SECTION 2--LOBATE OR DWARF FRUTICOSE.

2-A. Thallus yellow, orange, or red, K+ strong red-violet.

After Wetmore & Kaernefelt 1998

1. Thallus subfruticose or stipitate-areolate. ..... KEY 2-A-1 Subg. Polycauliona

1. Thallus with ± distinctly radiating marginal lobes, forming rosettes; thallus units ± flattened. Subg. Gasparrinia.. 2

2. Thallus sorediate or isidiate. [If thallus squamulose or only very vaguley short-lobed, see key to C. citrina group under non-lobed species (separate document)] ..... KEY 2-A-2 C. decipiens/C. granulosa, etc. group

2. Thallus not sorediate or isidiate. [if thallus squamulose or only very vaguely short-lobed, see keys to C. marina group and C. squamosa groups, under non-lobed species (separate document)]. ..... KEY 2-A-3 C. saxicola group

Key 2-A-1 On rock (or soil);
Thallus dwarf fruticose, ± orange, K+ strong red-violet
Subg. Polycauliona

1. Thallus lobes becoming subfruticose, more appressed, not "stereocauloid", without celluar cortex; medulla I-. On seacoast rocks just above normal high tide. 2

1. Thallus becoming stipitate-areolate, when well developed "stereocauloid", with cellular cortex; medulla I+ blue. On inland rocks or soil, in the mountains. Spores 20-26 x 15-20 um. Thallus composed of short, pale, round, slender, erect, clustered branches, crowded into a papillate orange-yellow (to red-orange?) crust, blackening below. Apothecia 0.7-1.3 mm diam., sessile; disc flat, powdery, dull brownish yellow; exciple thick, crenulate, concolorous with thallus. Spores oblong-ellipsoid. On soil or rock. Wyoming, Colorado; California?; probably elsewhere in the west. .....C. cladodes

2. Thallus dark orange; lobes 0.3-0.5(-0.7) mm diam., smooth; pseudocyphellae obvious, sunken. Baja California. ..... C. thamnodes

2. Thallus yellow-orange; lobes 0.2-0.4 mm diam., rough with lumps; pseudocyphellae absent or less obvious. Thallus to 2 cm diam., appearing as rather dense to very loose cushions; branches linear, terete, nodulose, dichotomous to subdichotomous, erect to arched outwards, or sometimes almost prostrate, 2-3(-8) mm long, loosely attached and sometimes rising from substrate, solid or in old parts sometimes hollow, bright yellow to orange-yellow, mat; prothallus sometimes present around base of branches, yellow and thin. Apothecia fairly common, absent to abundant, sometimes crowded, zeorine, terminal or lateral on branches, sub-pedicellate, 0.3-1(-2) mm across, round to irregular; disc concave to convex, dark orange; proper exciple raised then level, moderately thick, (25-)50-100(-125) um, concolorous with disk; thalline margin mostly present initially, to 175 um thick, later partly or completely excluded, concolorous with thallus. Spores ellipsoid, 9.5-14.5 x 4.0-6.5 um; septum mostly very thin, ca. 0.5 um, but some spores with septum 1.5-2.5(-4.8) um. California to Oregon, and Baja California. .....C. coralloides

2-A-2. Thallus lobate or squamulose, ± orange, K+;
Subg. Gasparrinia s. str.

2-A-2
Thallus with soredia, isidia, papillae, or phyllidia.
C. decipiens/C. granulosa, etc. group

1. Lower surface corticate, loosely appressed. ..... (see Xanthoria)
1. Lower surface lacking cortex or nearly so. 2
2. Fine soredia present, without isidia, papillae, or phyllidia. 3
2. Fine soredia absent, with isidia, papillae, or phyllidia. 6
3. Marginal lobes small and indistinct; soralia craterform or punctiform and eroding. Sonora. ..... C. cupulifera (Vainio) Zahlbr.
3. Marginal lobes large and distinct; soralia not crateriform. 4
4. Soredia originating from center of thallus laminally, greenish orange when fresh. Primarily on calcareous rock, on inclined and vertical, hard surfaces, in sheltered and often dry and shaded situations. Reported from Vermont, S. Dakota, Iowa, Texas, California; many reports are probably misidentifications. .....C. cirrochroa
4. Soredia orginating from tips of lobes, same color as thallus. 5
5. Thallus moderate in diam. (5-20 mm or more), lobes broad (0.4-1.0 mm). On ± calcareous rocks, walls, mortar, etc., California, through the Great Basin, to North Dakota. .....C. decipiens
5. Thallus small in diam. (1-2 mm), lobes narrow (0.1-0.2 mm). 5a

5a. Thallus not areolate in the center; lobes forming a more regular radiating pattern; soredia confined to lobe tips. Inland. S. California. ..... C. stellata Wetm. & Kaernef.
5a. Thallus areolate in the center; lobes rather irregularly arranged; soredia spreading to laminal areas of lobe surface. Coastal. On non-calcareous rocks, Baja California. ..... C. pygmaea Wetmore

6. Lobes strongly convex; cortex not paraplectenchymatous; globose isidia present. On exposed, strongly nutrient-enriched, siliceous or basic seacoast rocks (rarely on timber of coastal fenceposts), Pacific Northwest to Alaska. Lobes 0.5-1.0 mm wide. Spores usually narrowly ellipsoid with parallel sides, 12-14 x 5-6 um; septum 1-3 um wide. .....C. verruculifera
6. Lobes flat at tips; cortex paraplectenchymatous; paipillae or phyllidia present. 7
7. Thallus with small laminal papillae; lobes thin (85-100 um). ..... C. brouardii
7. Thallus with phyllidia on central areoles; lobes thick (175-240 um). Baja California Sur, Chihuahua. ..... C. texana Wetm. & Kaernef.

