

III-I. SAXICOLOUS.

Thallus poorly developed or not evident (Cryptothalline)

After Hertel, and others

III-I-1. Hypothecium \pm dark.

Medulla (under hypothecium) I+ blue-violet.

1. Exciple C+ red (according to Hertel; chemistry not mentioned by Hawksworth & Coppins). Apothecia to 2 mm, the margin well developed, sinuous. Epihymenium green-black; hymenium 35-45 μ m; hypothecium dark brown. Exciple pale inside. Spores subglobose, 4-5 μ m, or ellipsoid-oblong, (4.5-)6-7(-8) x (3.5-)4-4.5(-5) μ m. On siliceous, acid rocks. Arctic. Similar to L. auriculata but thallus areolate, the areoles flat to somewhat convex, often \pm immersed, whitish gray; prothallus often inconspicuous, and spore l:w = 1.1-2.1. Containing confluent or porphyritic acids, or no substances.L. auriculata subsp. brachyspora

1. Exciple C-. 2

2. Exciple K+ purple or red. 3

2. Exciple K+ yellow, or K-. 4

3. Exciple (at least the outer part) K+ purple, without crystals. Spores (5.5-)6.8-11.3(-13.5) x (2-)2.4-3.9(-4.0) μ m (l:w = 2.4-3.7). Exciple red-black to \pm violet at edge, internally reddish, C-, intensifying in K, wide and high, crenate in outline. Thallus areolate-verrucose, dispersed to disappearing; areoles \pm flat to somewhat convex, grayish. Apothecia adnate or sessile, constricted, often aggregated, 0.6-1.8(-4) mm, becoming irregularly lobate, flat or depressed convex, black, epruinose, the margin thin, raised, sometimes flexuose, persistent, bare, black. Exciple very broad, of radiating hyphae, outer part dark brown, I+ blue; hyphae in center 2.0-3.0 μ m thick, forming a loose network. Hypothecium light brown (ochre colored) to dark brown, to 200 μ m or more tall in old apothecia; hymenium 30-52(-60) μ m, \pm greenish; epihymenium blue-brown to green, green-black or blue-black. Paraphyses 1.3-1.8 μ m, mainly simple, occasionally anastomosed, apical cells clavate to 3.5 μ m wide, with dark green-brown hood to 5 μ m wide. Thallus P-, K-, C-, KC-, containing confluent or porphyritic acids, or no substances. Ascus apex strongly thickened, the outer coat I+ blue. Pycnospores 10-15 x 0.8 μ m. Usually on siliceous, acid rocks in humid regions. Arctic-alpine, widespread. Nevada, California; New Hampshire.L. auriculata subsp. auriculata

3. Exciple K+ red (crystals), gray inside. Spores 10-14 x 5-7 μ m, ellipsoid. Hymenium 55-65 μ m. Hypothecium pale to medium brown. Thallus lacking. Apothecia to 1 mm, often convolute; exciple filled with abundant crystals which are K+ yellow turning red (norstictic acid), the exterior blue-black, the interior pale with a violet tinge; hypothecium brown-black, in K turning more reddish brown; epithecium green-black; hymenium 30-35 μ m, I+ blue; paraphyses 3.5 μ m; spores ellipsoid, 8-15 x 5-7 μ m. Exciple P+ yellow. On acid rocks and pebbles. Arctic.L. ecrustacea

4. Spores 8-16 x 4.5-8 μ m. 5

4. Spores (7.5-)8.2-11.8(-16.0) x (2.7-)2.8-4.4(-5.5) μ m. Exciple normal sized, edge green-brown, of normal size, semicircular in outline; inside of exciple pale; hyphae in

center 3.0-4.5 μm thick, densely arranged. Apothecia to 1.5(-2) mm, plane to moderately convex, regular in outline, the margin thin, distinct or indistinct. Spore walls 0.3-0.6 μm thick. Hypothecium medium brown to dark brown. Hymenium under 75 μm , pale brownish below, faintly blue-green above. Paraphyses coherent. Epihymenium intense blue-green to blackish blue-green. Spores narrowly ellipsoid, L:W = 2.1-3.7 μm . Epilithic thallus absent or sparse. Containing confluent acid or no substances. On siliceous rock. Arctic-alpine; on sandstone, Ohio.L. promiscens

5. Paraphyses \pm simple; hymenium 35-65 μm . Spores 8-16 x 4.5-8 μm . Epihymenium blue-green. Stictic acid or rarely no substances. On siliceous or calcareous rock.(L. lapicida)

5. Paraphyses much-branched; hymenium 100 μm ; spores 6-12 μm or more long. 6

6. Epihymenium pale, yellowish. Spores 20 x 6.5-7 μm . Tennessee.(L. degelii)

6. Epihymenium green. Spores 9-18 x 5-8 μm(L. polycocca)

ADD:

Thallus lacking or of small gray-green areolae. Apothecia to 1.2 mm, adnate, base narrow, black, flat to slightly convex; margin prominent, flexuous; exciple almost entirely black but sometimes with a hyaline interior; hypothecium gray to violet-brown; epithecium brown-black or green-black; hymenium 45-55 μm , hyaline to reddish violet, it and subhymenium K+ violet, I+ blue; paraphyses simple to slightly branched and anastomosing, 2 μm , tips 4 μm ; spores ellipsoid, 7.5-12 x 4-6.5 μm . Cortex, medulla and exciple K-, C-, P-; medulla I+ blue (according to description in Thomson 1997, but in his key he says it can also be I-); exciple, hypothecium and hymenium I+ blue. On non-calcareous pebbles in windswept habitats. Greenland. L. haerjedalica H. Magn.

Exciple distinct; reactions of exciple not given. Spores 11-16 x 5-7.0 μm . Thallus rather well developed. On \pm siliceous rocks. British Columbia. (L. cf. cruciaria sensu Noble)

III-I-2-a. SAXICOLOUS.

Thallus poorly developed or not evident (Cryptothalline)

Hypothecium \pm dark.

Medulla I-.

Spores under 10 μ m long.

