

I. Axils/cups (usually) closed; apothecia and pycnidia red
Section Cocciferae

1. Podetia copiously branched, resembling sect. Unciales, usually forming lax, tangled colonies; K-, KC+ yellow, P+ yellow; containing usnic, baeomycic, squamatic acids plus accessory bellidiflorin and didymic acid. Primary squamules persistent on wood, disappearing on soil, appressed or slightly ascending, rounded, sparingly lobed, usually entire, less than 1 mm long. Podetia to 4-5 cm long, to 3 mm diam. or more; branching by wide forking with closed axils, sometimes sympodial at base, usually isotomic towards tips and commonly with 3-5 forks around an open axil, ultimate branchlets pointed or blunt; surface glabrous to rugose, the older parts with superficial ridges or folds; rhizine-like structures sometimes present at tips of small branches or on surface of old branches; cups and soredia lacking. Apothecia terminating branches. Pycnidia on tips of branches or tiny lateral branches. On sandy soil, also on old wood. N. J. to Fla., W to Texas; Cuba.C. leporina Fr.

1. Podetia (if present) simple or only slightly branched.2

2. Podetia absent or rare, to 1 cm tall, decorticate and blackened when old, often hidden among squamules. Basal squamules 2-10 cm diam., greenish yellow above, \pm rounded and entire, scarcely indented, sometimes \pm elongated, the margins ascending, when dry recurved and exposing pale yellow, distinctly cottony-arachnoid lower surface (x 10 lens). Apothecia and pycnidia red. Apothecia rare, on margins of cups, or sessile on squamules. Thallus P-, K-, KC+ yellow, C-, UV+ white or UV- (three chemotypes: 1: usnic acid, zeorin and \pm porphyrilic acid (widespread); 2 usnic and barbatic acids, 3: usnic, squamatic and didymic acids. Often overgrowing other species of Cladonia on peaty soils, mossy boulders and on rock ledges and walls in exposed heathlands and on mountains summits, rarely on bases of old trees. Alaska. C. luteoalba (also see Dahl & Krog, or Poelt)

2. Podetia present and usually numerous. 3

3. Podetia cup-bearing. Key I-A

3. Podetia non-cup-bearing, awl-shaped, with or without apothecia. Key I-B

I-A Apothecia and pycnidia red; with cups

1. K+ yellow or purple, P+ yellow, orange or red. 2

1. K- or weakly yellow, P-. 5

2. Primary squamules large, 5-15 mm broad (largest of any of the red-fruited species), lobed and incised; upper side gray green to olive green; underside white or yellowish, deepening to brownish orange toward base, finely sorediate especially along margin. Base of podetia corticate; upper part finely sorediate. Podetia forming distinct cups which broaden gradually from the base, the major part of podetium finely sorediate with whitish, yellowish or greenish soredia. Apothecia infrequent, on margins of cups. P+ yellow; containing thamnolic acid and substance G, plus accessory bellidiflorin. On soil rich in humus, on old logs and tree bases. Boreal-temperate, Alaska to SE Canada, S to N. Carolina in eastern mountains, S to Pacific NW in the west. C. digitata

2. Primary squamules small, less than 5 mm broad. 3

3. Primary squamules tiny, less than 0.5 mm broad, isidioid or granular, often dissolving into sorediate masses. Podetia well developed, often branched; gray, mostly corticate, with granular to isidioid structures or a few sorediate patches; K+ yellow, KC-, containing only thamnolic acid. Eastern, south to Fla. (see C. ravenelii Tuck.)

3. Primary squamules medium-sized, 1-3(-5) mm broad. 4

4. Podetia finely (or granular?) sorediate; K+ yellow turning red or purple, KC-; containing thamnolic acid and bellidiflorin, lacking usnic acid. Podetia usually pale gray or whitish gray, 2-3(-5) cm tall; cups when well developed to 5 mm wide, with numerous long, marginal proliferations; soredia usually granulose, mixed with large and small squamules; corticate patches may occur high up on podetia; cartilaginous cylinder always much thicker (in dry state) than medulla (at base of podetia). P+ yellow, UV- (thamnolic and decarboxythamnolic acid major substances). On decaying wood and bark, humus, peat bogs, mossy rocks, and sand; often in well lit sites. Alberta and westward along Pacific coast; records outside of Europe doubtful (probably misidentifications of C. umbricola) according to Tonsberg & Ahti, 1980. (C. polydactyla)

4. Podetia granulose sorediate, grading into isidioid structures and minute squamules; K+ yellow, P+ orange-red, KC+ yellow or KC-; containing thamnolic acid plus accessory usnic acid. Primary squamules small to large, to 10 mm long, irregularly lobed or divided, with crenulate divisions to 1 mm broad and sublinear; upper side glaucous with greenish to yellowish tinge; underside white to brownish or yellowish especially toward base.