Not treated by Wetmore & Kaernefelt:

Thallus coarsely granulate to weakly lobate. Prothallus mostly present and prominent yellow; areoles ± convex, incised at base; granules often present, coarse; soredia 36-46.8 um diam.,

concolorous with thallus. Apothecia farily common, 0.5-1.5 mm diam.; thalline margin often present, crenulate; spores 11.7-14.3 x 4.9-6.8 um (L:W = 1.86-2.72); septum 3.1-4.7 um 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, dscrete 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, concolorosu with or mostly somewhat darker than thallus; proper amrgin rather thin. On acidic, calcareous or ultramafic rocks, occasionally on driftwood, usually on sun-exposed, horizontal or somewhat sloping surface, occasioanlly on vertical or more protected parts, supralittoral to supralittoral fringe, often associated with Verrucaria maura, on at most weakly manured rocks. Pacific coast. Southern Alaska to northern California. [= Caloplaca sp. 3 of Ryan, 1988). ..... C. flavogranulosa Arup.

Lobes to 2 mm; rosettes to 1.5 cm; cortical cells not or only weakly cemented. On sheltered calcareous rocks in inland areas, circumpolar arctic to temperate. Thallus forming closely adpressed ± rounded thalli, yellow to orange, the margin of short, convex lobes, centrally ± granular-areolate; lobes to 2(-3) x ca. 0.5 mm, convex, ± contiguous, divided by furrows, palmately branched. Isidia abundant, variable in size, to 0.1 mm diam., spherical, usually ± obscuring centrer of thallus as a granular-areolate crust. Apothecia to 1 mm diam., scattered, rounded, ± sessile, constricted at base; disc concave then convex; thalline margin smooth, swollen, later granular-crenulate. Paraphyses broadened towards tips, apical cell to 8 um diam. Spores 11-13 x 7(-9) um, broadly ellipsoid; septum 3-6 um wide, ca. 1/4-1/2 length of spore. .....C. granulosa

2-A-3. Thallus yellow to red, K+;
Thallus without soredia, isidia, papillae, or phyllidia.
With distinct, ± elongated radiating lobes, forming rosettes
C. saxicola Group

1. Thallus usually heavily white pruinose; internal areoles well developed nearly to margin. Minnesota, Arizona, Texas, Oklahoma. ..... C. galactophylla

1. Thallus not pruinose or only slightly so. 2

2. Lobes flat, thin, laterally touching, indistinctly separated from each other, tips lighter yellow; internal areoles not well developed. On calcareous rocks, Texas and Colorado; eastern Mexico. ..... C. eugyra

2. Lobes convex, thick, not laterally touching or at least distinct; internal areoles always produced. 3

3. Thallus uplifted from substrate, with lower cortex. ..... Xanthoria elegans

3. Thallus attached to substrate, not uplifted, without lower cortex. 4

4. Thallus with thick, convex, linear, irregular lobes with warty surface. On rocks, very common in open, dry sites throughout much of the intermontane west. Montana, Wyoming, Nevada, etc. .....C. trachyphylla

4. Thallus with narrow or short lobes with smooth surface. 5

5. Occurring only on littoral or maritime rocks (HCl+ or -), near the high tide line; cortex of anticlinal hyphae. 6

5. Not restricted to littoral or maritime rocks; cortex distinctly paraplectenchymatous. 7

6. Found along coast of western North America. California to southern Oregon. ..... C. brattiae

6. Found along coast of eastern N. America. Rare, on seashore rocks manured by birds. New Brunswick, Newfoundland, Nova Scotia, Quebec, Maine, Massachusetts, Rhode Island. Report from British Columbia is based on misidentification of C. marina. ..... C. scopularis

7. Apothecia originating immersed near tips of lobes; lobes short; thallus small. ..... C. saxicola

7. Apothecia not originating immersed; not near lobe tips. 8

8. Lobes convex, not broadening at tips, usually bright red; spore isthmus 2-3 um. On acidic rocks, sometimes extending into upper supralittoral zone. Baja California. ..... C. ignea Arup

8. Lobes flat at tips or folded, not convex, usually yellow-orange or orange; spore isthmus 4-7 um. 9

9. With granules in medulla, some soluble in K, other insoluble in K; lobes appressed to substrate; lobe tips not yellow pruinose. 10

9. Without granules or crystals in medulla; lobe tips often yellow pruinose. On volcanic rocks, or occasionally on serpentine, sometimes in the supralittoral zone. Coastal California to Baja California. ..... C. impolita Arup

10. Apothecia common; disc often red; spore isthmus 5.5-7.0 um; oval cells in parathecium; usually without convex areoles and no phyllidia in center of thallus. Sonora, Sinaloa. ..... C. appressa Wetm. & Kaernef. ined.

