

## Artificial Keys to Lecidea sensu lato in US & Canada

After various authors

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This is an utterly horrible, and unfortunately ubiquitous, genus. Many hundreds of extremely common species in N. America will not key out worth beans in these keys. Abandon all hope ye who enter here.

### **I-A. CORTICOLOUS/LIGNICOLOUS. Thallus sorediate; apothecia often absent.**

After Tonsberg, 1992

#### **I-A-1 CORTICOLOUS/LIGNICOLOUS. Sorediate. C+ red or rose, UV- (gyrophoric acid).**

**1. Areoles usually distinct, markedly convex throughout, or when scattered or at the edge of thallus sometimes incised, usually over 0.1 mm diam. ....** see Trapeliopsis (T. flexuosa, T. granulosa, T. pseudogranulosa, and T. viridescens)

**1. Areoles usually indistinct, minute, under 0.1 mm diam., never incised. .... 2**

**2. Apothecia olive-black to brown-black. Thallus granulose (without soredia?),** gray-olive to yellow-gray, thin, K+ pale yellow, C+ pink. Apothecia to 0.5 mm, becoming immarginate, epruinose. Hymenium 65-70  $\mu$ m. Hypothecium hyaline. Epihymenium pale yellow to yellow-brown. Spores oblong to fusiform, 13-17 x 4-5  $\mu$ m, becoming 1-septate. On bark. New York. .... ("L." olivascens; = Lecanora s. lato sp.)

**2. Apothecia (if present) pale, at most red-brown or pale brown. Thallus with soredia, usually in distinct soralia at least at first. ....** Biatora chrysantha and B. vacciniicola

### **I-A-2. CORTICOLOUS/LIGNICOLOUS.**

#### **Sorediate.**

**Thallus with yellowish to orangish pigments,  
C+ orange, UV+ yellow, orange or red-brown  
(xanthones or unknown pigments).**

**1. Unknown yellowish or orange acetone-soluble pigments (1-3 subaurifera unknowns) present as major constituents.** On acid bark, British Columbia,

Washington. .... Japewia subaurifera

**1. Subaurifera unknowns absent; xanthones present.** ..... 6

**2. Lichexanthone present. Soralia yellow, UV+ yellow.** Arthothelin and granulysin, or 2,5,7-trichlor-3-methylnorlichexanthone, isoarthothelin and thiophanic acid present. .... Lecidella elaeochroma "f. soralifera"

**2. Lichexanthone absent. Thallus including soralia UV+ orange to reddish brown.** ..... 3

**3. Atranorin present (thallus K ± yellow).** Arthothlein ± thuringione present. .... Lecidella scabra

**3. Atranorin absent (thallus K- or weak).** ..... 4

**4. Spores ± globose, ca. 10 µm diameter, thick-walled.** Thallus composed entirely of soredia, yellowish. Apothecia small, ± scattered, the disc brown, initially ± shiny, the margin paler, disappearing. Hymenium inspersed with oily granules. Thallus C+ orange, UV+ red, containing thiophanic acid and unknown xanthone. On Thuja bark, Michigan. .... L. sp. 3 (Harris)

**4. Spores short ellipsoid to ellipsoid, (7-)8-12(-14) x (5-)6-7(-8) µm.** Thallus dull yellowish or yellowish fawn (in shade greenish yellow), sometimes with reddish-brownish tint, K-, P- or weakly yellowish, C+ and KC+ orange-red, UV+ orange or red (thiophanic acid, isoarthothelin and ± dichlornorlichexanthone). Apothecia, when present, dark red-brown, K+ reddish purple in section. Usually on moderately nutrient-rich, rough bark (especially Quercus), occasionally on wood, mostly in well lit situations, very rarely on sandstone rocks. Often very common, along the Pacific coast, at least from British Columbia to southern California. Also reported from Minnesota. .... Pyrrhospora quercea (Dickson) Körber

### **I-A-3. CORTICOLOUS. SOREDIATE.**

**Thallus C-, K± yellow or K-, KC-, P+ or P-, UV+ or UV-,  
With various acetone-soluble pigments.**

See Biatora flavopunctata, and various other usnic acid-containing taxa treated under Lecanora symmicta group

### **I-A-4. CORTICOLOUS. SOREDIATE.**

**Thallus C-, UV- or UV+ bluish white,  
Without or with only traces of acetone-soluble pigments  
(but may have colorless substances).**

**1. Thallus entirely diffusely sorediate or leprose; soredia usually superficial from the**

**beginning. Thallus containing divaricatic acid. Spores globose, 4-6 um diameter.** Thallus  $\pm$  verrucose-granular, gray-white, brownish to blue-gray, entirely granular-sorediate, P-, K-, C-, KC-, UV+ white; soredia whitish. Granules 20-60(-70) um diam.; external hyphae sometimes brown. Apothecia rare, 0.3-0.9 mm, discs red-brown to black. Hypothecium hyaline or pale. Exciple thin, pale brown, the outer part sometimes darker. Epithecium brown, K-. Asci Bacidia-type. Paraphyses simple; apices abruptly swollen with dark brown caps to 4 um wide. Hymenium 35-40 um, hyaline. Photobiont cells 5-12(-14) um. [If photobiont small, micareoid, see Micarea]. On bark, especially of conifers. Massachusetts; Washington? ..... L. nylanderii (possibly related to L. leprosula)

**1. Thallus (at least initially) partly continuous to verrucose or areolate, or with discrete soralia (sometimes thallus immersed and soralia originating from below the surface of the substratum). Thallus without divaricatic acid. Spores  $\pm$  ellipsoid [?].** [Note: most of the species below can eventually become completely sorediate]. ..... 2

