mortar, rarely on pure limestone; also reported from old wood; widely distributed. Indiana, S. Dakota, New England; Utah. The taxon reported from southern California by Hasse as "C. erythrella v. rubescens" has a light clay-colored thallus, apothecia 0.25-0.5 mm diam., and spores 16-23 x 8-9.5 μ m, and is quite likely another species). C. flavovirescens (syn. C. erythrella)

9. Apothecia immersed in thallus at first. Thallus yellow or brownish orange, occasionally in part whitish and pruinose; hypothallus when present black. Hypothecium with oil drops. Spores over 6 μ m wide. Discs yellowish to light brownish orange. Thallus crustose, fairly smooth to minutely roughened, continuous, usually finely rimose-areolate; prothallus gray-black, mosaic forming or absent. Apothecia to 0.8 mm diam., scattered or grouped, \pm rounded, \pm immersed at first, soemtiems becoming \pm sessile, later sub-convex; thalline margin conspicuous, often becoming \pm excluded when old; disc yellowish to light brownish orange, often concolorous with exciple. Paraphyses \pm straight, sparsely branched; most tips broadened, the apical cell 2-8 μ m wide. Spores 9-13 x 5-9 μ m, broadly ellipsoid; septum 3-5 μ m thick, 1/4-1/2 length of spore. On hard, smooth limestones in sunny situations, especially on walls. Alabama and Tennessee. C. dalmatica (synonyms: C. velana, C. schaeferi)

10. Thallus pale orange, yellow-cinnabar, gray-rose, or gray-orange, weakly marginally lobed (dispersed, patchy and not lobed according to Wetmore).

Apothecia immersed then appressed-sessile, to about 0.3 mm, crowded and angular (round according to Wetmore); discs rusty-cinnabar to carmine red, deeply concave then flat or slightly convex; thalline margin thin, disappearing. Paraphyses septate, with swollen cells; apical cell subglobose, 3-4 μ m thick. Asci oblong-ellipsoid, 8-spored. Spores (7-)8.8-9.8(-11) x 4(-7) μ m; septum wide (2.8 μ m according to Wetmore), at least 1/3 the spore length. Thallus thin, little developed, orbicular, to 1 cm diam. but often

coalescing, finely rimose-areolate in center; lobe tips usually "trimmed" or crenate; hypothallus indistinct, gray. Thallus K+ red. On siliceous rocks, New Mexico, Texas. (*C. rubelliana* [*Gasparrinia*?])

10. Thallus orange-red or orange; not lobed. 11

11. Discs red-orange. On limestone. Thallus intense red-orange, sometimes spottily white pruinose. Thallus matt, areolate, forming irregular patches 1-2 cm wide; areoles plane, contiguous, ca. 0.5 mm wide, angular; margin effigurate; lobes plane, minute, variously angular. Apothecia often covering thallus center, red-orange, adnate on areoles, 0.3-0.4 mm diam., becoming angular from crowding; margin thin, entire, concolor, persistent; disc red-orange, plane or rarely becoming convex. Epithecium granular; hypothecium hyaline; paraphyses free, simple or branched, septate; tips inflated; asci clavate, 8-spored; spores polarilocular, 10-13 x 5-6 um. New Mexico. *C. intermedia* (*Gasparrinia*)

11. Discs orange (to brownish orange). On siliceous rocks [need to check on *C. cinnabarina*]. 12

12. Spores 10-13 x 6-7 um, broadly ellipsoid; disc orange or brownish orange. Thallus crustose, in small patches, bright orange, often almost red, K+ purple, of small scattered to \pm contiguous areoles or lobulate granules to 0.5 mm diam., flat, \pm angular or irregularly rounded, on a blackish prothallus, often associated with cyanobacteria. Apothecia to 0.2-0.3(-0.5) mm diam., numerous, scattered, \pm rounded; true margin orange, becoming excluded with age; disc flat to \pm convex. Paraphyses simple, broadening towards tips, apical cells 2-3 um diam. Spore septum 3-5 um, ca. 1/3-1.2 length of spores. On siliceous rock. *C. irrubescens*

12. Spores 8.3-10.2(-12) x 3.5-5(-6.5) um, oblong-ellipsoid; Thallus orange-red or orange. Spore septum ca. 1/3 length of spore. Thallus rosette-forming to spreading, very closely attached, 0.5-2(-8) cm diam., effigurate, 0.2 mm thick, regularly areolate-cracked; areoles 0.5-1 mm diam., separated by deep cracks; margins of areoles noticeably thickened; surface matt. Apothecia scattered, infrequent, at margins of areoles, solitary, rarely 2-5-confluent, sessile, rounded, 0.1-0.6 mm diam.; disc plane to subconvex, matt or slightly scabrid, orange; margins minutely crenulate, slightly paler than disc, concolorous with thallus, persistent. Paraphyses septate, branched at apices. Chem.: emodin, parietin, xanthorin, fallicinal, parietinic acid. On rocks. "Throughout the United States" according to Fink. Wetmore places this close to *C. sipeana*. *C. cinnabarina*

ADD:

On calcareous silicate rocks, Greenland. See Thomson 1997 for description. *C. cacuminum* Poelt

**3-B. On rock;
Thallus yellowish white to \pm buff, K \pm reddish;
Well developed, not lobed; not sorediate or isidiate;
Apothecia yellow, orange, or red (to brownish)
C. rimosa etc. group**

Modified from unpublished key
"to the sections and species of Caloplaca in North America"
(by Rudolph?, but modified somewhat from his dissertation)

1. Thallus very thin, closely appressed to substrate, continuous to very closely rimose-areolate. [If thallus immersed or K-, also see C. pyracea group, which this group probably belongs under]. 2

1. Thallus usually thicker, less appressed, granular-effuse, widely areolate or squamulose. 4

2. Spores usually less than 6 μ m wide. Thallus buff, smooth, epruinose; hypothallus grayish. Hypothecium without oil drops. Apothecia yellow or orange. Thallus continuous to rimose-areolate, K+ reddish. On rock. C. rimosa Rud. ined.

2. Spores over 6 μ m wide. 3

3. Spores 9-13 x 5-9 μ m; septum 3-5 μ m. On limestone, eastern. Thallus usually well developed. (C. dalmatica)

3. Spores 12-20 x 6-8 μ m; septum under 2 μ m. On crumbling sandstone, western. Thallus often obscure or absent. (C. subpyraceella)

4. Thallus \pm lobed or squamulose (Gasparinnia sensu lato). (see C. teicholyta/C. modesta etc. group)

4. Thallus not lobed or squamulose. 5

5. Thallus deep olive-buff, K+ reddish. Apothecia frequently over 0.6 mm across. Hypothecium over 70 μ m high. Spore septum 3 μ m or more thick. On rock. C. shushanii Rud. ined.

5. Thallus light buff. Apothecia under 0.7 mm across. Spore septum 2-3 μ m thick. Spores more than 14 μ m long. Hypothallus absent. Apothecia under 0.7 mm across, yellow or orange. Hypothecium over 70 μ m, with oil drops. On rock. C. weberiana Rud. ined.

ADD:

Thallus pinkish or yellowish cream, without prothallus. Elongate cells in apothecial margin. On non-calcareous rock, Arizona.

Spores 12.6-15.4 x 7 μ m; isthmus 3.5-4.2 μ m. C. sp. 66 (Wetmore)

Spores (12.6-)14-15.4 x 4.2 μ m; isthmus 2-2.8 μ m. C. sp. 57 (Wetmore)

3-C On rock;
Thallus not lobed; ± grayish, K-, or immersed.
Apothecia black, usually K+ pale-violet to rose
C. variabilis Group
(Pyrenodesmia Sect. Nigrae, s. lato)

After Wetmore (1994)
much more could be added from Wunder's book

1. Apothecial margin with dense granules (dissolving in K); thallus usually K+ yellow (atranorin); epihymenium usually K-, sometimes slightly K+ muddy purple. Thallus greenish gray to gray, thin and smooth to thick and verruculose, occasionally sorediate; areoles continuous to dispersed; prothallus usually present, especially between dispersed areoles and where the thallus meets another thallus. Apothecia sessile, 0.3-1.0 mm diam., flat to concave with flush to slightly raised margin; disk brown to dark brown (sometimes almost black); only with proper margin or with additional thalloid margin; proper margin tan to dark brown when prominent. Epihymenium light brown to brown or occasionally in part aeruginose; hymenium 58-72 µm, usually with oil; hypothecium without paraplectenchymatous cells, usually with oil; thick walled hyphae in proper exciple; parathecium with small elongated paraplectenchymatous oval cells but usually obscured by granules; amphithecium with or without algae, often with thin cortex (30-40 µm) with indefinite cells. Paraphyses without swollen tips or with one or two cells slightly swollen and sometimes brownish, few to some branching. Spores 10-12.5 x 4-5.5 µm; isthmus 4-7 µm. Apothecial tissues K-. With unknown substance (6-7 A, colorless, UV+ pale before charring only) in addition to atranorin. Usually on noncalcareous rocks, rarely on calcareous rocks. Caribbaean and Central America; Mexico. C. diplacia (Ach.) Riddle