Podetia 17-40 mm tall, to 2 mm diam., typically cup-bearing, the cups broadening out gradually; upper edge of cups up to 5 mm broad and bearing a series of short stipes tipped with apothecia, or the podetia scarcely forming small cups and with a single stipe forming a larger apothecium; cortex smooth and continuous or areolate at the base, the interior of the cups and next to apothecia; otherwise sorediate; larger squamules sometimes present on the podetia; surface yellowish or yellowish-glaucous. On rotten logs and the bases of fir trees, Alaska to California, close to the coast. C. transcendens

5. Cups short, 1-3(-4) cm high, regular. Primary squamules sparsely divided into roundish lobes.(C. coccifera group; key after Stenroos, 1989) 6

5. Cups tall, 2-10 cm high, slender, often irregular. 11

6. Contains zeorin (fine needle-like crystals on surfaces in old specimens) and usnic acid, UV- Primary squamules ascending. Primary squamules to 3 cm tall, unbranched or more rarely branched by marginally (rarely centrally in C. pleurota) proliferating scyphi. 7

6. Zeorin always absent; usnic acid present (in N. American spp.); primary squamules appressed to ascending. 9

7. Podetial surface sorediate. 8

7. Podetial surface esorediate, smooth to with broad, low bullate verrucae or elevated areoles or scales, corticate to plated; inside of scyphi plated; areoles irregular in shape, 0.2-0.3 mm diam. Cups wide (up to 1.5 cm wide), gradually flaring. UV+ white (due to?; according to?); containing usnic acid and zeorin as major substances. Primary squamules small, or to 0.8-1.2 cm long and 5 mm wide, persistent or disappearing, irregularly crenately incised or lobed; upper side yellowish to glaucous or olive colored; underside white or rarely yellowish, base becoming orange to blackish brown; esorediate. Podetia to 50 mm tall but usually shorter; cups goblet shaped, often oblique at mouth, simple or with marginal proliferations which bear apothecia or more rarely cups in a second tier; surface yellowish to glaucous; cortex subcontinuous at base and becoming verruculose areolate above, the verrucules contiguous or dispersed; esorediate, with or without squamules; decorticate part opaque, white or yellowish white. Apothecia common, large. Barbatic acid. On soil, over rocks, and on rotten logs; abundant in muskegs on humus. Arctic-boreal. Arctic-alpine. Alaska to Iceland, south into NE U.S., Pacific NW, Great Lakes area, and Colorado. (Note: C. pseudodigitata is listed by Stenroos, 1989 as a synonym of C. coccifera, but is listed separately by Egan)C. coccifera

8. Soredia powdery, 15-30 um diam.; scyphae rather abruptly

flaring. Primary squamules small, to 0.4 cm long. Podetia to 4 cm tall, unbranched or 1(-2) times branched by marginally proliferating scyphi; surface sorediate, sometimes squamulose on basal parts. Apothecia uncommon, pale brown. Usnic acid, zeorin, \pm barbatic acid. Arctic-alpine and boreal. (see C. carneola in the brown-fruited species)

8. Soredia granulose or more rarely farinose, 30-120 μ m diam.; scyphae gradually flaring. Primary squamules middle sized, 1-7 mm long, persistent or disappearing, to 5 mm broad, irregularly crenate-incised to lobate; upper side yellowish to olivaceous or pale glaucescent; underside pale or brownish toward base, esorediate or with scattered granules below. Podetia to 40 mm tall but usually much less. Podetia surface rugulose corticate and often squamulose in the basal parts, outside and inside of the scyphae sorediate. Cups short, flaring quite soon and gradually from near the base, goblet-shaped, to 0.7(-1.5) cm wide; regular and entire or dentate to proliferate from the margin, the proliferations bearing apothecia or rarely small cups, very rarely with small cups from the center; inside of cups and upper part of podetia with granular soredia; base corticate; cortex continuous or areolate to verruculose. Apothecia fairly common, convex. Usnic acid and zeorin, \pm isousnic acid. On soil, particularly with heavy clay content, and also over rocks with thin coating of soil. Arctic-alpine, Alaska to Greenland, S to S. Carolina, Texas, Colorado, and California.C. pleurota