1. **Exciple C+ red.** Paraphyses coherent. Exciple pale inside. Similar to L. auriculata; differing in chemistry. 2

1. **Exciple C-.** 3

2. **Spores subglobose, 4-5 μ m, or ellipsoid-oblong, (4.5-)6-7(-8) x (3.5-)4-4.5(-5) μ m.**

Apothecia to 2 mm, the margin well developed, sinuous. Epihymenium green-black; hymenium 35-45 μ m; hypothecium dark brown. Thallus areolate, the areoles flat to somewhat convex, often \pm immersed, whitish gray; prothallus often inconspicuous.

Spore l:w = 1.1-2.1. Containing confluent or porphyritic acids or no substances. On siliceous, acid rocks. Arctic. (L. auriculata subsp. brachyspora)

2. **Spores (5.5-)7.2-10.2(-12.5) x (1.7-)2.3-3.4(-3.5) μ m.** Exciple K-, I-, C+ carmine-red (2'O-methylanzaic acid), the edge black-green. Apothecia to 1(-1.4) mm, constricted, crowded in groups or following cracks in the rock, black or weakly pruinose, plane to slightly convex, non-umbonate, the margin distinct, prominent, narrow, persistent, black, shining. Exciple well developed, outer part green-black or brown-black, inner part reddish brown or hyaline to grayish. Epihymenium blue-green to green-black, or brownish green when in poor condition; hypothecium pale brown to mid-brown or blackish brown. Spores oblong-ellipsoid.. Medulla I+ violet. Hymenium 30-50 μ m, hyaline to light green, I+ blue; paraphyses simple, rarely branched and anastomosing, 2 μ m with tips to 5 μ m; asci clavate.. Epilithic thallus lacking; gray-black hypothallus rare. Thallus containing confluent acid (according to ?-2'O-methylanzaic acid according to Culberson & Hertel 1972). On exposed siliceous, acid rocks, arctic-alpine. L. diducens

3. **Exciple K+ red or violet.** 4

3. **Exciple, if evident, K-, P-, pale inside.** 8

4. **Spores 4.5-6 x 3 μ m.** Apothecia dense or heaped, ca. 0.3 mm, convex, immarginate, black. Spores ovoid-ellipsoid. Exciple edge dark green. Hypothecium blackish violet brown above, paler and brown below. Hymenium 25 μ m; epihymenium blue-green. On sandstone, New York, New Jersey, Pennsylvania. L. (Micarea?) planetica

4. **Spores over 6 μ m long.** 5

5. **Spores 2-3.5 μ m wide.** Apothecia under 0.3 mm diameter. 6

5. **Spores 8-10 x 5-5.5 μ m, ellipsoid.** Hymenium 75-85 μ m. Paraphyses \pm distinct, 1.5-1.7 μ m thick, the tips hardly swollen but granular, the surface rough. Apothecia very dense (giving the specimen a blackish appearance), shallowly cup-like, 0.35-0.4(-0.5) mm diam., adpressed, regular in shape; disc black, plane, bare, the margin prominent. Thallus to 2-2.5 cm across, continuous, indistinctly and very minutely subareolate towards the circumference, pale brownish gray, very thin, K-; areoles convex, not contiguous. Excipulum 30-40 μ m thick, in thicker

sections appearing blackish brown and continuous with hypothecium, but in K the exterior 8-10 um dark brown, internally paler. Hypothecium \pm lens-shaped, dark brown, at the center to 100 um thick, not distinctly united with exciple margin. Hymenium I+ dark blue. Subhymenium pale brownish, ca. 20 um. Epihymenium blue-green (according to Latin diagnosis; sordid dark olive or the uppermost part pale greenish, according to the English description). Asci 45-50 x 12-13 um, 8-spored. Medulla below apothecia \pm transparent but with numerous stone particles; hyphae in K perpendicularly intricate, somewhat lax, 3-3.5 um thick. Algae 7-12 um diam., layer ca. 65 um thick. No cortex. On metamorphic (probably siliceous) rocks. Maine.L. merrillii

6. Epihymenium blue-brown or blue-green-brown. 7

6. Epihymenium blue-green (sometimes very pale). 8

7. Apothecia to 2.5(-4) mm diam. Spores 6-12 x 2-3(-4) um, simple. Exciple edge \pm violet, wide and high, crenate in outline. Thallus verrucose, dispersed to disappearing. Apothecia adnate, constricted, often aggregated, becoming irregularly lobate, flat or depressed convex, black, epruinose, the margin thin, persistent, bare, black. Exciple or radiating hyphae, outer part dark brown, K+ purple, I+ blue. Hypothecium dark brown; hymenium 50-60 um; epihymenium blue-brown. Confluent or porphyritic acids or no substances. Usually on acid rocks. Arctic-alpine, widespread.L. auriculata subsp. auriculata

7. Apothecia to 0.25 mm diam. Spores 5-8 x 2-3 um. Apothecia dense, adnate, constricted at base; disc black, shiny, epruinose, concave then plane (to convex); margin thin, persistent, black, epruinose, entire. Hymenium 60 um. Hypothecium brown-black or in narrow upper part pale brown. Exciple in margin blue-green brown towards outside, otherwise brown-black; hypothecium and exciple K+ purple. Paraphyses strongly coherent, gelatinous. Epihymenium blue-green-brown. Spores oblong-ellipsoid. Thallus evanescent, composed of very minute verrucules, white, constantly dispersed; hypothallus indistinct. On pebbles.L. enterophaea

8. Excipulum very pale (and K-?). Epihymenium very pale. Spores 6-7 x 2-3 um.

Thallus, if visible, dark gray or greenish. Thallus of minute granules, scattered to crowded, scurfy. Apothecia 0.2-0.5 mm diam., closely adnate; disc flat to convex, black; exciple black, thick, soon disappearing. Hypothecium blackish brown. Spores ovoid-ellipsoid. On rocks, New England to Delaware, west to Illinois and Minnesota. L. cyrtidia

8. Excipulum dark green. Epihymenium blue-green. Spores 7-9(-10.5) x 3-3.5(-4.4) um.

Thallus, if visible, ochraceous. Hymenium 35 um. Apothecia 0.1-0.15 mm diam.; disc flat to convex, black; exciple black, soon disappearing; hypothecium reddish brown; spores ovoid-ellipsoid. Thallus thin, verrucose-areolate, scattered and disappearing.