1. Apothecial margins without soluble granules; thallus K-; epihymenium K- or weakly K+ purple. 2

2. Spores 10-12.5 x 4-5.5 µm; young apothecia often sunken in thallus, with thin dark margin when mature; thallus continuous; disks flat, dark brown to black; epihymenium weakly K+ purple; spore isthmus 3-4 µm. Thallus gray to dark gray, often thin, cracked areolate; areoles flat or uneven, small; cortex thin with thin uneven necral layer; usually no prothallus. Apothecia sunken in areoles to slightly emergent or completely sessile, 0.2-0.5 mm diam., flat; disk dark brown to black; proper margin thin, same color as disk; no thalloid margin. Epihymenium light brown or gray; hymenium 34-58 µm; irregular small paraplectenchymatous cells in hypothecium and proper exciple; small oval paraplectenchymatous cells in parathecium; algae in upper amphithecium. Paraphyses with one to two slightly swollen cells, some branching. Spores 10-12.5(-14) x 4-5.5 µm, isthmus 3-4 µm. Epihymenium and margin weak or strong K+ purple without colored solution; thallus cortex weak K+ purple. No substances. On noncalcareous rocks. AZ, TX, MO, NW Mexico. C. conversa (Kremp.) Jatta

2. Spores over 12 µm, over 7 µm wide; all apothecia raised from thallus. 3

3. Thallus all subsquamulose or stipitate areolate, thick.4
3. Thallus areolate, not stipitate or only partly so, sometimes thin. 5

4. Thallus shiny olive brown; areoles subsquamulose; disks brown; epihymenium K+ purple. Thallus dark gray, shiny, stipitate subsquamulose; squamule margins undulate and divided, centers undulating; cortex 29-58 µm thick with necral layer on surface, round cells in upper cortex to 7 µm diam. Apothecia sessile, flat, 0.5-1.5 mm diam.; disk brown, shiny; proper margin thin, same color as disk; thalloid margin sometimes present, same color as thallus. Epihymenium light brown to brown; hymenium 72-116 µm; hypothecium with irregular paraplectenchymatous cells or none; proper exciple with large oval thick walled cells and thick walled hyphae; parathecium at margin with large (to 7 µm) oval paraplectenchymatous cells; amphithecium with algae, outer surface purple. Paraphyses with one to three slightly enlarged cells, unbranched or slightly branched. Spores 14-17 x 7-8.5(-10) µm, isthmus 3-4 µm. Epihymenium K+ red brown to weak purple; outer apothecial margin K+ purple; thallus cortex K+ purple (on slide). No substances. On noncalcareous rock, rare, California. C. peliophylla (Tuck.) Zahlbr.

4. Thallus light gray to bluish gray, usually mottled whitish; areoles stipitate in places; disks black to dark brown; epihymenium weakly K+ purple. Areoles convex, contiguous to dispersed, ca. 1 mm wide, to ca. 0.5 mm thick, matt, not isidiate or sorediate; hypothallus indistinct; cortex thin, cellular, to 21 µm, with necral layer; algal layer with columns of algae separated by columns of fungus. Apothecia numerous, to ca. 0.4-0.8 mm wide, 1-several per areole, sessile to stipitate (at first immersed, then adnate, according to Rudolph); disk persistently plane, sometimes becoming subconvex, epruinose, dark brown to black; thalline margin thick, entire to subentire; occasionally with inner brown proper margin. Hypothecium without or with some irregular pseudoparenchymatous cells, usually with oil; proper exciple with thick-walled cells; parathecium with small paraplectenchymatous oval cells; algae in upper amphithecium. Epihymenium light brown to brown, K+ light or muddy purple; hymenium and hypothecium hyaline; hymenium 72-116 µm; paraphyses free, septate, with two to three slightly swollen cells, no or few branches, apices clavate; asci ca. 75 µm long, clavate, slightly thickened at tip, 8-spored; spores oblong, polarilocular, 14-18(-26) x 7-10 µm, with thin end walls; septum 1.5-4 µm. Cortex of upper amphithecium and thallus K+ light purple. No substances. On calcareous or noncalcareous rock, CA, AZ, and Rocky Mountain states; Manitoba. C. albovariegata (B. de Lesd.) Wetmore

5. No algae in upper margin; epihymenium purplish brown; thallus white, within upper surface of rock; spores usually with incomplete isthmus or isthmus with wide pore or only septum present; apothecial margin usually black; disks black, nonpruinose. Thallus somewhat areolate; no cortex evident; no prothallus. Apothecia numerous, sessile or slightly immersed, 0.3-0.7 mm diam., flat, black, with slightly raised black proper margin; no thalloid margin. Epihymenium light purplish brown; hymenium 87-116 µm; hypothecium without paraplectenchymatous cells, with oil; proper exciple with thick walled cells; parathecium with radiating elongated to oval paraplectenchymatous cells; upper amphithecium without algae. Paraphyses with one to three slightly swollen cells or none swollen, unbranched or rarely branched. Spores nonseptate to one-septate, 15.5-21 x 5.5-8.5 µm, isthmus 0-1.5 µm. Epihymenium and apothecial margin K+ purple; thallus K- or weakly K+ purple. No substances. On calcareous rocks, rare, Utah and Colorado. C. oblongula (Magnusson) Wetmore

5. Algae present in upper margin; epihymenium light brown; thallus gray, on rock surface; spore isthmus well developed. 6

6. Apothecia or margins white pruinose; prothallus dark gray when present; epihymenium weakly K+ purple; spore isthmus 3-3.5(-4) um. Thallus fairly smooth but markedly areolate, becoming verrucose (bullate in v. bullata), sometimes with smooth inner margin, rather thin to thick, light grayish to deep gray or grayish brown, usually whitish from pruina (whitish gray in v. bullata), \pm rounded, with the central area darker and the margin occasionally surrounded by a black prothallus; cortex thin. Apothecia 0.3-1.0 mm diam.; scattered to crowded, \pm sessile, flat, becoming slightly convex; disks brown to dark brown or blackish, usually partly pruinose; thalline margin often present, \pm densely gray-bluish pruinose, persistent. Hymenium 87-116 um. Hypothecium ca. 70 um. Epihymenium light brown to gray. No cells in hypothecium; thick walled paraplectenchymatous cells in proper exciple; small elongated or oval cells in parathecium; algae in upper amphithecium. Paraphyses broadening and becoming rather stout toward tips, to 3 um diam., with one to two cells slightly swollen, unbranched or slightly branched. Spores 12.5-15.5(-21) x 7-8.5(-11) um, with thin end walls; isthmus (2-)3-3.5(-5) um thick. Epihymenium, apothecial margin and thallus cortex K+ weak violet. No substances. On \pm nutrient enriched, calcareous rocks, especially the horizontal tops of walls, etc., rare. Rocky Mountains (Montana to New Mexico); also reported from California. C. variabilis (Pers.) Müll. Arg.

6. Apothecial margins and disks never pruinose; prothallus light gray when present; epihymenium weakly K+ purple or K- (brownish); spore isthmus 1.5-3 um or sometimes absent. Thallus light to medium- or brownish-gray thin, chinky-areolate and rough or continuous and smooth; areoles sometimes obscurely lobed toward margin; cortex thin, uniform, with small cells, sometimes with thin necral layer; algal layer continuous; sometimes with light colored prothallus. Apothecia 0.4-1 mm diam., sessile; disc flat to slightly convex, brown (to black?); margin thin, rarely flexuous, colored like the thallus (or whitish?). Epihymenium light brown to brown; hymenium 87-116 um; hypothecium without paraplectenchymatous cells, frequently with oil; proper exciple with thick walled cells; parathecium with with some oval pseudoparenchymatous cells; algae in upper amphithecium. Paraphyses with one to two slightly swollen cells, no to few branches. Spores 14-24 x 5-8 um, sometimes non-septate; isthmus 1.5-3(-4) um. Epihymenium K+ weak purple or K- (brownish); cortex of thalloid margin and thallus weak K+ purple. No substances. On calcareous and occasionally on noncalcareous rocks. Widely distributed throughout of western N. America, east to Ohio. C. atroalba (Tuck.) Zahlbr.

ADD?:

Thallus squamulose to subsquamulose, dark gray, epithecium K+ red-brown to purple, spores 14-16 x 7 um with isthmus 4.2 um, growing in California..... C. sp. 2 (Wetmore preliminary key)

On streamside siliceous rocks; spores (12-)14-18 x 6-9 um; thallus verrucose, gray to greenish gray or brownish. Apothecia 0.6-0.9(-1.2) mm diam., scattered or densely grouped, rounded to angular, rather flat, slightly immersed to broadly sessile and somewhat prominent, with an algal layer, usually zeorine, with black proper margin to 0.05 mm wide, and entire, pale thalline margin to 0.1 mm wide; disc usually black, sometimes with slight violet tinge (to \pm ochraceous with all intermediates according to ?; brownish colors are due to damage according to Wunder). Hymenium 75-110 um, weakly to strongly inspersed with colorless crystals. Hypothecium 70-125 um, colorless. Paraphyses 1.5-2.5(-3) um; apical cells 2-5(-5.5) um. Spores 8 per ascus; septum 3-7 um. Epihymenium brownish, K+ violet-purple. Pycnospores oblong, 3.5 x 1.5 um. Prothallus absent. On siliceous rocks. Central and northern Rockies and British Columbia; Arctic. Reports from N. America not confirmed.C. diphyodes (Nyl.) Jatta