9. Podetia surface very rough, with small, protuberant verrucae.
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9. Podetia surface smooth to shallowly areolate corticate, inside and often upper outer surface of cups plated, with plates round and flat in shape, (0.2-)0.3-0.4 mm diam. Primary squamules large, ascending, to 1.0 cm long, sparsely divided into roundish lobes. Podetia to 4 cm tall, unbranched or more rarely branched by marginally proliferating scyphi; scyphi gradually flaring, up to 1 cm wide. Apothecia common. Usnic and barbatic acids major. Boreal-arctic. C. borealis

10. Podetial surface microsquamulose (squamules 0.2-0.4 mm long); stereome (edge of cup) blackening. Contains usnic acid, and didymic acid with accessory condidymic and subdidymic acids, squamatic acid with consquamatic acids, and sometimes (Eurasia) thamnolic acid. Primary squamules small, appressed to horizontal (or ascending?), 1-2(-4) mm long, 2-4 mm broad, moderately divided into small roundish lobes, crenate or incised, becoming involute, sparse to dense; upper side yellowish or yellowish green; underside white; esorediate. Podetia to 2-3 cm (or more?) tall, slender, slightly elongated, generally unbranched; cups gradually or more often rather abruptly flaring and trumpet shaped, to 1 cm wide; margins subtentire, rarely proliferate; surface ecorticate to partly

corticate, yellowish, esorediate, mostly covered by crowded, small, protuberant verruculae, many showing a tendency to rise from the deeper tissues and give rise to minute, \pm appressed squamules; upper parts may have granules. Apothecia sparse, on marginal stipes or short proliferations. Usnic and didymic acids, \pm squamatic and thamnolic acids. On soil rich in humus, often on hummocks in the tundra. Alaska and NW Canada, S to British Columbia and Alberta (and SE Canada?)C. metacorallifera

10. Podetial surface without microsquamules. Contains squamatic acid. Podetial surface essentially granulose in upper parts, with immixed scaly plates; unevenly to areolate corticate (sometimes cracked) or squamules in basal parts; inside of cups often corticate; corticoid granules variable in size. Primary squamules middle-sized, ascending, to 0.6 cm long, sparsely divided into roundish to elongate lobes. Podetia stout, to 2.5 cm tall, often 1-2 times branched by marginally proliferating scyphi; scyphi gradually to abruptly flaring, to 0.7 cm wide, the margins often dentate or irregularly proliferating. Apothecia uncommon. Occasional, Alaska and NW Canada.C. granulans

11. Podetia esorediate; containing usnic and squamatic acids and bellidiflorin; UV+ white12

11. Podetia farinose soresdiate, broadening near top into shallow cups; containing usnic acid and accessory bellidiflorin.13

12. Podetia becoming decorticate and very squamulose; dying bases very yellow. Podetia 20-50 mm tall, the base commonly dying; squamulose, the squamules small to middle-sized, 2-5 mm long, crenate or laciniate, ascending or erect, flat or involute, sparse to abundant; upper side yellowish or pale to glaucescent; underside white, becoming brown to black toward base. Podetia cupless or with short and narrow cups which are quite regular or oblique; margins subtentire or dentate to radiate proliferate, esorediate; cortex continuous to chinky or areolate discontinuous, smooth or verruculose, the squamules splitting off the cortex; surface yellowish or yellowish glaucescent; decorticate part white to faintly yellowish,, opaque. Apothecia on proliferation or on edges of cups. Usnic and squamatic. Primary squamules commonly disappearing, small to middle-sized. On soil and humus, often mixed with mosses. Arctic (Alaska to Iceland), S to SE Canada in the east, to California in the west.C. bellidiflora

12. Podetia remaining smoothly corticate, not squamulose or with exceedingly few squamules at base. Primary squamules persistent or disappearing, long digitate, lobate to incised and crenate, 4-7 mm long, \pm erect or convolute, rigid and thick; upper side glaucescent or orangish-yellowish; underside orange-brown;

esorediate. Podetia to 5 cm tall and 1-1.6 mm thick, erect to curved, cylindric, cupless or with narrow cups which are simple or proliferate with elongate proliferations, esorediate, the upper part becoming quite verruculose; base quite smooth, becoming slightly chinky, with a strong yellowish to glaucescent-yellowish color; inner part continuous chondroid, the chondroid layer even and 24-27 μ m thick. Apothecia aggregate or not, to 1 mm. Pycnida at tips of podetia. K-, KC+ yellow, P-; yellow basal parts and bases of squamules K+ red. Usnic and squamatic acid. Usually on sandy and loam soils. Newfoundland, Labrador, Alaska, Washington.C. hookeri

