

**Xanthoria** (Fr.) Th. Fr.  
(LECANORALES: TELOSCHISTACEAE)

After Lindblom (1997) and various other authors

Rev. 5/94

Thallus foliose to dwarf-fruticose, horizontal and  $\pm$  appressed, radiately lobed, tightly to loosely appressed, orbicular,  $\pm$  rosette-forming to spreading, or ascending to erect (but forming only low mats or cushions),  $\pm$  dorsiventral; heteromerous; at least the upper surface usually golden yellow to reddish orange, K+ red to purple, epruinose, smooth or wrinkled, matt or shining; lower surface often paler and white to pale brownish, smooth, sparingly rhizinate; both surfaces corticate; cortex paraplectenchymatous, of anticlinal hyphae; attached to substrate by simple, pale rhizines, but these often poorly developed, or small attachment discs present. Isidia, soredia, or blastidia present in some species. Medulla distinct, white. Photobiont Trebouxia.

Apothecia laminal, sessile to substipitate, orbicular to contorted; margin thalloid, involute, entire or crenulate, often paler than the disc, usually persistent; disc smooth, concave to plane, orange to red-orange, epruinose; hypothecium pale; epihymenium orange; paraphyses simple or little branched; asci clavate, Teloschistes-type, unitunicate, I+ blue; tholus I+ blue; spores 8, ellipsoid, polaribilocular, hyaline.

Pycnidia laminal, immersed in  $\pm$  prominent hemispherical thalloid warts, inconspicuous, concolorous with thallus, multilocular; conidiogenous cells lining the locules,  $\pm$  barrel-shaped, enteroblastic, acrogenous (fulcrum endobasidial according to Rogers); pycnospores colorless, mostly small, ellipsoid to subcylindrical or bacilliform. Anthraquinones (especially parietin; also fallacinal, teloschistin, emodin, parietinic acid, erythroglaucon, xanthorin, citeorosein, emodic acid, emodinal, erythroglauconic acid).

On bark, wood, or rock, often in nutrient-enriched habitats, often associated with man, or in coastal sites, arctic-alpine to temperate or (sub?-)tropical.

The K+ red-violet reaction distinguishes the genus from Candelaria (which also is never distinctly orange or red, and has yellow discs). Placodioid species of Caloplaca differ in not being readily separable from the substratum and lacking a lower cortex and rhizines, but can sometimes be confused with some species of Xanthoria (especially X. elegans).

**II. Thallus with papillae or vegetative propagules  
(sorediate, sorediate-pustulate, or blastidiate);  
apothecia usually rare.**

After Lindblom 1997 and Poelt & Petutschnig, 1992a,b

[Need to see the Himalaya article again, to get fuller description of X. fulva; my translation of the German from the European article was done without meine Wörterbuch, and thus may be slightly off for that species].

**1. Thallus with laminal isidia breaking up into soredia; lobes horizontal; thallus up to 50 mm across.** Usually on rock (mainly calcareous, but sometimes siliceous, mainly in exposed habitats but sometimes on vertical,  $\pm$  shaded faces, mainly arctic-alpine to boreal, extending south in the western mountains to Arizona and southern California. .... X. sorediata (Vainio) Poelt

**1. Thallus with marginal to submarginal soredia; lobes horizontal to erect; thallus up to 35 mm across.** Soredia or blastidia produced along lobe margins or on the underside; papillae and true isidia absent. On bark or rock, very widespread and common. .... 2

**2. Conidia (almost always present) ellipsoid, ca. 2.3-3 x 1-1.3  $\mu$ m. Thalline margin often with lobules (often with soredia); lobes dorsiventral or subterete (in outer parts), semierect to erect, narrow, attached at the base to the substrate, with sparse, very short hapters.** Corticolous (especially on Picea), saxicolous (acidic or calcareous, hard or soft) and lignicolous, generally in sunny areas, widespread in arctic to boreal region, most frequent in the west, from Alaska to southern California, often coastal. .... X. candelaria

**2. Conidia  $\pm$  bacilliform or with various shapes within a single pycnidium, or scarcely differentiated. Thalline margin without lobules (but often with soredia); lobes dorsiventral, horizontal or semierect to erect, narrow to wide, attached at the base or with sparse to abundant rhizines.** Thallus always dorsiventrally structured, not erect dwarf fruticose, appressed at least near the base. .... 3

**3. Lobes revolute,  $\pm$  erect, forming coalescing stands; soredia produced from lower surface; thallus  $\pm$  pruinose.** .... 4

**3. Lobes not or slightly revolute, horizontal to semierect, forming  $\pm$  distinct rosettes; soredia produced marginally to submarginally; thallus not pruinose.** .... 5

**4. Soredia  $\pm$  irregular,  $\pm$  of the same color as the upper surface, with a cortex-like surface (= blastidia); pycnidia immersed, visible as reddish spots; lower surface white,  $\pm$  shiny. On rock or soil among bryophytes, low elevations, Arctic (Alaska and Canada) .... X. borealis**

**4. Soredia spherical, with a soft surface, paler in color than upper surface (mostly lemon yellow to greenish yellow); pycnidia immersed to somewhat protruding, visible as large warts concolorous with upper surface; lower surface grayish, mat. Saxicolous, mainly on volcanic rock, also on granite and sandstone, usually on shaded vertical faces, sometimes among bryophytes. Montane areas, mostly at high elevations (400-2900 m), temperate western North America, southern British Columbia to southern California, E to Colorado; Mexico. .... X. mendozae**

- 5. Lobes narrow, c. 0.3-0.4-0.5 mm wide; soredia produced from lobe apices and the lower side of the lobes; pycnidia orange to red; uppermost cells of paraphyses usually with oil droplets; rhizines sparse or sometimes abundant.** Mainly corticolous, but also on rock (basalt, limestone, etc.) and lignum. Often in open to semi-open habitats. Widely distributed in temperate North America, with a few populations in the western Arctic. Common in inland areas from British Columbia to southern California, the northern Rockies, and from Minnesota to Texas and Louisiana, and in the Appalachians. .... X. fulva
- 5. Lobes wider, c. 0.8-1.1-1.4 mm wide; soredia produced marginally to submarginally; pycnidia light orange to orange; cells of paraphyses without oil droplets; rhizines sparse to (mostly) abundant.** ..... 6
- 6. Soredia produced in marginal crescent-shaped slits, bordered with the remaining upper and lower cortex ("bird nests"), color lighter than upper surface or greenish yellow; lobes mostly horizontal; conidia bacilliform.** Mainly corticolous on trunks of trees (especially oaks), occasionally on rock, lignum, and twigs, in open to semi-open,  $\pm$  dry to mesic areas. Widespread in temperate North America, with extensions into boreal regions; absent from the southeast. British Columbia to southern California, the Rockies, northern Great Plains, Great Lakes region, and New England. .... X. fallax
- 6. Soredia produced from the lobe margins or from the lower side of the helmet-shaped lobe apices,  $\pm$  colored as the upper surface; lobes horizontal or raised to suberect; conidia bacilliform or with variable shapes.** ..... 7
- 7. Conidia bacilliform, (2.5-)3.1-3.2-3.3(-4.0)  $\mu$ m long; soralia marginal to submarginal; laminal soralia also present on well developed thalli; lobes mostly raised, suberect, frequently with several rhizines visible from above; chemosyndrome A3. Thallus 8-14 mm. Soredia 39-51  $\mu$ m diam. Mainly north temperate (especially common in the western Great Lakes region) with eastern extensions and scattered western extensions.** Mainly corticolous on trunks of trees, occasionally on rock, lignum, and twigs, in open to semi-open, dry to somewhat moist areas. .... X. ulophyllodes
- 7. Conidia ellipsoid, oblong-ellipsoid, bacilliform, or irregular (variable within a single pycnidium), (3.0-)3.4-3.6-3.8(-4.0)  $\mu$ m long; soralia marginal to submarginal or from the lower side of the lobe apices, which often become helmet-shaped; laminal soralia absent; lobes horizontal to slightly erect, rhizines rarely visible from above; chemosyndrome A. Thallus 10-32 mm. Soredia 29-37  $\mu$ m diam. Western coastal and montane areas. Common. Southern British Columbia to southern California, east to the central Rockies.** Corticolous (especially on oaks), or occasionally on lignum, rock, or soil. .... X. oregana

Comparison of some members of the X. candelaria group, after Kondratyuk, 1997.

Character	<u>X. candelaria</u>	<u>X. fallax</u>	<u>X. fulva</u>	<u>X.</u>
<u>ulophyllodes</u>				
THALLUS	subfruticose	distinctly foliose	distinctly foliose	
distinctly foliose	± radially built	dorsiventral	dorsiventral	dorsiventral
vertical	horizontal	horizontal	mainly vertical	
horizontal	to 2 cm diam.	1-2 cm diam.	0.1-0.3 cm diam.	1-1.5(-3.5) cm diam.
upper surface	yellow-orange to	yellow-reddish to	reddish orange to	yellow-
reddish to	reddish orange;	orangish brown;	brownish orange;	
(evenly pigmented	reddish orange;			
reddish orange;	in herbarium	in herbarium	in herbarium	in
in all these spp.)				
herbarium	yellow-orange	yellow-orange	reddish orange	yellow-orange
lobe length (mm)	0.6-1.0(-1.5)	(2-)3-5	1(-3)	5-8
lobe width (mm)	0.1-0.3(-0.5)	0.3-0.5(-1.5)	0.3-0.8	0.3-0.5(-1.5)
rhizines	absent	for attachment	for support	for attachment
blastidia	25-35 um diam.	absent	25-30(-40) um	20-30 um
on margins and			on almost whole	in
lip-like marginal	lower surface;		lower surface; zone;	
conblastidia	very often;		rare;	rather
rare;	45-70(-110) um		50-60 um	40-
50(-60) um				
soralia	absent	marginal labriiform	absent	absent
APOTHECIA	many, terminal,	± rare, laminal,	± rare,	± rare, laminal,
	to 2 mm diam.	1-1.5(-2) mm		
spores (um)	11.5-14.5 x	10.5-16 x	13.5-17.5 x	10.5-
12.5(-14.5) x	4.5-6.5	6-7(-8)	8-10.5	(5.5-)7-8
septum (um)	4-5	3.5-5.0	3-5(-6.5)	5.5-6.5(-7)

conidia (um)	2.5-3 x 1.0-1.5	3.5-4.2 x 0.9-1.0	3.7-4.0 x 0.9-1.2	3.8-4.1 x
0.9-1.1	ellipsoid	bacilliform	bacilliform	
bacilliform				

**II. Thallus lacking vegetative propagules and distinct papillae;  
apothecia usually present**

**1. Thallus small, up to 25 mm across; lobes up to 0.7 mm wide, convex or flat; attached directly to the substrate or with short, sparse hapters. .... 2**

**1. Thallus usually larger, up to 100 mm; lobes up to 0.9 or 3.2 mm wide, convex or concave; attached with short, rather abundant hapters or relatively long, mostly abundant rhizines. .... 4**

**2. Thallus flat; lobes flat, tightly appressed to the substrate; lower cortex almost entirely absent, except under the lobe apices. Conidia ellipsoid, 2.6-3.0  $\mu$ m long. Spores with parallel sides. Corticolous, mostly on twigs, and lignicolous. Usually on smooth substrates in open to semi-open habitats, mainly oak savannah and coastal shrub. Caost and valleys and foothills of California, Sacramento River valley southward; Mexico. .... X. tenax**

**2. Thallus cushion-like; lobes flat to convex, horizontal and appressed or suberect; lower cortex present. .... 3**

**3. White pruina absent; conidia ellipsoid, 2.2-2.9  $\mu$ m long. Spores ellipsoid. Widespread in the area (mostly wwest coast, NE coast, and Great Lakes region; absent from Mexico or Texas), usually in  $\pm$  humid areas. Mainly corticolous, usually on twigs, but also common on rock and lignum, generally in open or semi-open areas. Boreal and western temperate regions, with extenxions into the Arctic. Common from British Columbia to southern California, and in the Great Lakes region, NE United States and SE Canada. .... X. polycarpa**

**3. White pruina present; conidia bacilliform, 3.5-4.0  $\mu$ m long. Spores with parallel sides. Southern parts of the area (Mexico and Texas), in dry areas. Corticolous on twigst. .... X. concinna**

**4. Conidia ellipsoid; lower surface with short, attached hapters; margin of thallus without rhizines but sometimes with short attached hapters; thallus up to 100 mm. .... 5**

**4. Conidia bacilliform; lower surface with long, free or attached rhizines; margin of thallus mostly with free as well as attached rhizines; thallus up to 30 mm. .... 6**

**5. Lobes concave to plane, wide (0.7-3.2 mm); thallus firmly to loosely attached; with short hapters; spore septum 3.8-7.9  $\mu$ m. Corticolous and saxicolous; occasionally on wood or other substrates. Coastal regions (occasional rom British Columbia to southern California and western Gulf of Mexico; common on northern Atlantic coast), and eastern Great Lakes region. .... X. parietina**

**5. Lobes convex, narrow to wide (0.4-1.3 mm); thallus  $\pm$  firmly attached; with extremely short hapters; spore septum 1.6-4.3  $\mu$ m. Usually saxicolous, occasional on other substrates, mainly in open areas, dry to moist. Mainly in the arctic to boreal region (Alaska, Canada, northern U.S.), but also common in arid, high elevation habitats over most of western North America (at least N of Mexico); sporadic in eastern temperate region. .... X. elegans**

**6. Spores ellipsoid, 15.4-18 x 7.5-9.5  $\mu$ m, with a wide septum, 5.6-6.5-7.4  $\mu$ m; upper surface yellow to orange. Corticolous (especially on Populus), occasional on rock and**

lignum, mostly open to semi-open habitats. Widespread and common in southern boreal and northern temperate regions in the east, throughout California and the Pacific Northwest, with disjunct occurrence in Alaska. .... X. hasseana

**6. Spores cylindrical to ellipsoid, with parallel walls, 13.0-15.6 x 5.2-7.4 um, with a narrow septum, 1.6-2.2-2.8 um; upper surface light orange to dark orange.**

Corticolous, occasional on lignum, in open,  $\pm$  dry habitats. Western montane to temperate areas (Rockies and Great Basin, from Alberta to Arizona and Texas) with disjuncts in Alaska and Washington, D.C. .... X. montana

## Descriptions of Species

### **X. borealis R. Sant. & Poelt**

Thallus small, up to 15 mm, foliose, forming small patches or sometimes extensive colonies covering the substrate, attached  $\pm$  centrally, by lower parts of lobes, sometimes with supporting rhizines. Lobes narrow to wide, 1.1-2.2 mm wide at widest point, 2.5 mm mm long,  $\pm$  erect, revolute, with or without thin terminal branches, apices down-turned; marginal lobes  $\pm$  appressed, central ones steeply ascending, often  $\pm$  cone-shaped inrolled, on the margins often divided into small lobuli, which are inflexed towards the lower side. Upper surface dark orange to reddish orange,  $\pm$  rough ("coarse"), often slightly pruinose; lower surface white, smooth. Rhizines scattered, mostly near lobe bases, white, thin, short, pointed to somewhat frayed. Blastidia developing on the whole underside, but often only spottily, produced submarginally and, later, from the apical (terminal) parts of the lower surface, orange to greenish orange, small, often lumped, 41-53-96  $\mu$ m. Algal layer discontinuous,  $\pm$  spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia very rare (not found in North American material). Spores narrowly ellipsoid, 11-13 x 5.5-7  $\mu$ m, the septum ca. 3-5  $\mu$ m.

Pycnidia sometimes few and poorly developed, but usually common, scattered,  $\pm$  immersed, reddish orange, c. 0.1-0.2 mm diam.; conidia bacilliform, (3.5-)3.8-4.3-4.7(5.25) x c. 1.5  $\mu$ m.

Parietin (major), fallacinal (major), emodin, teloschistin (major), and parietinic acid. (Chemosyndrome A3).

On bird manured rocks, arctic-subarctic. Reports from Oregon and Colorado are based on X. mendozae.

### **X. candelaria (L.) Th. Fr.**

Thallus small, to 30 mm, foliose-subfruticose, forming small cushions or extensive colonies covering the substrate, attached by lower parts of lobes, and by hapters. Lobes narrow, 0.2-0.5 mm wide, dorsiventral to subterete, strongly ascending to erect, richly branched with narrow, subterete outermost branches, which probably function as vegetative dispersal units.. Thallus when well developed lobed to lacerate, with blastidia on the underside, and therefore strongly sprouting into smaller lobes (except for aborted forms). The first sprout segments are however  $\pm$  dorsiventrally constructed and sprout again themselves; the ultimate, finest sprouts are radically structured and sprout in all directions. Lobes entirely corticate. Upper surface yellow to light orange, smooth to rough, often wrinkled. Lower surface white to yellow, mostly somewhat wrinkled. Hapters very rare, white, thin, short, situated near lobe base, attached. Soredia blastidious, produced marginally, submarginally, at lobe tips, laminally along wrinkles, and from thalline margin [of apothecia?], c. 29-38-49  $\mu$ m. Algal layer discontinuous, spread throughout the medulla. Medulla reticulate, with short to somewhat elongate irregular hyphae..

Apothecia generally rare but may be abundant on some thalli, up to 0.9-1.0-4.0 mm, concave to plane, laminar but often appearing to grow terminal and immersed in the surface of the ultimate sprouts (lobe apices). Thalline margin 0.05-0.19 mm, entire ("smooth"), often with lobules and soredia. Algal layer below exciple 38-64-88  $\mu$ m. Exciple visible from outside, thickness below hymenium 0-17-50  $\mu$ m, gelatinous, colorless, cell walls thick, lumina elongate. Hypothecium 25-39-68  $\mu$ m, colorless to pale brown, hyphae irregular, walls thin. Hymenium 58-71-90  $\mu$ m. Paraphyses simple to branched 1 or 2 times, 1.5-2  $\mu$ m wide, tips 5-7  $\mu$ m wide,



occasionally with oil droplets. Spores ellipsoid, rounded at the ends, (11.0-)12.1-13.5-14.8(--16) x (5.0-)5.4-7.0-8.0(-9.0)  $\mu$ m; septum  $\pm$  wide, (2.0-)2.9-4.3-5.7(-7.0)  $\mu$ m.

Pycnidia common, immersed, concolorous with upper surface or slightly darker, c. 0.07-0.15 mm diam. Conidia ellipsoid, (2.0-)2.3-2.6-2.9(-3.5) x c. 1-1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid (Chemosyndrome A).

Lindblom lumps the following varieties.

**1. Thallus often extensive, the lobes little or not divided and therefore bluntly rounded, erupting into large soralia and the margins and on the undersides; undersides provided with sparse rhizines.** Above all on bark of deciduous trees, but also on rock, and wood; widely distributed and form-rich. .... X. candelaria (L.) Fr. v. candelaria

**1. Thallus made up of small tufts of very narrow,  $\pm$  erect, strongly lacerated lobes, which are drawn out into isidia-like points and later break up into spreading soredia at the margin and on the upper side.** Especially on bird-boulders in the mountains, but also on steep faces and overhangs, very widely distributed in the north and in the mountains. .... X. candelaria v. finnmarkica (Ach.) Hillmann

### **X. concinna J. W. Thomson & T. H. Nash**

Thallus small, up to 14 mm, forming  $\pm$  distinct cushions. Lobes narrow, c. 0.3-0.5 mm, convex, somewhat revolute, horizontal to semierect, relatively richly branched. Upper surface bright yellow or grayish, mostly with a thick pruina. Lower surface white, smooth. Hapters rare, short, white, attached. Algal layer discontinuous, spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia frequent, usually abundant, to 1-2 mm diam., rounded, plane, with a somewhat inflated appearance. Disc orange, lightly pruinose. Thalline margin c. 0.1 mm, thin, entire, pruinose. Algal layer below hymenium c. 70-80  $\mu$ m. Exciple not visible from outside, thin, to c. 15  $\mu$ m thick below hymenium. Hypothecium c. 50  $\mu$ m. Hymenium c. 75  $\mu$ m. Paraphyses simple or sparsely branched, c. 2  $\mu$ m wide, tips c. 5  $\mu$ m. Spores narrowly ellipsoid, 13-15 x 5-6  $\mu$ m, septum 2.5-5  $\mu$ m.

Pycnidia common, immersed, concolorous with upper surface or slightly darker orange. Conidia bacilliform, 3.5-4.0 x 1-1.5  $\mu$ m.

Parietin (major), fallacinal (major), emodin, teloschistin (major), and parietinic acid. (Chemosyndrome A3). The K reaction becomes faint on parts of thallus where pruina is very thick.

### **X. elegans (Link) Th. Fr.**

Thallus small to large, to 55 mm, forming rosettes, sometimes coalescing. Lobes narrow to moderately wide, 0.4-0.8-1.3 mm wide, plane to convex, horizontal or rarely semi-erect,  $\pm$  sparsely branched. Upper surface yellowish orange to bright orange to dark orange to dull red,  $\pm$  rough, occasionally slightly pruinose. Lower surface white, somewhat wrinkled. Hapters scattered, white, thick, very short and tightly anchoring the thallus. Algal layer  $\pm$  continuous near upper cortex. Medulla with hyphae in bundles, cells regular, elongate.

Lobes  $\pm$  appressed and adnate but with lower cortex free of the rock; convex, radiate, often contiguous but not significantly overlapping, linear, smooth or weakly undulating surface, not ridged or rimmed. Isidia and papillae absent (thallus center sometimes becoming

irregularly rugose, knobby, or almost moniliform with bumps and restrictions, but distinct papillae and laminal thalline extensions always absent), with discrete tips, smooth and strongly convex to subterete; thallus center often fragmented; upper surface orange to reddish orange; apothecia and thallus epruinose. Lobes narrow,  $\pm$  linear,  $\pm$  highly convex to rounded-folded,  $\pm$  hollow inside, contiguous to overlapping, often developing secondary lobes; upper surface deep red to brownish orange. True rhizines absent; hapters short, irregularly scattered.

Apothecia mostly frequent, sometimes sparse or lacking (on at least halfway developed thalli almost always present), to 0.9-1.7-3.0 mm, slightly concave to plane or sometimes convex. Thalline margin 0.05-0.13 mm, entire to  $\pm$  crenulate. Algal layer below exciple 58-96-175  $\mu$ m. Exciple mostly visible from outside, 12-32-50  $\mu$ m thick below hymenium, gelatinous, colorless, walls thick, lumina elongate. Hypothecium 20-41-80  $\mu$ m, colorless to pale brown, irregular, walls thin. Hymenium 58-76-93  $\mu$ m. Paraphyses simple or sparsely branched (0-2 times), 2-2.5  $\mu$ m wide, tips 5-6  $\mu$ m wide, occasionally with oil droplets. Spores ellipsoid, (11.0-)11.8-13.4-15.8(-17.5)  $\times$  (5.5-)6.0-7.0-7.8(-8.5)  $\mu$ m, septum narrow, (1.0-)1.6-3.2-4.3(-5.0)  $\mu$ m.

Pycnidia sparse to abundant, immersed, somewhat darker than upper cortex, c. 0.07-0.15 mm diam. Conidia ellipsoid, (2.0-)2.6-2.9-3.2(-3.5)  $\times$  c. 1-1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid (Chemosyndrome A).

Extremely variable. Lindblom lumps the following varieties:

**1. Thallus clearly foliose, the lobes appressed to ascending, in closely crowded stands.** Widely distributed. .... X. elegans (Link) Th. Fr. v. elegans

**1. Thallus  $\pm$  dwarf-fruticose, the lobes tangled, ascending, usually strongly unevenly pitted-foled, branched in several directions.** Arctic islands. .... X. elegans v. splendens (Darbish.) M. S. Christ. ex Poelt

### **X. fallax (Hepp ex Arnold) Arnold**

Thallus small to moderately large, to 30 mm, form in rosettes, sometimes coalescing. Lobes narrow to moderately wide, 0.8-1.2-1.9 mm wide,  $\pm$  plane, horizontal or slightly raised, branched, with rounded, wide tips. Upper surface yellowish orange to orange, smooth to shiny. Lower surface white, smooth or slightly wrinkled. Rhizines frequent, white to yellow, medium thick, short to long, pointed or somewhat frayed, free or attached (with small foot). Soredia produced marginally, often on short side branches, in horizontal,  $\pm$  crescent-shaped slits, with upper cortex mostly persistent and forming a hood, common or rare (young thalli), small, distinct and  $\pm$  spherical, powdery, lemon yellow to greenish yellow, c. 32-40-51  $\mu$ m. Algal layer  $\pm$  discontinuous and spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Rhizines richly scattered over the underside, even on ascending lobes, threadlike. Lobes appressed to ascending.

Marginal lobes always clearly differentiated,  $\pm$  appressed, closely adnate but often with somewhat curved-up tips and margins, thickish, rather coarse, to 7 mm long and 1.5 mm wide, yellow-orange (to yellow-green in shade). Especially ephemeral blastidia occur subapically on the underside of very short side lobes, which become mostly strongly bent upwards and finally curved into funnel shape. Finally after a long time soredia develop from the medulla; soralia marginal in labriform patches, sulfur yellow to greenish yellow, clearly distinguished from the thallus color.

Apothecia rare, frequent on some thalli, to 0.7-1.4-2.2 mm, concave or slightly convex, disc often with a central hollow. Thalline margin 0.04-0.18 mm, entire, often breaking up with soredia, usually with vertical or ventral, white-yellow, pointed rhizines. Algal layer below exciple 50-97-163  $\mu$ m. Exciple not visible from outside, 8-47-83  $\mu$ m thick below hymenium, gelatinous, colorless, walls thick, lumina elongate. Hypothecium 33-52-88  $\mu$ m, pale brown, irregular, cells with thin walls. Hymenium 54-75-100  $\mu$ m. Paraphyses sparsely branched (0-3 times), 1.5-2  $\mu$ m, tips c. 4-6  $\mu$ m. Spores ellipsoid [to  $\pm$  narrowed towards the ends?], (11.5-)12.5-14.1-15.4(-17.0) x (5.-9-)5.7-6.3-7.1(-9.0)  $\mu$ m, septum wide, (2.0-)2.3-3..1-3.6(-5.0)  $\mu$ m.

Pycnidia common, immersed or slightly protruding, darker than upper surface, 0.10-0.18 mm diam. Conidia bacilliform, (3.0-)3.4-3.7-3.9(-4.5) x c. 1  $\mu$ m.

Parietin (major), fallacinal (major), emodin, teloschistin (major), and parietinic acid. (Chemosyndrome A3).

Lindblom does not mention the following varieties:

**1. Lobes appressed, clearly rosette-like, deeply divided, the tips and often even the margins bent under, provided with shell-like unfolded marginal soralia with granular lemon-yellow soredia.** Above all in dry overhangs of lime-poor rock, but also widely distributed on bark. .... X. fallax (Hepp) Arnold v. fallax

**1. Lobes ascending in the half towards the tips, strongly divided, often imbricate, the marginal lobes not radiating, the lobe ends and sometimes also the margins erupting into  $\pm$  large soralia.** On bark. .... X. fallax v. lychneoides (Mereschk.) Erichsen

### **X. fulva (Hoffm.) Poelt & Petutschnig**

Thallus small, to 9 mm, forming minute rosettes when young, coalescing with adjacent thalli and covering large parts of the substrate, attached by lower parts of lobes and with rhizines. Lobes narrow, 0.2-0.4-0.6 mm, thin, plane to somewhat convex, horizontal when young to semierect-erect when mature, richly branched (most distinct on the youngest lobes), tips narrow, pointed or rounded. Upper surface yellow to light orange to orange to dark orange, smooth. Lower surface white, smooth. Rhizines rare to frequent,  $\pm$  scattered, white-yellow, thin,  $\pm$  short, mostly pointed, free or attached. Soredia produced at apices of lobes, marginally-submarginally in  $\pm$  rounded cortex slits with upper cortex  $\pm$  persistent, common, sall, concolorous with upper surface or somewhat lighter, c. 30-40-48  $\mu$ m. Soralia often appear empty, since the soredia very easily fall out. Photobiont layer  $\pm$  discontinuous and spread through the medulla. Medulla reticulate, with short irregular hyphae.

Lobes to 2 mm long and mostly ca. 0.7(-1) mm wide, the marginal ones steeply ascending from a  $\pm$ appressed base, on the underside with blastidia.

Apothecia rare, although abundant on some thalli, to 0.7-1.5-3.6 mm, concave to plane or undulate, disc sometimes with central hollow. Thalline margin 0.05-0.1-0.18 mm, smooth, often sorediate, rarely with ventral, short, mostly attached rhizines. Algal layer below exciple 38-72-125  $\mu$ m. Exciple not visible to visible from outside, 0-12-30  $\mu$ m thick below hymenium, gelatinous, colorless, with somewhat elongated lumina. Hypothecium 25-37-55  $\mu$ m, pale brown, irregular, cell walls thin, occasionally with oil droplets. Hymenium 50-75-100  $\mu$ m. Paraphyses sparsely branched (0-2 times), c. 1.5-2.5  $\mu$ m wide, tips c. 4-6  $\mu$ m, mostly with one to several oil droplets in the uppermost cells.. Spores ellipsoid (broadly ellipsoid with broadly rounded ends), (11.0-)12.8-15.2-17.8(-20.0) x (5.0-)5.7-6.2-7.1(-9.0), septum wide, (2.5-)2.9-

4.9-6.8(-9.0)  $\mu$ m.

Pycnidia sparse but almost present, (immersed-) protruding, dark orange to reddish, 0.07-0.18 mm diam. Conidia bacilliform, (3.0-)3.2-3.6-4.0(-4.5) x c. 1  $\mu$ m wide.

Parietin (major), fallacinal (major), emodin, teloschisting (major), and parietinic acid (minor). (Chemosyndroma A3)

The species somewhat resembles a cross between X. candelaria and X. fallax; when apothecia are abundant, at a quick glance without a lens it will also resemble X. polycarpa.

Lobes 0.1-0.3 mm wide, partially provided with fibrils, appressed or ascending at the ends. Alaska. Some material from rocks on the coast of Washington state, with a rather deep red-orange thallus, may belong here. .... X. subramulosa Räsänen = X. fulva

### **X. hasseana Rasanen**

Thallus small to moderately large, to 30 mm, forming rosettes, often coalescing,  $\pm$  loosely attached with rhizines visible from above. Lobes narrow to moderately wide, 0.3-0.6-0.9 mm,  $\pm$  plane, smooth,  $\pm$  horizontal, frequently branched, with rounded apices. Upper surface yellow to light orange (to orange), smooth-shiny. Lower surface white, smooth to somewhat wrinkled. Rhizines frequent, white-yellow, medium thick, long, pointed to somewhat frayed (with small foot when attached), free or attached. Photobiont layer  $\pm$  discontinuous and spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia almost always present, to .9-2.5-3.1 mm, slightly concave to plane. Thalline margin 0.07-0.15 mm, entire, with  $\pm$  frequent, white-yellow, long, pointed, free or attached, vertical and ventral rhizines. Algal layer below exciple 38-83-150  $\mu$ m. Exciple sometimes visible from outside, 20-35-63  $\mu$ m thick below hymenium, colorless, gelatinous, cell walls thick, lumina  $\pm$  elongate. Hypothecium 73-82-90  $\mu$ m, pale brown, irregular, cell walls thin. Hymenium 73-82-90  $\mu$ m. Paraphyses usually branched (0-3 times), c. 2  $\mu$ m wide, tips c. 4-6  $\mu$ m. Spores ellipsoid, (14.5-)15.4-16.7-18.0(-20.0) x (6.0-)7.5-8.3-9.5(-10.0)  $\mu$ m, septum wide, (4.0-)5.2-6.5-8.5(-10.0)  $\mu$ m.

Pycnidia common, immersed to protruding, darker than upper surface, 0.10-0.18 mm diam. Conidia bacilliform, (3.0-)3.2-3.5-4.0(-4.25) x c. 1  $\mu$ m wide.

Parietin (major), fallacinal (major), emodin, teloschistin (major), parietinic acid. (Chemosyndrome A3).

### **Xanthoria mendozae Rasanen**

Thallus small, up to 25 mm, foliose, forming small patches or extensive colonies covering the substrate, attached  $\pm$  centrally, by lower parts of lobes, sometimes with supporting rhizines. Lobes  $\pm$  wide, 0.8-6.0 mm at widest point, short,  $\pm$  revolute, with or without thin terminal branches, apices curled downwards, mature lobes often  $\pm$  fan-shaped and wavy. Upper surface yellow to orange,  $\pm$  pruinose, often cracked near terminal parts. Lower surface dirty white, dull. Rhizines very rare, short, pointed or somewhat frayed, white. Soredia produced from lower surface, yellow to greenish yellow, large, spherical, with a dull, fuzzy surface ("tennis balls"), 46-70-84  $\mu$ m. Photobiont layer discontinuous,  $\pm$  spread throughout the medulla. Medulla reticulate, with short irregular hyphae. Lower cortex prosoplectenchymatous, thin.

Apothecia not seen.

Pycnidia common, scattered,  $\pm$  immersed, concolorous with upper surface, or dark orange when overripe, c. 0.2-0.3 mm diam. Conidia bacilliform, (3.8-)4.2-4.6-4.9(-5.8) x c. 1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid. (Intermediate chemosyntrome A/A3).

### **X. montanae Lindblom**

Thallus small to moderately large, to 30 mm, forming rosettes, often coalescing, loosely to firmly attached with rhizines often visible from above. Lobes narrow to moderately wide, 0.2-0.3-0.5 mm,  $\pm$  plane, smooth,  $\pm$  horizontal, frequently branched, with rounded apices. Upper surface yellow to light orange to dark orange, smooth-shiny. Lower surface white, smooth or somewhat wrinkled. Rhizines frequent, white to yellow, medium thick, short to long, pointed to frayed (with small foot when attached), free or attached. Medulla reticulate, with short irregular hyphae.

Apothecia almost always present, abundant, to 0.9-2.1-3.5 mm diam., slightly concave to plane (to convex). Thalline margin 0.05-0.15 mm, entire, with  $\pm$  frequent white-yellow, short to long, pointed, free or attached, vertical and ventral rhizines. Algal layer below exciple 50-73-115  $\mu$ m. Exciple mostly not visible from outside, 15-20-25  $\mu$ m thick below hymenium, colorless, gelatinous, cell walls thick, lumina  $\pm$  elongate. Hypothecium 10-23-63  $\mu$ m, pale brown, irregular, cell walls thin. Hymenium 58-71-95  $\mu$ m. Paraphyses usually branched (0-3 times), c. 2  $\mu$ m wide, tips c. 4-7  $\mu$ m. Spores cylindrical to narrowly ellipsoid, (12.0-)13.0-14.5-15.6(-17.0) x (4.5-)5.1-6.2-7.5(-8.0)  $\mu$ m, septum narrow, (1.0-)1.4-2.2-4.0(-6.0)  $\mu$ m.

Pycnidia  $\pm$  common, immersed to protruding, darker than upper surface, 0.06-0.18 mm diam. Conidia bacilliform, (2.8-)3.2-3.7-4.5(-5.0) x c. 1  $\mu$ m.

Parietin (major), fallacinal (major), emodin, teloschistin (major), parietinic acid. (Chemosyndrome A3).

### **X. oregana Gyeln.**

Thallus small to moderately large, to 30 mm, forming  $\pm$  flattened rosettes, attached by lower parts of lobes and with rhizines. Lobes narrow to wide, 0.4-0.6-1.0 mm, thin,  $\pm$  plane to convex to somewhat inflated, horizontal when young to  $\pm$  erect when mature, richly branched, tips narrow,  $\pm$  pointed. Upper surface yellow to orange (to dark orange), wrinkled or smooth-shiny. Lower surface white, smooth to slightly wrinkled. Rhizines  $\pm$  frequent,  $\pm$  scattered, white to yellow, medium thick, short to long, pointed or somewhat frayed, free or attached. Soredia produced marginally to submarginally, blastidial from the somewhat crenulate margins or fine and powdery from the lower outer parts of the lobe (which can become almost helmet-shaped), greenish yellow to orange, c. 29-37-47  $\mu$ m. Photobiont layer  $\pm$  discontinuous and spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia very rare, to 3.2 mm diam., concave to plane. Thalline margin c. 0.1 mm, entire or sorediate, rhizines not observed. Algal layer below exciple 50-75  $\mu$ m. Exciple not visible from the outside, thickness below hymenium 25-38  $\mu$ m, gelatinous, colorless, with somewhat elongated lumina. Hypothecium 25-38  $\mu$ m, pale brown, irregular, cells with thin walls. Hymenium 70-80  $\mu$ m. Paraphyses sparsely branched (0-2 times), c. 1.5-2  $\mu$ m wide, tips c. 2-4  $\mu$ m. Spores ellipsoid, 16.0-16.5-17.0 x 7.6-8.1-8.7  $\mu$ m, septum wide, 6.2-6.6-7.0  $\mu$ m.

Pycnidia rare to common, sometimes in groups, immersed to protruding, darker than upper surface to reddish, 0.1-0.2 mm diam. Conidia variable within the pycnidium, ellipsoid to oblong-ellipsoid to bacilliform, or irregular, (3.0-)3.4-3.6-3.8(-4.0) x c. 1-1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid. (Chemosyndrome

A; the concentration of teloschistin sometimes approaches A3).

[Note: X. ascendens S. Kondratyuk, described from South America, also has helmet-shaped soralia, but differs in (among other things) lacking rhizines and having abundant apothecia; I have seen a specimen under that name in John Davis's herbarium; it looks to me like a "somatic hybrid" between a Xanthoria and Physcia adscendens]

**X. parietina (L.) Th. Fr.**

Thallus large, to 100 mm, forming rosettes, sometimes coalescing,  $\pm$  firmly attached with hapter. Lobes wide, 0.7-1.6-3.2 mm,  $\pm$  concave, often somewhat wrinkled,  $\pm$  horizontal, sparsely branched, with rounded, wide apices. Upper surface yellow to light orange (to orange),  $\pm$  smooth. Lower surface white, wrinkled. Hapters scattered to frequent, white, thick, short, pointed in early stages, attached with a terminal foot. Photobiont layer  $\pm$  continuous near upper cortex. Medulla with hyphae in bundles, cells regular, elongate.

Apothecia almost always present,  $\pm$  abundant, to 1.1-2.6-8.0 mm, concave-plane or folded, sometimes undulate. Thalline margin 0.07-0.12 mm, entire to crenulate, with very short anchoring hapters. Algal layer below exciple 50-80-113  $\mu$ m. Exciple often visible from outside, 10-25-55  $\mu$ m thick below hymenium, colorless, strongly gelatinous, cell walls thick, lumina elongate. Hypothecium 15-30-48  $\mu$ m, pale brown, irregular, cell walls thin. Hymenium 53-73-90  $\mu$ m. Paraphyses sparsely branched (0-3 times), 1.5-3  $\mu$ m wide, tips c. 4-7  $\mu$ m, oil droplets sporadically present. Spores ellipsoid, (12.0-)12.9-14.8-16.0(-17.5)  $\times$  (5.0-)5.9-7.9-8.7(-10.0)  $\mu$ m, septum wide, (3.0-)3.8-6.2-7.9(10.0)  $\mu$ m.

Pycnidia common, sometimes sparse, immersed or somewhat protruding, usually slightly darker than upper surface, 0.07-0.17  $\mu$ m diam. Conidia ellipsoid to  $\pm$  oblong-ellipsoid, (2.5-)2.7-3.1-3.6(-4.0)  $\times$  c. 1-1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid. (Chemosyndrome A).

On rocks on the east coast, and rare on bark of deciduous trees in lowland areas of the Pacific NW; on nutrient-rich and -enriched surfaces.

**X. polycarpa (Hoffm.) Th. Fr. ex Rieber**

Thallus small, to 25 mm, forming distinct to coalescing cushions, attached with wrinkles and hapters from the lower surface. Lobes narrow, 0.2-0.4-0.7 mm, plane to convex, mostly horizontal, sometimes slightly raised, richly branched, with narrow apices. Lower surface white,  $\pm$  wrinkled. Hapters scattered, white, thin to thick, short, attached (free when young), often with small foot. Photobiont layer discontinuous and spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia frequent, mostly very abundant, to 1.0-1.9-4.5 mm, concave to plane or folded. Thalline margin 0.05-0.09-0.18 mm, entire or sometimes crenulate. Algal layer below exciple 50-75-123  $\mu$ m. Exciple sometimes visible from outside, 0-8-28  $\mu$ m thick below hymenium, colorless, mostly consisting of not more than a few layers of hyphae, gelatinous, cell walls thick, lumina elongate. Hypothecium 18-33-50  $\mu$ m, pale brown, irregular, cell walls thin. Hymenium 43-68-90  $\mu$ m. Paraphyses sparsely branched (0-1(-2) times), 1.5-2  $\mu$ m wide, tips c. 5-8  $\mu$ m, occasionally with one to several oil droplets in the uppermost cells. Spores ellipsoid, (10.0-)11.3-13.0-15.0(-16.5)  $\times$  (4.0-)5.4-6.7-7.9(-9.0)  $\mu$ m, septum (2.0-)2.8-4.2-6.2(-7.0)  $\mu$ m.

Pycnidia common, immersed, concolorous with upper surface or slightly darker, 0.05-0.18 mm diam. Conidia ellipsoid, (2.0-)2.2-2.5-2.9(-3.0)  $\times$  c. 1-1.5  $\mu$ m.

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid. (Chemosyndrome A).

Lindblom lumps the following taxa:

**1. Thallus pale ashy blue-green when dry, very green when wet**, the lobes close to the substratum but rising irregularly, finely divided, 0.2-1 mm broad, irregularly branching, downturned at the edges, some of the smallest lobes with small edge papillae, K- but turning purple where apothecial initials are forming; underside white, corticate, lacking rhizines but loosely attached by holdfast rhizoids. Apothecia forming on the surface of the lobes and becoming raised on short, rather thick, stipes; disk orange, 0.5-2 mm diam., K+ purple, with thick thalloid margin which is smooth at first and becomes crenulate; cortex 25 µm thick, paraplectenchymatous, the upper part brown; medullary hyphae ca. 3 µm with a slender lumen; asci 37 x 12.5 x 12.5-15 µm; paraphyses 1-1.5 µm, the tips 4-5 µm and golden granulose; spores biseriate, ellipsoid, 12.5-15 x 6-8 µm, the septum 4-6 µm. On alnus along seashore, Alaska. .... X. alaskana Thomson = X. polycarpa

**1. Thallus yellow to orange.** ..... 2

**2. Lobes barely 0.2 mm wide, separate, scattered, loosely appressed to semi-erect, also loosely overlapping, elongate at maturity, often partly cylindrical**, richly branched (sparingly branched according to Fink), closely adnate, semi-cylindrical, slightly ascending, finally imbricated, pale yellow to greenish yellow or yellowish gray. Apothecia 0.3-0.8 mm across, subsessile, the disc concave to flat, yellowish orange, the exciple thick, colored like the thallus, entire; spores ellipsoid, (12-)14-16(-17) x 5-6(-9) µm. On base-rich bark of trees and shrubs along the coast, California to British Columbia, apparently rare. .... X. ramulosa

**2. Lobes 0.5-2 mm wide, crowded, ± closely appressed and tightly overlapping, mostly short, dorsiventral throughout.** Spores 11-16 x 6-8.5 µm. Thallus yellow to orange-yellow, seldom gray-yellow, forming small tufts, usually with abundant apothecia; lobes irregularly branching, narrow, to 0.5 mm broad, flat, more or less ascendent and overlapping; underside pale, with scattered white rhizines. Apothecia adnate on short stalks, to 4 mm broad; disc matt, dark or yellowish orange; margin thick, thalloid, often crenulate. On base rich bark of stems and branches of conifers and broad-leaved plants, boreal to subtropical (to arctic Alaska and NW Canada), widely distributed in N. America. The taxon as currently delimited is heterogeneous. An apparently undescribed Caloplaca species on riverside oaks in California mimics X. polycarpa but lacks a lower cortex. .... X. polycarpa

### **X. soredata (Vain.) Poelt**

Thallus small to large, to 35 mm, forming rosettes, sometimes coalescing. Lobes narrow to wide, 0.4-1.1 mm, plane to convex, horizontal, branched, apices occasionally ± concave. Upper surface yellow to ± bright orange, ± rough. Lower surface white, smooth-wrinkled. Hapters scattered, white, thick, very short and ± tightly anchoring the thallus. Soredia produced laminally, colored as the upper cortex or lighter, initiated as small isidia, which later break up and become crater-like soralia, eventually coalescing and covering the central thallus parts. Photobiont layer ± continuous, near upper cortex. Medulla with hyphae in bundles, cells

regular, elongate.

Apothecia very rare, found sparsely on a few thalli, to 0.6-1.1-1.9 mm, slightly concave to plane or convex. Thalline margin 0.07-0.15 mm, entire to crenulate. Algal layer below exciple 75-86-100  $\mu\text{m}$ . Exciple mostly visible from outside, 25-29-38  $\mu\text{m}$  thick below hymenium, gelatinous, colorless, cell walls thick, lumina elongate. Hypothecium 23-40-50  $\mu\text{m}$ , colorless, irregular, cell walls thin. Hymenium 63-72-88  $\mu\text{m}$ . Paraphyses mostly sparsely branched (1-3 times), c. 2  $\mu\text{m}$  wide, tips 5-7  $\mu\text{m}$ , rarely with small oil droplets. Spores ellipsoid, (11.0-)12.8-13.1-13.5(-15.0) x (5.5-)6.2-7.2-8.1(-9.0)  $\mu\text{m}$ .

Pycnidia usually abundant, immersed, usually among the soralia, somewhat darker than upper surface, c. 0.07-0.13 mm diam. Conidia ellipsoid, (2.2-)2.6-2.9-3.0\*-3.3) x c. 1-1.5  $\mu\text{m}$ .

Parietin (major), fallacinal, emodin, teloschistin, and parietinic acid. (Chemosyndrome A).

Isidia, papillae, or blastidia produced on the upper surface (not mainly on margins). Lobes convex, radiate, often contiguous but not significantly overlapping, linear, 0.3-1.0(-1.5) mm broad, with smooth or weakly undulating surface, not ridged or rimmed. Blastidia ("isidiose soredia") originating from laminal coarse pustules, breaking open. Thallus crustose centrally, foliose marginally; lobes branching irregularly, narrow, convex-flattened, expanded at tips, dorsiventral,  $\pm$  closely adnate; upper side red-orange to brownish orange or pale ochre-orange.

Apothecia rare, similar to those of X. elegans.

On rock (calcareous according to Thomson, but in my experience also quite frequent on siliceous rocks), usually on very shaded surfaces, in high mountain areas, widespread in the West and North, arctic-alpine to boreal-temperate, south to California and Mexico, Great Plains and midwestern U.S. .

### **X. tenax Lindblom**

Thallus small, 5-11-25 mm, forming flat, appressed,  $\pm$  distinct rosettes. Lobes narrow, 0.2-0.4-0.7 mm wide, plane, thin to thick, horizontal, closely appressed to substrate, sparsely branched, with rounded to fan-shaped tips. Upper surface yellow to orange, slightly to heavily pruinose. Lower surface attached to substrate (free near lobe tips), white, smooth, lower cortex lacking except near lobe tips. Hapters very rare, situated submarginally and near lobe apices, white, very short. Photobiont layer  $\pm$  continuous near upper cortex.

Apothecia frequent, usually abundant, to 1.1-1.5-2.7 mm, slightly concave to plane, disc  $\pm$  pruinose. Thalline margin 0.05-0.13 mm, entire to crenulate. Algal layer below exciple 50-84-113  $\mu\text{m}$ . Exciple visible from outside, 8-31-75  $\mu\text{m}$  thick below hymenium, gelatinous, colorless, cells with thick walls and elongate lumina. Hypothecium 25-41-98  $\mu\text{m}$ , colorless to pale brown, irregular, cell walls thin. Hymenium 60-78-95  $\mu\text{m}$ . Paraphyses  $\pm$  sparsely branched (0-3 times), 1.5-2  $\mu\text{m}$  wide, tips 4-6  $\mu\text{m}$ . Spores narrow, cylindrical, (10.5-)11.2-14.3-16.8(-18.0) x (4.5-)5.0-5.9-7.5(-8.0)  $\mu\text{m}$ , septum wide, (2.5-)2.9-4.6-5.8(-8.0)  $\mu\text{m}$ .

Pycnidia common, immersed, slightly darker than upper surface, 0.07-0.18 mm diam. Conidia ellipsoid, (2.5-)2.6-2.8-3.0(-3.2) x c. 1-1.5  $\mu\text{m}$ .

Parietin (major), fallacinal (major or not), emodin, teloschistin (major or not), and parietinic acid. (Chemosyndrome A and A3).

### **X. ulophyllodes Rasanen**

Thallus moderately large, to 32 mm, forming rosettes, frequently coalescing. Lobes



narrow to moderately wide, 0.3-0.9-1.4 mm,  $\pm$  plane, horizontal or mostly slightly raised (showing the rhizines), branched, with rounded, wide tips. Upper surface yellowish orange to light orange to orange, smooth to shiny. Lower surface white, smooth to somewhat wrinkled. Rhizines very frequent, whit-yellow, moderately thick, short to long, pointed or somewhat frayed, free or attached. Soredia blastidious, produced marginally-submarginally, rare (on young thalli) to common, also laminal on well developed thalli, beginning as small holes in the upper cortex, gradually coalescing and covering large parts of the upper surface,  $\pm$  irregular, with  $\pm$  smooth surface, colored as the upper surface or slightly lighter, c. 39-47-51  $\mu$ m. Photobiont layer  $\pm$  discontinuous and spread throughout the medulla. Medulla reticulate, with short irregular hyphae.

Apothecia rare, abundant on some thalli, to 1.0-1.8-2.7 mm diam., (slightly concave to) plane to convex, disc sometimes undulate. Thalline margin 0.05-0.13 mm,  $\pm$  entire, often with soredia, usually with vertical or ventral, white-yellow, pointed rhizines. Algal layer below exciple 50-77-125  $\mu$ m. Exciple not visible from outside, 20-45-75  $\mu$ m thick below hymenium, gelatinous, colorless, cell walls thick, lumina elongate. Hypothecium 28-40-68  $\mu$ m, pale brown, irregular, cell walls thin. Hymenium 50-69-80  $\mu$ m. Paraphyses sparsely branched (0-2 times), 1.5-2.5  $\mu$ m wide, tips c. 4-7  $\mu$ m. Spores ellipsoid, (12.5-)13.8-15.0-16.3(-18.0) x (6.0-)6.8-7.3-7.9(10.0)  $\mu$ m, septum  $\pm$  wide, (2.5-)3.3-3.9-5.2(-6.0)  $\mu$ m.

Pycnidia common, immersed or slightly protruding, darker than thallus, 0.10-0.13 mm diam. Conidia bacilliform, sometimes almost oblong-ellipsoid, (2.5-)2.9-3.2-3.6(-4.0) x c. 1  $\mu$ m.

Parietin (major), fallacinal (major), emodin, teloschistin (major), and parietinic acid. (Chemosyndrome A3).

ADD:

Lobes closely attached, short, lacking a lower cortex. ....(see Caloplaca cirrochroa)

Soralia in hood-shaped structures similar to those of Physcia adscendens. This is probably a "somatic hybrid" between Physcia adscendens and Xanthoria sp., resulting from the growth processes described by Ott; I have seen several examples of this in addition to the one in Davis's herbarium. .... X. "adscendens" Davis in herb.

### **Excluded**

#### X. papillifera

Papillae (sometimes isidia-like) densely covering the upper surface, not breaking open into soredia, finger-shaped, developing in thallus center, abundant to very sparse, constricted, cylindrical, relatively thick and uniform in thickness. Thallus foliose with  $\pm$  appressed lobes; lobes narrow, highly convex-inflated, mostly distinctly separated, 0.5-1.0(-1.5) mm broad; tips contiguous, with slightly undulate surface; thallus center sometimes dying, but in healthy thalli not breaking into small areoles and lobe fragments; upper surface orange-yellow to orange, frequently pruinose. Apothecia not rare, often slightly pruinose. The report of X. cf. elegans from New Brunswick (Gowan & Brodo, 1988) which I thought referred to X. papillifera, was apparently based on X. elegans, since according to Lindblom Brodo's exsiccati of X. cf. papillifera is X. elegans.

## Literature

- Galloway, D. 1985. Flora of New Zealand Lichens.
- Goward, T., B. McCune and D. Meidinger. 1994. The Lichens of British Columbia.
- Hale M. E. & M. Cole, 1989. Lichens of California. U. of California Press, Berkeley.
- Kondratyuk, S. 1997. Notes on Xanthoria Th. Fr. III. Two new species in the Xanthoria candelaria group. Lichenologist 29: 431-440.
- Lindblom, L. 1997. The genus Xanthoria in North America. J. Hattori Bot. Lab. 83: 75-172.
- Laundon, J. R. 1992. Xanthoria. In: Purvis, et al., Lichen Flora of Great Britain and Ireland.
- Lindblom, L. 1997. The genus Xanthoria in North America. J. Hattori Bot. Lab
- Poelt, J. 1969. Bestimmungsschlüssel europäischen Flechten. J. Cramer, Lehre.
- Poelt, J. and W. Petutschnig. 1992a. Xanthoria candelaria und ähnliche Arten in Europa. Herzogia 9: 103-114.
- Poelt, J. and W. Petutschnig. 1992b. Beiträge zur Kenntnis der Flechtenflora des Himalaya IV. Die Gattungen Xanthoria und Teloschistes zugleich Versuch einer Revision der Xanthoria candelaria-Gruppe. Nova Hedwigia 54(1-2): 1-36.
- Rogers, 19 . Genera of Australian Lichens.
- Rudolph, E. D. 1955. Studies in the lichen family Blasteniaceae in North America north of Mexico. Unpublished thesis, Washington University. University Microfilms, Ann Arbor.
- Talbot, S. S., S. L. Talbot and J. W. Thomson. 199\_. Lichens of Tuxedni Wilderness, Alaska. The Bryologist \_: \_\_\_\_.
- Thomson, J. W. 1984. American Arctic Lichens I. The Macrolichens. Columbia University Press, New York.