**2. Thallus verrucose-uneven or areolate,** whitish; soredia coarse. Discs plane or convex. .... 3

**2. Thallus continuous,** thin, with discrete, rounded mound-like soralia. Apothecia rare,  $\pm$  scattered, pale to dark brown; spores 10-15 x 3-4 um, narrow-ellipsoid to fusiform; hypothecium, exciple, hymenium and epihymenium hyaline. On bark of Populus and Fraxinus, especially at base, Michigan. .... L. sp. 4 (Harris)

**3. Alectorialic acid present.** ..... 4

**3. Alectorialic acid absent.** ..... 5

**4. Prothallus brown. Soralia bursting from the apices of the areoles, concave. Medulla indistinct.** ..... Fuscidea praeruptorum

**4. Prothallus usually indistinct. Soralia marginal or laminal, flat to strongly convex.** ..... Hypocnomyce leucococca and H. sorophora

**5. Soralia P+ red or orange (argoposin or fumarprotocetraric acid).** ..... 6

**5. Thallus including soralia P-.** ..... 8

**6. Thallus with argoposin (major) and norargoposin.** Discs pale reddish brown. Soralia pale yellow, bright yellow-green, or green, P+ immediately rust-red, bursting from apices or margins of areoles, or originating beneath substrate, diffuse, often efflorescent, variable in size, to 0.5 mm diam.,  $\pm$  circular or irregular, often only slightly raised, usually plane, discrete or becoming confluent into a leprose crust which may become thick and crack into angular, variably sized portions. Soredia fine, 15-30(-40) um diam.; wall distinct. Medulla indistinct. Photobiont often aggregated, to 7.5(-10) um diam. Thallus K-, C-, KC-, UV-, without atranorin. Thallus indeterminate, usually forming rounded to irregular patches to a few cm diam., rarely to 10 cm or more, thin to thick, usually areolate. Prothallus rarely distinct, whitish. Areoles mostly marginal on the thallus, discrete or contiguous, grayish or grayish green, to 0.2 mm diam., flat or slightly convex, rounded, entire to  $\pm$  incised, adnate, to  $\pm$  subsquamiform along a marginal zone. Apothecia infrequent (not yet known in N. American material), biatorine, to 0.9 mm diam., pale reddish brown, glossy; margin slightly paler than disc, disappearing; disc plane to strongly convex. On Alnus, Populus and Salix, near sea level on the Pacific coast. Alaska. .... Biatora efflorescens (Hedl.) Erichsen nom. cons. prop. (Syn.: L. epixanthoidiza Nyl. non auct.)

**6. Without argoposin and norargoposin, with fumarprotocetraric acid (major), and protocetraric acid (trace).** ..... 7

**7. Thallus K+ yellow, with atranorin. Discs cinnabar red.** Soredia pale yellowish white, grayish or greenish. Subalpine to alpine, on shrubs. California to Washington. ....  
(*Pyrrhospora cinnabarina*)

**7. Thallus K-, without atranorin. Discs pale to dark brown, flesh colored or blackish.**

Thallus P+ red (fumarprotocetraric acid, protocetraric acid,  $\pm$  cph-2). Apothecia somewhat uncommon, few, brown, marginate. Soralia brownish,  $\pm$  diffuse. Spores broadly ellipsoid to globose. Thallus crustose, episubstratal or endosubstratal in non-sorediate parts, indeterminate, forming irregularly spreading patches between other crustose lichens, to a few cm across, areolate. Prothallus usually indistinct, sometimes forming pale to dark brown or pale grayish blue border around areoles and soralia. Areoles rare, grayish white to green, discrete to  $\pm$  contiguous, rounded and convex, to 0.3 mm diam. Soralia usually grayish brown to brownish green, green in shaded niches, punctiform, to 0.2(-0.3) mm diam., diffuse or sometimes surrounded laterally by a thin irregular sheet formed by substrate, plane to convex, discrete or sometimes becoming  $\pm$  contiguous or fused into a  $\pm$  leprose crust; soredia fine, 15-20  $\mu$ m diam.; wall distinct.

Photobiont to 10 cm diam. Apothecia lecideine, sessile, to 0.3(-0.5) mm diam.; proper margin pale to blackish brown, glossy, to 0.15 mm wide, persistent; disc pale to dark brown, sometimes  $\pm$  carneous or black, mostly matt, plane. Proper exciple colorless or pale brown, the outer rim dirty green, K- or K+ intensifying, N+ pale reddish brown, with crystals of fumarprotocetraric acid (P+ red); hyphae strongly conglutinated in outer and lower part, less so in inner part.

Epithemium brown, sometimes greenish tinged, not granular, K- to dark green; hymenium 40-70  $\mu$ m, hyaline, gel KI-; paraphyses simple or slightly branched in upper part, 1.5-2.0  $\mu$ m wide, apical cell brown-walled; asci clavate, 40-60 x 12-20  $\mu$ m, 8-spored, surrounded by a KI+ blue cap; wall not amyloid; tholus well developed, KI+ deep blue, with distinct axial masse; ocular chamber absent. Spores colorless, simple, often immature, broadly ellipsoid to globose when mature, 5-10 x 5-7  $\mu$ m. Pycnidia not seen. On *Betula*, 10-20 m, Alaska. .... *L. praetermissa* Tonsberg (related to *L. leprosula*)

**8. Asci *Rimularia*-type.** Thallus occasionally sorediate; soredia dark brown and somewhat glossy, 15-25  $\mu$ m diam.; soredial hyphae short-celled, brown pigmented; soralia rounded, mostly 0.1-0.25 mm diam. and  $\pm$  confluent, rarely 0.2-0.45 mm diam. and well delimited. Thallus containing unknown UV+ whitish substance, or no substances. On conifers (fir, tamarack, spruce, pine), or occasionally on birch.