13. Containing zeorin (UV-); primary squamules 3-4 x 0.5-2.5 mm; podetia more or less regular, little split, tall, broadening at tip into shallow cups; margins with red projections or apothecia or pycnidia. Primary squamules usually isappearing, 2-4 mm long, incised crenate or lobate, flat to convex or involute; upper side glaucscent to yellowish; underside whtie to pale brown or dark; esorediate or underside sparingly sorediate. Podetia 25-85 mm tall, to 5 mm thick on stalk; cups gradually flaring, moderately or little expanded; margin entire or dentate to proliferate with blunt or cup-bearing proliferations, the cups usually imprefroate, the major portion of the podetium except the base densely covered with fine, farinose soredia; soredia quite yellowish; basal corticate portion continuous to chinky, yellowish glaucescent; decorticate portion opaque. Apothecia sometimes pale, on margins of cups or on short marginal proliferations. Usnic acid, zeorin. On soil rich in humus, among mosses, on rotten logs, tree bases, and over rocks with a little humus. Arctic-borea. S to W. Virginia, northern California, and Colorado.C. deformis

13. Containing squamatic acid (UV+).14

14. Primary squamules large, 5-10 x 2.5-5 mm; podetia robust, 2.5-8.5 mm tall, irregular, with split and torn sides, corticate at the base. Primary squamules 5-10 mm long, 2.5-5 mm wide, incised or lobate; upper side yellowish glaucescent; underside white to pale brown or dark; sometimes sorediate. Podetai ca. 25-85 mm tall, stout; cups rather irregular; marginal proliferations prominent; sides often fissured and split; surface covered, except at base, with farinose yellowish soredia; basal area corticate. Squamatic acid. On soil with fairly high humus content. Arctic-boreal, Alaska to Greenland, south across Canada and to Colorado and northeasternmost U.S.C. sulphurina

14. Primary squamules smaller.15

15. Primary squamules 3-4(-6) x 3(-5) mm. Podetia 1-2(-3) cm high, 0.5-1.5(-4) mm wide, more or less cylindrical or widening in distal parts. Resembling C. polydactyla. Podetia usually greenish gray (whitish gray

where soredia have been shed), shorter, with smaller (to 2, or rarely 4, mm wide) cups, without or with few, rather short (usually to ca. 2 mm long) marginal proliferations, soredia usually farinose; squamules sparse or absent; cortical patches hardly present above the short, basal, cortical sheath; cartilaginous cylinder thinner, often equal to the medulla in thickness (in dry state). P-, UV+ white (squamic acid). Basal squamules persistent, ascending or horizontal, usually esorediate; upper side green, entirely smooth; lower side white, often yellow to orange towards the base; margin crenulate to deeply incised. Podetia numerous, laminal, erect, usually \pm cylindrical or widening in distal parts, sometimes longitudinally cracked; cups usually present, closed or perforated; sorediate from cups to base. Apothecia and pycnidia along the margins or proliferations of the cups. On decaying wood and bark (Abies grandis and Thuja plicata), and among mosses on moist rocks; usually in deep shade. Western (British Columbia to Montana).C. umbricola

15. Primary squamules to 5(-10) x 1-3(-4) mm. Podetia 3-5(-7) cm tall, 1-3(-4) mm wide; cups 3-4(-8) mm wide, the margin sinuate to dentate areolate to partly granular. Resembling C. digitata. Reports from N. America are misidentifications. (C. yunnana)

I-B Apothecia and pycnidia red; without cups

1. Containing usnic acid, yellow in color, KC+ yellow

(Stramineoflavidae). 2

1. Lacking usnic acid (or with it rarely as accessory substance), predominantly gray in color, usually KC-

(Subglaucescentes). 8

2. Podetia (and usually primary squamules) esorediate, corticate. 3

2. Primary squamules and/or podetia sorediate. 4

3a. Thallus K+ yellow, P+ yellow (thamnolic acid). Otherwise similar to *C. bellidiflora*. Washington. *C. sp.*