On arctic or alpine siliceous rocks; spores 12-17 x 5-8.5 um; thallus lacking or white to grayish, sometimes slightly yellowish (rarely rusty brown). Apothecia with proper margin black, thin but persistent; thalline margin absent. (Blastenia). Prothallus absent. Disc very variable, light yellow, brown, greenish, or black (\pm brownish or blackish ferruginous red according to Thomson). Spores (9.5-)12-17(-18.5) x 5-8.5 um; septum 5-7 um. Exciple wall 5-50 um, carbonaceous or greenish. Thallus continuous, cracked, granulose, pulverulent or \pm indistinct; always poorly delimited, less than 1 cm across. Apothecia plane or slightly convex; margin thin, blackish, sometimes finally disappearing. Hypothecium brownish or brownish, 50-125 um. Epihymenium with orange-yellow granules, K+ red. Paraphyses 1.5-2 um, the apical cells 1.5-4 um. Hymenium 65-135 um, not inspersed. On siliceous rocks, arctic-alpine. Alaska to Greenland. Excluded from this group by Wetmore (1994). (C. exsecuta)

Thallus areolate, medium gray, prothallus absent, apothecia sessile, the disks brown, the margins never pruinose, spores 15-19 x 7-8 um, the septum often incomplete, 1.4-2.8 um, paraphyses lax, growing in Utah and Sonora. C. sp. 3 (Wetmore's preliminary key)

Apothecia without algae in margin and below hypothecium. (Blastenia). Thallus blackish, evanescent. Apothecia sunken to emergent, round, black, K+ purple, 0.4-0.8 mm diam., convex; margin concolorous, disappearing with age, without algae. Exciple ca. 35 um wide in upper part; epithecium blackish encrusted; hymenium ca. 120 um; hypothecium yellowish-hyaline, ca. 60 um; paraphyses ca. 1.7 um wide, septate, branching above asci, coherent; tips encrusted and slightly capitate; asci clavate, 45.2-59.2 x 13.1-13.9 um, 8-spored; spores biserially arranged, ellipsoid, polarilocular, 10.4-11.3 x 4.8-6.1 um; lumina subconic; walls thick; isthmus narrow, usually less than 1 um wide. On calcareous rock, Alabama. Blastenia calcarea Rud. ined.

Spores 10.4-11.3 x 3.8-4.9 um. Hymenium ca. 35 um. Hypothecium ca. 10 um. Thallus areolate, crustose, thin, the areoles 0.2-0.3 mm across, smooth, olive-black, K-. Apothecia 0.1-0.2 mm across, sessile, black, K+ slightly red; margin black; epihymenium blackish-granular;

paraphyses branched above, tips scarcely enlarged. Spore septum ca. 2.5 μ m wide. On basalt, Arizona. Of uncertain status. C. spaldingii Zahlbr.

Discs plane then convex, not pruinose; margin thin, disappearing. Thallus rather thin, poorly developed, granulose to rimulose, dirty brownish to greenish gray. Apothecia to 0.6 mm diam., adnate, black, epruinose, at first plane with thin margin, then \pm convex and immarginate; hypothecium hyaline; paraphyses lax, slender; epithecium violet to bluish-brownish, K+ green or blue-violet; asci inflated-clavate to clavate; spores 8 per ascus, ellipsoid to broadly ellipsoid, 9-13 x 6-8 μ m; septum very thin. Pycnidia rare; spermatia very short cylindrical, straight to slightly curved. On irrigated rock. Report from N. America not confirmed. C. atrocyaneascens (Th. Fr.) H. Olivier

Discs concave then plane, thinly pruinose; margin rather thick, persistent. Spores 10-13 x 5-7 μ m. Thallus very thin, of dispersed verruculae, ashy gray or obsolete. Apothecia to 0.7 mm wide, crowded, at first concave, then \pm plane with black, thinly pruinose disc and rather thick, prominent, persistent, gray margin. Hypothecium colorless. Paraphyses easily free, branched, at apices constrictedly septate and capitate, pale grayish violet, K+ intensely and distinctly violet (not reddish). Asci inflated-clavate. Spores ellipsoid or ovoid, polarilocular. On bone or sometimes mosses. Ellesmere Island. Not mentioned by Wetmore (1994). C. celata [Pyrenodesmia]

Thallus chalk white to dirty whitish, sometimes (on heavy-metal containing substrates) ochraceous, epilithic, 0.5-1(-2.5) mm high; center rimose-areolate, with numerous small and few coarse cracks; margin often thinner, mostly with almost lobe-shaped areoles; Prothallus not evident. Cortex (in section) K+ lilac. Apothecia (0.1-0.2-1.4 mm diam., to 0.3 mm thick, solitary or mostly in groups, becoming angular and irregular from crowding, mostly sessile, sometimes immersed when young or appearing immersed when crowded; discs mostly flat, finally somewhat convex, matt, black, rarely somewhat white pruinose, often brown when wet; proper margin black, not or weakly visible; thalline margin mostly very thin, 0.05-0.1(-0.15) mm wide, normally smooth, sometimes appearing crenate when damaged. Hymenium 120-150 μ m, hyaline; epihymenium ca. 15 μ m thick, pale grayish or brownish, K+ lilac, with colorless crystals, without orange-yellow granules; hypothecium 120-150(-250) μ m thick; paraphyses 1.5-2.5(-3) μ m thick, mostly strongly coherent, mostly simple; apical cells 1.5-5.5(-6) μ m; spores (13-)14-18.5-22 x 6.5-9.5-12(-15) μ m, broadly ellipsoid; septum very narrow, (0.5-)1-3(-3.5) μ m. Pycnidia black, immersed, (0.05-)0.1-0.15 mm diam.; pycnosporos 3-3.5 x 1.5-2 μ m, simple, oblong, often pointed at tips. Mostly on calcareous rocks, but sometimes on siliceous rocks. Reports from N. America not confirmed. C. paulsenii (Vainio) Zahlbr.

Thallus fuscous brown. Spores 12-15 x 8-10 μ m (18-19 x 10 μ m according to Rudolph). Arctic. Thallus verrucose. Epihymenium K+ blue-violet; septum 1-2 μ m. Greenland. Status uncertain. C. groenlandica Lynge [Pyrenodesmia]

On non-calcareous rocks, eastern. Apothecia mostly without thalline margin. Thallus continuous, gray, blackish, or absent; not sorediate. Apothecia disk black, K+ lavender in section; proper margin blackish; hymenium with oil drops; paraphyses simple; end cells slightly enlarged, ca. 4 μ m. Spores 14-20 x 7-8 μ m; septum ca. 3 μ m. Michigan. Caloplaca sp. 6

(Harris).

Spores slightly constricted in middle, 12-19 x 6-9 μ m. Asci oblong. Thallus graphite colored, forming small patches of loosely aggregated, graniforme [?] verrucae, the surface delicately rimose, K-, C-; hypothallus black, indistinct. Apothecia sessile; disk blackish, flat; thalline margin suburgid; hypothecium with algal layer below; epithecium subcontinuous, blue-gray; hymenium 64-68 μ m high, hyaline; paraphyses moderately thick, thickened and septate above; tips capitate, with globular faintly colored apical cell; asci 8-spored; spores simple to polarilocular, oblong-ellipsoid; septum thin, often indistinct. On sandstone. Arizona; southern California. Not mentioned by Wetmore (1994). C. verrucosa Hasse

Spores not constricted at middle, 16-24 x 6-9(-10) μ m. Asci clavate. Thallus K-, black, thin, granulose-effuse; hypothallus indistinct. Apothecia K- (but epithecium K+ violet), black, adnate, numerous, dispersed, 0.3-0.6 mm diam., persistently plane; margin dark gray or then becoming paler, entire to almost, prominent; epithecium olive; hypothecium hyaline; paraphyses scarcely coherent, rather thick, articulate; tips inflated; spores 8, simple to thinly 1-septate, On rock, New Mexico. Not mentioned by Wetmore (1994). Pyrenodesmia montana

3-D-1 On rock;
Thallus whitish to blackish, brownish, etc., K- or weak.
Apothecia \pm rusty colored, or brown or blackening, K+ or K-;
Thallus \pm well developed, \pm squamulose but not lobed.
C. sideritis/C. pelodella Group
(Pyrenodesmia sect. Cinereae pr. p.)

After Wetmore (1996)

If thallus poorly developed, also see C. ferruginea group, e.g., C. scotoplaca)

1. Apothecia absent; thallus with lobules, isidia, or blastidia. Arizona. (C. chlorina)
1. Apothecia present; thallus with or without lobules, isidia, and blastidia. 2
 2. Thallus brown; apothecial margins brown. 3
 2. Thallus gray; apothecial margins gray, black, or orange. Margins of apothecia orange or same color as thallus; thallus medium to dark gray. 4
3. Parasitic on Candelariella; thallus absent; disk brownish red; spores 11.0-14.0 x 5.5-7.0 μ m; isthmus 2.0-4.0 μ m. Arizona. C. grimmiae (Nyl.) Olivier
3. Not parasitic; thallus obvious; disk brown or brownish orange; thallus squamulose; spores 11.0-12.5 x 5.0-5.6 μ m; isthmus 1.5-3.0 μ m. Southern Mexico. C. hueana de Lesd.
 4. Proper margins of apothecia dark or black; thallus light gray to whitish. Tropical. 5
 4. Margins of apothecia orange or same color as thallus; thallus medium to dark gray. 9
5. With granules in thallus cortex or apothecial margin dissolving in K. 6
5. Without granules in thallus cortex or apothecial margin. 8
 6. Thallus smooth, continuous to finely rimose-areolate. Caribbean. C. leptozona (Nyl. in Nyl. & Crombie) Zahlbr.
 6. Thallus not smooth, coarsely areolate to subsquamulose. 7
7. Thallus subsquamulose, thick. Caribbean and Yucatan Peninsula of Mexico. C. boergesenii (Vainio) Zahlbr.
7. Thallus areolate to dispersed, thin. Caribbean. C. agrata (Vainio) Zahlbr.
 8. On maritime rocks; thallus whitish to light gray; hymenium 84-126 μ m; spores 1.40-18.0 x 8.5-11.0 μ m, isthmus 5.5-7.0 μ m. British Columbia, Washington. C. littoricola Brodo
 8. On inland or high elevation rocks; thallus thin to almost absent; hymenium 56-70 μ m; spores 11.0-15.0 x 5.5-7.0 μ m, isthmus 3.0-5.5 μ m. C. exsecuta (Nyl.) Dalla Torre & Sarnth.
9. Apothecial margins orange, with no outer gray margin. 10
9. Apothecial margins gray or same color as thallus, occasionally with inner orange margin. Apothecial discs orange. 15
 10. Pycnidial ostioles red or orange. 11
 10. Pycnidial ostioles black or not found. 13
11. Spore isthmus 2.0-4.0 μ m; pycnidial ostioles orange. (C. luteominia)