Temperate eastern N. America, especially in Great Lakes area, Minnesota to New York, New England, Newfoundland, and New Brunswick. [David, 1992, would exclude this species based on paraphyses type]. .... *Rimularia caeca*

**8. Asci not *Rimularia*-type.** ..... 9

**9. Thallus UV+ brightly bluish white. Lobaric, divaricatic or perlatolic acids present.** ..... 10

**9. Thallus UV-. Lobaric, divaricatic and perlatolic acids absent.** ..... 12

**10. Lobaric acid present.** Soralia bursting through substratum or from areoles, at first delimited and  $\pm$  discrete, punctiform, rounded, later becoming diffuse and confluent, medium brown to dark brown to yellow to yellowish green. Apothecia sparse, emarginate, biatorine, discrete, irregularly dispersed, chestnut brown, to 0.4(-0.6) mm diam., On acid bark, British Columbia, Washington. .... (*Japewia subaurifera*)

**10. Perlatolic or divaricatic acids present.** ..... 11

**11. Thallus containing perlatolic acid. Thallus composed of often clustered verrucules, grayish brown to whitish, only partly sorediate. Spores oblong, 7-12 x 2.5-4.5  $\mu$ m. Discs red-**

**brown to dark brown or black.** Hypothecium red-brown to black. Spores oblong to ellipsoid, 7-12 x 2.5-4.5 µm, non-septate. Thallus composed of often clustered verrucules, grayish brown to greenish white or grayish white, K-, C-, P-, I-, sometimes sorediate; verrucules to 0.3 mm wide, compact or scattered. Apothecia solitary or often clustered, 0.2-0.4 mm across, adnate to sessile; margin thin, paler than disk; exciple dark brown or yellow-brown externally, paler brown internally, radiate. Hymenium 50-65 µm, pale below epihymenium, I+ blue; paraphyses 1.5-2.5 µm, coherent, tips not thickened; asci clavate. Epithymenium ± brown above. Asci similar to *Micarea*-type. On rotting wood and charred wood. Arctic-boreal. .... ("L." *botryosa*)

**11. Thallus containing divaricatic acid. Thallus ± verrucose-granular, gray-white, brownish to blue-gray, entirely granular-sorediate, Spores globose, 4-6 µm diameter.**

Massachusetts; Washington. .... (*L. nylanderi*)

**12. Without lichen substances. Spores 0-3(-5)-septate.** Soralia pale greenish to yellowish or pale buff. Thallus pale, gray green or gray, immersed or thinly granular-verrucose, with irregular, often confluent; soredia 20-60 µm diam. Apothecia 0.4-1.2 mm diam., sessile and ± turbinate, later hemispherical to subglobose, gray brown to red-brown; Spores 17-25(-30) x 4.5-7 µm, fusiform. Over bryophytes or on bark of mossy trunks of old deciduous trees in ancient woodlands, rarely on mossy rocks in wooded ravines. .... (*Mycobilimbia*: "*Biatora*" *epixanthoides*)

**12. With lichen substances. Spores simple.** ..... 13

**13. Thallus containing pseudoplacodiolic acid. Apothecia richly present, black, without anthraquinones,** often bluish pruinose, emarginate. Thallus crustose, endosubstratal in esorediate parts, grayish white, yellowish gray, or pale green, sometimes with pale brown tinge, indeterminate, forming irregularly spreading patches to several dm across; prothallus indistinct or absent. Soralia usually present, diffuse, bursting here and there through substrate, irregular, forming a discontinuous leprose crust; soredia fine, 10-30 µm diam., often in aggregations, but easily free in squash preparations; wall distinct. Medulla absent. Photobiont to 10 µm diam. Apothecia lecideine, strongly convex, sometimes tuberculate, to 0.4(-0.6) mm diam. Pycnidia unknown. On dry bark (or wood) of conifers (e.g., *Picea*), 400-650 m, Alaska and British Columbia. .... *L. leprarioides* Tonsberg (related to *L. turgidula*; position unclear)

**13. Thallus containing subcinnabarina unknowns. Apothecia present or absent; discs cinnabar red, containing anthraquinones.** External soredia brown. Thallus whitish to greenish gray. On bark (e.g., *Acer*), 400 m, British Columbia. .... (*Pyrrhospora subcinnabarina* (Tonsberg) [ined.?!])

ADD among P- species [chemistry unknown; usually not sorediate]:

Apothecia pale to dark reddish brown, dark brown or brown-black (usually all colors on same thallus, if large enough), sometimes pruinose, the margin at first thin, ± shiny, black, usually persistent, or sometimes ± excluded. Apothecia common, often abundant, adnate, moderately constricted, round to slightly irregular, to 0.8(-0.1) mm, plane to moderately convex. Thallus green-white/gray or yellowish gray, K-, C-, KC-, P-, thin and membranous to verruculose or granulose, continuous to scattered or grouped, or absent; granules small, corticate; hypothallus absent. Hypothecium yellow-brown to medium-brown; exciple hyaline on outer edge; hymenium ca. 75 µm, I+ blue; epithymenium ± brown or light brown; paraphyses strongly coherent; spores ellipsoid to citriform or ± fusiform, (8-)11-13 x (3-)5-6 µm, simple, with pointed or rounded ends. On bark and

wood. British Columbia. ....(L. albofuscescens; belongs near Lecidella)

## I-B. CORTICOLOUS/LIGNICOLOUS.

**Apothecia bright red or orange.**

(several additional species, with "rusty red" apothecia, such as L. holopolia, may also key out here)

**1. Hypothecium yellow to reddish.** Thallus thin, greenish ashy to pale cream-colored,  $\pm$  limited by dark hypothallus. Apothecia 0.5-1.5 mm, slightly concave to convex, bright or dull red, the margin concolorous or lighter, thin, finally disappearing. Spores oblong-ellipsoid, 8-12 x 3-4  $\mu$ m. Thallus UV+ yellow (lichexanthone). On trees, New York to Florida, west to the Rocky Mountains. .... Pyrrhospora russula

**1. Hypothecium hyaline.** Spores oblong. .... 2

**2. Growing in Louisiana. Thallus dark gray, K+ yellow, granulose,** Hypothallus indistinct. Apothecia red-orange, to 0.4 mm, plane to sub-convex, the margin finally disappearing. Epithymenium colorless [?--how can that be, with red-orange apothecia???]. Spores 9-10 x 3.5  $\mu$ m. On old palm tree, ..... L. louisianae (position unclear)

**2. Growing in the West. Thallus whitish to greenish gray, chinky, K+ yellow or K-, thin.** Spores 8-12 x 2-3  $\mu$ m. Apothecia to 1 mm, flat to convex, scarlet, the margin lighter colored, soon disappearing. .... Pyrrhospora (P. cinnabarina and P. subcinnabarina)

## I-C. CORTICOLOUS/LIGNICOLOUS.

### Non-soresiate.

Thallus dark, grey, brown, greenish or blackish.