3b. Thallus K-, P-. 3b

3b. Podetia tall, densely squamulose. (*C. bellidiflora*)

3b. Podetia short, usually not densely squamulose. 3c

3c. Containing usnic, barbatic and didymic acids (rarely usnic lacking). Cartilaginous layer of wall of podetium not exposed. Primary squamules persistent, quite small, to 2-3 mm long; upper side yellowish to greenish-glaucous or ashy; underside white; esorediate. Podetia cylindrical, simple to sparingly branched, distinctly yellowish green to pale green or glaucous, sometimes dark green, with continuous cortex or \pm dispersed verrucules, the ecorticate part opaque and whitish; esorediate, sometimes squamulose. Apothecia sometimes pale yellowish or orange, quite large, on tips of podetia or branches. Pycnidia on primary squamules. K-, KC+ yellowish, P-. In old fields, especially on sandy soils, also on earthen banks, logs and stumps, and tree bases. Newfoundland W to Alberta, S to Arkansas and Florida, but rare S of the Carolinas. *C. cristatella* Tuck.

3c. Containing usnic, grayanic, 4-O-demethylgrayanic, congrayanic, and squamatic acids. Primary squamules 0.5-1 mm broad at maturity, esorediate or with few to relatively many granular soredia on the margins and lower surfaces. Podetia pale yellowish, to 1 mm thick, to 10(-14) mm tall, slender, to 1 mm thick, erect, simple or occasionally branched once or twice, corticate, smooth or areolate, with few or no squamules, flaring at the summit to 3 mm broad, the tops sometimes torn. Apothecia one to several, terminal. Pycnidia on primary squamules, erect, sessile or slightly stalked, 0.3-0.5 mm tall; conidia (5-)8-10(-13) \times < 1 μ m, straight to slightly bent or curved. Thallus K-, C0, KC-, P-. On sandy soil, North Carolina to Florida. *C. anitae* Culb. & C. Culb.

4. Podetia obconical, tending to be sorediate, cartilaginous layer of wall exposed occasionally. Three chemotypes: a) usnic,

squamatic and didymic acids, b) usnic, squamtic and barbatic acids, c) (very rare) squamatic, didymic and thamnolic acids. Primary squamules to 4 mm, numerous, often contorted, crenulate-incised, ± erect, not tinged orange at point of attachment; upper surface yellowish gray green; underside and sometimes upper side usually conspicuously very sorediate, the soredia farinose to granular. Podetia to 2-5 mm tall, infrequent, often deformed or produced from an extension of a squamule, ± flattened with a partly corticate-granular and sorediate surface. Apothecia frequent, usually sessile on upper surface and extended margins or squamules, more rarely on short podetia. On rotting wood, more rarely on acid soil in woodlands or on old cut surfaces of peat. Eastern, south to Florida. C. incrassata
Flörke

4. Podetia cylindric, cartilaginous layer of podetium not exposed; surface sorediate. Primary squamules sorediate. 5

5. Containing thamnolic (K+ P+, UV-) or squamatic acid (K-, P-, UV+) in addition to usnic acid. 6

5. Containing barbatic acid (K-, P-) in addition to usnic acid. Podetia ± simple. Wide ranging but not in Alaska 7

6. Containing squamatic acid (UV+; K-, P-) in addition to usnic acid. Primary squamules small; upper side yellowish-glaucous; lower side white, sorediate. Podetia cupless, slender, to 30 mm tall, terete, undivided to sparingly branched above, sorediose throughout, or the base and region near apothecia with a restricted cortex; yellowish-glaucous, occasionally squamulose and more corticate. Apothecia on tips of podetia. On soil, Kodiak Island, Alaska. C. pseudomacilenta

6. Containing thamnolic acid (UV-, K+ yellow, P+ yellow to red) and decarboxy thamnolic acid in addition to usnic acid. Similar to typical C. macilenta except in that the podetia are usually yellowish, containing usnic acid, and usually taller, more branched and more frequently tipped with apothecia. With few or no well developed cups. On rotten wood or at bases of trees in coastal woods in Washington and British Columbia (in NE Asia, it occurs on soil around hot springs on recent volcanic ground). C. vulcani