(Hertel considers this species to be a synonym of L. cyrtidia) On quartz, Pennsylvania to Florida.L. micthyo

9. Spores mostly under 8 um long. 10

9. Spores mostly over 8 um long. 12

10. Spores 4.5-6.5 x 2-3 um. Hymenium 30-40 um.

Thallus \pm dark gray (to

olive-brown), \pm smooth and continuous, or absent. Apothecia to 0.5 mm, epruinose, plane to convex, the margin thin or thick, sometimes disappearing. Hypothecium dark brown to brown-black; epihymenium very pale, olive to dark brown. On siliceous rock. Eastern. L. cyrtidia (see note under L. micthyo, above)

10. Spores mostly over 6 μ m long. Hymenium 40-50 μ m. Apothecia plane then slightly convex, epruinose. 11

11. Hypothecium sordid or faintly violet, more intensely violet laterally. Apothecia to 1 mm. Epihymenium dark blue-green. Spores 5-8.5 x 2.5-4 μ m. Rocky Mountains of Colorado. (L. "saximontana" Anderson ined.)

11. Hypothecium dark red-brown to brown-black. Apothecia to 0.5 mm. Epihymenium greenish black. Spores 6-9 x 2.5-3.5 μ m. On siliceous rock. (Micarea erratica)

12. Spores over 4 μ m wide. Epihymenium green or blue-green. 13

12. Spores under 4 μ m wide. 15

13. Hymenium 50-70 μ m. Paraphyses \pm free; tips strongly capitate. Spores 6-11 x 4-6.5 μ m. Hymenium greenish, not inspersed. Hypothecium brown-black. Outer part of exciple carbonaceous, inner part reddish to rose-brown. Epihymenium blue-green. Apothecia 0.5(-0.8) mm diam., black. On exposed, calcium rich rocks, arctic-alpine. (see Cephalophysia leucospila)

13. Hymenium over 75 μ m. Paraphyses coherent; tips not capitate. 14

14. Hymenium 75-85 μ m. Paraphyses tips not capitate. Apothecia very dense, to 0.5 mm, plane, bare, the margin prominent. Thallus continuous, pale brownish gray, very thin. Spores 8-10 x 5-5.5 μ m. Hypothecium dark brown; epihymenium dark olive (to blue-green?). Maine. L. merrillii

14. Hymenium 100 μ m. Spores (6-)9-12(-18) x 4-5(-8) μ m. Paraphyses much-branched. Epihymenium green. (L. polycocca)

15. Exciple indistinct. Hymenium under 50 μ m. (Micarea erratica and M. sylvicola)

15. Exciple distinct. Hymenium mostly over 50 μ m. 16

16. Apothecia to 2.5(-4) mm diam. Spores simple, 6-12 x 2-3(-4) μ m. Exciple edge \pm violet, wide and high, crenate in outline. Thallus verrucose, dispersed to disappearing. Apothecia adnate, constricted, often aggregated, becoming irregularly lobate, flat or depressed convex, black, epruinose, the margin thin, persistent, bare, black. Exciple or radiating hyphae, outer part dark brown, K+ purple, I+ blue. Hypothecium dark brown; hymenium 50-60 μ m; epihymenium blue-brown. Confluent, porphyritic, or no substances. Usually on acid rocks. Arctic-alpine, widespread. (L. auriculata)

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

III-I-2-b. SAXICOLOUS.

Thallus poorly developed or not evident (Cryptothalline)

Hypothecium \pm dark.

Medulla I-.

Spores averaging over 17 μ m long.

1. Epihymenium bright blue-green. Hymenium 70-90 μ m high (Thomson's 1979 statement that it is 150-350 μ m is incorrect). Thallus lacking or a thin, continuous, finely chinky, soft chalky white crust; hypothallus lacking. Hypothecium and exciple black-brown to red-brown, C-, K+ red-violet. Spores 11-21 x 5-9 μ m. Apothecia to 2.5(-3.5) mm diam., adnate with a narrow base, when young flat, with swollen margin, later convex and with pitted to cerebriform upper surface (the center becoming raised and the disk gradually fissuring and breaking away, new apothecia arising from the remaining attached portions). Exciple darker inward and paling to the outside, brownish, the color extending deeply into the hymenium; hypothecium red-brown, K+ violet, darker than the exciple; hymenium 70-90 μ m, upper part blue-green, lower part red-brown, in thin sections almost hyaline. Paraphyses coherent, strongly swollen, gelatinous, branched and anastomosing, 2-2.5 μ m, tips to 5 μ m; asci clavate; spores poorly developed, ellipsoid with tips slightly pointed, often halonate when young, 11-21 x 5-9 μ m. Thallus K-, C-, KC-, P-; medulla weakly I+ blue; exciple and hypothecium red-violet. On calcareous rock, sandstones or limestones. Arctic-alpine, south to Utah and Illinois. (L. hypocrita)

1. Epihymenium not bright blue-green. 2

2. Spores with thick, gelatinous "halo" (perispore), at least when young. Ascus with thickened tholus I+ blue, containing a more densely amyloid, tubular pore. 3

2. Spores without a halo (?--need to check). Ascus type not studied. Spores 16-21 x 6-9 μ m. Hypothecium olive-blue-black. Apothecia adnate, 0.5-1.5 mm, \pm convex, epruinose, the margin thick and elevated, \pm persistent. Epihymenium olive to green-black. Hymenium 90-120 μ m. New York. (L. diversa)

3. On siliceous rock, or rarely on calcareous rock, and then with lichen substances detected by TLC. Porpidia

3. On calcareous rock. No lichen substances detected by TLC. 4

4. Discs red-brown at least when wet. Apothecial pigment brown, K-, N-. Epihymenium red-brown to brown. Medulla I-. Conidiogenous cells in chains. Clauzadea

4. Discs black even when wet. Exciple and upper hypothecium K \pm purplish in section. Epihymenium greenish to brownish. Medulla, when developed, I+ violet. Conidiogenous cells cylindrical. Farnoldia

III-I-2-c. SAXICOLOUS.

Thallus poorly developed or not evident (Cryptothalline)

Hypothecium \pm dark.

Medulla I-.

Spores mostly 10-17 μ m long, over 4 μ m wide.

1. **Exciple C+ red.** Thallus usually well developed, only rarely immersed. [If spores under 10 μ m long see L. diducens]. (see Lecidella subincongrua and Lecidea fuscoatra)

1. **Exciple C-.** 2

2. **Exciple K+ red or violet.** 3

2. **Exciple K-, P-.** 9

3. **Spores over 14 μ m long.** 4

3. **Spores under 14 μ m long.** 7

4. **Epihymenium bright blue-green.** Hymenium 70-90 μ m high (Thomson's 1979 statement that it is 150-350 μ m is incorrect). Thallus lacking or a thin, continuous, finely chinky, soft chalky white crust; hypothallus lacking. Hypothecium and exciple black-brown to red-brown, C-, K+ red-violet. Spores 11-21 x 5-9 μ m. Apothecia to 2.5(-3.5) mm diam., adnate with a narrow base, when young flat, with swollen margin, later convex and with pitted to cerebriform upper surface (the center becoming raised and the disk gradually fissuring and breaking away, new apothecia arising from the remaining attached portions). Exciple darker inward and paling to the outside, brownish, the color extending deeply into the hymenium; hypothecium red-brown, K+ violet, darker than the exciple; hymenium 70-90 μ m, upper part blue-green, lower part red-brown, in thin sections almost hyaline. Paraphyses coherent, strongly swollen, gelatinous, branched and anastomosing, 2-2.5 μ m, tips to 5 μ m; asci clavate; spores poorly developed, ellipsoid with tips slightly pointed, often halonate when young, 11-21 x 5-9 μ m. Thallus K-, C-, KC-, P-; medulla weakly I+ blue; exciple and hypothecium red-violet. On calcareous rock, sandstones or limestones. Arctic-alpine, south to Utah and Illinois. (L. hypocrita)

4. **Epihymenium not bright blue-green.** 5

5. **Exciple dark inside; asci Porpidia-type; spores 15-25 x 7-11 μ m, with gelatinous halo when young.** Epihymenium brownish. Hypothecium dark brown. Exciple brown to brown-black, K+ red. Apothecia to 2 mm, \pm flat, persistently swollen marginate. On siliceous rock. (see Porpidia nigrocruenta)

5. **Exciple pale inside; asci and spores not as above.** L. hebescons

6. **Exciple dark inside. Spores with "halo" at least when young. Asci \pm Porpidia-type.** (see Farnoldia, Porpidia, and Clauzadea)

6. **Exciple pale inside, or not evident. Spores and asci not as above.** Spores 13-17 x 6.5-8.5 μ m. Hymenium 65-85 μ m. Apothecia to 0.5 mm, plane, bare, the margin thick, elevated, persistent. Thallus gray-white, minutely areolate, very thin. Epihymenium

olivaceous; hypothecium brown to brown-black. Paraphyses not or slightly thickened. On gneiss, Maine. [*L. hebesceus* may possibly key out here instead of above].*L. katandinensis*

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

7. Epihymenium green, blue-green, or blackish green. 8

8. Hymenium 100 μ m. Spores (6-)9-12(-18) x 4-5(-8) μ m. Paraphyses much-branched. Epihymenium green.*L. polycocca*

8. Hymenium 60-75 μ m high. Spores 11-13 x 4-5 μ m, narrowly ellipsoid. Exciple entirely carbonaceous, distinct from \pm paler hypothecium (as seen in very thin sections), \pm "cellular". Paraphyses clavate thickened at tips. Asci clavate. Pycnosporos filiform, 12-35 μ m long. Hypothecium brown-black. Apothecia 0.3-0.8 mm across, subsessile, often closely crowded, irregular and confluent in heaps; disk flattish, black; exciple black, thick, prominent, becoming flexuous and lobed, usually persistent. Thallus thin, granulose to chinky-areolate or disappearing. On siliceous rocks or very seldom somewhat calcareous rocks. On sandstone, Arizona.(*Carbonea vorticosa*)

9. Exciple indistinct. (*Micarea sylvicola* and *M. erratica*)

9. Exciple distinct. 10

10. Spores 9-12 x 4-5 μ m. Exciple \pm well developed. Hymenium 60-70 μ m. 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. West Virginia.(*L. virginiensis*)

10. Spores 13-17 x 6.5-8.5 μ m. Hymenium 65-85 μ m. Thallus minutely areolate; areoles very thin, plane, dispersed to partly contiguous, gray-white. Apothecia rather numerous, dispersed to aggregated, \pm rounded, to 0.4-0.5 mm diam., plane, black, epruinose, matt; margin thick, entire, elevated, persistent. Exciple and hypothecium brown to brown-black, K-. Paraphyses discrete below but coherent at tips, simple to branched, 1.5-2 μ m; apices not or slightly thickened; epihymenium olive, K-. Spores oblong to oblong-ellipsoid. On gneiss. Maine. (*L. katahdinensis*)

III-I-2-d. SAXICOLOUS.

Thallus poorly developed or not evident (Cryptothalline)

Hypothecium \pm dark.

Medulla I-.

Spores 10-17 μ m long, under 4 μ m wide.

1. Exciple K \pm distinctly violet. Spores 9-12 x 2.5-3(-3.5) μ m. Thallus subtartareous, rimose-areolate to verruculose-uneven, yellowish gray, K-, C+ pale orange, well-delimited at margin, hypothallus indistinct. Apothecia sessile, dispersed to crowded, to 2 mm, black, concave to plane, epruinose, the margin thick, prominent. Exciple blue-green-violet at edge. Hypothecium hyaline or faintly violet-red or brownish. Hymenium 45-50 μ m; epihymenium sordid blackish green. Containing schizopeltic acid. On sandstone, S. California. [If spores averaging 3.5 μ m wide, and thallus containing planaic acid, see L. plana]. (L. hassei)

1. Exciple K-. 2

2. Apothecia to 2.5(-4) mm. Spores 6-12 x 2-3(-4) μ m. Exciple edge \pm violet, wide and high, crenate in outline. Thallus verrucose, dispersed to disappearing. Apothecia adnate, constricted, often aggregated, becoming irregularly lobate, flat or depressed convex, black, epruinose, the margin thin, persistent, bare, black. Exciple or radiating hyphae, outer part dark brown, K+ purple, I+ blue. Hypothecium dark brown; hymenium 50-60 μ m; epihymenium blue-brown. Confluent, prophyrillic, or no substances. Usually on acid rocks. Arctic-alpine, widespread. L. auriculata

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

III-I-e. SAXICOLOUS.
Thallus poorly developed or absent.
Medulla (under hypothecium) I+ blue-violet.
Hypothecium hyaline or pale.

1. Hymenium 75-85 um. Apothecia bare. Spores 8-10.5 um long.
 (*Fuscidea lowensis*)

1. Hymenium under 75 um. 2

2. Hymenium 50-70 um. Spores 8-16 um long. Apothecia often
 pruinose.(*L. lapicida*)

2. Hymenium 35-55 um. 3

3. Spores 5.5-9 x 3-5 um. Apothecia numerous, 30-100 per square centimeter, often in very dense and large groups, becoming strongly angular through mutual pressure, 0.2-1.1(-2) mm diam., black (unchanged wet), \pm shiny, flat to shield-form convex; margin narrow, swollen, sometimes indistinct, often deeply infolded when old. Excipulum strongly developed, *Lecidea*-type; cortical zone narrow, epihymenium-like, reddish brown to black; towards the inside with a narrow, confluent, entirely strong reddish violet zone; innermost part hyaline or dirty pale gray. Hypothecium hyaline to dirty grayish; hymenium 35-55 um, colorless, I+ blue; epihymenium ca. 20 um, blue-green to green-black. Paraphyses simple, ca. 2 um diam.; apical cells somewhat thickened, 3.5-5 um, strongly coherent. Asci clavate, 8-spored, 30-45 x 8-11 um. Spores oblong-ellipsoid (L:W = 1.8-2.2). Thallus immersed; medulla I+ strong blue-violet. On non-calcareous rocks. Arctic.....*L. steineri*

3. Spores 10-12(-14) x (3-)3.5-4 um, oblong. Apothecia to 1(-1.4) mm. Thallus very thin and grayish white or absent. Apothecia sessile, constricted at base, 0.6-1 mm diam.; disc black, partly slightly white-pruinose, plane, smooth; margin thin, distinctly prominent, somewhat flexuous. Exciple marginally 60-70 um thick, only exterior 5-6 um dark blue-green, the rest grayish to whitish, at the bottom darker, opaque. the whole I-, K-, but masses of thin, angular, colorless plates produced round the sections. Below the exciple only few lumps of 6-8 um diam. algae and densely intricate, indistinct hyphae. Hypothecium hyaline, 35 um, the hyphae perpendicular; below it a lens-shaped medulla, dark gray from air, 80 um thick at center, I+ dark blue. Hymenium 50-55 um, colorless, the lower limit indistinct; I+ dark blue; epihymenium \pm dark blue-green, 7-12 um. Paraphyses rather distinct, not lax, 1.5 um thick, dense, the apices thickened, bluegreen with adherent lumps, K+ sordid dark olive. Asci 40-45 x 10(-12) um, clavate, 8-spored. On non-calcareous rock, Labrador; on sandstone, Cascades of Washington.*L. eckfeldtii*

III-I-f. SAXICOLOUS.

Thallus poorly developed or absent.

Medulla (under hypothecium) I-.

Hypothecium hyaline or pale.

Spores under 10 μ m long.

1. Exciple C+ red. Apothecial margin thick; exciple \pm brown. 2

1. Exciple C-. 3

2. Spores 9-10 x 5 μ m. Apothecia very convex. Hymenium 55-65 μ m. New York; Maine. [See Lowe for more info.] (*Lecidella granulata*)

2. Spores (6-)8-11(-13) x (3-)3.5-5 μ m. Apothecia flat, Hymenium 35-50 μ m. Apothecia bare; margin thin, often folded. On siliceous rock. (*Adelolecia pilati*)

3. Exciple K+ red or violet. Spores 8-10 x 4-5 μ m. Hypothecium \pm hyaline. Apothecia to 0.5 mm, convex and immarginate from the start, brown-black, often aggregated into tubercles. Hymenium 40-50 μ m; epihymenium sordid bluish green. Exciple green-brown or sometimes violet, N+ violet-red. On pumice, Oregon. (*L. pumicicola*)

3. Exciple K-. 4

4. Paraphyses free. Spores 8-12 x 6-9 μ m. Hymenium 100 μ m. Epihymenium blue-black. Thallus of a few scattered ash colored squamules or absent. Apothecia substipitate, to 1.75 mm, slightly concave to slightly convex, the margin thin, \pm gray, often sinuous. Hypothecium pale brownish gray. (*L. californica*)

4. Paraphyses coherent. Spores under 6 μ m wide. Hymenium under 100 μ m. 5

5. Spores over 4 μ m wide. 6

5. Spores under 4 μ m wide. 7

6. Apothecia under 0.35 mm diam., convex and immarginate from the start. Spores 8-10 x 4-5 μ m. Discs epruinose. Epihymenium blue-green or bright green. Hypothecium hyaline or \pm sordid yellowish. Exciple green-brown or sometimes violet, N+ violet-red. Apothecia to 0.5 mm, brown-black, often aggregated into tubercles. Hymenium 40-50 μ m; epihymenium sordid bluish green. On pumice, Oregon. *L. pumicicola*

6. Apothecia over 0.5 mm diam., plane to slightly convex, with margin at least when young. Spores at least partly over 10 μ m long and 5 μ m wide. see *L. lithophila* and *L. plana*

7. Hymenium 60-70 μ m. Spores 8-12 x 2.5 μ m. Exciple edge blue-green. Spores 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 μ m; epihymenium green-black. (*L. conferenda*)

7. Hymenium mostly under 50 μ m. 8

8. Hypothecium hyaline (cloudy above). Spores 8-10 x 2.5-3 um, often poorly developed. Apothecial margin thin. **hymenium 45-50 um.** Apothecia constricted at base. Epihymenium very dark sordid blue-green with a brown shade. Exciple edge olive, middle part pale brown-violet. Thallus absent. Apothecia to 1 mm, plane to slightly convex, the margin thin, disappearing. On non-calcareous rock, S. California.L. san-tae-monicae

8. Hypothecium ± pigmented at least in lower part. Spores mostly under 8 um long.
..... 9

9. Hymenium I+ intense blue then paler. Thallus dark olivaceous green to greenish brown, verrucose. Apothecia to 0.35-0.45(-0.6) mm diam.; disc concave then sometimes flat; margin not or at first slightly prominent. Spores 5-6(-9) x 2-3 um. Hymenium 35-60 um, hyaline or totally blue-green, Epithecium bright smaragdine green to greenish black or olivaceous black, K+ green, the granular matter dissolving. Paraphyses very indistinct, coherent, 1-1.5 um thick (according to Vainio; 1.5-2.5 um according to Lowe), the tips not or weakly thickened. Asci clavate, moderately thickened at tip. Hypothecium ± hyaline or pale greenish black or pale olive, granular appearing, the hyphae 4-5 um diam., with narrow lumina, vertically arranged for most part, fragmenting under pressure, not at all conglutinate, K+ purplish in lower part. Excipulum distinct from hypothecium, in outer half dark brown (violaceous according to Th. Fries) or above somewhat greenish black, the hyphae thin (2-4 um), to 5 um at tips, with narrow lumina, ± conglutinate, somewhat radiating. Thallus verrucules scattered, to 0.7 mm wide, K-. On siliceous rocks. New York. (L. atomaria)

9. Hymenium I+ orange-brown. Thallus whitish gray to gray, often darkened in places from hypothalline hyphae, rimose-areolate or subareolate. Apothecia to 1 mm diam., to 0.7 mm high (including stipe), distpersed to contiguous, often 5-10 or more crowded together in a tight group, round to angular or sublobated, sessile to short-stalked, moderately to strongly constricted at the base; disc plane to slightly convex, ± smooth to minutely roughened, matt or subnitid, epruinose; margin moderately thick, distinct, persistent, elevated, soemtiems slightly flexuous, matt to subnitid, epruinose. Spores 5-8.5 x 2.5-4 um. Hypothecium ± blue-green to violet, or pale. Rocky Mts. of Colorado.(L. "saximontana" Anderson ined.)

ADD:

Spores 6.0-14.0 x (4.0-)4.8-5.7(-6.5) um. Hypothecium hyaline, pale gray, or very pale ochre-colored. Epilithic thallus often scarcely developed or lacking. Medulla I-. Hymenium 50-70 um tall. Major substances: 4-O-demethylplanaiic acid. Epihymenium dull olive-gray, never with a reddish tinge, K-, ± uniformly thick. Discs ± smooth. Subxeric to xeric, on acid rocks. California, central Rockies, Alberta, NW Territories. L. laboriosa

III-I-g. SAXICOLOUS.

Thallus poorly developed or absent.

Medulla (under hypothecium) I-.

Hypothecium hyaline or pale.

Spores mostly over 10 um long and over 4 um wide.

1. Exciple C+ red [?--check on L. cinerata]. 2

1. Exciple C-. 3

2. Apothecial margin thin, often folded. Exciple \pm brown. Spores (6-)8-11(-13) x (3-)3.5-5 um [check this again]. Apothecia flat, Hymenium 35-50 um. Apothecia bare; On siliceous rock.(Adelolecia pilati)

2. Apothecial margin thick, flexuous but not folded. Exciple \pm blue-green at edge. Spores 10-12(-15) x 5-6(-7) um, oblong-ellipsoid. Apothecia numerous, 0.4-1 mm, adnate, \pm dispersed, sessile, ca. 0.6 mm thick, rounded, angular or flexuous; disc at first densely pruinose, then less pruinose, urceolate to concave then plane; margin raised, ashy pruinose, persistent, Exciple 60 um thick at the margin, 100 um below, only exterior 6-9 um dark blue-green, N+ bright violet red, the rest pale, sordid gray, opaque, "unchanged by reagents" according to Magnusson. Hypothecium 100-150(-300?) um thick at center, narrower (50 um) towards the sides, very pale reddish brown; hymenium 55-60 um, colorless or greenish, I+ dark blue; epihymenium 10-17 um, sordid dark olive, N+ bright violet red. Paraphyses coherent, indistinct, the apices swollen. Asci ca. 50 x 13-16 um. Thallus not evident between apothecia, only small parts below them, internally gray from granules, dissolving in N; hyphae 3-3.5 um thick, thick-walled, K-. On non-calcareous rock (e.g., disintergrated granite), southern California, Colorado. In v. complicata Magn., from S. California, the apothecia become strongly complicated or composite, strongly constricted at base, and very irregular and flexuous in shape, often with several small deeply immersed discs heaped together, and the spores (seldom fully developed) only 8-9 um long.L. cinerata

3. Exciple K+ red or violet. Paraphyses free. Spores over 12 um long and over 6 um wide.(Lecidella stigmatea)

3. Exciple K-. 5

4. Paraphyses free. Spores over 6 um wide. 5

4. Paraphyses coherent. 7

5. Asci with I+ blue tholus. Epihymenium \pm blue-green. Apothecia black.(see Lecidella stigmatea)

5. Asci without I+ blue tholus (?). 6

6. Spores 12-16 x 7-8.5 um (10-13 x 5-7 um according to Fink). Epihymenium yellowish brown. Apothecia medium to rather large (0.6-1 mm diam. and sometimes clustered and irregular, according to Fink), sessile, scattered; disc dark red-brown to blackish brown or reddish black, plane becoming convex; margin thick, entire to flexuous, finally disappearing. Hypothecium hyaline (brownish according to Fink).

Thallus thin to very thin, brownish gray (ashy white according to Fink). Paraphyses simple, thread-like, their blackish brown tips subcoherent. Hymenium I+ blue. Asci clavate. Spores variously disposed, ellipsoid to short ellipsoid. On granite rocks in creek bed, Santa Cruz Peninsula, California. L. (Lecidella?) pacifica

6. Spores 8-12 x 6-9 um. Epihymenium blue-black. Thallus of a few scattered ash colored squamules or absent. Apothecia substipitate, , scattered to 4-8 grouped, 0.5-1.75 mm diam. (separate ones being the larger); disc dull black, faintly papillate, mostly slightly concave then slightly convex; margin thin, \pm gray, entire or \pm sinuous, at times deeply, almost parting the disk into several lobes. Hypothecium pale brownish gray. Hymenium 100 um, hyaline below, not horny, I+ blue to sordid greenish blue. Epihymenium subcontinuous, bluish black to almost black, gradually paling downward. Paraphyses separate, stout, septate, branched, the rounded top clavate-thickened and not or but slightly colored. Asci 88 um long, composed of an upper oblong-oboid bullate expansion 28-36 x 12-15 um, contracting to a peduncle 60 x 8-9 um; contents K+ reddish, N+ dull violet-purple. Spores ovoid to oblong-ovoid. On granite, southern California. L. (Lecidella?) californica

7. Epihymenium yellow-brown, olive-brown, or red-brown. Apothecia brown or red-brown when wet. Spores 8-13 x 4.5-6 um. Epihymenium olive brown. Thallus thin or moderately thick, continuous to rimose-areolate, ashy white. Apothecia to 1.3 mm, flat or depressed convex, sometimes thinly pruinose, the margin thin. Hypothecium hyaline; hymenium 55 um. 4-O-Demethylplanaic acid, \pm Planaic acid. Arctic-alpine, reported south to Minneosta, Tennessee, Texas, and California. (L. lithophila)

7. Epihymenium \pm green or blue. Apothecia black when wet. 8

8. Apothecia under 0.35 mm diam., bare, convex and immarginate from the start. Epihymenium blue-green or bright green. Hymenium 40-65 um high. 9

8. Apothecia over 0.5 mm diam. 10

9. Hymenium (55-)65 um. Hypothecium yellowish. Thallus thin, brown-gray, continuous, indistinctly subverruculose. Apothecia 0.3-0.4(-0.5) mm diam., ca. 0.3 mm thick, black, convex from the beginning, epruinose, black. Exciple at upper margin ca. 70 um thick, sordid yellow, exterior 10-13 um sordid olive green, the hyphae radiating. Hypothecium 50-100 um thick, yellowish, in K intenser, hyphae mainly perpendicular. Hymenium colorless, I+ dark blue. Paraphyses in much gelatin, ca. 1.7 um thick, in K very discrete; apices distinct, ca. 2(-2.5) um thick. Asci 35-40 x 15-17 um, broadly clavate, 8-spored. Epihymenium sordid blue-green. Spores somewhat broadly ellipsoid, 9-12(-13) x 5.5-6.5 um. Photobiont to 16 um diam. On siliceous rocks (gneiss), Maryland. L. marylandensis

9. Hymenium 40-50 um. Hypothecium pale grey-blue. Exciple edge very narrow, pale. (Micarea bauschiana)

10. Hymenium over 60 um. 11

10. Hymenium under 60 um. 12

11. Hymenium 60-70 um. Exciple edge violet-brown. Thallus thin, areolate to verrucose- or

rimose-areolate or sometimes nearly absent, grayish or whitish. Apothecia to 1 mm, epruinose, plane to convex, the margin distinct, usually persistent. Hypothecium hyaline above, brownish below; hymenium 60-70(-75) μ m; epihymenium olivaceous. Spores 8-16 x 4-7.5 μ m. Rocky Mts., Colorado. (L. "kieneri" Anderson ined.)

11. Hymenium 100 μ m. Spores 8-12 x 6-9 μ m. Thallus of a few gray squamules or absent. Apothecia substipitate, to 1.75 mm, slightly concave to slightly convex, the margin thin, \pm gray, often sinuous. Hypothecium pale brownish gray. Epihymenium blue-black. (L. californica)

12. Paraphyses 2-2.5 μ m thick. Apothecial margin thin, persistent. Apothecia black, remaining so when wet, to 0.5(-1.5) mm, sessile, plane to slightly convex, the margin thin, raised, persistent. Exciple green-black at outer edge, internally yellowish gray or colorless. Thallus pale gray, thin, granular to irregularly rimose-areolate, often dispersed, indistinct or absent; prothallus indistinct. Epihymenium greenish black (to rarely green-brown), K⁺ intensifying green, N⁺ reddish purple. Hymenium 35-50(-55) μ m. Spores (7-)8-11(-13) x (2-5)3.5-5(-6) μ m, ellipsoid. Hypothecium hyaline to pale yellowish brown, of \pm vertically oriented hyphae. Paraphyses sparsely branched and anastomosed, apices with a dark green hood, to 4 μ m wide. Asci Lecidea-type. Thallus P-, K-, KC-, C-, containing planaiic and 4-O-methylplanaiic acids. On siliceous, especially coarse-grained, rocks. Reported from Greenland south to New York and Michigan in the east, and British Columbia to New Mexico and southern California in the west, but many reports could be misidentifications. Differs from L. lapicida in the yellow-gray exciple and I- medulla, from L. lithophila in the mainly immersed thallus, small ascospores and greenish epithecium, and the disc remaining black when moist.L. plana

12. Paraphyses under 2 μ m thick. Apothecial margin thick, becoming flexuous. Exciple edge dark. Spores 11-16 x 3.5-6 μ m. Thallus grayish white, smooth, very minutely granular-farinose. Apothecia to 0.7 mm, plane, sometimes faintly pruinose, the margin distinct, prominent, becoming flexuous. Hypothecium hyaline above, pale brownish below; hymenium 65 μ m; epihymenium blackish green. California, Oregon; Noble's "L. cf. cruciaria" from British Columbia has a well developed, I⁺ violet thallus and differs in a number of other ways, and is not this species)L. cruciaria

Comparison of L. lithophila and L. plana

1. Epihymenium usually brownish or light brown, rarely olive brown, K-, N-. Apothecia turning brown when wet. Hymenium (45-)50-80 μm . Spores usually (8-)9-13(-15) x (4)5-6(-7) μm , narrowly ellipsoid. Thallus usually \pm distinct. Containing planaic or 4-o-demethylplanaic acid.(L. lithophila)

1. Epihymenium greenish black (to rarely green-brown), K+ intensifying green, N+ reddish purple. Apothecia remaining black when wet. Hymenium 35-50 μm . Spores (7-)8-11(-13) x (2-5)3.5-5(-6) μm , ellipsoid. Thallus usually \pm immersed. Containing planaic acid.L. plana

III-I-h. SAXICOLOUS.

Thallus poorly developed or absent.

Medulla (under hypothecium) I-.

Hypothecium hyaline or pale.

Spores averaging over 10 μm long but less than 4 μm wide.

1. Exciple K+ red or violet. 2

1. Exciple K-. 3

2. Apothecial margin thick. Spores 9-12 x (2-)3.0-3.2(-3.5) μm . Thallus subterranean, rimose-areolate to verruculose-uneven, yellowish gray, K-, C+ pale orange, well-delimited at margin, hypothallus indistinct. Apothecia sessile, dispersed to crowded, to 2 mm, 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 μm ; epihymenium sordid blackish green. Containing schizopeltic acid. On sandstone, S. California. (L. hassei)

2. Apothecial margin thin. Apothecia to (1-)2-3 mm diam, dispersed, few, adpressed but strongly constricted at base, almost umbilicate, regular when young, soon becoming sinuate-lobate; disc black, bare or \pm pruinose, plane (lobes concave); margin prominent. Exciple 100-150 μm thick at margin, exterior dark violet (according to Latin diagnosis; exterior 10-15 μm dark olive-green but interior to that distinctly red-violet, according to English description), the interior pale violet red; hyphae \pm distinctly radiating; C-, K+ red-violet. Paraphyses coherent, indistinct, or not very gelatinous, 1.7-2 μm thick, apices gradually thickened, 3-3.5 μm , uneven. Spores (8-)10-12 x 3 μm , cylindrical-oblong. Hypothecium pale, concolorous with hymenium, with perpendicular hyphae. Medulla below hypothecium 50-100 μm thick, with intricate hyphae, enclosing much air and \pm dark, below with sharp limit to the exciple, which may be 200-400 μm thick at center. Hymenium 40-50 μm , colorless or, especially in K, pale greenish gray; I+ dark blue. Epihymenium indistinctly dark green-brown, sordid olive in K. Thallus K-, thin, grayish, subgranulose or often absent. S. California. L. violascens

3. Spores 7-9-12(-14) x 2-2.6-3.2(-3.6) μm . Apothecia 0.3-1.4 mm diam., to 0.3 mm high, separate but occasionally in dense groups, distinctly to strongly constricted at base; disc pure black (unchanged when wet), flat to rather strongly convex, epruinose, matt to slightly shiny; margin mostly distinct, (occasionally in age even swollen-crisped), later often disappearing. Thallus absent. Excipulum of L. lithophila-type (with thin, epihymenium-like cortical zone and inner 25-40 μm thick pale ochre-yellow zone, producing through finely crystalline deposits visible in polarized light, but not always very distinct). Hypothecium hyaline; hymenium 35-50 μm , colorless; epihymenium 8-15 μm , dirty olive-green to brown-black or occasionally light brown, K-. Paraphyses simple, strongly coherent, ca. 2 μm diam., the apical cells to 4 μm . Asci clavate, 8-spored. Spores oblong, L:W = 3.4-3.6:1. Exciple K-, C-, P-, I-. Containing 4-O-demethylplanic acid. On siliceous rocks. L. laboriosa Muell. Arg. agg. (syn. L. leptoboloides agg.)

3. Spores 8-12 x 2.5 μm . Apothecia to 0.5(-0.8) mm diam. Exciple C-. Exciple edge blue-green. Spores indistinctly 1-septate. Thallus very thin to moderately thick, granulose or subverrucose to areolate, grayish or olive. Apothecia epruinose, becoming convex, the margin

persistent or disappearing. Hypothecium \pm hyaline, or olive-blackish to purple-brownish or dark brown above; hymenium 40-70 μ m; epihymenium green-black. (L. conferenda)

ADD:

Epilithic thallus lacking or rarely in traces. Apothecia to 2.5 mm broad, usually less, adnate with narrow base, flat to moderately convex, fissuring with age; margin lacking; exciple with narrow green-black exterior and hyaline to yellowish gray interior; hypothecium clear brown to medium brown; epithecium olive-green to blue-green or black-green; hymenium 40-65 μ m, hyaline, I+ blue; paraphyses simple, rarely branching or anastomosing, 2 μ m with tips to 4.5 μ m; asci clavate; spores ellipsoid to oblong-ellipsoid, moderately thick-walled, 5-13 x 2.5-5 μ m. Exciple and subhypothecial layers K-, C-, KC-, P-, I- or weakly I+ blue. On acid rocks in xeric habitats, on blocks, pebbles, or outcrops. Greenland. Very similar to L. promiscens, differing in having a pale brown hypothecium, a weaker reaction of the medulla with I, and shorter, broader spores. L. paratropoides Muell. Arg.