**1. Hypothecium red-brown.** Thallus of granular or isidiate-granular goniocysts or areoles. Asci Trapelia-type, the apical dome not, or weakly I+ blue. Spores mostly over 10  $\mu\text{m}$  long, (4-)5-6(-7)  $\mu\text{m}$ . Discs flat to convex, brown to black; margin disappearing. Paraphyses  $\pm$  coherent. On wood. .... Placynthiella uliginosa and P. oligotropa

**1. Hypothecium hyaline or pale.** ..... 2

**2. Apothecia with algae at least under hypothecium. Spores fusiform, (7-)8-12 x 2-3.5  $\mu\text{m}$ .** [If spores mostly 6-7 x 3-3.5  $\mu\text{m}$ , see Lecanora fuscidula]. .... (Protoparmelia ochrocoeca)

**2. Apothecia without algae. Spores  $\pm$  ellipsoid or oblong.** ..... 3

**3. Spores (15-)17-20(-24) x (8-)12-15  $\mu\text{m}$ , broadly ellipsoid to subglobose, with strongly thickened (2-3.5  $\mu\text{m}$  thick) walls.** Thallus dark brown, uneven, or evanescent. Apothecia 0.3-0.5(-0.8) mm diam., strongly convex, deep red-brown; Thallus P-, K-, C-, KC- (no substances). Pacific NW, S to Arizona. .... Japewia tornensis

**3. Spores under 15  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide, thin-walled.** ..... 4

**4. Spores mostly over 10  $\mu\text{m}$  long.** ..... 5

**4. Spores 5-9  $\mu\text{m}$  long.** ..... 8

**5. Apothecia 0.3-1.5 mm diameter.** Spores 9-14 x 4-7  $\mu\text{m}$ , ovoid. Discs rusty red to blackish, flat to convex; margin blackish, thick, becoming wavy-lobed (flexuous). Thallus coarsely granular, olive brown to blackish; granules tough, round, scattered or finally crowded. Apothecia adnate. Hypothecium hyaline. On wood. Washington, California, Colorado. .... L. holopolia (position unclear)

**5. Apothecia mostly under 0.5 mm diameter.** Thallus mostly thin. .... 6

**6. Spores 11-13 x 8-9  $\mu\text{m}$ .** Thallus dark olive-gray, thin, subverrucose. Apothecia to 0.4 mm, black, the margin thick, persistent. Hypothecium hyaline. Epihymenium olive-brown to blue-green-black. Spores broadly ellipsoid. On bark of white birch, New York. .... "L." pulla (probably = Rimularia fuscisora)

**6. Spores to 6  $\mu\text{m}$  wide.** ..... 7

**7. Spores 10-15 x 3-5  $\mu\text{m}$ , oblong.** Apothecia to 0.3 mm, sessile; disc brown to blackish, convex; margin disappearing. Thallus thin, widespread, uneven, brown, on black hypothallus. Hypothecium hyaline. On bark, Washington. .... "L." furvonigrans (Fuscideaceae)

**7. Spores 11-13 x 5-6  $\mu\text{m}$ , oblong-ellipsoid to ellipsoid.** Apothecia to 0.5 mm; discs black,  $\pm$  plane; margin thick then thin. Thallus verrucose, white to sordid olive or brown to blackish, K-. Epihymenium black. New York. [An apparently similar species, possibly a Lecidella, occurs in New Brunswick]. .... (Rimularia caeca)

**8. Spores 7-12 x 2.5-4.5  $\mu\text{m}$ .** Thallus grey-brown, verrucose. .... (see L. botryosa)

**8. Spores to 8  $\mu\text{m}$  long and 3.5  $\mu\text{m}$  wide.** ..... 10

**9. Thallus olive brown, membranous to granular or somewhat scurfy (granulose-squamulose according to Hasse), rather thin, scattered, or immersed.** Apothecia to 0.5 mm, adnate, plane to convex and swollen or undulate, dark reddish- or yellowish-brown, to black, the margin thick (thin according to Hasse), slightly paler than disc, usually persistent. Spores 6-8 x



2.5-3.5  $\mu\text{m}$ , ellipsoid (4-5  $\mu\text{m}$  wide, broadly ellipsoid, according to Hasse). Hypothecium dark yellowish- or reddish-brown to brown-black, K- (pale brown according to Hasse). Thallus granules minute, irregular, somewhat flattened to rarely hemispherical. Hymenium (according to Hasse) ca. 48  $\mu\text{m}$  high, I+ blue then soon brown; epithecium dark brown; paraphyses confluent; asci clavate. On wood, Illinois, Iowa, Minnesota; California; also southern U.S. according to Hasse. .... L. myriocarpoides

**9. Thallus dark grayish green to blackish, thin to moderately thick, verruculose.** Spores 5-7 x 2.5-3.5  $\mu\text{m}$ . Apothecia 0.1-0.4 mm diam. Epithecium greenish or brownish black, or dark bluish green. Hymenium ca. 25-32  $\mu\text{m}$  high. Hypothecium dark brown to black; exciple dark bluish green marginally, hyaline within. On wood. .... Micarea erratica