7. Podetia more or less corticate at least in patches throughout entire length, base entirely corticate; soredia granular-squamulose, 80 µm diameter. Containing barbatic acid plus accessory usnic and didymic acids and substance F; KC+ yellow. Primary squamules persistent, scattered or in depressed mats, small to middle-sized, to 2 mm long, undivided to crenate or slightly lobed; upper surface glaucous to olivaceous; underside white, to dark at base. Podetia slender, cylindrical, 4-10(-45) mm

tall, simple or sparingly branched in upper part; cortex variable, from smooth and unbroken to indistinct areolate, sometimes the areoles separated by narrow bands which may be opaque or \pm translucent, usually with granular soredia intermingled and more abundant in upper part; squamules sometimes present, resembling the primary ones. On rotten wood, logs, earth with humus, and on rocks in fissures containing soil rich in humus. Boreal-temperate, Great Lakes area to NE U.S., and southern Greenland.C. floerkeana

7. Podetia entirely decorticate above, base may be corticate; soredia farinose, to 40 μ m diameter. Exposed stereome opaque.

Apothecia rare, to 2 mm across, often imbedded in podetial tips. Containing barbatic, didymic and usnic acids with accessory F; KC- or KC+ yellowish. Primary squamules persistent, small to middle-sized, to 3 mm long, crenate to lobed; upper side glaucescent to olive-glaucous; underside white, to darker at base; esorediate or more commonly sorediate at margin and on underside. Podetia 10-20(-50) mm tall, commonly club-shaped, broadening slightly towards the blunt tip, rarely sharp pointed; usually covered with greenish farinose soredia, the base with only a very short corticate patch; white throughout after dispersal of soredia although in one form with yellowish K+ violet spots. On old logs, tree bases, earthen banks, and humus. Arctic-boreal to temperate, Alaska to SE Canada, S to Florida in the east, to Pacific NW (and further?) in the west. C. bacillaris Nyl. (treated by Purvis & James, 1992 as a synonym of C. macilenta)

8. K+ yellow, P+ red, containing thamnolic acid; podetia sometimes showing aborted cups at tip. 9

8. K-, P-, lacking thamnolic acid (K+ red-purple in C. bacillaris f. reagens). 13

9. Esorediate (or with occasional patches of soredia in C. ravenelii); surface of podetia smooth or verruculose.

Southeastern. 10

9. Sorediate (except C. macilenta f. corticata which is esorediate but not verruculose). 12

10 With broad yellow bands on the lower sides of the primary squamules, which are large and intricately branched, at most with marginal soredia; thallus grayish, K+ yellow, KC+ orange, P+ deep yellow to orange-red, containing thamnolic acid and bellidiflorin. Podetia poorly developed, corticate. Primary squamules persistent, forming depressed mats, to 5 mm long and 1 mm broad, irregularly crenate or lobulate, some with minute isidioid structures or granular soredia at tips; upper side glaucescent; underside with distinct yellowish or brownish median bands clearly marked off from the cream-colored margins. Podetia mostly 3-7 mm tall, with poorly developed and rudimentary cups or irregular cups with lacerate or

toothed edges, to 3 mm across; cortex continuous and of minute slightly elevated areoles separated by narrow grooves, esorediate; squamules rare. Apothecia all rudimentary. Pycnidia on primary squamules. On trees and logs. Fla. C. hypoxantha

10. Lacking yellow ventral bands on the primary squamules which are simple or little branched; containing didymic and thamnolic acids. 11

11. With occasional exposed patches of cartilaginous tissue on podetia; podetia short, turbinate, obconical, gradually widening from narrow base (resembling C. cristatella but not cylindrical). Thallus yellowish, corticate, K+ yellow, KC+ yellow-orange, P+ deep yellow to orange, UV+ white, containing thamnolic, didymic and squamatic acids. Primary squamules persistent, forming depressed mats, 1-3 mm long, ca. 1 mm wide, overlapping; margins crenate or lobulate; upper side glaucous green, pale brown where covered, not yellowish; underside white; esorediate. Podetia rarely over 10 mm tall, somewhat obconical, broadening from a cylindrical base, cupless; apices truncate or tipped with apothecia, undivided or sparingly branched in upper part; cortex usually continuous and smooth or minutely and irregularly verruculose; on some older podetia the cartilaginous layer partly exposed and translucent, on very short podetia the cortex may be lacking over larger areas; squamules present in greater or less abundance or absent, smaller than primary ones. Apothecia single or in coalescent clusters. Pycnidia on primary squamules. On humus and old logs, and often on Taxodium, Fla. C. abbreviatula Merr.

11. Cortex of podetia usually continuous, of crowded low verruculae; occasionally with patches of soredia; podetia well developed, often branched, cylindrical or with occasional cups, or circle of apothecia. Basal squamules persistent, at first minute, rounded, closely appressed, becoming divergent and forming depressed mats; lobes to 2-3 mm long and 0.5 mm wide, simple or sparingly divided, irregularly lobed or crenate, rounded at apices, sometimes the apices more finely divided and appearing isidioid or granular, often the entire primary thallus dissolving into sorediate masses; upper and lower sides similar, pale grayish, tinged with green. Podetia usually forming irregular cups with apothecia on marginal stipes, the cup sometimes being converted into an irregular whorl of branches, rarely forming regular cups which broaden out from a slender base with a circle of sessile apothecia on the entire margin, the largest cup 2.5 mm across; well developed podetia to 15 mm tall and 1 mm diam.; cortex continuous, of crowded areoles or low verruculae, sometimes the verruculae forming minuted squamules; some podetia with patches of coretes replaced by areas of granular soredia. Apothecia to 1-2 mm diam. and usually slightly lobate, on stipes on edges of cups or sessile on primary squamules. Pycnidia rare, on upper side of primary squamules. Thallus K+ yellow, KC+ yellow-orange, P+ deep yellow to orange, containing thamnolic and didymic acids. On logs and stumps and on weathered branches and

twigs. East coast, New Jersey to Fla. C. ravenelii Tuck.

12. Podetia mostly decorticate; stereome (cartilaginous layer) (often?) translucent where exposed; K+ yellow, KC+ yellow orange, P+ deep yellow to orange-red, containing thamnolic and didymic acids, and often accessory barbatic acid. Soredia granular. Primary squamules small to middle-sized, linear; upper side glaucescent to olivaceous-glaucous to pale; underside white; fragile; esorediate. Podetia 2-45 mm tall, to 3 mm broad, simple or sparingly branched, lacking cups, obtuse or subulate, often tipped with apothecia; base and part below apothecia corticate, pale to brownish; verrucules and squamules minutely isidioid; ashy or glaucescent-whitish, areolate, the base especially squamulose. Apothecia small or middle-sized, to 1.5 mm broad, single or clustered. Pycnidia rare, at tips of podetia. On old logs and sandy soil. East coast, New Jersey south to Alabama and Fla. C. didyma var. vulcanica (Zoll. & Moritzi) Vainio

12. Podetia varying from entirely corticate (f. corticata) to sorediose, cartilaginous layer not translucent where exposed; K+ yellow, KC+ orange-yellow, P+ yellow to red, containing thamnolic acid and accessory bellidiflorin, didymic, and barbatic acids, and substances F and G. Primary squamules persistent, small to middle-sized, to 4 mm long and 3 mm wide, lobate or crenate-lobate, flat or involute; upper side glaucescent to whitish or olivaceous-glaucous; underside white or the base darker, rarely yellowish brown; underside and margins granulose sorediate or esorediate. Podetia short to elongate, 5-42 mm tall, to 3 mm thick (in my experience, usually to 5 mm tall and 1 mm thick), cupless, simple or sparingly branched, the tip blunt or pointed, entirely sorediate or with base and area next to apothecia corticate, or with much of podetium corticate and amount of sorediate area reduced; soredia granular or farinose, whitish or pale greenish; cortex of grayish green areoles or verrucae. Apothecia often few or absent, to 2 mm diam. Pycnidia on primary squamules. On earth, road banks, old pastures, thin soil over rocks, rotten wood, and bases of trees (especially old Douglas firs, at least in Pacific NW). Newfoundland to Alaska, S across the U.S. from N. Carolina to California. C. macilentia

13. Primary squamules broad and thick, bearing soredia; podetia usually densely sorediate, green tissues flat rather than verruculose, denuded surface opaque, white, rough, or arachnoid, cartilaginous layer exposed only in very old specimens. 14

13. Primary squamules deeply lacinate, incised or crenate, esorediate; podetial surface at first with scattered squamules or verruculae, more or less interspersed with fine (granular according to Harris, 1990) soredia which soon disappear leaving translucent inner medullary layer