11. Spore isthmus 4.0-8.5 um; pycnidial ostioles red. 12
12. Collected in Sonoran desert. Parathecium with oval to elongated cells; thallus cortex cellular with necral layer, brown pigment layer K-; hypothecium hyaline; often with outer gray apothecial margin; thallus subsquamulose to areolate. Arizona, Sonora, Chihuahua. C. sonorae Wetmore
12. Collected in Caribbean. Parathecium with radiating hphae; thallus cortex without distinct cells, without necral layer, no brown pigment layer, weakly K+ red; hypothecium hyaline to light brown; never with gray apothecial margin; thallus areolate. C. crenularia (With.) Laundon
13. Isthmus 4.0-5.5 um; thallus dark gray to black. Channel Islands of California; Baja California, Colorado, British Columbia. C. atroflava (Turner) Mong.
13. Isthmus 2.0-3.0 um; thallus medium gray. 14
14. Apothecial margins thin, flush; thallus CN+ violet. NE United States. C. oxfordensis Hedrick
14. Apothecial margins thick, raised (especially when young); thallus cN(concentrated N)-. West coast. (C. luteominia)
15. Apothecial discs brown; thallus subsquamulose; apothecial margin uniform color like thallus. Costa Rica. C. subsquamosa (Muell. Arg.) Zahlbr.
15. Apothecial disks orange. 16
16. Inner apothecial margin orange, outer margin gray. (C. sonorae)
16. Apothecial margin uniform gray. 17
17. Thallus with lobules, isidia, or blastidia. Apothecia without dark excipular ring. California, Arizona, Great Lakes region, Queen Charlette Islands, Newfoundland. C. chlorina (Flotow) Olivier
17. Thallus without lobules, isidia, and blastidia. Apothecia with or without dark excipular ring. 18
18. Thallus dark gray, squamulose at margins; apothecia without dark excipular ring between margin and disk. Arizona to Texas, S California, Baja California. C. pellodella (Nyl. in Hasse) Hasse
18. Thallus light gray, areolate at margins; apothecia with dark excipular ring between margin and disk. Arizona to Great Lakes and Appalachians. C. sideritis (Tuck.) Zahlbr.

ADD:

On calcareous pebbles, southern California. C. marmorata (Bagl.) Jatta

Detailed Descriptions

(More need to be added from Wetmore)

C. atroflava (description from Wetmore)

Thallus dark gray to black, thin, smooth, finely areolate; areoles with thin indistinct cortex.

Apothecia sessile, 0.3-0.6 mm diam., rounded, flat; disk orange to dirty orange; margin moderate to thick, raised, same color as disk or little lighter; epihymenium dark golden; hymenium 49-70 μm ; hypothecium hyaline; parathecium with radiating elongated cells; upper amphithecium with algae; paraphyses with few to some branches, tips with 2-3 slightly swollen cells; spores 11.0-12.5 x 5.5-7.0 μm , isthmus 4.0-5.5 μm . Thallus pigment layer K+ violet, cN+ violet (thalloid green); epihymenium K+ red, H-, C+ slowly red-brown.

On non-calcareous rocks that are frequently wet.

C. crenularia

Apothecia sessile with a narrow base. Disk bright rusty red or darkening to blackish rusty or reddish brown; proper margin brownish red. Spores 12-14 x 6-8 μm , ellipsoid. Thallus whitish gray to usually dark gray, effuse to areolate or lacking, usually forming a roughened, continuous or cracked-areolate surface; hypothallus dark. Apothecia to 1.0 mm diam., scattered to contiguous, \pm rounded but occasionally slightly flexuose, flat to somewhat swollen; proper margin well-defined, glossy; Epihymenium K+ purple. Paraphyses flexuose, the tips only slightly broadened, to 3.5 μm . Spores ellipsoid; septum ca. 5 μm wide, to 1/2 length of spore. Pycnidia 0.1-0.2 mm diam., brownish red, K+ violet. On acid or calcareous rocks, especially vertical surfaces.

C. grimmiae (description from Wetmore)

Thallus reduced to a rim around the apothecia; prothallus absent.

Apothecia round to angular, sessile or immersed in the host, round, 0.3-0.7(-1.0) mm diam., scattered; disk brownish red to reddish orange; thallid margin brown, flush to slightly raised; epihymenium dark golden; hymenium (56-)70-84 μm ; 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 μm , isthmus 2.0-4.0 μm . Pycnidia not seen. Epihymenium K₋ red, H-, C-; thalloid margin K-, C+ red, cN-.

On Candelariella on noncalcareous rocks, usually in moist localities.

C. leptozona

Thallus whitish gray, not chalky. Apothecia sessile; spores 9.8-11.2 x 4.2-5.6 μm ; isthmus 4.2-5.6 μm . Areoles convex.

C. oblongula

[Description based on Hertel and Poelt]

Thallus continuous to weakly rimose, uneven, pure white (to ochre-white on reddish substrate), chalky, thin to thick (to 0.8 mm) but confluent with granules of substrate, I-, K-, C-, P-, to 4 cm across, with broad and irregular fissures and grains of sandstone visible in the surface, but partly subareolate, rough and distinctly limited with a thick margin to another lichen. Hypothallus not visible. Photobiont trebouxoid, 15-20 μm diam.

Apothecia dense (ca. 45 per square cm), 0.5-0.8(-1.2) mm wide, single or in dense groups, rounded, at first subimmersed, then \pm prominent or rarely sessile, 0.3-0.4 mm thick, distinctly constricted at base, pale part 250-400 μ m deep and at base a 100 μ m thick, continuous algal stratum; medulla little developed; disc pure black, concave to plane; margin thick, black, soon elevated above thallus, containing a few algae. Exciple cellular, pale inside, thin, confluent with hypothecium, when young 50-70 μ m thick at edge and laterally, at least in exterior half sordid blue-green (according to Magnusson; narrow outer marginal zone reddish black according to Hertel), but at base ca. 20 μ m and colorless, I+ blue; cortex K+ violet. Hypothecium ca. 50-150 μ m high, hyaline, grayish grumose (inspersed?), I+ dark blue. Hymenium (75-)85-100(-110) μ m, hyaline, I+ dark blue. Epihymenium 15-25 μ m, indistinctly delimited, sordid bluish (according to diagnosis; gray-green according to Magnusson's description, brownish pale gray according to Hertel), P-, C+ brown-violet, N \pm violet, K+ bright (bluish- to reddish) violet. Paraphyses gelatinized, indistinct, 1.7-2 μ m, branched above, apices slowly and constrictedly clavate, 4-6 μ m. Asci 60-70 x 15-20 μ m, clavate, Teloschistaceae-type, without axial mass; tholus I+. Spores 8, simple or occasionally 1-septate, hyaline, (14-)17-24 x (4-)6-8 μ m, oblong-ellipsoid (L:W = 2.7-2.8:1). On calcareous sandstone, Utah, Colorado. Distinguished by the long spores, K+ violet epihymenium, and presence of algae below the hypothecium.

C. oxfordensis

Spore septum 3-4 μ m. Apothecia 0.1-0.4 mm diam., adnate to subsessile; disc slightly concave to flat or somewhat convex, orange to brown or dusky; thalline margin rather thin, orange to darker, becoming flexuous. Thallus rather thin. Thallus composed of minute, flat to convex, granules, scattered or crowded into a continuous, areolate crust, thin to moderately thick, becoming effigurate and subsquamulose, pale dirty gray (shade) to almost black (sun). Paraphyses tipped with numerous enlarged moniliform cells (according to Rudolph; according to Harris the tips are clavate, only slightly enlarged, to 3-4 μ m; the protologue just says that the tips are \pm enlarged). Apothecia numerous, often crowded and irregular, spores ellipsoid to oblong-ellipsoid, 13-16 x 5.5-8 μ m. On non-calcareous rocks, Ohio, Michigan.

C. pelodella (syn.: C. amabilis Zahlbr. non B. de Lesd., C. arizonica Rud, non Magn., Pyrenodesmia elaeodes)

Apothecia usually immersed at first, later sessile. Disc yellowish ("C. amabilis", according to Rudolph), orange ("P. elaeodes"), or brownish orange to dark brown or dull black; margin grayish to olive or black, Spores (8-)11-14 x (5-)7 μ m, oblong-ellipsoid. Thallus forming small, irregularly orbiculate patches. Epihymenium K+ purple. Apothecia 0.4-1.4 mm diam.; disc flat to \pm convex, margin becoming wavy, moderately thick. Thallus areolate, thick, gray to dark olive or greasy black, or sometimes ("C. amabilis"), squamulose, glaucous to glaucous-blue-green; K-, smooth, papillose, usually with black hypothallus. Epithecium yellow-orange. Spore septum 3-4.5 μ m wide. On basalt and other siliceous rocks, California and Sonoran Desert.