10. Apothecia rare; disc orange; spore isthmus 4.0-5.5 um; radiating hyphae in

parathecium; with convex areoles and phyllidia in center of thallus. Texas. ..... C. texana Wetmore & Kaernef..

Not Treated by Wetmore & Kaernefelt

Thallus usually areolate to squamulose, the squamules with effigurate margins; marginal lobes almost always absent. Apothecia usually numerous, to 1 mm wide; discs concave; proper margin thickish; hymenium (60-)70-90 um high; subhymenium 70-340 um; spores (9-)10.5-15.0(-19.5) x (3.7-)4.5-6.5 um; septum (1.8-)2/5-4/5(-5.2) um. California to British Columbia. .....C. marina subsp. americana Arup

Thallus large to very large; spores 10-15 x (5-)8-11 um; lobes narrow but flat, deeply divided. Thallus forming bright orange, closely adpressed, rounded or palmate patches; lobe ends 0.3-0.7 mm broad, convex, finger-like, contgiuous, divided by frequently parallel furrows; central area convex-areolate. Apothecia to 0.8 mm diam., mostly confined to central area, usually scattered; thalline margin orange, ± excluded when old; discs brownish orange, flat then convex. Paraphyses lax, mostly forked towards tips, which are slightly swollen. Spores swollen, ellipsoid to rhomoboid or lemon-shpaed; septum 4-5 um wide, 1/3-1/2 length of spore. On acid, rocky seashore, mesic to submesic supralittoral zones, more rarely on calacersous cliffs near the sea, often with C. marina but in often in more sheltered situations. North American reports are misidentifications. (Xanthoria parietina also keys out here). ..... [C. thallincola]

Spores swollen, orbicular-rhomboid to lemon shaped, clearly inflated, 10-13 x (7-)8-10(-12) um; septum 5(-8) um; ends of paraphyses not capitate; large species (rosettes to ca. 5 cm). Thallus forming large, closely adpressed, partially or entirely rounded thalli to 12 cm across, ususally ± zoned or piebald; lobe ends rounded and flat, without furrows, bright orange-yellow, the interior frequently paler or white due to loss of pigment, the central area ± cracked-areolate, in part brownish orange due to apothecia. Apothecia to 1(-1.5) mm diam., confined to central area, usually abundant and crowded, falt with distinct orange=yellow thalline exciple, often becoming ± convex and ± immarginate when old; disc orange-brown, deeper colored in strong light. Paraphyses 1-2 um thick, slender and ± straight, septate, not or only slightly swollen at tips. On well-lit limestones in nutrient-rich habitats. Colorado. .....C. aurantia

Detailed Descriptions of Species

[Shorter descriptions need to be expanded using Wetmore & Kaernefelt.

C. appressa Wetmore & Kaernef.

Thallus yellowish orange to orange, areolate in center, with rather convex, shiny areoles, distinctly lobed at margins, slightly broadening at tips, slightly linearly folded, sometimes branching, usually tightly appressed to rock, terminal lobes 0.7-2.0 mm, total lobes 1-3 mm long, 0.4-1.0 mm wide, prothallus none. Cortex paraplectenchymatous, 7-35 um thick, cells 5-7 um, without epinecral layer, algal layer continuous but uneven, medulla dense, with granules dissolving in K and crystals insoluble in K.

Apothecia sessile to substipitate, with thin thalline margin, disk reddish orange, flat to convex, parathecium with oval cells, hymenium 70-84 um, tips of paraphyses with 2-3 swollen cells, some branching. Spores 11-14 x 5.6-7.0(-8.5) um.

Pycnidia red, conidia 3.6-4.8 x 1.2 um.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

C. brattiae W. A. Weber

Thallus to 2 cm across, forming rosettes, often coalescing; thallus center verruculose to areolate or covered with apothecia, 0.15-0.25(-0.40) mm thick; margin consisting of radiating lobes, 0.8-2.6 x 0.15-0.5(-0.7) mm, strongly convex to subcylindric, not or only slightly wider toward tips, mostly even, straight and simple or more often irregularly branched, divided by deep narrow furrows. Apothecia few to abundant, sometimes lacking, scattered to crowded, zeorine, raised to almost stipitate, developing in globular projections on lobes and inner parts of thallus, 0.4-1.4 mm, round to irregular; disk concave to ± plane, sometimes flexuose, deep golden- to orange-yellow, sometimes with brownish tinge; proper margin fiarly thick, 50-100 um, mostly raised above and concolorous with disk; thalline margin excluded to thick and prominent, 0-125 um thick, initially even, later crenulate, rough or cracked, yellow. Spores narrowly ellipsoid, (9.7-)10.0-12.8(-13.6) x (3-6)4.2-5(5.8) um; septum (2.2-)2.4-3.4(-4.6 um). California to southern Oregon.

C. brouardii (de Lesd.) Zahlbr.

Thallus orange to yellowish orange, areolate in center, lobed at margin, lobes radial or irregular, flat, terminal lobes 0.5-1.5 mm, total lobes 0.5-1.5 mm long, 0.3-0.5 mm wide, frequently with numerous small papillae scattered on upper surface, prothallus none. Cortex paraplectenchymatous, 20-30 um thick, without epinecral layer, algal layer continuous.