## I-D-1. CORTICOLOUS/LIGNICOLOUS.

**Non-soresiate.**

**Thallus ± pale or not evident.**

**Spores ellipsoid, under 3 µm wide.**

**Apothecia under 1 mm diameter, black.**

**1. Hypothecium dark.** Epithymenium ± pale, olive-brown or yellow-brown. Apothecia 0.3(-0.5) mm diam., numerous, adnate; discs black, bare, dull, plane when young; margin thin, black, often disappearing; exciple brown-black or reddish black, paler externally. Spores 7-11 x 2-4 µm. Paraphyses ± contiguous, capitate. Exciple pale inside. Hypothecium olive-brown to reddish brown, brighter or more olivaceous in K, hyphae irregular. Hymenium 45-50 µm, pale brownish, I+ blue turning reddish; paraphyses 1.5-2 µm, tips to 3 µm, coherent; asci narrowly clavate; spores simple, narrowly ellipsoid or subfusiform. Thallus absent or indicated by a whitening of the substratum, sometimes a very thin olive-green or gray-green crust of minute verrucules. Thallus K-, C-, P-. On weathered wood. Boreal. .... L. plebeja (position unclear)

**1. Hypothecium hyaline or pale.** ..... 2

**2. Spores over 9 µm long. On bark.** On bark of Ulmus, New York. ....  
(L. cellularis; possibly = L. areolata)

**2. Spores under 9 µm long. On wood, or roots of trees.** Apothecia 0.1-0.25(-0.35) mm diameter. .... 3

**3. Spores 4-5 x 1.5-2 µm, ± tear-shaped (oblong-ovoid).** Thallus granular to granular-verrucose, white to pale greenish gray (yellowish green to dark green according to Lowe), UV-, with no lichen substances. Discs dark brown to blue-black or sometimes livid blackish or reddish brown. Apothecia frequent, 0.1-0.3(-0.4) mm diam., ± globose to tuberculate, often surrounded by a basal white rim of protruding excipular hyphae; Hypothecium ± hyaline to pale green (pale olivaceous to green-black according to Lowe). On roots, stones and consolidated soil of dry underhangs on banks or the root systems of fallen trees. [If thallus C+ red and apothecia pale, see P. leprosa, which is known from Greenland]. .... Psilolecia clavulifera

**3. Spores over 5 µm long and 2 µm wide, not tear-shaped.** ..... 4

**4. Spores 5-7.5 x 2.5-3 µm, non-septate, oblong to ellipsoid or ovoid-ellipsoid.** Discs convex, pale lead-colored to black, epruinose; margin disappearing. On wood, New York, Massachusetts. .... (Micarea rhabdogena (Norm.) Hedl. [Syn. L. punctella])

**4. Spores 7-9 µm long.** ..... 5

**5. Apothecia (sometimes) becoming clustered. Illinois.** Discs flat to convex, brown-black to black, the margin thin, disappearing. Spores 7-9 x 2-3 µm, ellipsoid. Thallus very thin, green-gray to ashy. Hypothecium hyaline to brownish. Apothecia 0.1-0.25 mm diam., adnate, sometimes clustered; exciple dull blackish, indistinct. On old wood, Illinois. .... L. torquens (belongs in Lecanora s. lato)

**5. Apothecia scattered. Southern California.** Discs convex, brown to blackish brown. Spores 7-9.5 x 3-3.5 µm, oblong-ellipsoid. Thallus thin, ashy to greenish gray, minutely granulate, becoming scurfy and disappearing. Apothecia 0.15-0.25 mm, slightly immersed to sessile. Hypothecium hyaline. On old wood, southern California. .... (Micarea misella)

## I-D-2. CORTICOLOUS/LIGNICOLOUS.

Non-soresiate.

Thallus  $\pm$  pale or not evident.

Spores ellipsoid, under 3  $\mu$ m wide.

Apothecia under 1 mm diameter, at least partly pale.

1. **Hypothecium dark.** Epihymenium  $\pm$  pale, brown. Spores to 11  $\mu$ m long. On wood. **Apothecia mostly to 0.3 mm diam.,** numerous; discs bare, dull, plane when young. Spores 7-11 x 2-3  $\mu$ m. Paraphyses  $\pm$  contiguous, capitate. Exciple pale inside. Hypothecium olive-brown to reddish brown, brighter or more olivaceous in K. Thallus whitish, verruculose or absent. Disc color? ..... L. plebeja (position unclear)
1. **Hypothecium hyaline or pale.** ..... 2
  2. **Spores over 9  $\mu$ m long. On bark.** Thallus pale, whitish or greyish. Hypothecium hyaline or pale. Apothecia to 0.4 mm diameter. Hymenium I+ blue then  $\pm$  red. ....4
  2. **Spores under 9  $\mu$ m long. On wood, or roots of trees.** Apothecia 0.1-0.25(-0.35) mm diameter. .... 5
3. **Spores 11-18 x 2.5-3  $\mu$ m, oblong.** Paraphyses lax. Discs red-brown to pale, convex. Apothecia to 0.4 mm diameter. Thallus white to glaucous, thin, verrucose-uneven. Hypothecium pale, sordid or reddish above, hyaline below. On bark. .... L. meiocarpa
3. **Spores to 11  $\mu$ m long.** ..... 4
  4. **Spores oblong or fusiform-oblong (ellipsoid according to Thomson 1997), often 1-septate. Thallus absent, or thin, leprose,** dirty whitish, K-, C-. Hypothallus lacking. Apothecia 0.2-0.3 mm diam., simple or partly confluent, constricted at base, becoming convex or sublobose, discs whitish or pale flesh-pink or yellowish-ashy, darkening when old, commonly thinly pruinose; exciple pale, becoming excluded. Epihymenium hyaline. Hypothecium hyaline or pale; hymenium hyaline, 40-50  $\mu$ m, I+ blue; paraphyses coherent, tips partly thickened. Spores biseriate, 9-11 x 2-3  $\mu$ m, Pycnospores short. On bark or wood. Arctic and Great Lakes region. .... L. albohyalina
  4. **Spores oblong, often slightly curved, non-septate. Thallus  $\pm$  thick, composed of flattened verrucules 0.1-0.2 mm diameter,** white, K-, Apothecia to 0.4 mm, discs pale olive then olive-black, immarginate. Epihymenium green-black. Hypothecium nearly hyaline, K+ pale yellow. Hymenium 50-55  $\mu$ m. Spores 8.5-11 x 2.5  $\mu$ m, On bark of Ulmus, New York. .... L. cellularis (possibly = L. areolata)
5. **Thallus greenish yellow. Discs lemon-yellow, becoming brownish.** Spores 4-7 x 2-3  $\mu$ m. Usually on rock, occasionally on tree roots. .... Psilolechia lucida
5. **Thallus and apothecia not yellow.** ..... 6
  6. **Spores 4-5 x 1.5-2  $\mu$ m,  $\pm$  tear-shaped (oblong-ovoid).** Discs dark brown to blue-black or sometimes livid blackish or reddish brown. Washington state. .... (Psilolechia clavulifera)
  6. **Spores 5-7.5 x 2.5-3  $\mu$ m, oblong to ellipsoid or ovoid-ellipsoid, non-septate.** Discs convex, pale lead-colored to black, epruinose; margin disappearing. Thallus disappearing. Hypothecium hyaline to pale yellowish brown. Apothecia 0.1-0.2 mm., adnate. On wood, New York, Massachusetts. .... Micarea rhabdoformis (syn. L. punctella)