C. sideritis

Spore septum ca. 4-6 μ m. Apothecia 0.2-1 mm diam., immersed to adnate; disc flat to convex, yellowish rust colored to rusty brown or black; exciple concolorous with thallus, entire, sometimes disappearing. Thallus rather thick. Paraphyses tips swollen, with some

branching. Epithecium golden. Spores (8-)11-13(-15) x 5-7(-8) μm , ellipsoid; Thallus white to gray, iron gray to greenish gray, K-, moderately thick, contiguous, areolate to squamulose; areoles coarse, often convex, uneven, somewhat scaly. On acid rocks. Northeastern U.S. [C. scotoplaca, treated under the ferruginea group, is apparently very similar, but has somewhat smaller apothecia and a dark gray, very thin, finely rimose-areolate thallus].

C. sonorae (description from Wetmore)

Thallus tan to gray, sometimes scant, areolate to subsquamulose; areoles uneven and irregular, moderately thick, cortex 21-35 μm thick with necral layer 0-14 μm , with brown pigment layer and well developed cells. Apothecia sessile, scattered, 0.3-0.8 mm diam.; disk red-orange; margin same color as disk, moderate thickness, flush, sometimes crenate, older apothecia often with outer gray margin; epihymenium golden; hypothecium hyaline; hymenium 70-84 μm ; parathecium with oval to elongated cells; upper amphithecium with algae; paraphyses with some to frequent branches, tips with 2-3 slightly swollen cells; spores (11-)12.5-15.5(-17) x 5.5-8.5 μm , isthmus 4.0-7.0 μm . Pycnidia immersed with red ostioles; conidia 3.6 x 1.8 μm . Epithymenium K+ red, H-, C+ red; thallus cortex K-, cN+ red-brown, H-, C-, unknown substance present, lacking thalloidima green. On non-calcareous rocks.

C. subsquamosa (description from Wetmore)

Thallus whitish gray, areolate to subsquamulose; areoles and squamules slightly lobed; cortex cellular, 14 μm thick, without granules; no prothallus.

Apothecia sessile, scattered, flat, round, 0.2-0.3 mm diam.; disk light brown; margin flush, same color as thallus; epihymenium dark golden brown; hymenium 70 μm ; parathecium without granules, with round cells; algae in upper amphithecium; paraphyses without branches, one slightly swollen tip cell; spores 12.5-14.0 x 7.0 μm , isthmus 7.0 μm . No pycnidia seen. Thallus cortex K-, cN-; epihymenium K+ red; margin K-, cN-. On non-calcareous rock.

3-D-2 On Rock;
Thallus ± grayish, K-
Apothecia discs ± rusty colored, to brown or blackish, K+ or K-;
margin ± concolorous with disc, K+ or K-
Thallus immersed or poorly developed
C. ferruginea group (s. str.)
(Pyrenodesmia sect. ferrugineae; Blastenia pr. p.)

After various authors

1. Spore septum very narrow, to 2-2.5(-3.5) um thick. (if apothecia to 0.6 mm diam., rather bright rusty red, with spores 11-13 x 6-8 um, growing on other lichens, also see C. epithallina). 2

1. Spore septum broader, over 2.5 um thick. 5

2. Discs dark rusty red, brownish red, or rusty red-orange. 3

2. Discs not distinctly reddish. 4

3. Apothecia scattered, not clustered and touching; margins thin and disappearing; paraphyses tips with 1-2 swollen cells; discs dark rusty red; paraphyses tips not branched; spores 15.4-19.6 x 5.6 um; isthmus 1.4-2.8 um. Thallus absent. On non-calcareous rocks, Baja California. C. sp. 26 (Wetmore)

3. Apothecia clustered, often touching and angular. Discs dark brownish red or rusty red orange; margins lighter than disks; paraphyses tips not branched; spores 11.2-12.6 x 4.2-5.6 um; isthmus 1.4-2.8 um. Thallus absent. Common. On non-calcareous rocks, southwestern. C. sp. 17 (Wetmore)

4. Apothecia 0.4-1.2 mm diam.; disks rusty or dingy orange to orange brown (to pale orange or yellowish orange); Paraphyses tips scarcely thickened, 1.7-2 um. Spores 12-14 x 5 um; septum 2-2.5(-3.5) um. Apothecial margin glossy; thallus indefinite, thin, ashy to whitish, minutely granulose to warty, widespread or disappearing; apothecia sessile, numerous and frequently crowded; thalline margin orange and thick (according to ?) or very thin, soon disappearing (according to ?); discs flat to convex; Thallus immersed, or thin, forming whitish to yellowish pale patches, K+ slowly reddish. On shale, southern California; on rocks and bones, Alaska. (C. fraudans)

4. Apothecia 0.4-0.5 mm diam.; discs rusty yellow. Paraphyses tips thickened to 3-3.5 um. Spores 10 x 3-4 um; septum 2 um. Thallus indistinct. Apothecia dense. Hymenium 55 um. Pennsylvania. Type apparently lost (Thomson, pers. comm.). C. pennsylvanica

5. Apothecia with proper margin black, thin but peristent; thalline margin absent. (Blastenia). On siliceous rocks, arctic-alpine. Alaska to Greenland. (see C. exsecuta)

5. Apothecia margin concolorous with disc or slightly paler (but sometimes blackish or grayish), sometimes at first with thin, soon disappearing grayish thalline margin

(Pyrenodesmia). 6

6. Thallus absent or inconspicuous. Insufficient info. to separate the next two species. 7

6. Thallus well developed and conspicuous. On non-calcareous rocks. 8

7. Spore septum 4.2-5.6 μm . Thallus absent. Hymenium under 70 μm . Young apothecial margins thin to moderate; disc brownish red; margin paler than disk, the outer part the same color as the top. Spores 12.6-14 x 7 μm . On non-calcareous rock. Arizona. C. sp. 28 (Wetmore)

7. Thallus immersed, often overgrowing other lichens and then thinly uneven, pale to dark gray brown. Spore septum 2-3.5(-5) μm . Apothecial to 0.5 mm diam.; disks red-brown to orange-red; margin thin, \pm concolorous with disc, red-orange. Apothecia scattered to crowded, rounded to flexuose, flat; disc dark to dull orange; proper exciple orange to reddish orange, prominent, \pm elevated, persistent. Paraphyses broadening gradually, 2-3 μm wide at apices. Spores ellipsoid, (9-)13-17 x (4-)5-8 μm ; septum ca. 1/5 length of spore. Primarily on exposed siliceous rock, very nitrophilous. Northern and central Rockies, and possibly elsewhere. C. arenaria [sensu Laundon] (syn. C. lamprocheila and C. subpallida)

8. Proper margin of apothecia rusty red-brown to blackish, flexuose. Some apothecia with thin outer gray margin. Thallus whitish gray to usually dark gray, effuse to areolate or lacking, usually forming a roughened, continuous or cracked-areolate surface; areoles flat to uneven, often separated by cracks with the dark hypothallus showing through; edge areoles often with black margin. Apothecia 0.3-1.5 mm diam., scattered to contiguous, sessile with narrow base, \pm rounded but occasionally slightly flexuose, flat to somewhat swollen; disk bright rusty red or darkening to blackish rusty or reddish brown; proper margin well-defined, thick, glossy, concolorous with disk or slightly darker. Hypothecium 50 μm , grayish; hymenium 70-80 μm , hyaline; paraphyses distinct, not clearly septate, slightly branched, flexuose, the tips only slightly broadened, to 3.5 μm . Spores 12-14(-18) x 6-8.4 μm , ellipsoid; septum ca. 5(-7) μm wide, to 1/2 length of spore. Pycnidia 0.1-0.2 mm diam., brownish red, K+ violet. On acid or calcareous rocks, especially vertical surfaces. Widespread. Arctic-boreal to temperate. Alaska to California; Montana; Arizona; Texas. C. crenularia (syn. C. festiva)

8. Proper margin of apothecia orange or yellowish, or if \pm reddish brown then apothecia only to 0.4 mm diam. 9

9. Thallus composed of minute, flat to convex, granules, scattered or crowded into a continuous, areolate crust, thin to moderately thick, becoming effigurate and subsquamulose, pale dirty gray (shade) to almost black (sun), Paraphyses separate, unbranched, free, tipped with numerous enlarged moniliform cells (according to Rudolph; according to Harris the tips are clavate, only slightly enlarged, to 3-4 μm ; the protologue just says that the tips are \pm enlarged). Asci clavate. Spore septum 3-4 μm . Apothecia numerous, 0.1-0.4 mm diam., adnate to subsessile, often crowded and irregular; disc slightly concave to flat or somewhat convex, orange to brown or dusky; thalline margin rather thin, orange to darker, becoming flexuose; spores ellipsoid to oblong-ellipsoid, 13-16 x 5.5-8 μm . On exposed, non-calcareous rocks, Ohio,

Michigan. [This may not belong in this group.] (*C. oxfordensis*) (*Pyrenodesmia*)

9. Thallus continuous to rimose-areolate, smooth to warty or wrinkled, not granulose or subsquamulose 10

10. Apothecia 0.4-0.8 mm diam.; discs \pm reddish yellow, plane; margin thick, entire, prominent, persistent, bright yellow-orange. Spores 14-17 x 8-9 μ m; septum 6-8 μ m. Thallus deep gray or blackish, thin or thick, smooth or rugose, continuous, areolate, or \pm deeply cracked. On \pm moist rocks, sometimes even submerged. Thallus thin, cracked-areolate when well developed, smooth or warted; areoles ca. 0.5 mm diam., with a black fimbriate bordering prothallus. Apothecia to 0.5 mm diam., margin orange, smooth. Apothecia scattered to crowded, rounded to flexuose, flat, constricted at base; thalline exciple absent; proper exciple persistent, prominent, even, convex, glossy, bright orange; disks bronwish orange to rust-orange to rust-brown. Paraphyses slender and flexuose, septate, not or only slightly broadened at tips. Spores 12-16 x (7-)9-10 μ m, Spores broadly ellipsoid, swollen; septum 5-7 μ m thick, 1/3-1/2 (or more) length of spore. On siliceous rocks, British Columbia. *C. atroflava*

10. Apothecia 0.2-0.4 mm diam.; discs dark ferrugineous brown, plane or slightly convex; margin thin, concolorous with disc (or slightly paler when very young), persistent for a long time. Spores 10-12 x 7-8 μ m; septum 4-5 μ m thick. Thallus very dark gray or blackish, very thin, finely rimose-areolate. Areoles smooth, plane, not glebulose-bullate. Apothecia 0.2-0.4 mm diam; thalline margin concolorous with disc (gray according to Wetmore), thin, persistent; disc dark ferrugineous or ferrugineous-brown. Spores 10-12 x 7-9 μ m; septum 4.5 μ m thick. On non-calcareous rock. Wetmore places this close to *C. sideritis*. *C. scotoplaca*

ADD:

Apothecial margin concolorous with disk, without outer gray margin. Apothecial disks dark orange or rusty red. Hymenium 70-90 μ m. Apothecia never crowded and angular. Thallus white or gray.

Thallus of thick gray areoles, dispersed; apothecia becoming convex. Spores 14-15.5 x 5.6-7 μ m; isthmus 1.4 μ m. Baja California. *C.* sp. 11 (Wetmore)

Thallus thin, continuous, granular between rock granules; apothecia remaining almost flat; spores 15-16.8 x 5.6 μ m; isthmus 1.4-2.8 μ m. Baja California. *C.* sp. 10 (Wetmore)

ADD?:

Thallus mostly warty, wrinkled, whitish or gray. Apothecia rather large, crowded, deeply concave then flat, fox-red; margin distinct, later disappearing. Thallus thin, sometimes poorly developed or almost absent. Hypothecium and excipulum pseudoparenchymatous; algae present in margin and below hypothecium; spores broadly ellipsoid to ovoid, 10-17 x 7-9 μ m. On rock and bark. [Description from Migula. This may belong under species with apothecia over 0.5 mm. The name was formerly applied to *C. scotoplaca*, but according to Magnusson, and Ozenda & Clauzade, *C. caesiorufa* is a "nomen confusum" and should be abandoned]. *C.*

caesiorufa [(Schrader) Flagey non auct.?)

3-E-1 On Rock;
Thallus not lobed or squamulose,
immersed to well developed and \pm gray, K-;
Apothecia discs yellowish to \pm orange;
thalline margin \pm gray, K-
C. cerina Group
(Pyrenodesmia sect. Cinereae, pr. p.)

After various authors

1. Sorediate. Thallus tan at margin, becoming dark gray in center; soredia dark gray. Apothecia with dark yellow disk and gray margin; paraphyses not branched above, end cells somewhat enlarged, ca. 4 μ m across. Spores 13-14 x 6-7 μ m; isthmus 3-4 μ m. On non-calcareous rock, Michigan. Caloplaca sp. 4 (Harris)

1. Not sorediate. 2

2. On seaside rocks near high tide levels in the Pacific Northwest; spores 12.5-17 x 7.5-11.5 μ m; septum 3.5-4.5 μ m; disk yellow to orange. Thallus mainly grayish but occasionally with yellow or orange tints; apothecial margins sometimes flecked with orange. British Columbia. C. litoricola

2. Not on seaside rocks. 3

3. Thallus \pm well developed, squamulose or effigurate. [Also see C. teicholyta/C. modesta etc. group and C. sideritis/C. pelodella group]. 4

3. Thallus poorly developed or immersed. [also see C. ferruginea group and C. pyracea group]. 5

4. Thallus squamulose and lobate. Disc rusty brown to orange. Southwest (Arizona); also reported from Maryland. (see C. modesta (Zahlbr.) Fink, non sensu Nash (Gasparrinia sensu lato))

4. Thallus not squamulose or lobed (?), but effigurate. Disc yellow-orange to light orange; Thallus pale gray. Apothecial margin gray; paraphyses somewhat branched above, \pm moniliform; end cells ca. 4 μ m; spores polarilocular, 10-12 x 5-6 μ m; isthmus ca. 3 μ m. Thallus effigurate, rather shiny, non-sorediate, K-. On non-calcareous rocks, Michigan. [This may be C. oxfordensis sensu Rudolph, based on the paraphyses types] Caloplaca sp. 1 (Harris)

5. Apothecia usually yellowish, reaching 1.7 mm across; amphithecium usually persistent; hypothecium usually 50 μ m or more high. Thallus lead gray, thin, \pm widespread, distinctly areolate; areoles usually flat. Apothecia 1-4 per areole, round to angular and crowded. Spore septum 5-8 μ m. On rocks, Vermont. C. cerina (v. areolata?)

5. Apothecia usually orange or darker, less than 0.8 mm diam.; amphithecium soon disappearing; hypothecium usually under 50 μ m high. Thallus gray or darker, not areolate, usually thin or absent. Hypothecium not cellular. Disc pale to dirty orange. Spore septum 3-5 μ m. [If thallus partly yellowish white and almost areolate, and hypothecium cellular, see C. carolinae; C. oxfordensis sensu Rudolph may possibly also key out here]. ("C. pyracea")

pr. p., at least sensu Rudolph)

ADD:

Thallus lacking. Hymenium under 70 μm . Young apothecial margins thin to moderate, flush with disk; discs dark orange; margins paler than disc, the outer surface whitish. Spores 14-16.8 x 7-8.4 μm ; isthmus 4.2 μm . On non-calcareous rock, Baja California. C. sp. 21 (Wetmore)

3-E-2 On Rock;
Thallus ± grayish, indistinct and K-, or immersed
Apothecia yellow to orange or red
C. pyracea Group
Pyrenodesmia sect. Reductae; Blastenia pr. p.

After McCune, and many others;

An especially difficult group, partly because many of the species that are treated as usually having a distinct thallus can have a thin and indistinct one. Also see the C. ferruginea group, C. cerina group, C. rimosa etc. group, and parasitic species under the document CALOPLAC.TER.

1. Spores large, 20-27 x 6-8 um; apothecia 0.7-1 mm diam.; disc bright red (cinnabar); proper exciple concolorous with the disk, disappearing in larger apothecia. Hypothecium to 200 um. Thallus thin, soon disappearing, pale greenish gray or buff, granular. On acid rocks, coastal California. (bright red); On acid rocks, coastal California.

..... C. bolanderi

1. Spores shorter, at most to 20 um long. 2

2. On HCl- rock. 3

2. On HCl+ rock or mortar (possibly also on ultramafic rock, or calcareous sandstones). 12

3. Spore septum under 3 um. 4

3. Spore septum over 3 um. 8

4. Spores narrow, 4-6 um. Discs not bright red. 5

4. Spores broader, 6-8 um. Disk bright red (cinnabar to miniate); spores 15-17 x 6.5-7 um; septum ca. 2 um. Thallus immersed (to occasionally evident but thin, smooth, grayish). Apothecia ± numerous, sessile, (0.7-)1(-1.2) mm diam., ca. 0.5 mm thick, constricted at base, with algae below hypothecium but not in margin; disc plane; proper margin thick, concolorous with disc, often flexuous. Amphitecium wide at top, over 100 um across. Hymenium 70-100 um. Hypothecium ca. 50 um, with oil droplets. Paraphyses 1.7 um, the tips capitate-clavate, to (4-)5-6 um in KOH, with 2(-3) subglobose cells, the next ones down clavate. On seashore rocks just above high tide, California (to Washington and British Columbia?). (if septum thick and discs orange, see C. holocarpa?). C. laeta

5. Growing in Michigan. Apothecia dark orange with ± concolorous margin. Paraphyses ± branched above; end cells not much enlarged, 2-3 um; spores 12-14 x 5-6 um; isthmus ca. 3 um. Thallus dark and thin, K-, or absent. On non-calcareous rocks, Michigan. Caloplaca sp. 3 (Harris)

5. Growing in the Southwest. 6

6. Some apothecia with yellow outer surface, spores 14-15.4 x 5.6 um with isthmus 2-2.8 um, margin thick, somewhat raised. Growing in Arizona. C. sp. 19

(Wetmore)

6. Apothecia without yellow outer surface. 7

7. Apothecia scattered, not clustered and touching. Apothecial margins moderately thick and raised; paraphyses tips not swollen; spores 16.8 x 4.2-5.6 μm ; isthmus 1.4 μm .

California. C. sp. 44 (Wetmore)

7. Apothecia clustered, often touching and angular. Paraphyses tips barely swollen. Spores 12.6-16.8(-20) x (4.2-)5.6(-8) μm ; isthmus under 1.4 μm . Disk pale yellow orange to rusty yellow. Apothecia sessile, 0.25-0.75 mm diam.; disk pale yellow orange to rusty yellow (pure orange according to Wetmore), plane to slightly convex; proper margin yellow or pale orange, brighter than the disk (concolorous according to Wetmore), thin, persistent, entire. Hymenium 72-80 μm ; paraphyses not well separated, some forked below the tips; tips capitate. Asci oblong-tubular. Spores oblong-ellipsoid, polarilocular. Thallus clay color (to darkened yellow according to Rudolph), quite thin, obscure or absent. On crumbling sandstone, southern California foothills. C. subpyracea

8. Growing in the Southwest. 9

8. Growing [mostly?] in northern or eastern areas. (also see C. dalmatica). "C. pyracea coll." [Most recent authors, following Wade, 1965, lump C. pyracea as being merely a corticolous form (with densely crowded discs, which is also common on rock) of C. holocarpa, the latter being the older name, but Magnusson, and Hansen, et al., 1987, suggest that C. pyracea be reserved for corticolous (or lignicolous?) material. See "ADD" section at end of this key for a comparison of Laundon's (essentially Wade's) concept of C. holocarpa, vs. Hansen, et al.'s concept. If Laundon's concept is followed, some modifications in the description of "C. lithinella" are needed. [C. sp. 2 of Harris also keys out here: Apothecial margin yellow at least when young; disc orange; paraphyses not much branched above; end cells enlarged, 4-5 μm . Spores 10-14 x 5-6 μm ; isthmus 3-4 μm . Thallus dark and thin, K-, or absent, non-sorediate. On non-calcareous rocks, Michigan.] 11

9. Hymenium over 100 μm . Spores 14-15.4 x 5.6 μm . Young apothecia with very thick, raised margin. California. Spore isthmus 3-4.2 μm C. sp. 22 (Wetmore)

9. Hymenium lower. Spores over 7 μm wide. Arizona or Baja California. Spore isthmus mostly 4.2 μm or more. Insufficient information to distinguish the two species below. 10

10. Growing in Arizona. Thallus lacking or barely evident around apothecia, slightly pinkish cream. Apothecia clumped and touching, many angular; hymenium under 84 μm ; paraphyses tips branched and enlarged; spores (12.6-)14-15.4 x (5.6-)7-8.4 μm ; isthmus (3.5-)4.2(-5.6) μm . Disc color not given. On acidic rocks C. sp. 56 (Wetmore)

10. Growing in Baja California. Thallus completely lacking. Hymenium under 70 μm . Young apothecial margins thin to moderate, flush. margins lighter than disks, whitish. Disc dark orange. (If disc brownish red and growing in Arizona, see C. sp. 28 of Wetmore, under ferruginea group). (see C. sp. 21 of Wetmore, under C. cerina group)

11. Apothecia \pm scattered to dense, orange to often dirty reddish orange; hypothecium not cellular [not stated, but implied]; spore septum (3.5-)5-6 μ m. Usually on calcareous rock.

Thallus pale to yellowish (gray or darker according to Rudolph) or evanescent; not areolate.

Apothecia 0.3-0.4(-0.5) mm diam., sessile; disc plane to slightly convex; margin distinct, conocolorous, persistent or often disappearing. Hymenium 60-70 μ m. Paraphyses tips subclavate, 2.5-3(-5) μ m. Spores (10-)11-12(-13) μ m, broadly ellipsoid. "C. lithinella" (Magnusson's name for saxicolous forms of C. pyracea sensu lato; =? C. holocarpa s. str?)

11. Apothecia denser and more intensely colored than in "C. pyracea"; hypothecium cellular; Spore septum 3.5-4.5 μ m (narrower than in "C. pyracea" according to

Magnusson). On siliceous rock. Spores 12-14 x 6-7 μ m, \pm oblong; Thallus yellow or in part yellowish white, effuse, or evanescent; areoles uneven or rough, \pm plane with raised margins, 0.2-0.35 mm wide, angular, in most parts indistinct. Apothecia 0.3-0.5 mm diam., dense to contiguous, often irregular in shape; discs intense orange; thalline margin pale; outside of margin diffuse; 0.2 mm thick. Hypothecium distinctly cellular. Hymenium 65 μ m high; epihymenium granular, K⁺; paraphyses distinct, 1.5 μ m thick; constricted septate; tips 3-3.5 μ m. Spores 8 per ascus, apical wall apparently simple. S. Carolina. C. carolinae

12. Apices of paraphyses capitate, 6-8 um. Thallus usually immersed or indistinct and whitish, K-. On calcareous rocks or shells. North Dakota. (a seashore species on ultramafic rock and slightly calcareous sandstone, in the Pacific Northwest, reported by Ryan, 1988 under this name also seems to key out here, but may not be the same) (also see C. approximata sensu Wetmore, Sonoran Desert keys, with spores (11.2-)14-16.8(-18.2) x 5.6-7(-8.4) um, isthmus 1.4-2.8 um, disc pure orange, and tips of paraphyses with 2-4 large cells, to 5.6 um wide; according to Wetmore C. lactea has dark orange disks and smaller paraphyses tips than C. approximata, and occurs in Arizona and N. Dakota; C. sp. 20 of Wetmore may also key out here; it has outer surface of apothecia grayish yellow, spores 14-15.4 x 7 um, and isthmus 3-4.2 um and occurs in Arizona). 13

12. Apices of paraphyses < 6 um. Thallus usually (?) distinct and yellow, K+ red or purple. 14

13. Spores 15-20 x 8-10 um (5.6-7 um wide according to Wetmore). Thallus thin, forming a whitish stain or immersed and conspicuous; prothallus indistinct. Apothecia similar to those of C. holocarpa but often more rounded, constricted at base and widely dispersed, sometimes forming shallow pits when shed; true margin prominent, moderately thick, sometimes \pm elevated; discs often appear pellucid and irregularly concave when moist; outer surface of apothecia yellow. Spore septum 1.4(-2.8) um thick, less than 1/8 of length of spore. C. lactea var. lactea

13. Spores under 14 um long and 5-7 um wide. Thallus immersed. Apothecia 0.1-0.3 mm across, orange. On rock. C. lactea var. americana B. de Lesd.

14. Spore septum under 3 um. 15

14. Spore septum over 3 um. 16

15. Spores 11-15 x 5-7 um; apothecia dingy orange or yellowish. (C. fraudans may also key out here). Thallus immersed, or continuous to areolate or granulose-effuse. Apothecia numerous, dense, partly contiguous, sessile, constricted at base, 0.4-0.5 (0.7) mm diam., sometimes distorted by pressure but not angular; disc smooth, plane only as young slightly concave; margin pale, smooth, scarcely prominent, with algal layer. Spores sometimes rather rare, ellipsoid to broadly ellipsoid; septum to 1.5-2.5 um thick. Paraphyses 2-3 um thick, subdiscrete; apices twice clavate, to 5(-7) um thick. Hypothecium 35-50 um. Hymenium 85-90 um. On calcareous rock or mortar, Great Lakes area (at least Wisconsin, Michigan, Ontario) C. feracissima

15. Spores (11.2-)14-16.8(-18.2) x 5.6-7(-8.4) um, disc light orange or pure orange; spore isthmus 1.4-2.8 um; tips of paraphyses with 2-4 large cells, to 5.6 um wide. [see "ADD" list at end, for comparison of N. American and European material under this name]. (C. approximata, at least sensu Wetmore)

16. Discs yellow. Spores 9-11 x 4-7 um; thallus yellow when present; septum 4-6 um. Apothecia lecanorine, 0.3-0.5 mm diam., aggregated; discs plane. Especially on vertical surfaces and beneath overhangs. (C. vitellinula)

16. Discs orange to often dirty reddish orange. Apothecia \pm scattered to dense, orange to often dirty reddish orange; hypothecium not cellular [not stated, but implied]; spore

septum (3.5-)5-6 um. Usually on calcareous rock. Thallus pale to yellowish (gray or darker according to Rudolph) or evanescent; not areolate. Apothecia 0.3-0.4(-0.5) mm diam., sessile; disc plane to slightly convex; margin distinct, conocolorous, persistent or often disappearing. Hymenium 60-70 um. Paraphyses tips subclavate, 2.5-3(-5) um. Spores (10-)11-12(-13) um, broadly ellipsoid. "C. lithinella" (Magnusson's name for saxicolous forms of C. pyracea sensu lato; =? C. holocarpa s. str?)

ADD (to C. pyracea group):

C. holocarpa sensu lato:

1. Spores 10-15 x 5-10 um, ellipsoid; septum 3-5 um thick, ca. 1/3-1/4 length of spore. Apothecia usually very crowded, contiguous, 0.1-0.3(-0.8) mm diam. Disc deep orange to orange-brown. Usually on calcareous rocks, more rarely on acidic rocks, or bark or wood. Thallus often immersed, inconspicuous, or sometimes forming a thin, continuous, pale gray to black crust. Apothecia becoming contorted; thalline margin gray, poorly developed and usually inconspicuous, or absent; proper margin well delimited, often glossy, orange, \pm excluded when old; disc flat to \pm convex. Paraphyses \pm straight. Spores ellipsoid. Thallus K-. C. holocarpa sensu Laundon

1. Spores 8-9.5 x 5.5-7 um, broadly ellipsoid; septum 2.5-3.5 um. Apothecia single or in small groups, 0.2-0.4 mm diam.; discs pale or dirty orange. [Usually?] on bark or wood. Thallus immersed. Apothecia distinctly constricted sessile; margin [presumably the proper margin] at first distinct and level with disc, later indistinct. Hymenium ca. 60 um. Paraphyses tips clavate-capitate, to ca. 5 um wide; epihymenium moderately granular. On wood, Greenland. "C. pyracea coll." sensu Hansen, et al., 1987

C. approximata sensu lato:

Spores (11.2-)14-17(-18.2) x 5.6-7(-8.4) um. Thallus yellow or absent. Disc pale orange. Spore septum 1.4-2.8 um. Tips of paraphyses with 2-4 large cells (to 5.6 um). On calcareous rock. (Description from Wetmore (N. American material is atypical and may be a different species) S. Dakota, Utah. C. approximata sensu Wetmore

Spores (9-)10(13) x (3-)4(-6) um, occasionally shorter and broader, 8 x 5 um. Thallus crustose, bright yellow to orange-yellow, poorly developed and often reduced to a black prothallus, or (according to ?) areoles thick, irregular or verrucose. Apothecia 0.2-0.5 mm diameter, numerous, dense and close to each other but not contiguous or crowded, conspicuous; disc bright orange, plane; margin thin, \pm elevated (to depressed), regular; hymenium 50-60 um; paraphyses mostly simple, the tips only slightly enlarged, 3.5-5 um; spore septum indistinct 1(-2) um. On calcareous rock, especially beneath overhangs. C. approximata s. str.