Apothecia rare, sessile, 0.3-0.5 mm diam., margin fairly thick, flush with disk, disk similar in color to thallus, parathecium with oval cells, hymenium 63 um, tips of paraphyses hardly swollen, with few branches. Spores 11-14 x 5.5-7.0 um, isthmus 3.5-4.0 um.

Pycnidia with orange ostioles, conidia 3.6-4.2 x 1.2-1.5 um.

Major pigment parietin, small amounts of emodin, fallacinal, and teloschistin. Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

Mainly on shaded acidic rocks. Arizona, western Texas, Baja California, and Mexico.

C. cirrochroa (Ach.) Th. Fr.

Soredia originating from center of thallus laminally, greenish orange when fresh. Soralia

orbicular, laminal, towards center of thallus, lemon yellow (much more yellow than the thallus); thallus rosettes to 1 cm wide, but often coalescing to 5 cm across, irregularly rounded or small scattered or ± contgiuos thalli, dirty or brownish orange. Lobes narrow, finger-like, closely adpressed, divided; the tips often ± pruinose and paler orange; lobe ends 0.2-0.5 mm wide, rounded, forked, shallowly convex, elongated, ± contgiuous, separated by almost parallel-aligned furrows. Soralia scattered, flat, ulcer-like, rounded, to 0.8 mm diam.; soredia farinose. Apothecia rare, to 0.5 mm diam., scattered, flat; thalline margin persistent, oragne; disc deeper orange. Paraphyses flexuose, mostly not swollen at tips. Spores 10-15 x 5 um, narrowly ellipsoid; septum 2-3 um wide, under 1/3 length of spores. Primarily on calcareous rock, on inclined and vertical, hard surfaces, in sheltered and often dry and shaded situations. Reported from Vermont, S. Dakota, Iowa, Texas, California; many reports are probably misidentifications

C. cladodes (Tuck.) Zahlbr.

Thallus composed of short, pale, round, slender, erect, clustered branches, crowded into a papillate orange-yellow (to red-orange?) crust, blackening below. Apothecia 0.7-1.3 mm diam., sessile; disc flat, powdery, dull brownish yellow; exciple thick, crenulate, concolorous with thallus. Spores oblong-ellipsoid, 20-26 x 15-20 um. . On soil or rock. Wyoming, Colorado; California?; probably elsewhere in the west.

C. coralloides (Tuck.) Hulting

Thallus yellow-orange; lobes 0.2-0.4 mm diam., rough with lumps; pseudocyphellae absent or less obvious. Thallus to 2 cm diam., appearing as rather dense to very loose cushions; branches linear, terete, nodulose, dichotomous to subdichotomous, erect to arched outwards, or sometimes almost prostrate, 2-3(-8) mm long, loosely attached and sometimes rising from substrate, solid or in old parts sometimes hollow, bright yellow to orange-yellow, mat; prothallus sometimes present around base of branches, yellow and thin. Apothecia fairly common, absent to abundant, sometimes crowded, zeorine, terminal or lateral on branches, sub-pedicellate, 0.3-1(-2) mm across, round to irregular; disc concave to convex, dark orange; proper exciple raised then level, moderately thick, (25-)50-100(-125) um, concolorous with disk; thalline margin mostly present initially, to 175 um thick, later partly or completely excluded, concolorous with thallus. Spores ellipsoid, 9.5-14.5 x 4.0-6.5 um; septum mostly very thin, ca. 0.5 um, but some spores with septum 1.5-2.5(-4.8) um. California to Oregon, and Baja California

C. cupulifera (Vainio) Zahlbr.

Thallus yellowish orange, 70-85 um thick, areolate, with slightly lobed marginal areoles, thallus margin thinning, terminal and total lobes 0.3-0.4 mm long, 0.2-0.3 mm wide, prothallus none. Thallus with small laminal or marginal crateriform eroding soralia, 0.2-0.4 mm diam., soredia 17-34 um. Cortex paraplectenchymatous, 21-28 um, algal layer continuous, medulla dense.

Apothecia and pycnidia unknown.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

On deeply shaded acidic rocks, Baja California Sur, Chihuahua, Michoacan, Sinaloa, Sonora.

C. decipiens (Arnold) Blomb. & Forss.

Thallus moderate in diam. (5-20 mm or more), lobes broad (0.4-1.0 mm). Soralia lip-

shaped to capitate, on the margins and lobe tips (partly in the interior of the thallus), often spreading along the areoles, only slightly yellower than the thallus; thallus continuous to centerally areolate, producing ± rounded rosettes to about 2.5-3 cm wide, greenish yellow (shade) to deep orange-yellow. Lobes closely contiguous, adpressed; lobe ends to ca. 1 mm wide, convex, ± densely pruinose, palmately branched. Soredia minutely granular. Apothecia occasional, to 1.0 mm diam.,; thalline margin swollen, pesistent; disc concave at first, becoming rounded, constricted at base and flat when mature, orange. Paraphyses lax, simple, most tips broadeneed, apical cells 2-6 um wide. Spores 10-15 x 5-8 um, ellipsoid; septum 2-3 um thick,ca. 1/4-1/3 length of spore. Chem.: emodin, parietin, xanthorin, fallacinal. On ± calcareous rocks, walls, mortar, etc., California, through the Great Basin, to North Dakota.

C. eugyra (Tuck.) Zahlbr.

Thallus orange-yellow, paler at lobe tips and lightly whitish pruinose, pruina sometimes better developed in some specimens, center of thallus areolate, margin lobed, lobes flat, closely appressed on the rock surface and each other, 90-230 um thick, terminal lobes 0.5-2.0 mm, total lobes 1.5-5.0 mm long, 1 mm wide, broadening at the tips, prothallus absent. Cortex paraplectenchymatous, with scattered algae reaching surface, medullary hyphae loose, with abundant crystals insoluble in K.

Apothecia not abundant, scattered in central portions, disk darker orange than thallus, flat, 0.5-1.0 mm diam., with thalline margin, hymenium 60-70 um high. Paraphyses tips with 1-2 slightly swollen cells, with few branches. Spores 10.0-12.5 x 3.5-5.5 um, isthmus 3 um.

Pycnidia dark orange, conidia 3.6-4.2 x 1.2 um.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

On calcareous rocks, Kansas to Texas and southern Mexico.

C. galactophylla (Tuck.) Zahlbr.

Thallus dirty orange to white, tips or whole thallus white pruinose, cracked areolate in the central part, with marginal lobes slightly convex, terminal lobes short, 0.5-1.5 mm, total lobes 1.0-2.5 mm long, 0.3-0.8 mm wide, 115-230 um thick, prothallus none. Cortex paraplectenchymatous, medulla of dense hyphae without crystals.

Apothecia abundant in central parts of thallus, immersed when young, with thin thalline margin, 0.4-0.8 mm diam., disk flat, darker orange, hymenium 40-70 um thick, tips of paraphyses with 2-3 slightly swollen cells, somewhat branched. Spores (10-)11.0-12.5 x 5.5-7.0 um, isthmus 3-4 um.

Pycnidia orange, conidia 3.6-4.2 x 1.0 um.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

Mainly on calcareous, rather exposed rocks, occcasionally on acidic rocks. Minnesota and Wisconsin, south to Texas and southern Mexico.

C. ignea Arup

Lobes (0.5-)1.0-2.0(-3.5) mm long, (0.1)0.3-0.5(-0.7) mm wide; cortex mostly 30-50 um. Apothecia ± plane; spore septum (1.8-)2.2-3.0(-3.7) um; proximal cells of excipulum wide and thin-walled. Thallus to 1.5(-2.5) cm across, often coalescing, forming rosettes or of irregularly arranged lobes ad areoles, verruculose to areolate in center or covered with apothecia; marginal lobes radiating, moderately convex to rather flat, mostly convex at base, flatter and broader toward tips, 0.1-0.3 mm thick, sparingly branched, mostly close together, divided by narrow

furrows; surface smooth, slihgtly shiny, orange, apricot orange to orange-red, occasionally almost red, sometimes with brownish tinge, often with paler lobe tips, occasionally with a thin white pruina; prothallus lacking. Apothecia often present, sometimes abundant, zeorine, scattered to crowded, initially sessile but soon raised, 0.3-0.8(-1.2) mm, round to irregular; disc ± plane, orange to orange-red, mostly darker than thallus; proper margin mostly rather thin, (25-)40-75(-100) um, slightly raised to level with disk,; thalline margin thin to thick, sometimes excluded, 0-75(-125) um, even to crenulate, surfaces smooth. Spores ellipsoid, (9.2-)9.6-12.8(-13.4) x (4.2-)5.0-6.2(-6.6) um. On acidic rocks, sometimes extending into upper supralittoral zone. Baja California.

C. impolita Arup

Thallus to 2.0(-4.5) cm, often coalescing, forming rosettes or irregularly organized, verruculose to areolate in center or covered with apotheica; marginal lobes radiating, 1-3(-5) x (0.2-)0.4-1.0(1.5) mm, convex at base but flat and broad, often fan-shaped toward tips, 0.1-0.3(-0.45) mm thick, sparingly branched, mostly close together or somewhat overlapping, often slightly folded lengthwise; surface mat, coarsely yellowish pruinose. Apothecia often present, sometimes abundant, zeorine, scattered to crowded, initially sessile but soon very shortly stalked, 0.4-1.2(-1.6) mm, round to irregular; disk ± plane, yellow-orange, pale orange to orange, mostly darker thant thallus; proper margin mostly rather thin, 25-70 um, slightly raised or mostly level with disk. Spores ellipsoid, (9.6-)10.8-14.4(-16.2) x (4.2-)4.5-6.3(-6.8) um; septum (2.5-)3.6-5.6(-6.0). On volcanic rocks, or occasionally on serpentine, sometimes in the supralittoral zone. Coastal California to Baja California.

C. pygmaea Wetmore

Thallus orange, areolate; areoles undulating, notched, developing short lobes, intially sorediate on margins, soredia spreading to lobe surface, terminal lobes 0.1-0.3 mm, total lobes 0.2-0.5 mm, 0.1-0.2 mm wide; soredia granular, 45-60 um, lighter orange than thallus. Thallus cortex 7-15 um with small cells, algal layer continuous, medulla dense; no prothallus or occasionally with a slight thin white prothallus. Apothecia scattered, sessile, round, flat, 0.3-1 mm diam.; disk orange, thalline margin usually absent at top of apothecium, proper margin orange like disk, flush, margin not sorediate. Epihymenium dark golden; hymenium 55-80 um; algae in outer margin, indefinite cells under hypothecium, indistinct cells in parathecium. Tips of paraphyses with 1-2 very slightly swollen cells, with frequent branching. Spores 11-14 x 5.5(-7) um, isthmus 3-4 um. Pycnidia rare, immersed, ostioles orange, conidia bacilliform, 3-3.6 x 1.2 um. Thallus K+ red, C-, I-, epihymenium K+ red, C-. On non-calcareous rocks, coastal, Baja California.

C. saxicola (Hoffm.) Nordin

Need to modify description below according to Wetmore & Kaernefelt

Lobes 0.5-1.0 mm long (to 1.5-2 on calcareous rock), to 0.5 mm wide (to 1.5 mm according to Laundon); cortex rather thin. Apothecia mostly convex. Spore septum (1.4-)2.5-4(-4.2) um wide, ca. 1/5-1/4(-1/3?) length of spore. Proximal cells in excipulum rather small and rather thick-walled. Thallus yellow to deep orange (or red-orange?). Lobes irregular or radiating; thallus cortex with large cells. Lobes smooth to granular, often ± densely white-pruinose (not according to Wetmore), finger-like to broad but not broadened and flattened at tips.

Thallus forming closely adpressed, ± rounded, rosette-like patches; lobes ± contiguous, convex, sometimes divided by furrows; thallus center extensive, of convex granules. Apothecia to 1.0 mm diam., abundant crowded, usually obscuring thallus center; margin conspciuous, yellow to orange, excluded when mature; disc orange to brownish orange, flat then convex. Paraphyses tips capitate, 6-8 um diam. Spores (8-)10-16 x 5-7(-8) um, ellipsoid; septum often poorly developed. An extremely variable species as presently circumscribed. Chem.: emodin, parietin, xanthorin, fallacinal. On both calcareous and acid rocks, nitrophilous, often on vertical surfaces, often in dry, sheltered situations, temperate to circumpolar. Apparently very common and widespread at least in the west, but material identified as this species is extremely variable, and may include other species. Some forms are rather difficult to separate from forms of Xanthoria elegans.

C. scopularis (Nyl.) Lettau

Thallus to 1.5 cm diam., often coalescing to cover larger areas, growing radiately in rounded rosettes, verruculose to areolate in center or covered with apothecia, 0.15-0.3(-0.45) mm thick; margin consisting of radiating lobes, 0.3-2.0 x 0.15-0.6 mm, strongly convex but flatter and broader toward tips, mostly uneven, straight and simple or more often irregularly branched, divided by deep narrow furrows; upper surface matt, yellow to yellowish orange or more rarely deep orange; prothallus very rare, poorly developed, white to yellow; cortex with anticlinally arranged hyphae; medulla in cross section with periclinally arranged hyphae in lower part and clusters of algal cells divided by ± anticlinally arranged hyphae in upper part.

Apothecia rarely lacking, mostly abundant, zeorine, scattered or mostly crowded, initially sessile but soon raised to very shortly stalked, 0.4-1.2(-1.8) mm diam., round to irregular; disk plane to convex but sometimes flexuose, yellowish orange to orange, more rarely yellow or reddish orange, concolorous with or darker than thallus; proper margin mostly rather thin, 25-75(-100) um, slightly raised or level with disk, consisting of radiating, thick-walled, tightly packed hyphae; thalline margin very thin and inconspicuous to moderately thick and prominent, to 100 um, even to flexuose or rarely crenulate, the surface sometimes cracked; hymenium (75-)80-90(-100) um high, hyaline; hypothecium (30-)70-140(-160) um high, hyaline; paraphyses mostly simple but occasionally branched once above, 1-2 um broad, somewhat monilliform in upper part, the tips capitate, 3-6 um broad; asci cylindrical, 12-14 x 52-68 um; spores 8, polaribilocular, ellipsoid, (9.8-)11.2-14.8(-15.6) x (4.7-)5.0-6.5(-7.2) um; septum (3.0-)3.3-5.0(-6.0) um.

Pycnidia very rare, immersed, orange; pycnospores ellipsoid, 2.8-4.0 x 1.2-1.5 um.

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

On non-calcareous rocks, especially on sunny, manured surfaces, middle suipralittoral zone (or somewhat lower) on seashore. New Brunswick, Newfoundland, Nova Scotia, Quebec, Maine, Massachusetts, Rhode Island.

C. texana Wetmore & Kaernef.

Thallus orange in center, yellowish at tips, areolate in center, central portions with abundant phyllidia 0.2 mm diam., lobed at margin, lobes delimited at edge, dendritically branched several times, flat and broadening at tips, laterally appressed to each other, 170-240 um thick, terminal lobes 0.3-1.0 mm, total lobes 1-4 mm long, 0.4-0.8 mm wide, prothallus none. Cortex paraplectenchymatous, 15-60 um thick, algal layer continuous or uneven, medulla of

dense hyphae, with granules and crystals insoluble in K.