**I-E. CORTICOLOUS/LIGNICOLOUS.**  
**Thallus  $\pm$  pale or immersed; non-sorediate.**  
**Spores many per ascus.**

Thallus usually wine-red pigmented, occasionally without pigment. Apothecia with poorly developed exciple; spores simple to 1-septate, medially constricted, 12-15 x 6-8  $\mu$ m. Thallus usually P+ yellow, containing psoromic acid, sometimes P-. Common on Alnus; also on Picea sitchensis and Salix, near sea level, Pacific and Atlantic coasts. Alaska; Newfoundland; Nova Scotia. .... L. roseotincta Coppins & Tonsberg (position unclear)

[If spores very tiny, also see Biatorella sensu lato]

**I-F-1. CORTICOLOUS/LIGNICOLOUS.**

**Thallus  $\pm$  pale or immersed; non-sorediate.**

**Spores 5-10  $\mu$ m wide.**

**Hypothecium dark.**

**Discs at least partly pale**

**1. Thallus continuous to minutely rimose-areolate or granular**, green-gray to ashy or brownish. Spores 10-18 x 5-9  $\mu$ m, ovoid-ellipsoid. Apothecia adnate, 0.5-1.2 mm; discs bright to dark brownish or black, flattish, finally convex and proliferous. Hypothecium brownish black. On trees, Florida to Texas. ....L. hypomela

**1. Thallus granulose**, ashy to dusky gray, the hypothallus thin, inconspicuous, blackening; granules minute, round, sometimes scattered. Apothecia sessile, light yellow-brown to blackish, 0.4-0.9 mm, the exciple thin, black, transversely striated, finally disappearing. Spores ovoid, 12-16 x 6-8  $\mu$ m. Hypothecium brown-black. On trees, Florida and Louisiana. ....L. furfurosa

**I-F-2. CORTICOLOUS/LIGNICOLOUS.**

**Thallus ± pale or immersed; non-sorediate.**

**Spores 5-10 µm wide.**

**Hypothecium hyaline or pale.**

**Discs at least partly pale**

**1. Apothecia under 0.3 mm diameter, ± aggregated. Black hypothallus present. .... 2**

**1. Apothecia over 0.3 mm diameter. Apothecial margin mostly thin, disappearing. .... 3**

**2. Discs flat to convex, dull brown (or sometimes pale yellow or blackish).** Apothecia often conglomerate; margin thin, soon or at least finally disappearing. Thallus pale ash color, green-grey, or yellow-green, with black hypothallus, K+ yellow, thin, granular, not sorediate. Apothecia common, under 0.3 mm diam., separate or often conglomerate, adnate, semitranslucent when wet, soon ± convex. Spores 7-12(-15) x 5-7 µm, ovoid. Thallus UV-, without xanthones. Usually on wood. .... Pyrrhospora varians

**2. Discs plane to concave, pale to reddish or black,** pruinose or not, shiny to rather opaque; margin concolorous or paler, moderately thick to rather thin, entire, slightly elevated, ± persistent. Spores 8.5-10.5 x 5-7 µm, ovoid to ± globose, simple, rather thick-walled. Thallus hypophloedal, to 2.5 cm across, green-gray, very thin, continuous, on distinct black prothallus, K+ yellowish, C-. Photobiont 8.5-13(-15) µm diam. Apothecia numerous, to 0.2 mm. diam., thin, subgelatinous, ± aggregated, round to angulate or compressed from mutual pressure, broadly andnate. Excipulum gelatinous, brown towards outside, otherwise hyaline to pale. Hypothecium hyaline to pale; hymenium 40-70 µm, not interspersed, I+ blue then red or brown; epihymenium ± brown. Apothecial tissues K-. Paraphyses ± conglutinate, simple, ca. 2 µm thick, indistinctly septate, the tips clavate to globose, ca. 3-5 µm. Asci subclavate, ca. 50 x 13-16 µm, rather thin-walled. On bark of Tilia, Smoky Mountains. .... L. subtilis (= closely related to or identical to L. hunana)

**3. Spores mostly over 13 µm long and 7 µm wide. On bark. .... 4**

**3. Spores mostly under 13 µm long and 7 µm wide. Hypothecium hyaline. Apothecia under 0.7 mm diameter. .... 6**

**4. Apothecia with algae below hypothecium.** Asci Lecanora-type. Thallus C+ orange. Thallus immersed or greenish grey to yellowish or greenish black, K+ yellowish. Apothecia 0.1-0.5 mm diam.; margins pale flesh-colored, soon disappearing; disks waxy, convex pinkish brown to greenish black (pale yellow to pale brown or dark flesh-colored, rarely medium or dark brown, according to [Thomson?]). Thallus thin, subgranular, uneven, effuse. Spores ellipsoid with rounded ends, straight, 11-20 x 7-12 µm. On conifer bark and old wood. Arctic-boreal, S to Arizona. .... Lecanora symmicta

**4. Apothecia without algae. .... 5**

**5. Thallus rather thin, continuous, granulose, ashy gray. Discs under 0.5 mm diameter, flat, finally convex, pale to red-brown or black; margin thin, soon disappearing. Apothecia adnate. Spores 13-16 x 7-9 µm, ovoid-ellipsoid. Hypothecium hyaline to yellowish. On trees. Florida, Louisiana, Minnesota, California. .... L. mutabilis**

**5. Thallus rather thick, granulose-verrucose, whitish to brownish, on white hypothallus. Discs 0.5-1.2 mm diameter, flat to convex, reddish brown to dark purplish. Spores 13-18(-21) x 6-9 µm, oblong-ellipsoid. Hypothecium yellowish. Apothecia sessile; exciple concolorous**

with disc. On trees. Colorado. ....L. rufofusca (= related to L. leprosula; possibly identical with L. porphyroplaca)

**6 Spores under 14 um long.** ..... 7

**6. Spores 12-17 x 4-6 um.** Thallus of very minute granules. Apothecia pale yellow to red-brown or blackening. On bark or sometimes wood. On bark or rarely wood, northeastern, west to Minnesota. ....(see Biatora vernalis)

**7. On bark of oaks, Florida. Discs flesh colored to yellowish or whitish. Thallus continuous, ± scurfy,** thin, green-gray. Discs concave to convex; margin paler than disc, slightly raised or sometimes disappearing. Hypothecium hyaline. Spores 11-14 x 6 um, oblong-ellipsoid. Apothecia 0.2-0.5 mm diam., adnate. Hymenial gel I+ blue then yellowish brown. ....L. carneoalbans (position unclear)

**7. On old conifer wood, Montana and Washington. Discs dull yellowish brown to lead-colored to dark red or blackish. Thallus granulose,** greenish gray to white. Apothecia 0.5-1 mm, flat to slightly convex, the margin becoming flexuous, finally disappearing. Hypothecium hyaline. Spores globose or long-ovoid, 6-12 x 4-7 um. ....L. paddensis (= related to L. antiloga)

**I-F-3. CORTICOLOUS/LIGNICOLOUS.**

**Thallus  $\pm$  pale or immersed; non-soresiate.**

**Spores 5-10  $\mu$ m wide.**

**Hypothecium dark.**

**Apothecia black.**

**1. Apothecia under 0.4 mm wide. .... 2**

**1. Apothecia over 0.4 mm wide. .... 3**

**2. Spores 12-15 x 5.5-6  $\mu$ m, ovoid to ovoid-oblong.** Thallus greyish to yellow-brown, wrinkled-granulose to verrucose, thin, ecorticate, K-, C-. Photobiont 10-18  $\mu$ m.

Apothecia 0.2-0.4 mm, sessile; discs black, matt, slightly concave to finally convex, the margin thin, subnitid, finally disappearing. Hypothecium dark brown, N-, K+ brownish. Hymenium 160-180  $\mu$ m [according to the protologue; ???--that's huge for a Lecidea], I+ blue then yellow-brown. Paraphyses confluent, thin. Asci oblong- to ovoid-cuneate. Spores 8, simple, thin-walled, the ends obtuse. Excipulum brown. On bark of conifers, mountains of S. California. .... L. xanthococcoides

**2. Spores 7-9  $\mu$ m, globose.** Thallus moderately thick, composed of small, convex, light brown, somewhat crenate, finally imbricated squamules. Apothecia to 0.5 mm, adnate, sometimes clustered, flat to slightly convex, black, the margin brownish to blackish, soon disappearing. Hypothecium brown to blackish brown. On bark, California. .... L. dolodes

**3. Paraphyses free. ....(see Lecidella)**

**3. Paraphyses coherent. .... 4**

**4. Spores halonate when young.** Usually on rock, rarely on wood. .... (Porpidia)

**4. Spores not halonate. .... 5**

**5. Apothecia black.** Hypothecium "dusky". Thallus thin, continuous, slightly powdery, ashy to darker. Apothecia to 1 mm, adnate, flat to slightly convex, the exciple thick, raised, black. Spores 11-15 x 6-8  $\mu$ m, ellipsoid. On bark, Florida. .... "L." floridensis = position unclear

**5. Apothecia partly brown or paler. ....** see L. hypomela and L. furfurosa



**I-F-4. CORTICOLOUS/LIGNICOLOUS.**

**Thallus  $\pm$  pale or immersed; non-sorediate.**

**Spores 5-10  $\mu$ m wide.**

**Hypothecium hyaline or pale.**

**Apothecia black.**

**1. Apothecia with algae at least under hypothecium. Spores short-ellipsoid to globose, 5-10 x 4-8  $\mu$ m.** Apothecia to 0.6 mm. Hypothecium hyaline. .... (*Lecanora fuscescens*)

**1. Apothecia without algae. Spores  $\pm$  ellipsoid. .... 2**

**2. Apothecia mostly under 0.5 mm. .... 3**

**2. Apothecia over 0.5 mm. .... 4**

**3. Asci not *Rimularia*-type (?). Hypothecium pale brownish. Spores 11-18 x 5-9  $\mu$ m.**

Thallus grey to whitish, thin, scant, of small verrucules, lacking soredia; hypothallus lacking.

Apothecia 0.3-0.5 mm, attached broadly, not much constricted at base; exciple brown to violet-brown, of radiating, slightly branching hyphae; discs flat to slightly convex, black or brownish black, bare, dull, becoming immarginate. Upper part of hypothecium of erect hyphae.

Epihymenium hyaline but with inspersed granules. Hymenium 60-100  $\mu$ m, lower part brownish, I+ blue becoming red.. Paraphyses contiguous, simple to slightly branched, tips not thickened, coherent; spores biseriate or uniseriate, ellipsoid or oblong-ellipsoid. Reactions negative with usual reagents except for the I+ hymenium. Thallus K-. On bark. NW

Territories. .... *L. phaeopelidina* (position unclear)

**3. Asci *Rimularia*-type. Hypothecium hyaline. Spores 7.5-10.5-13.5 x 4.5-5.5-7.5  $\mu$ m.**

..... *Rimularia caeca*

**4. Spores 11-15 x 6-8  $\mu$ m.** Apothecia black. Hypothecium "dusky". On bark.

Florida. .... (*L. floridensis*; = Pilocarpaceae, possibly *Fellhanera* sp.)

**4. Spores 6-12 x 4-7  $\mu$ m.** Discs dull yellow brown to lead colored or dark red-black,  $\pm$  flat. Apothecia 0.5-1 mm diameter. On wood. Thallus green-grey to white, granulose-areolate. Hypothecium hyaline. .... (*L. paddensis*; related to *L. antiloga*)

**I-G-1. CORTICOLOUS/LIGNICOLOUS.**

**Thallus  $\pm$  pale or immersed; non-soresiate.**

**Spores 3-5  $\mu$ m wide.**

**Hypothecium hyaline or pale**

**Apothecia black.**

**1. Spores under 8  $\mu$ m long. Apothecia to 0.25 mm.** Thallus very thin and inconspicuous or disappearing. Apothecia very numerous, flat to strongly convex, dark brown to dull black, the margin very thin, dull black, soon disappearing. Hypothecium hyaline. Spores ellipsoid or ellipsoid-oblong, rarely 1-septate, 7-8.5 x 3-4  $\mu$ m. On old wood, Washington. .... (*L. myriocarpella*; probably = *L. enalla* Nyl.)

**1. Spores over 8  $\mu$ m long, or if partly smaller, then apothecia larger. .... 2**

**2. Thallus  $\pm$  distinct. .... 3**

**2. Thallus indistinct or absent.** (also see *L. turgidula*, *L. carnulenta*, *L. holopolia*, and *Placynthiella* spp.). Thallus very thin, appearing as a pale stain, smooth and continuous, only weakly K<sup>+</sup> and P<sup>+</sup>. Discs persistently plane. Spores ellipsoid-fusiform to reniform or narrowly diamond-shaped. Hypothallus absent. Apothecia common, scattered, adnate, not constricted, 0.3-0.5(-0.9) mm diam.; margin sometimes very inconspicuous, not immediately apparent because it is of same color and texture as the disc, at other times obvious, thick and raised, persistent or not; discs usually irregular rather than round, minutely roughened or smooth, epruinose, brown-black or black, almost transparent when wet. Hypothecium hyaline with light orange-brown streaks or entirely orange-brown; paraphyses appearing simple but probably branched below (rather tightly coherent), with an enlarged, dark brown, globose apical cell; hymenium 35-50  $\mu$ m high, fulvous to very light brownish, darker above; spores 8-9(-13) x ca. 5  $\mu$ m. Thallus C-, KC-. On bark or wood. British Columbia. .... "*Lecidea* cf. *elabens*" (Noble)

**3. Apothecia mostly over 0.5 mm diam.** Thallus usually well developed, thin to moderately thick and verrucose, C-; medulla usually K<sup>+</sup> yellow, with atranorin (K- according to Hasse), P<sup>+</sup> orange-red, with fumarprotocetraric acid, or P-. Discs plane to convex. Spores narrowly ellipsoid to ellipsoid. Thallus whitish or grayish, Apothecia 0.25-1.25 mm wide; discs black, often glossy, the margin usually thin and inconspicuous, disappearing. Hypothecium hyaline to pale yellow-brown. Epihymenium dark olivaceous to red-brown or brown-black, N<sup>+</sup> reddish. Spores non-septate, 8-10(-13) x 3-4  $\mu$ m. Thallus UV- (without xanthones). Usually on wood. New England, New York, Iowa, S. Dakota, Colorado, Minnesota, and possibly California. .... *Pyrrhospora elabens*

**3. Apothecia mostly under 0.5 mm. .... 4**

**4. Spores short-ellipsoid to globose, 5-10 x 4-8  $\mu$ m. .... (*Lecanora fuscescens*)**

**4. Spores oblong to ellipsoid or fusiform, 3-4(-5)  $\mu$ m wide. .... 5**

**5. Hymenium (35-)40-55  $\mu$ m.** Apothecia from the first hemispherical to subglobose and immarginate. Thallus thin, verruculose-uneven, greenish to whitish or absent. Apothecia white to flesh-brown to red-black or brown-black, to 0.4 mm. Hypothecium hyaline to reddish or brown. Epihymenium hyaline to red-brown. Spores sometimes 1-septate, oblong, 7-11 x 3-4  $\mu$ m. On bark or wood of deciduous trees. .... (*L. sphaerella*; possibly related to *Lecania cyrtella*)

**5. Hymenium over 50  $\mu$ m. .... 6**

**6. Spores non-septate, oblong to ellipsoid, 9-14(-16) x 3-5  $\mu$ m. Thallus whitish to**

**greenish or olive, thin and fibrous or thicker and granuulose-verruculose, K-.** On bark, New York. .... (L. erythrophaea)

**6. