

**III-G-1. SAXICOLOUS.**  
**Thallus well-developed, ± grey or white,**  
**medulla I+ violet.**  
**Hypothecium hyaline or pale**

Spores mostly over 7 um long. Hymenium over 45 um high.

**1. Thallus (or at least exciple) K+ yellow then red, P+ yellow** (norstictic acid). Hypothecium of erect hyphae, hyaline to medium brown or with a thin darker brownish layer in the center. Spores 9-15 x 4-7 um, ellipsoid-oblong. Paraphyses conglomerate, unbranched; tips slightly thickened. Epihymenium bright blue-green or blue-black. Exciple black or bluish black at edge, pale inside. Hymenium over 45 um. Thallus chinky or areolate; areoles contiguous or rarely dispersed, flat, rarely slightly convex, smooth, ashy, white or rarely darker or orange; black hypothallus sometimes visible. Apothecia to 1.5 mm, innate or becoming adnate and raised, the base not constricted or slightly so; disk flat, black, bare or pruinose, matt; margin thin, black, rarely pruinose, persistent. On siliceous rock. Arctic-alpine, south to Quebec, Colorado, and Washington. [This taxon is lumped under L. lapicida by some authors; differing from that species in chemistry and in that the thallus is usually thicker and whiter, with more neatly arranged, angular areoles; a peculiar unnamed species from SE Alaska will also key out here; it has scattered round areoles and needs further study]. .....L. lapicida var. pantherina

**1. Thallus K- or + yellow.** .....2

**2. Spores globose, 5 um.** Hymenium 40 um, hyaline below. Thallus thick, rimose-areolate, white to gray-white; areoles angular, 0.5-1.0 mm across, smooth, convex and verrucose, separated by deep cracks. Apothecia numerous to very numerous and confluent, angular from mutual pressure, 1.0-1.5 mm diam., immersed in thallus; disc depressed-convex, black, matt, epruinose; margin indistinct, level with thallus or slightly raised. Excipulum in narrow exterior part gray-brown, otherwise hyaline to pale, not distinctly delimited from hypothecium. Hypothecium hyaline. Epihymenium ± dark olive to brown. Paraphyses coherent, easily separated in K, distinctly septate, ca. 2 um thick, thickened above to 4-5 um. Asci narrowly pyriform, 25-45 x 10 um, the wall moderately thick above. Spores thin-walled. Apothecial tissues K-, N-. On non-calcareous rock, arctic. ....L. occidentalis

**2. Spores ± ellipsoid and mostly over 7 um long.** ..... 3

**3. Thallus K+ yellow.** ..... 4

**3. Thallus K-.** ..... 5

**4. Hymenium 55-65 um high.** Thallus rimose-areolate to areolate, whitish gray; areoles to 0.8 mm diam., contiguous in small groups or rows in cracks and depressions of the substrate, angular, plane to slightly convex, surface rough and minutely cracked, C-; hypothallus gray-black, evident among the areoles. Apothecia black, to 0.7 mm diam., roundish, immersed at first, later ± sessile though broadly adnate; disc slightly concave to plane; margin thin to moderately thick, slightly elevated, persistent. Exciple greenish olive or sorided greenish at edge, pale inside with colorless crystals and pale yellowish

granules, I+ blue-purple, C-, K+ pale yellow, P+ weak yellow in places. Hypothecium hyaline or pale. Hymenium 55-65 µm; epihymenium blue-green to olive green; paraphyses branched above. Spores ovoid to ellipsoid, 8-17 x 4-8 µm. Subalpine. Colorado. ....L. sp. 7 (Anderson)

**4. Hymenium to 100 µm high.** Thallus very variable, usually small, usually thin (to 0.4 mm), irregularly rimose-areolate, whitish to ashy, often unevenly rust colored (f. oxydata); prothallus often conspicuous, black. Apothecia to 1.2 (-1.8) mm, immersed to ± adnate or sessile, arising between the areoles and often compacted together with angular margins, flat or depressed-convex, black, matt, epruinose, the margin thin, raised, usually persistent. Exciple dark green at outer edge, ± colorless within, K+ yellowish. Hypothecium hyaline to medium brown. Epihymenium bluish brown or greenish black, K+ bright blue-green, N+ reddish purple; hymenium 50-70(-90) µm; hypothecium hyaline, or pale to dark brown below, K-. Paraphyses ca. 1.5-2 µm, simple or sparsely branched and anastomosed, tips expanding to 3 µm wide or with a green-brown hood and 3-4(-5) µm wide. Asci Lecidea-type. Spores (8-)8.8-15.2(-17) x (3.5-)4.7-7.4(-9.0) µm, broadly ellipsoid. Pycnospores 8-12(-20) x 1 µm, bacilliform. Medulla and exciple usually P- or P+ yellowish, K± yellow (flooding out in squash mounts), KC-, C- (stictic and constictic acids, unknowns); rarely without lichen substances. On acid rocks, usually in full sunlight. In alpine, humid areas. Widespread. ....L. lapicida v. lapicida

**5. Thallus chalky white (often strongly infected with torulose fungi and then appearing more gray), ± thick, ± continuous to weakly rimose or areolate, often zonate, with black hypothallus lines;** Apothecia immersed to adnate, to 2.4 mm, flat, black, often with central raised umbo of sterile tissue, the margin thick. Epihymenium green to brown; hypothecium hyaline to pale brown or brownish ochre or medium brown; subhymenium mostly greenish; hymenium 50-80 µm; subhymenium coppery green; paraphyses very gelatinous, the tips clavate. Spores thin-walled, (8-)9.0-12.8(-16) x (4.0-)5.1-7.0(-9.0) µm, bluntly ellipsoid, pseudo-2-celled. Medulla I- to I+ strongly blue-violet. Without lichen substances. On calcareous rocks. Arctic-alpine, in humid areas, Alaska to Greenland, south to Alberta, Utah, Colorado. ....L. umbonata

**5. Thallus ± gray or sordid, thin or thick. .... 6**

**6. Thallus continuous to very thinly rimose-areolate, blue-gray, ± thick (0.17-0.2 mm); areoles angular, plane, smooth, ca. 0.5 mm across, K-.** Cortex 10-15 µm, sordid grayish olive, in K almost colorless, surface indistinct. Aglae 4-7 µm, in dense layer ca. 85 µm thick. Medulla ± gray from air, the hyphae ± anticlinal, thick-walled, short-celled, dense. Apothecia numerous, innate, hardly prominent, separated from thallus by a circular crack; disc 0.6-0.8(-1.2) mm diam., 0.3-0.4 mm deep (pale part only 120-160 µm thick, limit to the underlying 100-200 µm thick medulla distinct), plane; margin thin, indistinct, only slightly prominent. Exciple 25-35 µm thick in upper margin, exterior half blue-green, interior gradually ± colorless, in part visible far in under hypothecium. Hypothecium 80-100 µm, hyaline to pale, apparently granular; hyphae perpendicular, like the exciple and hymenium I+ dark blue. Hymenium 55-65 µm, colorless; epihymenium 8-10 µm, sordid blue-green; paraphyses distinct, little gelatinous, 1.7 µm thick, in water distinctly and ± constrictedly septate, apices swollen, 2.5-3 µm with adherent granules, apices coherent in K. Asci 40-45 x 10-12 µm, clavate. Spores (6-)7-8.5(-11) x 3(-4) µm, often poorly developed and not released. Pycnospores 8-11 x 0.7 µm, straight. New

England. ....L. homalodes

**6. Thallus ± areolate.** ..... 7

**7. Apothecia ± pruinose, innate between areoles.** ..... 8

**7. Apothecia epruinose.** .....10

**8. Spores 8-10 x 5-6 um.** Thallus moderately thick to quite thick, areolate; areoles to 1.2 mm broad, contiguous, angular, flat or depressed-convex, whitish to ashy or darker gray, K-; black hypothallus sometimes visible. Disk flat, black, matt; exciple thin, persistent, angular or flexuous or circular. Hypothecium hyaline or pale, the upper part of vertical hyphae, the lower part with inspersions of air; exciple with inner part hyaline, outer part brownish, the lower marginal part brown and grading into the thallus, lacking under the apothecium; epithecium black or olive black; paraphyses confluent, 1.5 um thick, tips slightly thickened. Spores ellipsoid or oblong to subglobose. Subhymenium and hypothecium hyaline. Ascospores thick-walled, 6.2-13.0 x 3.6-5.9 um, L:W = 1.5-2.3. Apothecia not umbonate. Hymenium 45-70 um. Main substance: confluent acid. On rocks, mainly siliceous. Sometimes lichenicolous. Arctic-alpine and temperate, Alaska to Baffin Island, south to Virginia, Minnesota, Arizona, and Washington. .... 9

**8. Spores 13-16 x 6-8 um.** Mexico. ....L. tessellata var. mexicana

**9. Thallus pale yellowish to dark gray, moderately thick, areolate, slightly bullate;**

**hypothallus black-green. On calcium-free rock.** Thallus 0.3-0.5 mm thick, pale gray to yellow-gray. Thallus becoming medium to large sized. Apothecia not very dense. Usually not lichenicolous. Hypothecium unpigmented. L:W of spores averaging 1.5-2.2 um. Spore walls to 1.3 um thick. Alpine and semi-arid. Widespread. ....L. tessellata var. tessellata

**9. Thallus blue-gray, chalky, very thick (to 3 mm in center), finely areolate; hypothallus pale. On calcium-high rock.** Thallus pale blue-gray, areolate. Apothecia with thin margins and without regular umbos. Subhymenium and hymenium hyaline. Spores oblong-ellipsoid, (5.0-)6.2-12.0(-16.5) x (3.0-)3.6-6.0(-7.5) um. Especially in the Columbia Basin of the Pacific Northwest. ....L. tessellata var. caesia

**10. Spores 8-15 x 2.5-4 um.** Thallus endolithic to rimose-areolate, whitish gray or faintly bluish gray; areoles to 0.5 mm diam. (or up to 0.7 x 0.4 mm), contiguous or dispersed in small groups, angular to roundish angular, plane, often incompletely subdivided, K-, C-, P-; black hypothallus sometimes evident among the areoles and at the margins. Apothecia black, to 0.8-0.9 mm, roundish to roundish-angular, sessile; disc plane at first, becoming somewhat convex; margin thin, distinct, not much elevated, persistent. Excipulum usually dark olivaceous at the edge, pale inside (faintly sordid or pinkish-violet), I+ blue inside, K-, C-, P-. Hypothecium brownish below, colorless above. Hymenium 50-60 um, I± blue-green; epihymenium dark olive, K± olive-blue-green; paraphyses ± distinct, 1-2 um thick below; apical cells broadly clavate, 2-.45 um thick. Spores oblong. Mostly on pebbles and small cobble, upper montane to alpine tundra, Colorado. ....L. "subpromixta" (sp. 3) Anderson ined.

**10. Spores mostly over 4 um wide.** ..... 11

**11. Hymenium 100 um high.** Edge of exciple brown. Apothecia ± adnate on top of

areoles. ....(*L. lapicida*)

**11. Hymenium to 70  $\mu$ m high. ....12**

**12. Edge of exciple brownish.** Apothecia innate between areoles. ....(*L. tessellata*--see key to varieties above)

**12. Edge of exciple  $\pm$  blue or green. .... 13**

**13. Thallus brownish.** Thallus rimose-areolate to mostly areolate, pale brownish to brownish with a faint blue-green tinge to brownish gray or grayish; areoles to 0.8-0.9 mm diam., contiguous, angular, plane to moderately convex, K-, C-, P-. Hypothallus dark, weakly developed, sometimes evident at thallus margin. Apothecia black, to 1 mm diam., dispersed to 5-6-contiguous, roundish to angular, sessile, at first  $\pm$  immersed; disc concave to moderately convex; margin thin,  $\pm$  distinct, persistent to  $\pm$  excluded. Exciple K-, C-, P-; outer part rather weakly developed, pale to moderately blue-green throughout or at least externally, I-; inner part extensive, nubillous from granular crystals, containing a few algal cells at the side, I+ blue-purple. Hypothecium floccos-brownish below, faintly blue-green above in a moderately thick layer. Hymenium faintly blue-green, 50-60  $\mu$ m; epithecium blue-green. Spores ovoid to ellipsoid, 6.5-12 x 3.5-5.5  $\mu$ m. On periodically inundated boulders in larger subalpine streams, Colorado. Possibly belonging to the *L. atrobrunnea* group. .... *L.* sp. (Anderson)

**13. Thallus whitish to gray or blue-gray, without brownish tinges. .... 14**

**14. Epithymenium dark olivaceous, unchanged in K; spores ovoid to sometimes ellipsoid, 8-15 x 5-8  $\mu$ m. Thallus sordid whitish to whitish gray,** rimose-areolate to nearly areolate; areoles to 1.5 mm diam., contiguous, angular, plane to slightly convex, often incompletely subdivided, K-, C-, P-; black hypothallus evident at thallus margin. Apothecia black, to 3.0 mm diam., dispersed to several contiguous, roundish, sessile, broadly adnate; disc plane to slightly convex; margin moderately thick, slightly elevated at first, persistent. Excipulum whitish-nubilous except for edge at the side and above which is blue green, very thick (to 250  $\mu$ m), I+ blue-purple, K-, C-, P-. Hypothecium faintly brownish below, colorless above, to 250  $\mu$ m thick, I+ blue, K-, C-, P-. Hymenium 60-70  $\mu$ m, I+ blue (the asci red-brown). On boulders in alpine stream, Colorado. .... *L.* sp. 6 (Anderson)

**14. Epithecium dark blue-green. Spores ovoid to ellipsoid, 7-11 x 3.5-5  $\mu$ m. Thallus dark grayish to bluish gray,** areolate; areoles to nearly 1 mm diam., mostly less than 0.6 mm, contiguous, angular, slightly convex, K-, C-, P-; black hypothallus absent. Apothecia black, to 0.8 mm diam., roundish to roundish-angular, sessile, immersed at first; disk plane to slightly convex; margin thin, distinct, persistent. Excipulum blue-green at edge,  $\pm$  colorless or faintly blue-green inside, I+ blue, K-, C-, P-. Hypothecium colorless to faintly sordid blue-green. Hymenium faintly blue-green to colorless, 40-55  $\mu$ m, I+ red-brown, K-, C-, P-; On massive outcrops in the alpine, Colorado. .... *L.* sp. 8 (affin. *L. tessellata*) (Anderson)

ADD:

Thallus thick or fairly so, areolate; areolae 0.3-2.5 mm broad, contiguous or dispersed, convex to verruciform, bluish-ashy or brownish-ashy, esorediate; hypothallus black. Apothecia to 1.2 mm

broad, from emergent to adnate, crowded, angular, base not constricted; margin thin, black, shining; exciple radiate, purplish black in exterior part, interior pale, K+ reddish, continuing into hyaline hypothecium, which is I+ blue, K+ reddish; disk flat, black, slightly shining; epihymenium blue-brown, N+ violet; hymenium 70-90 um, I+ blue turning red; paraphyses 1.5 um, tips 2.5 um, coherent; asci clavate, Lecanora-type; spores 8, oblong-ellipsoid, simple, not halonate; 9-17 x 4-6 um. Conidia filiform, arcuate, 22-30 x 7-8 um. Thallus K-, C-, P-; exciple K+ reddish; hypothecium and hymenium I+ blue. On acid rocks. Arctic. .... "L."  
subplumbea Anzi

### III-G-2. SAXICOLOUS.

**Thallus well-developed, ± grey or white,  
medulla I+ violet.  
Hypothecium dark.**

**1. Thallus or exciple K+ yellow then red (norstictic acid).** On siliceous rock in humid areas. Hypothecium dark brown to black-brown (seen in sections 14-20 µm thin). Queen Charlotte Islands. .... L. swartzioidea

**1. Exciple K-; thallus K- (or + yellowish).** Thallus white. .... 2

**2. Exciple pale inside.** Thallus soft, chalky, continuous to rimose, white. .... (Porpidia speirea)

**2. Exciple dark inside.** (for other species with spores over 7 µm wide or over 20 µm long, see Porpidia and Farnoldia) ..... 3

**3. Spores (8.0-9.9-14.7(-16.0) x (4.0-)4.2-5.2(-6.0) µm.** Thallus chalky (powdery-crumbly), rimose-areolate, bluish-, smoky- or whitish- gray, on black hypothallus, often very large (to 50 cm diam.), rather thick (0.4-1.5 mm). Areoles flat to slightly convex, not regularly constricted at base. Subymneium unpigmented. Hymenium unpigmented. Apothecia sessile, to 2 mm, becoming elevated, convex and immarginate. Hypothecium medium brown to dark brown; epihymenium olive-black. Similar to L. lapicida but exciple blackish at outer edge, ± colorless within and epithecium green to olive-green, brownish green or black, hypothecium darker, spores usually more slender, thallus larger and thicker. Thallus P-, K-, KC-, C-, containing confluent and 2'O-methylperlatolic acids, and often trace or minor amounts of stictic acid. On acid rocks in full sun. Arctic-alpine. .... L. confluens

**3. Spores > 6 µm wide.** ..... 4

**4. Spores 20 x 6.5-7 µm. Thallus indistinctly rimose-areolate, with soralia, K+ yellow, patchy?** ("maculatum dissolutus"), the patches ± linearly arranged and radiating toward periphery of thallus, thin, Apothecia rare, sessile, to 1.2 mm, plane, blueish pruinose, the margin black, slightly prominent. Epihymenium pale dirty yellowish granular, K+ yellow (dissolving the granules); hypothecium brown-black; paraphyses richly branched towards tips; tips unthickened. Medulla I+ blue. On shaded rock, Smoky Mts. .... (L. degelii)

**4. Spores (often not developed) 13-14 x 7.5-9(-10 µm. Thallus deeply rimose-areolate to dispersed areolate, without soralia, K-,** thin to very thin, white; areoles angular, 0.15-0.25 mm diam., plane to depressed convex, shiny, usually smooth. Apothecia numerous to very numerous and partly congested, 0.15-0.3 mm diam., round, immersed then elevated, black, almost shiny, plane, the margin thick, concolorous with disk, persistent, giving the apothecia an aspicilioid appearance. Excipulum very dark. Hypothecium red-brown; epihymenium blue-brown, K+ pale violet. Hymenium I+ blue-black. Paraphyses coherent, articulate, branched, scarcely thickened at tips. Asci strongly inflated, the wall strongly thickened above. On granitic rock, arctic. Greenland; NW Territories. .... L. subrhagadiella

### III-H-1. SAXICOLOUS.

Thallus  $\pm$  well-developed, gray or white,  
I-, C+ or KC+ red or red-orange or pale orange.

1. With cephalodia. ....(see Amygdalaria spp. and L. shushanii)

1. Without cephalodia. ....2

2. Hypothecium dark. ....3

2. Hypothecium  $\pm$  hyaline. Spores under 10  $\mu$ m long, without halo. Hymenium under 100  $\mu$ m high. ....7

3. Paraphyses coherent. Spores over 20 x 10  $\mu$ m, with halo. Hymenium over 100  $\mu$ m high.  
.....(see Amygdalaria elegantior)

3. Paraphyses free. Spores smaller, without halo. Hymenium lower. Thallus C+ red or orange. ....4

4. Asci with I+ blue tholus. ....(see Lecidella spp.)

4. Asci without I+ blue tholus? .....5

5. Thallus immersed or poorly developed, subtartareous, rimose-areolate to verruculose-uneven, yellowish gray, K-, C+ pale orange, well-delimited at margin, hypothallus indistinct. Spores 9-12 x 2.5-3.5  $\mu$ m. Apothecia sessile, dispersed to crowded, to 2 mm, pure black (unchanged when wet), concave to plane, epruinose, the margin thick, prominent. Exciple blue-green-violet at edge, K $\pm$  distinctly violet. Hypothecium hyaline or faintly violet-red or brownish. Hymenium 35-50  $\mu$ m; epihymenium sordid blackish green. Containing schizopeltic acid. On sandstone, S. California. .... (L. hassei)

5. Thallus better developed. .... 6

6. Growing in Labrador. Thallus rimose-areolate, smooth to warty-squamulose. Hypothecium yellow-brown to red-brown, K+ brown-orange. Hymenium not interspersed. Thallus epilithic, K-, I+ slightly blue. ....L. labradorica (possibly a synonym of Schaereria tenebrosa according to Anderson)

6. Growing in California. Thallus moderately thick, greenish gray to ashy, composed of small, flat to convex areoles, making a continuous crust, K- or faintly yellowish. Apothecia 0.5-1.3 mm diam., partly immersed, often clustered and angular; disk flat or slightly convex, black or obscurely gray-pruinose; exciple black, entire. Hypothecium dark brown. Spores oblong-ellipsoid, 10-15 x 6-7  $\mu$ m. Containing gyrophoric acid. Santa Cruz Peninsula. .... L. fuscoatra v. grisella

7. Apothecia lecanorine. Thallus C+ red-yellow, K+ yellow. ....(Lecanora atrosulphurea)

7. Apothecia lecideine or biatorine. .... 8

8. Apothecia with pseudothalline margin. Asci I-. Paraphyses under 1.5  $\mu$ m thick. Hypothecium hyaline. ....(see Trapelia spp.)

8. Apothecia without pseudothalline margin. Asci usually I+ (except in Trapeliopsis);

paraphyses mostly over 1.5 um thick. .... 9

**9. Thallus  $\pm$  squamulose.** ....(see Trapeliopsis)

**9. Thallus not squamulose.** ..... 10

**10. Spores  $\pm$  brown.** Thallus brownish gray. ....(see Fuscidea praeurptarum)

**10. Spores hyaline, broad. Thallus whitish, grayish, yellowish or greenish,** C+ red or orange or C-. Apothecia sessile, round. Paraphyses free. Ascus with I+ blue tholus. ....(see Lecidella spp.)



### III-H-2. SAXICOLOUS.

Thallus  $\pm$  well-developed, grey or white,  
I-, C-, K+ red.

**1. Thallus with white granular soralia**, gray to blue-gray, of  $\pm$  convex areoles. Apothecia to 0.7 mm, black, plane, shiny. Hypothecium hyaline; hymenium 90  $\mu$ m; epihymenium dark brown. Spores 13-16 x 6.5-8  $\mu$ m. .... (L. petsamoensis)

**1. Thallus not soresiate.** .....2

**2. Spores 8-10 x 6-7  $\mu$ m.** Exciple K+ red. Arctic. ....L. circumnigrata v. reagens H. Magn.

**2. Spores 4.5-10 x 2.5-4  $\mu$ m.** Thallus areolate, "light-colored", on black hypothallus. Apothecia to 0.8 mm, black, sessile, plane to somewhat convex, subnitid; margin moderately thick, slightly elevated, subnitid, persistent. Exciple blue-green throughout, streaked with yellowish or sordid yellowish acid deposits, K+ red, P+ yellow, I-. Hypothecium hyaline, to 75-80  $\mu$ m; hymenium 40-45  $\mu$ m, I+ red-brown; epihymenium blue-green, K-; paraphyses coherent, 1.5-2.0  $\mu$ m thick below, apical cells to 3  $\mu$ m; spores ovoid to ellipsoid. On subalpine talus boulders, Colorado. ....L. dendroclinis (L. sp. 16 in Anderson).

### III-H-3-a. SAXICOLOUS.

Thallus  $\pm$  well-developed, grey or white,  
I-, C-, K- or + yellow.

Hypothecium hyaline or pale.

Spores under 10  $\mu$ m long

1. **Thallus K-**. Epihymenium  $\pm$  blue or green. Apothecia  $\pm$  black when wet. .... 2

1. **Thallus K+ yellow.** ..... 8

2. **Spores under 8  $\mu$ m long.** ..... 3

2. **Spores over 8  $\mu$ m long.** ..... 5

3. **Thallus thin, continuous. Exciple  $\pm$  well developed, dark at edge. Epihymenium olive-brown. Apothecia to 0.3 mm**, adpressed, black, epruinose, becoming convex and immarginate. Hymenium 40  $\mu$ m; hypothecium hyaline. Spores 4-5(-6) x 2-2.5  $\mu$ m. Arctic. Not mentioned by Thomson 1997. .... L. polaris (also see the various "cryptothalline" species in Group III-I)

3. **Spores 6.5-8 x 5-6  $\mu$ m.** Thallus thick. .... 4

4. **Thallus of convex squamules.** ..... L. rugosa

4. **Thallus rimose-verrucose**, thick (to 5 mm), chinky-areolate, shining, dirty clay-colored/yellow-gray, K-; verrucae thinly rimulose, bearing some apothecia on pedicels. Apothecia flexuous, tuberculate, plane and marginate then subglobose and immarginate, to 1.5 mm, adnate, black. Exciple with blackish blue-green exterior, interior hyaline, margin with hypothecium and hymenium. Spores globose, 5-6  $\mu$ m, to globose-ellipsoid, (5-)6.5-8(-9) x 5-6  $\mu$ m. Hymenium 55-60  $\mu$ m, lower part pale yellowish, upper part dark blue-green; paraphyses coherent in water, free in K, tips to 3-5  $\mu$ m and dark blue-green; asci clavate; hypothecium hyaline; epihymenium blue-green-black. Pycnospores acicular,  $\pm$  straight, 12-14  $\mu$ m long. Thallus K-, C-, P-; hypothecium and hymenium I+ blue. On acid rocks. Arctic. Similar to Lecanora marginata and Lecidella bullata. .... L. scrobiculata

5. **Spores 8-12 x 2.5  $\mu$ m**, indistinctly 1-septate. Thallus very thin to moderately thick, granulose or subverrucose to areolate, grayish or olive, K-; areoles 0.2-0.3 mm wide. Hypothallus thin, discontinuous, black, or absent. Apothecia solitary or aggregated, 0.2-0.5(-0.8) mm, adnate to moderately constricted; disc at first depressed or plane, often becoming convex or hemispherical, black, epruinose; margin persistent or thinning and often disappearing. Exciple distinct from hypothecium, intensely greenish black or with brown, the hyphae 5-7  $\mu$ m diam., radially arranged, conglutinate, the lumina variable in width. Hypothecium  $\pm$  hyaline, or olive-blackish to purple-brownish or dark brown above; hymenium 40-70  $\mu$ m, subhyaline to pale violaceous brown or pale greenish black below; epihymenium  $\pm$  green-black. Paraphyses coherent, sometimes slightly enlarged above, the exterior of the walls confluent; lumina ca. 1.5  $\mu$ m wide. Spores oblong with rounded ends or varying to oblong. On rock in a brook bed. New York, Newfoundland. .... Adelolecia kolaensis

5. **Spores over 3.5  $\mu$ m wide.** ..... 6

**6. Thallus ± lobate, yellow-white**, thickish, matt, K-, determinate, on blackish hypothallus. Spores 8-12 x 5-6 µm. Apothecia soon adnate or sessile, to 1 mm, ± flat, black, epruinose, the margin thick. Epihymenium olive green; hypothecium hyaline. On calcareous rocks. Arctic (and alpine?). ..... (L. atromarginata)

**6. Thallus not lobate, (mostly?) not yellowish.** Hymenium hyaline. .... 7

**7. Hymenium 35-50 µm.** Thallus fairly well-developed, crustose, of dark grey to whitish areoles, or ± immersed and scarcely apparent, I-, C-, K-, P-, KC+ pink or KC- (unidentified compound in some specimens). Apothecia 0.5-1.5(-2) mm diam., sometimes aggregated and then angular and mosaic-like, sometimes tuberculate; discs black, plane, epruinose, the margin thick or thin, often folded; exciple not carbonaceous, brownish, K+ purple-red (2-chloroemodin); hypothecium hyaline or pale; hymenium 35-50 µm; epihymenium blue-green, N+ purple-red ("Lecidea green"); paraphyses mostly simple, mostly coherent. Tholus of asci ± entirely I+ blue. Spores narrow, simple, (6-)8-11(-13) x (3-)3.5-5 µm (Thomson and others say they're much larger: 15-17 x 7.5-10 µm). On non-calcareous siliceous rocks, arctic-alpine. .... (Adelolecia pilati)

**7. Hymenium 60-80 µm.** Apothecia ± sessile. Paraphyses tips not or only slightly thickened. Thallus white to grayish. Paraphyses lax. Thallus verrucose-areolate. ...(Lecidella granulata)

**8. Apothecia immersed, mostly under 0.5 mm diam. Spores mostly under 5 µm wide.** Apothecia plane, not confluent. Hypothallus black. Thallus white, whitish gray, or yellowish, rimose-areolate. Apothecia immersed, to 0.5(0.7) mm, black, plane, immarginate. Hypothecium hyaline to gray; hymenium 45-55(-65) µm; epihymenium sordid olive to blackish green; spores 7-10(-14) x 3-5(-7) µm. On non-calcareous rocks, often on sandstone. Widespread. ....Lecanora oreinodes

**8. Apothecia sessile, to 1-1.2 mm diam. Spores 5-6 µm or more wide.** ..... 9

**9. Spores 6-13 x 3.5-8 µm.** Thallus areolate, whitish gray; areoles to 1.5 mm diam., dispersed in places to crowded, roundish-angular to irregular in outline, weakly to moderately convex or convex-undulate, C-, K+ yellow, P+ yellow. Black hypothallus absent. Apothecia black, to 1.5 mm diam., roundish, sessile on the areoles, moderately to strongly constricted; disc plane to moderately convex; margin distinct, slightly elevated, persistent; excipulum blue-green or sordid blue-green; ectal region interspersed with somewhat yellowish acid granules, K+ yellow, P+ yellow; medullary region nubilous from a dense incrustation of calcium oxalate; hypothecium colorless, to 80-100 µm thick; hymenium 60-65 µm; epithecium dark blue-green, somewhat granular above. Spores ovoid to ovoid-ellipsoid. High subalpine. Colorado. .... L. sp. 20 (Anderson)

**9. Spores 8-10 x 5-6 µm.** ..... 10

**10. Thallus ± yellow-white, areolate. Apothecia plane.** Thallus thick, the areoles plane, to 0.5 mm diameter. Apothecia to 1 mm, sessile, the margin thick. Epihymenium and edge of exciple green-black or blue-green; hypothecium hyaline or pale; hymenium 60 µm. Spores 8-10 x 5-6 µm. ....L. crisima

**10. Thallus white to glaucous, rimose-areolate. Apothecia soon convex, dense, confluent, to 1.2 mm, black.** Epihymenium and exciple edge blue-green. Thallus

maculiform. Epithymenium and exciple edge blue-green. Hypothecium hyaline or pale.  
Spores 8-10 x 5-6 um, ellipsoid. Paraphyses contiguous,  
simple. ....L. homosema

**III-H-3-b. SAXICOLOUS.**

**Thallus ± well-developed, grey or white,  
I-, C-, K- or + yellow.**

**Hypothecium hyaline or pale.**

**Spores 10-17 µm long, over 4 µm wide.**

**1. Epihymenium yellow-brown to red-brown. Apothecia ± red-brown, at least when wet.**

..... 2

**1. Epihymenium ± blue or green. Apothecia ± black when wet. ....6**

**2. Paraphyses free. .... 3**

**2. Paraphyses coherent.** Apothecia margin thin. Thallus ashy white (to greenish), often thick. .... 4

**3. .... Lecidella (e.g., L. stigmathea)**

**3. Apothecial margin thick when young. Thallus grey-brown (ashy white according to Fink), thin to very thin, K-, C-, determinate, soon effuse, sometimes bordered by a scarcely evident black hypothalline line, from contiguous becoming minutely fissured and areolate, the surface smooth or minutely roughened, appearing to the eye as a uniform brownish gray film. Apothecia scattered (to clustered and irregular according to Fink), medium to rather large (0.6-1 mm diam. according to Fink), sessile, dark red-brown to blackish brown or reddish black; disc at first plane or flattish with an evident, thick, entire sometimes flexuous margin, becoming convex and finally immarginate. Hymenium I+ blue. Asci clavate. Spores 12-16 x 7-8.5 µm (10-13 x 5-7 µm according to Fink), ellipsoid to short ellipsoid, variously disposed in the asci. Hypothecium hyaline (brownish according to Fink). Epihymenium yellowish brown. Paraphyses simple, free, threadlike, their blackish tips subcoherent. On granite in creek bed, ca. 1100 ft, California. ....L. (Lecidella?) pacifica**

**4. Apothecia to 1.3(-2.5) mm diam.** Thallus ± continuous to irregularly rimose-areolate, ashy white or rarely ochraceous or rusty in parts, smooth to slightly warted; prothallus generally indistinct. Thallus K-, P-, C-, KC-, containing 4-O-demethylplanic and ± planic acids. Spores (9-)11-15 x (3.5-)5-6(-7) µm, narrowly ellipsoid. Apothecia partly immersed in early stages, then emergent, ± sessile, flat or depressed-convex, thinly pruinose or becoming bare, brown to black, brown when wet, sometimes angular by compaction, not constricted below; margin ± thin, raised, persistent. Exciple with outer edge dark brown ± with greenish tinge, internally pale brown to ± colorless, K-. Epithecium brown or olive brown, K-. Hypothecium hyaline, composed of ± vertically oriented hyphae; hymenium (45-)55-80 µm, sometimes brownish in parts. Paraphyses sparsely branched and anastomosed, the apices brownish, to 4.5 µm, often with granules adhering., Asci elongate-clavate, Lecidea-type. Pycnosporos 12-18 x 0.5-1.5 µm, cylindrical. On siliceous rocks (often iron-rich) in open, arctic-alpine. [see notes under L. plana] .....L. lithophila

**4. Apothecia to 0.5 mm diam. .... 5**

**5. Spores 9-12 x 3-6 µm.** Exciple ± well developed. Hymenium 60-70 µm. Thallus thin to moderately thick, white or grayish or greenish-white, verrucose or more commonly areolate.

Apothecia to 0.5 mm, pale brown to brown-black or black, epruinose, becoming moderately convex, the margin becoming thin and often disappearing. Hypothecium pale to dark yellowish- or reddish-brown; epihymenium  $\pm$  olive-brown. Spores oblong-ellipsoid,

Eastern. .... (*L. virginiensis*)

**5. Spores 12-18(-23) x 5-6(-7)  $\mu$ m**, narrowly ellipsoid, somewhat inequilateral and plano-convex, apices often attenuated. Thallus whitish or pale gray, C-, K+ strongly to weakly yellowish, KC+ yellow, P+ yellow, containing atranorin and psoromic acid; irregularly rimose to  $\pm$  areolate, smooth; prothallus white, often well developed, sometimes replaced by dark contact zones with other thalli. Apothecia to 0.5 mm, plane to concave, immersed, aspicilioid, irregular in shape, sometimes coalescing, dark brown or black, sometimes pruinose,  $\pm$  immarginate. Exciple outer edge red-brown where exposed, internally pale. Epihymenium red-brown, somewhat olivaceous in K; hymenium (95-)100-150(-160)  $\mu$ m. Hypothecium dark red-brown. Paraphyses  $\pm$  simple, occasionally branched towards tips; apices reddish brown, scarcely swollen to 3  $\mu$ m wide. Asci *Biatora*-type. In damp shaded crevices of siliceous rock outcrops, often near the ground. ....*L. phaeops*

6. Paraphyses tips strongly gelatinized, in KOH over 4  $\mu\text{m}$  thick. ....(*Tephromela aglaea* and *T. testaceoatra*)
6. Paraphyses in KOH ca. 1.7  $\mu\text{m}$  thick (?). .... 7
7. Thallus yellowish. .... 8
7. Thallus (mostly?) not yellowish. .... 10
8. On calcareous rocks. .... 9
8. On siliceous rock. Thallus not lobate, pale yellowish, rimose to areolate, K-, C-. Apothecia to 1.8 mm, black, becoming convex, the margin weakly swollen. Epihymenium dirty olive; hymenium 45-52  $\mu\text{m}$ ; hypothecium hyaline to ochre; spores 9-14 x 5-7  $\mu\text{m}$ . ....(*L. sulphurea*)
9. Thallus  $\pm$  lobate, yellow-white, thickish, matt, K-, determinate, on blackish hypothallus. Spores 8-12 x 5-6  $\mu\text{m}$ . Apothecia soon adnate or sessile, to 1 mm,  $\pm$  flat, black, epruinose, the margin thick. Epihymenium olive green; hypothecium hyaline. Arctic (and alpine?). ....*L. atromarginata*
9. Spores 8-14 x 4.5-7.5  $\mu\text{m}$ . Thallus mostly pale lemon yellow (to straw-colored) chalk-white, rarely "sattgelb", thick, well-developed, on whitish prothallus. Apothecia sessile, soon convex-immarginate, to 1.5(-2.5) mm, black (even when wet). Epihymenium yellow- to black-green. Hypothecium hyaline or pale; exciple at least partly pale. Alpine, on calcareous rocks. ....*Lecanora marginata*
10. Hymenium bright green-blue. Thallus K+ yellow. ....(*Lecidella carpathica*)
10. Hymenium hyaline or pale. .... 11
11. Thallus pale green, verrucose-areolate; areoles to ca. 1.5-2.0 mm diam., roundish to lobated, surface irregular to verrucose, completely subdivided, K-, C-, P-; black hypothallus not evident. Apothecia black-olivaceous to yellowish, to 1.5 mm diam., roundish, immersed and pseudolecianorine at first, becoming immersed-sessile; disc moderately convex; margin moderately thin, not elevated, becoming  $\pm$  indistinct. Excipulum pale externally, interspersed with a yellowish granular material, colorless inside, I-, the granular material dissolving in K (except for the calcium oxalate crystals), C-, soluble in P. Hypothecium colorless, thick, with characteristically large vesicular hyphae, I+ pale brown, K-, C-, P-. Hymenium 55-60  $\mu\text{m}$ , I+ red-brown; epihymenium ca. 15-20  $\mu\text{m}$ , yellow-brown from granules mixed with blue-green pigmentation; granules soluble in K. Spores ovoid to ellipsoid, 8-14 x 5-8  $\mu\text{m}$ . Superficially similar to *Lecanora marginata*. On boulders in and along larger subalpine streams. Colorado. .... *L.* sp. 14 (*L. viridiatra-luteoatra* group) (Anderson)
11. Thallus not greenish. .... 12
12. Spores 12-15 x 8-9  $\mu\text{m}$ . Thallus whitish, rather thick, areolate, on black hypothallus. Apothecia black, epruinose, plane, ca. 1 mm, immersed, with very thin, concolorous margin. Hypothecium hyaline. Epihymenium emerald green to olive. On siliceous rocks, Mexico. ....*L. subaglaea*
12. Spores mostly under 8  $\mu\text{m}$  wide. .... 13

**13. Spores brownish.** .....(*Fuscidea placidiensis*)

**13. Spores hyaline.** .....14

**14. Apothecia greenish pruinose.** Thallus rimose-areolate to areolate, white; areoles to ca. 1.5 mm diam., contiguous in small groups, roundish to angular, slightly convex, incompletely subdivided, C-, K+ dark yellow, P+ pale yellow. Apothecia black, to nearly 2 mm diam., roundish to sublobate, sessile; disc becoming somewhat convex; margin moderately thick to thin, persistent. Excipulum blue-green at edge, yellowish nubilous elsewhere from granules and crystals, thick, I-, K+ yellow (diffusion), P+ yellow, C-. Hypothecium colorless. Hymenium colorless, 60-70 µm; epithecium pale blue-green, sometimes interspersed with granules. Spores ovoid to ellipsoid, 7-13 x 3.5-7 µm. On massive outcrops in high subalpine. Colorado. ....*L. subchilena* Anderson ined. (sp. 17)

**14. Apothecia epruinose(?).** ..... 15

**15. Hymenium 35-50(-55) µm.** ..... 16

**15. Hymenium over 50 µm.** ..... 19

**16. Apothecia 0.5-1.5(-2) mm diam.,** sometimes aggregated and then angular and mosaic-like, sometimes tuberculate; discs black, plane, epruinose, the margin thick or thin, often folded; exciple not carbonaceous, brownish, K+ purple-red (2-chloroemodin); hypothecium hyaline or pale; hymenium 35-50 µm; epihymenium blue-green, N+ purple-red ("*Lecidea* green"); paraphyses mostly simple, mostly coherent. Tholus of asci ± entirely I+ blue. Spores narrow, simple, (6-)8-11(-13) x (3-)3.5-5 µm (Thomson and others say they're much larger: 15-17 x 7.5-10 µm). Thallus fairly well-developed, crustose, of dark grey to whitish areoles, or ± immersed and scarcely apparent, I-, C-, K-, P-, KC+ pink or KC- (unidentified compound in some specimens). On non-calcareous siliceous rocks, arctic-alpine. .... *Adelolecia pilati*

**16. Apothecia to 0.5(-0.7) mm.** ..... 17

**17. Apothecia immersed.** Hypothallus black. Thallus white, whitish gray, or yellowish, rimose-areolate. Apothecia to 0.5(0.7) mm, black, plane, immarginate. Hypothecium hyaline to gray; hymenium 45-55(-65) µm; epihymenium sordid olive to blackish green; spores 7-10(-14) x 3-5(-7) µm. On non-calcareous rocks, often on sandstone. Widespread. ....*Lecanora oreinodes*

**17. Apothecia sessile.** ..... 18

**18. Spores 10-12 x 6-7 µm. Thallus white, pulverulent, rimose-areolate, K-, C-.**

Apothecia to 0.5 mm, discs black, flat to slightly convex, the margin thin, finally disappearing. Hypothecium hyaline. On small pebbles on the ground, S.

California. ....*L. austro-californica* Zahlbr. (= *L. subplebeia* Nyl. non Vainio)

**18. Spores 12-14 x 6-8(-9) µm. Thallus gray-brown, granulose, K+ dark yellow, C-,** rather thick. Apothecia black, epruinose, adnate, to 0.4 mm, becoming convex and immarginate. Epihymenium olive-green; hypothecium hyaline. Mexico. ....*L. (Lecidella?) goniophiloides*



**19. Hymenium 60-80 um. Apothecia ± sessile. ....20**

**19. Hymenium 50 um. Apothecia immersed,** to 1 mm, plane, immarginate, black, thinly pruinose when young. Thallus limited, whitish or grayish white, moderately thick, rimose-areolate, K-, C-. Spores 12-18 x 6.5-8 um, often poorly developed. Epihymenium sordid olive; hypothecium hyaline or yellowish. Mexico. ....L. moreliensis

**20. Paraphyses lax.** Thallus verrucose-areolate. ....(Lecidella granulata)

**20. Paraphyses coherent (?).** ..... 21

**21. Apothecia margin shiny.** Thallus ashy to brown-ashy. Spores 8-15 x 4-7 um. Paraphyses tips thickened. ....Miriquidica leucophaea

**21. Not as above.** ..... 22

**22. Thallus K-, P-.** Apothecia margin dull. Thallus gray-white or creamy, areolate to verrucose- or rimose-areolate or sometimes nearly absent, to a few cm across, to ca. 0.1 mm thick; areoles or verrucae to 0.6 mm diam., rarely to 1.0 x 0.6 mm, dispersed or contiguous, roundish to angular, often irregular, plane to convex, sometimes incompletely subdivided in rimose forms; surface smooth to slightly irregular, matt, K-, C-, P-; black hypothallus not evident. Apothecia to 0.8(-1) mm, black, sessile, rather broadly adnate to moderately constricted at the base, at first ± immersed between areoles (if thallus well enough developed); disc plane to convex, smooth, epruinose, matt; margin thin to moderately thick, distinct, slightly elevated, usually persistent, entire, matt. Ectal excipulum violet-brown externally, paler or brownish inside, sometimes slightly bluish-green externally at the base, ± continuous with the hypothecium laterally, to 60(-70) um thick at the side, to 70 um at the lower flank, I- or + blue inside above, K- or slightly more intense violet-brown, C-, P-, composed of branched, parallel-radiate hyphae on the upper flank and above, the hyphae 3.0-4.5 um thick, with slightly carbonaceous walls, becoming ± pseudoparenchymatous on the lower flank at and near the point of attachment, the cells 3.5-6.0 um diam., thin-walled; medullary excipulum absent or only developed as a "stipe" of ± colorless hyphae and cells, not developed laterally at the flank. Hypothecium colorless above in a layer 10-25(-30) um thick, brownish below and 35-130(-240) um thick, of predominantly vertical hyphae 1.5-2.0 um thick, I+ blue in places or throughout, K-, C-, P-. Hymenium faintly greenish to nearly colorless, often more intensely greenish laterally at the juncture with the excipulum, to 60-70(-75) um thick, I+ blue, the asci somewhat yellowish. Epithecium olivaceous, ± greenish below, olivaceous to greenish in K. Paraphyses subdiscrete to discrete in water, coherent even in K, simple to once-branched apically, anastomosing in the subhymenium, 1.0-1.5(-2.0) um thick below; apical cells clavate to irregular, to 4 um wide. Asci clavate, 8-spored. Spores ovoid to ellipsoid, 8-16 x 4-7.5 um. Hypothecium brownish below; epihymenium olivaceous. On siliceous pebbles. Rocky Mts., Colorado. ....L. "kieneri"  
Anderson ined.

**22. Thallus K+ yellow, P+ yellow.** The differences between the next two taxa are not clear. .... 23

**23. Apothecia sessile.** Spores 6-13 x 3.5-8 um. Thallus areolate, whitish gray; areoles to 1.5

mm diam., dispersed in places to crowded, roundish-angular to irregular in outline, weakly to moderately convex or convex-undulate, C-, K+ yellow, P+ yellow. Black hypothallus absent. Apothecia black, to 1.5 mm diam., roundish, sessile on the areoles, moderately to strongly constricted; disc plane to moderately convex; margin distinct, slightly elevated, persistent; excipulum blue-green or sordid blue-green; ectal region inspersed with somewhat yellowish acid granules, K+ yellow, P+ yellow; medullary region nubilous from a dense incrustation of calcium oxalate; hypothecium colorless, to 80-100  $\mu$ m thick; hymenium 60-65  $\mu$ m; epithecium dark blue-green, somewhat granular above. Spores ovoid to ovoid-ellipsoid. High subalpine.

Colorado. .... L. sp. 20 (Anderson)

**23. Apothecia immersed at first, later sessile.** Thallus areolate, whitish to whitish gray; areoles to 1.6 mm diam., mostly below 1 mm wide,  $\pm$  contiguous, roundish-angular,  $\pm$  plane to slightly convex, C-, K+ yellow, P+ yellow; black hypothallus not evident. Apothecia black, occasionally faintly pruinose, to 2 mm diam., roundish to somewhat irregular in outline, sessile; disc slightly concave to moderately convex, matt; margin thin to moderately thick,  $\pm$  persistent; excipulum blue-green externally, colorless internally, commonly inspersed externally along the lower flank with granular crystals, I-, K-, C-, P-. Hypothecium colorless, with conspicuous vesicular hyphae, I+ blue. Hymenium colorless to faintly blue-green in places, 55-80  $\mu$ m, I+ red-brown; epithecium olivaceous blue-green to somewhat olivaceous. Spores ovoid to ellipsoid, 8-17 x 4-10  $\mu$ m. On schist, alpine tundra. Colorado. .... L. sp. 21 (Anderson)

ADD:

Paraphyses coherent. Thallus areolate, white, K-. Spores ellipsoid, 9-12 x 5-6  $\mu$ m. Paraphyses tips slightly thickened (1.7  $\mu$ m in KOH). Epihymenium bluegreen to olive-black. Hypothecium hyaline or pale. Apothecia over 0.5 mm. Arctic. .... Lecanora marginata (syn. Lecidea despecta)

Lecidella spp.

**III-H-3-c. SAXICOLOUS.**

**Thallus  $\pm$  well-developed, grey or white,  
I-, C-, K- or + yellow.**

**Hypothecium hyaline or pale.**

**Spores 10-17  $\mu$ m long, but under 4  $\mu$ m wide.**

**1. Epihymenium intense blue. Thallus moderately thick, rimose-areolate. Exciple indistinct, pale yellow. Apothecia to 1.5 mm,** often crowded, adpressed, black, irregularly concave to subplane, matt, the margin prominent. Spores 10-12 x 4  $\mu$ m,  $\pm$  cylindric.

Hypothecium pale. Thallus K-, C-. Arctic. Not mentioned by Thomson

1997. .... L. baffiniana

**1. Epihymenium green-black, olive, etc. .... 2**

**2. Apothecia to 1.5-2 mm,** Spores 9-12 x 2.5-3.5  $\mu$ m. Thallus immersed or poorly developed, subtartareous, rimose-areolate to verruculose-uneven, yellowish gray, K-, C+ pale orange, well-delimited at margin, hypothallus indistinct. Apothecia sessile, dispersed to crowded, black, concave to plane, epruinose, the margin thick, prominent. Exciple blue-green-violet at edge, K $\pm$  distinctly violet. Hypothecium hyaline or faintly violet-red or brownish. Hymenium 35-50  $\mu$ m; epihymenium sordid blackish green. Containing schizopeltic acid. On sandstone, S. California. .... (L. hassei)

**2. Apothecia to 0.5(0.8) mm. .... 3**

**3. Thallus very thin to moderately thick, granulose or subverrucose to areolate,** Spores indistinctly 1-septate, 7-12(-15) x 2.5-4  $\mu$ m. Thallus subcontinuous or dispersed, ashy to bluish-ashy or olive, dull, K-; hypothallus indistinct. Apothecia single or conglomerate, 0.2-0.4 mm, or when confluent to 1 mm, adnate, constricted at base, black, epruinose, becoming convex, the margin persistent or disappearing. Exciple black-violet to dark bluish, cells radial. Hypothecium  $\pm$  hyaline, or olive-blackish to purple-brownish or dark brown above; hymenium 40-70  $\mu$ m, partly or entirely blue; epihymenium green-black; paraphyses coherent, gelatinous; spores oblong. Medulla K-, C-, KC-, I-; hymenium I+ blue. . .... L. conferenda

**3. Thallus thin, continuous.** Exciple  $\pm$  well developed, dark at edge. Epihymenium olive-brown. Apothecia to 0.3 mm, adpressed, black, epruinose, becoming convex and immarginate. Hymenium 40  $\mu$ m; hypothecium hyaline. Spores 4-5(-6) x 2-2.5  $\mu$ m. Arctic. Not mentioned by Thomson 1997. .... L. polaris (also see the various "cryptothalline" species in Group III-I)

### III-H-4-a. SAXICOLOUS.

Thallus  $\pm$  well-developed, grey or white,

I-, C-, K- or K+ yellow.

Hypothecium dark.

Spores under 10  $\mu$ m long.

1. Hypothecium greenish, bluish, or violet. ....2

1. Hypothecium  $\pm$  brown or brown-black. ....7

2. Thallus K+ yellow. Hypothecium  $\pm$  blue-green. Rocky Mts. of Colorado. ....3

2. Thallus K-. ....4

**3. Spores 6-12 x 3.5-7  $\mu$ m.** Thallus areolate-squamulose, whitish; areoles to 3.5 mm diam., or up to 4.5 x 2 mm, contiguous to slightly subimbricate, roundish angular to sublobate, plane to somewhat convex, K+ yellow, P+ pale yellow, C-. Apothecia black, to 1.5 mm diam., roundish or roundish-angular, immersed-sessile to sessile, broadly adnate; disc moderately convex; margin not evident; excipulum rather weakly developed, unevenly blue-green or sordid blue-green or in places at the base somewhat brownish blue-green, I-, K-, C-, P-. Hypothecium  $\pm$  colorless above, gradually sordid blue-green below, to 250-300  $\mu$ m or more thick. Hymenium I+ red-brown; epihymenium  $\pm$  dark blue-green, thick, K+ bluish, P-. Spores ovoid to ellipsoid. On large rocks in alpine-like areas of the subalpine. Colorado. .... (*L.* sp. 19 of Anderson)

**3. Spores 6.5-13 x 2.5-4  $\mu$ m.** Thallus verrucose-areolate, whitish to bluish-gray, K+ yellow, C-. Apothecia to 2.5 mm, sometimes slightly pruinose. Hypothecium hyaline to faintly bluish or blue-greenish; epihymenium intense bluish or bluish-green. On siliceous rocks. Colorado. .... (*L.* "*coloradensis*" Anderson ined.)

**4. Thallus gray-white. Spores 5-8.5 x 2.5-4  $\mu$ m. Hypothecium  $\pm$  blue-green to violet. Apothecia to 1 mm, epruinose. Epihymenium dark blue-green.** Thallus rimose-areolate or subareolate, in places only endolithic, forming irregular and  $\pm$  confluent patches in cracks and depressions of the rock surface, often darkened in places from hypothalline hyphae; areoles to 0.8 mm diam., usually much smaller, to 0.2 mm thick,  $\pm$  contiguous, angular to irregularly angular, frequently incompletely subdivided, plane to slightly convex or minutely undulate; surface matt, K-, C-, P-. Hypothallus blackish, evident below and at the sides. Apothecia to 0.7 mm high (including stipe), dispersed to contiguous, often 5-10 or more crowded in a tight group, round to angular or sublobate, sessile to short-stalked, moderately to strongly constricted at base; disc plane to slightly convex,  $\pm$  smooth to minutely roughened, matt or subnitid; margin moderately thick, distinct, epruinose. Spores ovoid to oblong. Outer excipulum K+ intense violet, other reactions in apothecia negative. On low, acid rocks, alpine. Rocky Mts., Colorado. .... *L.* "*saximontana*" Anderson ined.

**4. Thallus yellow to ochre-white. Spores (7-)8-10 x 2.5-3  $\mu$ m. Hypothecium olive/blue (hyaline according to Thomson 1997). Apothecia to 2 mm, epruinose, Epihymenium bluish-olive.** Hymenium 45-50  $\mu$ m, hyaline. Thallus moderately thick, to 1 mm, deeply areolate; areolae angular, flat to convex, surface minutely cracked, smooth, waxy to bony shining, soft when wet; black hypothallus visible between.

Apothecia becoming conglomerate, to 2 mm broad, black, elevated, plane to depressed-convex; disk epruinose, scabrid; margin at first prominent, becoming excluded as disk becomes convex; exciple strongly adspersed, exterior with thin dark layer, interior hyaline. Paraphyses septate, strongly coherent, 2.5-3  $\mu$ m; asci narrow; spores narrowly oblong, straight or slightly curved. Thallus K-, P-, I-; hypothecium and hymenium I+ blue; epihymenium very blue with HCl or N. On siliceous rock, arctic. .... L. theodori

**5. Hymenium ca. 100  $\mu$ m. Thallus K+ yellow.** Epihymenium yellow-brown to red-brown. Apothecia  $\pm$  red-brown, at least when wet. Spores 7 x 4-5  $\mu$ m. Thallus areolate, gray. Apothecia to 0.6 mm, immersed to adnate, plane, black, epruinose, the margin thin, entire, concolorous. Hypothecium brown; epihymenium brown. Exciple K+ red. Arctic. Not mentioned by Thomson 1997. .... (L. somphoterella)

**5. Hymenium 40-55  $\mu$ m. Thallus K-. .... 6**

**6. Epihymenium brown-yellow.** Spores 8-9(-10) x 3.5-4(4.5)  $\mu$ m. Thallus chalky, very thin, scattered, white. Apothecia 0.3 mm, sessile, black to brown-black, plane, the margin thin or indistinct. Hypothecium brown. Hymenium 45-55  $\mu$ m. On shaded rock along brook, New York. .... L. albonigra

**6. Epihymenium  $\pm$  green-black, dark greenish blue to greenish brown, K+ green intensifying, N+ purple-red.** Spores (6-)7-9(-10) x (2-)2.5-3.5(-5)  $\mu$ m, narrowly ellipsoid, rather abruptly truncated at the ends. Thallus gray, thin, membranous or verrucose, continuous or of scattered fragments; prothallus often predominant, fimbriate and black. Hypothecium brown to brown-black. Apothecia to 0.5(-0.7) mm, sessile, constricted at base; disc concave to  $\pm$  flat, rarely somewhat convex, black, epruinose; margin usually persistent, raised. Exciple blue-black at outer edge, pale brownish (K+ purplish) within. Hymenium 35-50  $\mu$ m. Hypothecium dark brown. Paraphyses 1.5-2.5(-3)  $\mu$ m, sparsely branched and anastomosed, not strongly swollen or capitate at tips. Asci with K/I+ blue apical dome penetrated by a darker tube-like structure. Pycnidia often abundant, sometimes only those present, 80-150  $\mu$ m, black; conidia 3-5 x 1.5  $\mu$ m,  $\pm$  cylindrical. Thallus P-, K-, KC-, C-. On pebbles, especially flints. Rarely also on wood (thallus  $\pm$  immersed, hardly discoloring the wood) .... Micarea erratica

ADD:

**Spores 8-12 x 2.5  $\mu$ m,** indistinctly 1-septate. Thallus very thin to moderately thick, granulose or subverrucose to areolate, grayish or olive, K-. Apothecia to 0.5(0.8) mm, epruinose, becoming convex, the margin persistent or disappearing. Hypothecium  $\pm$  hyaline, or olive-blackish to purple-brownish or dark brown above; hymenium 40-70  $\mu$ m; epihymenium green-black. .... (L. conferenda)

### III-H-4-b. SAXICOLOUS.

Thallus  $\pm$  well-developed, grey or white,

I-, C-, K- or K+ yellow.

Hypothecium dark.

Spores 10-17  $\mu$ m long.

1. Hypothecium greenish, bluish, or violet. ....2

1. Hypothecium  $\pm$  brown or brown-black. ....5

2. Thallus K+ yellow. Hypothecium  $\pm$  blue-green. Rocky Mts. of Colorado. ....3

2. Thallus K-. ....4

**3. Spores 6-12 x 3.5-7  $\mu$ m.** Thallus areolate-squamulose, whitish; areoles to 3.5 mm diam., or up to 4.5 x 2 mm, contiguous to slightly subimbricate, roundish angular to sublobate, plane to somewhat convex, K+ yellow, P+ pale yellow, C-. Apothecia black, to 1.5 mm diam., roundish or roundish-angular, immersed-sessile to sessile, broadly adnate; disc moderately convex; margin not evident; excipulum rather weakly developed, unevenly blue-green or sordid blue-green or in places at the base somewhat brownish blue-green, I-, K-, C-, P-. Hypothecium  $\pm$  colorless above, gradually sordid blue-green below, to 250-300  $\mu$ m or more thick. Hymenium I+ red-brown; epihymenium  $\pm$  dark blue-green, thick, K+ bluish, P-. Spores ovoid to ellipsoid. On large rocks in alpine-like areas of the subalpine. Colorado. ....L. sp. 19 (Anderson)

**3. Spores 6.5-13 x 2.5-4  $\mu$ m.** Thallus verrucose-areolate, whitish to bluish-gray, K+ yellow, C-. Apothecia to 2.5 mm, sometimes slightly pruinose. Hypothecium hyaline to faintly bluish or blue-greenish; epihymenium intense bluish or bluish-green. On siliceous rocks. Colorado. ....L. "coloradensis" Anderson ined.

**4. Spores 12-16 x 5-8  $\mu$ m. Thallus gray-green, membranaceous to membranaceous-areolate.** Hypothecium dark green-black. Apothecia to 1 mm, adnate, black, epruinose, becoming convex and immarginate. Hymenium 60-70  $\mu$ m; epihymenium olive-brown. New York. (L. delincta may also key out here, although only the upper part of the hypothecium is slightly bluish or greenish) ....L. nemoralis

**4. Spores 16-21 x 6-9  $\mu$ m. Thallus gray-white, verrucose-areolate to areolate.** Hypothecium olive to blue-black. Apothecia 0.5-1.5 mm, adnate, becoming convex, the margin thick and elevated, usually persistent. Hymenium 90-120  $\mu$ m. Epihymenium green-black. New York. ....L. diversa

**5. Apothecia blue-green pruinose (epruinose and shiny black according to Thomson 1997), soon  $\pm$  globose, to 0.4(-0.6) mm.** Thallus usually immersed, sometimes epilithic, thin, yellowish white to green-gray, verrucose-areolate, the areolae isolated, shining, to 1 mm broad; hypothallus lacking. Apothecia narrowed at base, at first flat and with obvious margin, becoming strongly convex and immarginate; exciple very clear, the edge narrow, gray-green or dark green. Hymenium 35-55  $\mu$ m, hyaline, strongly I+ blue; paraphyses very confluent, partly branched and anastomosing, 2  $\mu$ m, tips to 4  $\mu$ m. Hypothecium dark red-brown or black-brown, turning red in K. Epihymenium gray-green to dark green. Spores ellipsoid, often apiculate, 10-12 x 4-5  $\mu$ m (9-18 x 5-8  $\mu$ m according to Thomson 1997). Conidia 4-8 x 1.2  $\mu$ m. Medulla and lower

apothecium K-, C-, KC-, P-, I- or I+ blue (weakly in the medulla). Hypothecium and exciple K+ violet. On calcareous rock. NW Territories. .... L. polycocca

**5. Apothecia epruinose.** ..... 6

**6. Epihymenium some shade of brown.** ..... 7

**6. Epihymenium blue-green or green-black.** ..... 9

**7. Epihymenium dark red-brown. Thallus verrucose, gray.** Apothecia to 0.4 mm, epruinose, adnate, depressed, often with a central columnella, the margin thick, angular or subgyrose. Hypothecium dark brown. Hymenium 60  $\mu$ m. Spores 11-12 x 5-7  $\mu$ m. On rock along brook, New York. .... L. columnata

**7. Epihymenium pale-, yellowish-, or olive-brown.** ..... 8

**8. Spores 9-12 x 4-5  $\mu$ m, Thallus white or grayish or greenish-white or dull yellow, verrucose or more commonly areolate,** thin to moderately thick. Apothecia to 0.5 mm, sessile. pale brown to brown-black or black, epruinose, flat becoming moderately convex, the margin concolorous with disk, becoming thin and often soon disappearing. Exciple  $\pm$  well developed. Hymenium 60-70  $\mu$ m. Hypothecium pale to dark yellowish- or reddish-brown; epihymenium  $\pm$  olive-brown. Asci somewhat broadly clavate, the apical wall somewhat thickened. Spores oblong-ellipsoid, irregularly arranged. On sandstone, West Virginia. .... L. virginensis

**8. Spores 11-14 x 5-6  $\mu$ m. Thallus gray-green or olive, membranous to subverruculose or scurfy,** thin to moderately thick. Apothecia to 0.5(-0.9) mm, plane to strongly convex, epruinose, the margin usually thick when young. Apothecial margin usually thick when young. Epihymenium pale or olivaceous- or yellowish-brown. Hypothecium pinkish-brown to red-brown or brown-black, or olive-black to blue-black above. Hymenium 60-80  $\mu$ m; ..... (L. delincta)

**9. Spores over 6  $\mu$ m wide. Apothecia mostly over 0.5 mm wide.** ..... 10

**9. Spores to 6  $\mu$ m wide. Apothecia mostly under 0.5 mm wide.** ..... 11

**10. Paraphyses free. Thallus white, K+ yellow.** ..... (Lecidella carpathica)

**10. Paraphyses coherent. Thallus  $\pm$  yellowish gray-white, K-.** Spores 13-16 x 6.5-7.5  $\mu$ m. Apothecia 0.5-1 mm, K+ yellow, immersed, plane, the margin indistinct. Thallus rimose-areolate. Hypothecium  $\pm$  brown. Hymenium 75-85  $\mu$ m. Epihymenium  $\pm$  blue-green. On non-calcareous rock, Mexico. .... L. amabilis

**11. Thallus K+ yellow.** Paraphyses 0.5-1.0  $\mu$ m wide, strongly coherent, slightly gelatinous, branched and occasionally anastomosed, the apices olivaceous and swollen to 5  $\mu$ m wide. Spores (9-)10-18(-22) x (3-)4-5.5(-6)  $\mu$ m, elongate-ellipsoid. Thallus gray-white to olive-gray, contiguous to subdispersed, thick or thin, verruculose or compacted areolate-verruculose,  $\pm$  shiny, sometimes scarce, P+ weakly yellow, usually K+ yellow, KC+ yellow, C- (atranorin and unknown); medulla I+ blue in parts; prothallus black, fimbriate, sometimes dominant. Apothecia densely conglomerate and often tuberculose-proliferate, arising in compact groups of to 25 on a common black "stroma",  $\pm$  botryose, sessile, not constricted at base, to 0.25(-0.35) mm,  $\pm$  plane to slightly convex, black, epruinose, slightly shiny, the margin thick at first, persistent or not.



Exciple red-brown, often indistinct. Hypothecium pale to usually dark red-brown; epihymenium blue-black to olive-black or blue-green or green-brown, K+ intensifying green, N+ reddish purple. Hymenium 30-50  $\mu$ m tall, often pigmented as the epithecium. Asci Bacidia- or Biatora-type, clavate, thickened at the top, with narrow apical cushion. On coarse grained siliceous rocks, especially granites, New York. .... L. pycnocarpa

**11. Thallus K-**. .... 12

**12. Spores 14 x 3-6  $\mu$ m.** Thallus gray-white to white, verrucose, K-. Apothecia to 0.3 mm, epruinose, densely conglomerated and frequently proliferate,  $\pm$  adnate, plane, black, the margin thin. Epihymenium green-black. Hymenium 50-60  $\mu$ m. Hypothecium yellow-brown to brown-black. New York. .... L. marciensis

**12. Spores 8-12 x 2.5  $\mu$ m,** indistinctly 1-septate. Thallus very thin to moderately thick, granulose or subverrucose to areolate, grayish or olive. Apothecia to 0.5(0.8) mm, epruinose, becoming convex, the margin persistent or disappearing. Hypothecium  $\pm$  hyaline, or olive-blackish to purple-brownish or dark brown above; hymenium 40-70  $\mu$ m; epihymenium green-black. .... L. conferenda

ADD:

Thallus thin, verrucose to cryptothalline, to 70 mm diam., to 0.25 mm thick. Areoles irregularly shaped to angular, white to pale gray, sometimes rusty colored, plane, with rough surface, to 0.5(-1.0) mm across; cortex ca. 25  $\mu$ m thick; upper cell layer not pigmented; hyphae ca. 4  $\mu$ m diam.; epinecral layer not developed; algal layer to > ca. 60  $\mu$ m thick; algal cells ca. 9-11(-17)  $\mu$ m; medulla I-I hyphae 4  $\mu$ m thick; hypothallus not obvious. Apothecia roundish to angular, dispersed to crowded, 20-40/cm<sup>2</sup>, sessile, with  $\pm$  constricted base, ca. 0.6-1.0(-1.3) mm diam.; disc plane, black, mostly matt, epruinose; margin at first distinct, later persistent or vanishing, black, rarely nitid. Excipulum max. 100-150  $\mu$ m, lateral of hymenium 100-150  $\mu$ m thick, sometimes completely reduced; ectal zone black to brown-black; pigmented zone 15-40  $\mu$ m thick; hyphae 4  $\mu$ m diam., with lumina 2  $\mu$ m; inner zone gray-brown to colorless; hyphae 4-5  $\mu$ m diam., with lumina 1-2  $\mu$ m; medullary zone well developed; hypothecium dark brown (K $\pm$  violet brown at basal part), 120-250  $\mu$ m tall; hyphae 3-4  $\mu$ m diam.; subhymenial layer colorless, 15-25  $\mu$ m tall. Hymenium 65-80  $\mu$ m, colorless, I+ blue, I<sub>conc.</sub> + blue. Epihymenium brownish green, 10-15  $\mu$ m; paraphyses occasionally branched, sometimes anastomosing, 2  $\mu$ m, apices 3-4  $\mu$ m; asci ca. 50-65 x 11-13  $\mu$ m; tholus max. 9-12  $\mu$ m, min. 5-6  $\mu$ m thick; outer amyloid wall layer 0.5-0.8  $\mu$ m thick, I+ blue, I<sub>conc.</sub> + blue-brown; non amyloid wall layer 0.5  $\mu$ m thick; amyloid cap ca. 0.5-1  $\mu$ m thick; spores ellipsoid, 10-11.0-14.0-15 x 5-5.1-6.2-7  $\mu$ m. Pycnidia immersed; conidia 9-10.-12 x 1  $\mu$ m. Cortex and medulla K-, C-, P-; excipulum K+ yellow, C-, P $\pm$  orange. Stictic acid agg. On rock. Queen Charlotte Islands, British Columbia. .... L. crassilabra Müll. Arg.