(sterome) exposed; K-, KC+ orange, P-, containing didymic and barbatic acids with accessory F. Primary squamules persistent or evanescent, 2-4 mm long and split up into crenulate or lobulate laciniae which are narrow, to 0.5 mm wide; upper side glaucous to olivaceous; underside chalky white with older parts darker; flat and appressed, or when dry reflexing to expose underside; esorediate or rarely with isidioid branchlets. Podetia cupless and terete, 10(-50) mm tall, tipped with apothecia, or sterile and tapering to blunt or sharp points; fine soredia and coarser granules scattered or crowded; with occasional patches of cortex but over major part of podetium the cartilaginous layer exposed, white to pale, or dark brown and translucent; sometimes with scattered squamules resembling primary ones. Apothecia to 2 mm diam., on tips of podetia. Pycnidia on tips of sterile podetia. On logs, stumps, rocks, and soil rich in humus, Eastern, Massachusetts to Wisconsin, S to Fla., W. to Colorado; Mexico. C. didyma (Fée) Vainio var. didyma

14. Podetia more or less corticate, at least in patches throughout entire length, base entirely corticate; K-, KC+

orange, P-, containing barbatic with accessory usnic and didymic acids plus F. Primary squamules persistent, scattered or in depressed mats, small to middle-sized, to 2 mm long, undivided to crenate or slightly lobed; upper side glaucous to olivaceous; underside to dark at point of attachment; esorediate or the apices slightly granular sorediate. Podetia slender, cylindrical, 4-10(-45) mm tall, unbranched or sparingly branched in upper part; cortex variable, from smooth and unbroken to indistinct areolate; some podetia with areoles separated by narrow bands which may be opaque or \pm translucent; most with granular soredia intermingled with areoles and more abundant on upper part; squamules sometimes present, resembling primary ones. Apothecia tipping podetia. Pycnidia on upper side and margins of primary squamules, rarely also on podetia. On rotten wood and logs, on earth with humus, and on rocks in fissures containing soil rich in humus. Eastern (Quebec to Minnesota, S to Mississippi and Florida). C. floerkeana

14. Podetia entirely decorticate above; base may be corticate;

K-, KC- or + yellowish, P-, containing barbatic acid plus accessory didymic and usnic acids and F. Primary squamules persistent, small to middle-sized, to 3 mm long, crenate to lobed; upper side glaucescent to olive-glaucous; underside white to darker at base, esorediate or more commonly sorediate at margins and on underside. Podetia 10-20(-50) mm tall, commonly broadening slightly to the blunt tip, club-shaped, rarely sharp-pointed, usually covered with greenish farinose soredia, white throughout after dispersal of soredia, sometimes with whitish K+ violet spots. Apothecia small to medium-sized, to 2 mm across, often imbedded in tips of podetia. Pycnidia on surface and margins of primary squamules. On old logs, humus and tree bases, sometimes on old road banks. Over entire continent, Alaska across

Canada and U.S., S to Florida. C. bacillaris Nyl.

ADD:

Primary thallus persistent, consisting of elongate, incised, suberect to imbricate, green squamules, 2-5 mm long and 0.5-1 mm wide; underside arachnoid, white, turning orange-yellow at the very base, occasionally an orange streak extending higher up; rhizomorphs of hypothallus orange, often clearly visible in the soil, extending several cm outward from the squamules. Often forming large, conspicuous patches of richly fertile podetia and well-developed cushions of squamules. Podetia when mature (fertile) 0.5-1.5 cm tall, rather stout, 0.5-2 mm thick, sometimes absent and apothecia sessile on squamules, simple to sparingly branched, ascyphose but sometimes with scyphoid axils. Surface of podetia greenish gray (rarely browning), rather smooth, areolate-corticate or, more frequently, verruculose-granulose to heavily microsquamulose, esorediate, with few decorticate patches. Conidiomata on basal squamules, sometimes on the podetial microsquamules near tips of podetia, usually fairly large, 0.2-0.4 x 0.15-0.2 mm, ampullaceous, sessile to shortly stalked, containing red slime; conidia 8-10 x 1 µm. Hymenial discs very common, purple-red, coalescent to form 2-5 mm wide compound discs, initially with tiny, often darker red, botryose ascogonial primordia (trichogynes visible) at tips of very young podetia; spores 11-12 x 5 µm, simple, oblong. Thallus K+ yellow, P+ yellow, containing thamnolic and didymic acids as constant major secondary substances and inconstantly traces of usnic (rarely), decarboxythamnolic, conididymic and subdidymic acids. On bare to humus-covered soil, more rarely on rotting wood or tree bases, in submesophilous oak-pine woodlands or sometimes in treeless mountain pastures. Mexico, Arizona. C. jaliscana Ahti & Guzman-Davalos