Apothecia usually rare, to 0.5 mm diam., sessile, flat, margin flush to slightly raised, thalline margin concolorous with thallus, thin inner margin same color as disk, disk dark orange, epihymenium golden, parathecium with radiating hyphae with somewhat enlarged and elongated cells, hymenium 70-80 um, paraphyses with 2-3 slightly swollen tip cells, unbranched. Spores 12.5-14.0 x 5.5-7.0 um, isthmus 4.0-5.5 um.

Pycnidia orange, conidia 3.6-4.2 x 1.2 um.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

On shaded non-calcareous rocks, at 1,200-2,100 m elevation. Texas, northern Mexico.

C. thamnodes Poelt

Thallus subfruticose, dark orange, not areolate in center, 3-5 mm tall, lobes branching up to 3 times, surface smooth, with slightly sunken pseudocyphellae, lobes 0.5-1.5 mm long, 0.3-0.5 mm wide, prothallus none. Cortex of dense irregular hyphae, 20-125 um thick, overlying dense clusters of algae and mixed medullary hyphae.

Apothecia not uncommon, to 1.5 mm diam., thalline margin and disk same color as thallus, disk flat, parathecium with radiating hyphae, hymenium 70-80 um thick, paraphyses tips not swollen or with one cell slightly swollen, without branches. Spores 10-14 x 5.0-5.5 um, isthmus 1.5-3.0 um.

Pycnidia not seen.

Thallus and epihymenium K+ red, C-, I-; medulla K-, C-, I-.

On acidic rocks in coastal areas, Baja California.

C. trachyphylla

Lobes large and long (almost like Xanthoria elegans), to several mm long, 0.7-1.3 mm wide, thick, granular, rough and lumpy, tips often somewhat broadened, flattened, and paler. Thallus tightly adnate, dark orange, roughened by minute or larger granules. Lobes strongly convex, parallel, areolate toward center. Apothecia sessile, round, ± dark orange., 0.3-1.5 mm diam., plane; margin concolorous or slightly paler, becoming thin, persistent. Spores 10.4-15.6 x 4.8-7.0 um; isthmus 2.8-3.5 um. On rocks, very common in open, dry sites throughout much of the intermontane west. Montana, Wyoming, Nevada, etc.

C. verruculifera (Vainio) Zahlbr.

Thallus to 4 cm, often coalescing to cover larger areas, growing radiately in irregular rosettes, centrally granular-areolate or of disoriented small lobes, 0.2-0.7(-1.2) mm thick; margin consisting of radiating lobes, 1-5(-10) x 0.2-0.6(-1.0) mm, strongly convex but flatter and broader toward tips, mostly straight and simple or irregularly branched, divided by deep narrow furrows; isidia mostly present and abundant, verruculose to globose, 0.05-0.2 mm, first appearing in inner part of lobes, later obscuring center of thallus; upper surface matt, greenish yellow, yellow, to bright orange; lobe tips paler than rest of thallus and sometimes white-pruinose; prothallus absent; cortex with anticlinally arranged hyphae, often with scattered maculae (pseudocyphella-like structures of thin-walled cells in thin parts of cortex, externally ssen as paler sports, especially when wet); medulla in cross section with periclinally arranged hyphae in lower part and clusters of algal cells divided by ± anticlinally arranged hyphae in upper part.

Apothecia rare and mostly sparse, zeorine, scattered to crowded, raised and constricted at

base, 0.5-1.2 mm diam., round to irregular; disk mostly ± plane or flexuose, yellowish orange to orange; proper margin 40-75(-100) um thick, slightly raised or not, consisting of radiating, thick-walled, tightly packed hyphae; thalline margin mostly thick and cenulate, 25-125 um; hymenium 85-100 um high, hyaline; hypothecium 85-100 um high, hyaline, occasionally with oil droplets; paraphyses simple or sometimes branched once, 1-2 um wide, somewhat monilliform in upper part, the tips capitate, 3-6 um broad; asci cylindrical; spores 8, polaribilocular, ellipsoid, (9.0-)10.8-13.8(-14.8) x (4.2-)4.5-6.1(-6.6) um; septum (2.4-)2.8-4.2(-4.7) um.

Pycnidia mostly present, as small depressions or slightly raised, darker than thallus; pycnospores narrowly ellipsoid, 2.5-4.0 x 1.2-1.5 um.

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

Usually on siliceous rocks, but occasionally on calcareous or ultramafic rocks; rarely also on wood; mostly on tops of manured rocks in the upper supralittoral, but also in the supralittoral fringe, on the seashore. Alaska to California; Nova Scotia to New York.

2-B. On rock;
Thallus whitish to blackish, brownish, etc., K- or weak.
Apothecia yellow to red or brown, K+ or K-;
Spore septum usually narrow (under 3 um)
Thallus ± well developed, ± lobed.
Subg. Gasparrinia sensu lato:
C. teicholyta/C. modesta etc. Group

Mostly after Rudolph

(If discs black, see C. variabilis group; if discs rusty to brown but thallus poorly developed, see C. ferruginea group; if thallus well developed but discs yellowish to orange, with whitish to grayish or blackish thalline margin, see C. cerina group)

1. Thallus pale, grayish white, slightly bluish, entirely granulose or granulose-pulverulent sorediate except at the margin, cracked, at least towards center. Apothecia uncommon, often absent. Thallus well developed, ± obscurely placodioid, forming closely adpressed rounded thalli, thin to thick, grayish white; lobe ends rounded, obtuse, flat or slightly convex, without furrows, often poorly differentiated, forming a ± complete lobate zone around the edge of the thallus, ± uniform, plain and scurfy towards center, often with small granules, sometimes weakly areolate. Soredia farinose, whitish, poorly developed, formed by the erosion of the surface in the central area. Apothecia to 0.8 mm diam., uncommon but conspicuous when present, scattered, sometimes crowded, immersed in thallus and deeply concave at first, becoming ± flat; discs orange-red-brown, sometimes ± white pruinose; proper margin flexuose, swollen, bright orange; thalline margin sometimes also present, white, undulate. Paraphyses slender, flexuose, branched, not noticeably swollen at apices. Spores 15-18 x 7-10 um, ellipsoid; septum often under 4 um wide, to 1/4 length of spore. Thallus K- or + pale violet. On calcareous or ± basic rocks, mortar, etc., especially along the coast. [Ozenda & Clauzade suggested that this might be just a variant of C. arenaria, differing mainly in having a darker thallus, with the central part entirely rimose-areolate but coarsely granulose on the surface; that concept of that species was rather different from that of Laundon] ..... C. teicholyta (Gasparrinia?)

1. Thallus not sorediate, but sometimes (C. modesta) granulose, with pustulose lobe tips. Apothecia usually present, sometimes numerous. 2

> **2. Thallus ashy-buff, glaucous ashy, greenish gray, deep olive buff, or dirty yellow, K+ purple under lens (type description) or K- (Rudolph); pustulose at tips of lobes.** Thallus areolate, granulose. Squamules about 1 mm across. Spores 10-14 x 5-8 um, ellipsoid. Thallus well developed, the margin rarely? often? of short crenate lobules. Apothecia 0.1-0.6 mm across, sessile; disk flat to convex, rusty brown to orange; margin dirty yellow to orange or of same color as thallus, entire, soon depressed. On rock. Southwest (Arizona); also reported from Maryland. ..... C. modesta (Zahlbr.) Fink, non sensu Nash [material under this name at ASU, including my own, has a distinctly orange, K+ thallus]
>
> **2. Thallus light buff or darker, K+ reddish or pale violet; tips of lobes not pustulose.** 3

3. Thallus pinkish-buff with whitish pruina, yellowish brown when rubbed. Hypothecium less than 50 um high. On calcareous rocks, [mostly?] east-central U.S. Thallus K+ pink to red, well developed, squamulose to areolate in center, the areoles sometimes (usually?) passing into crenate lobules at the margin; lobes appressed but not very parallel to each other. With large cells in thallus cortex. Apothecia 0.2-0.6(-0.8) mm diam., immersed to adnate or sessile, round; disc flat, smooth, cinnamon brown or "Mars orange"; proper exciple concolorous with thallus, thick, entire to wavy; thalline margin whitish. Epihymenium orange granular. Paraphyses tips slightly capitate, mostly simple. Spores oblong-ellipsoid, (9.8-)11.2-12.6(-15) x 5-6(-7) um; isthmus 2.8-3(-4.2) um wide. On calcareous rocks, Kansas and Missouri. Minnesota, Arizona, Texas, Oklahoma. ..... C. galactophylla

3. Thallus not pruinose (but may be sorediate), buff or darker colored. Hypothecium over 50 um high. 4

> **4. Thallus buff-colored, the margin more intensely colored than the center. Apothecia rust-colored.** Thallus usually distinctly yellow or orange and K+ strong red-violet. ..... (see C. aurantia, syn.: C. callopisma)
>
> **4. Thallus darker, the margin the same color or lighter than the center. Apothecia orange or purple-brown.** Thallus never distinctly yellow or orange, at most K+ weak reddish or pale violet. 5

5. Apothecial discs brownish yellow to reddish brown, K+ red-purple. Spores 9-13 x (3.5-)4-5.6(-7) um. Margin of thallus lighter than center. Hypothecium under 150 um. Hymenium under 100 um. Thallus thin, round to irregular, dirty brownish green to brownish yellow, chinky-areolate, passing toward the margins into short, paler, white-powdery, crenate lobes. Apothecia 0.4-0.8 mm across, adnate; disc flat; margin thin, colored much like thallus, crenulate. Spores ovoid-ellipsoid; septum 2-3 um. Lobes vert thin (0.08-0.2 mm), flat, closely appressed, broadening. No thallus cortex. On calcareous rocks, Texas and Colorado; eastern Mexico. ..... C. eugyra

5. Apothecial discs chestnut brown or light seal brown, K-. Spores 14-19(-21) x (5-)6-8(-9) um. Margin of thallus same color as center. Hypothecium over 150 um; hymenium over 100 um. Spores ellipsoid; septum ca. 2 um. Apothecia 0.7-2 mm diam., sessile, round; disc flat; thalline margin thick, entire to flexuous, becoming crenulate, persistent. Thallus smooth to warty, greenish gray to blackening (according to Fink) or vinaceous tawny (according to Rudolph), thick, K+ slowly purple; the margins laciniate, extending into numerous linear, ca. 1.5 mm wide, unequal lobes. On granite or other rocks, California, Montana. ..... C. peliophylla