Thallus lacking or of small yellowish verrucules which become apothecioid. Apothecia numerous, thickly dispersed or contiguous, rounded or angular, 0.5-1.5 mm broad, adnate or becoming narrowed at base, margin smooth or crenulate, soon reflexed, concolorous with disk or slightly paler, yellowish; exciple fan-shaped radiate; disk flat or uneven, slightly rough, orange; hymenium 50-75 um, yellow granular above; paraphyses capitate, 4-6 um with granular episamma above; spores 8, narrowly ellipsoid, 8-12 x 3.5-4.5 um, septum 1.7-2 um. On manured rocks. Greenland southwest to Arizona. C. approximata sensu Thomson 1997

C. alcarum:

Thallus to several cm across, light gray, sometimes with scattered, orange-yellow, to 0.2 mm across squamules, which can become rather effigurate. Apothecia zeorine,

numerous, dispersed or very crowded, sometimes forming raised conglomerates, 0.5(-0.9) mm diam.; disc flat to slightly convex, orange; margin prominent, rather thick (60 µm), persistent; proper margin slightly paler than disc; thalline margin somewhat paler than proper margin, irregular. Spores 12-13 x 5.5-8.5 µm; septum 3.5-5 µm thick. On strongly eutrophicated substrates (rock or wood), not far from the sea. C. alcarum

C. dalmatica:

Thallus crustose, brownish orange to yellowish white, occasionally in part whitish, fairly smooth to minutely roughened, continuous, sometimes pruinose, usually finely rimose-areolate; prothallus gray=black, mosaic forming or absent. Apothecia to 0.8 mm diam., scattered or grouped, ± rounded, ± immersed at first, sometimes becoming ± sessile, later sub-convex; thalline margin conspicuous, often becoming ± excluded when old; disc yellowish to light brownish orange, often concolorous with exciple. Paraphyses ± straight, sparsely branched; most tips broadened, the apical cell 2-8 µm wide. Spores 9-13 x 5-9 µm, broadly ellipsoid; septum 3-5 µm thick, 1/4-1/2 length of spore. On hard, smooth limestones in sunny situations, especially on walls. Alabama and Tennessee. C. dalmatica (synonyms: C. velana, C. schaeferi)

Check Egan supplements and CALOPLACA.ADD for additional species.

Detailed Descriptions

Caloplaca fraudans (Th. Fr.) Olivier

Thallus to 3 cm broad, various shades of gray, matt, K-, poorly developed or verrucose, uneven to rugulose, mostly discontinuous, to 1.0 mm thick, sometimes as small cushions covered with aggregate apothecia; prothallus absent; cortex poorly developed, consisting of rather loosely arranged \pm isodiametric cells, covered by a 25-50 μ m thick, amorphous epinecral layer.

Apothecia 0.4-2.0 mm diam., round to irregular, sessile to raised, zeorine, always present and numerous, separate to frequently strongly aggregate and crowded; disks \pm plane to strongly convex, sienna to rusty or dark brownish red, often umbonate (central formation of sterile hyphae through the hymenium, seen as a wart on the disk); proper margin initially thick, raised above disk, bright yellow to reddish orange, clearly lighter than disk, with age thinner, more level, and concolorous with disk, 25-125 μ m thick, matt to shiny, consisting of radiating, thick-walled, tightly packed hyphae; thalline margin mostly excluded, sometimes present and to 50 μ m thick, gray; hymenium 60-100 μ m high, hyaline or pale ferruginous; hypothecium 75-130 μ m, hyaline; paraphyses simple or occasionally branched twice, the tips to 3 μ m broad; asci cylindrical, 35-45 x 10-14 μ m; spores 8, polaribilocular, 9.5-13.5 x 4.0-6.5 μ m; septum 2.5-4.5 μ m.

Pycnidia not seen.

Parietin and parietinic acid as major pigment, and small amounts of emodin and teloschistin.

On siliceous rocks, on or near the seashore, Nova Scotia. Reports on shale in southern California and on rocks and bones in Alaska have not been confirmed.

Caloplaca lithophila Magnusson [NEEDS TO BE ADDED TO THE KEY]

Thallus to 1 cm broad but mostly smaller, crustose, mostly present but poorly developed, occurring only around apothecia or as scattered areoles between apothecia, occasionally forming a thin, cracked-areolated crust; areoles plane or slightly convex, to 0.2 mm thick; cortex paraplectenchymatic; margin indistinct; thallus color yellow to yellowish orange, sometimes beige or grayish; prothallus absent.

Apothecia always present and often abundant, scattered to aggregate, zeorine, sessile or mostly raised, 0.2-0.5(-0.7) mm diam., round to irregular; disk plane to convex, yellow to orange to reddish orange; proper margin thin, 25-50(-70) μ m, somewhat raised or level with disk, paler or concolorous with disk, \pm even, consisting of radiating hyphae of elongated cells, which become wider and shorter toward edge; thalline margin mostly absent, sometimes to 50 μ m thick but always suppressed and inconspicuous, yellowish; hymenium 50-85 μ m high, hyaline; hypothecium 30-60 μ m high, hyaline; paraphyses simple or branched once, somewhat moniliform in upper part, ca. 1.5 μ m broad, the tips widened to capitate, 3-6 μ m broad, often with one to several oil droplets; asci cylindrical, 38-55 x 12-16 μ m; spores 8, polarilocular, (9.4-)10.0-13.5(-13.9) x (4.8-)5.6-7.5(-8.8) μ m; septum (3.1-)3.6-6.0(-6.5) μ m.

Pycnidia not seen.

Parietin as major pigment, and small amounts of emodin, teloschistin, parietinic acid, and fallacinal. In some specimens with reddish orange apothecia the amounts of teloschistin and fallacinal were higher. Thallus K+ purple.

Mostly on siliceous rocks, sometimes on calcareous rocks. Inland, and terrestrial region or occasionally lower supralittoral zone of the seashore. New Brunswick to New York; Great Lakes area; possibly elsewhere in interior of the continent.

Caloplaca microthallina (Wedd.) Zahlbr.

Thallus to 2(-3) cm broad, 0.1-1.0(-1.8) mm thick, composed of contiguous to imbricate, or often \pm scattered, small, individual microlobes or squamules, or sometimes as 1-2 mm broad rosettes; lobes and squamules rounded to irregular or \pm elongate, 0.3-0.5(-1.0) mm wide, convex, sometimes growing upon each other and building up a thick crust with scurfy or occasionally granular, but never sorediate, appearance; lobes in cross section showing a paraplectenchymatous structure of thin-walled cells and clusters of algal cells; margin mostly of scattered lobes, indistinct; surface citrine yellow to orange-yellow or more rarely orange, in shade often greenish-to pale-yellow, matt; prothallus absent.

Apothecia lacking or few to fairly abundant, 0.4-1.2(-1.6) mm diam., round to irregular, scattered to aggregate, sometimes isolated and appearing away from its own thallus, zeorine, initially sessile but soon raised or very shortly stalked; disk plane to convex, sometimes flexuose, mostly bright orange or sometimes yellowish orange but mostly darker than thallus; true exciple conspicuous, moderately thick, (25-)40-60(-75) μ m, slightly raised or not, concolorous or paler than disk, yellow orange at first, reduced or \pm crenulate when mature, consisting of radiating, thick-walled, tightly packed hyphae; thalline margin fairly thick and conspicuous, (0-)25-125(-175) μ m, mostly uneven to crenulate; hymenium 75-90(-100) μ m high, hyaline; hypothecium 30-80 μ m high, hyaline, occasionally with oil droplets; paraphyses simple or branched once, somewhat moniliform in upper part, 1-2 μ m, often with apical cell swollen (capitate), 3-6(-7) μ m diam.; asci cylindrical, 56-66 x 10-14 μ m; spores 8, polaribilocular, ellipsoid, (10.0-)11.0-15.2(-17.0) x (4.0-)4.8-6.8(-8.0) μ m; septum (2.4-)3.0-5.4(-7.2) μ m wide, ca. 1/4 length of spore.

Pycnidia mostly present and rather common, immersed, orange; pycnospores narrowly ellipsoid, 2.5-3.2 x 1.0-1.2 μ m.

Parietin as major pigment, and small amounts of emodin, teloschistin, and fallacinal. Thallus K+ purple.

On hard siliceous rocks, in the supralittoral fringe and lower supralittoral on the seashore. Maine, New Hampshire, New Brunswick, Nova Scotia, Quebec, and Newfoundland.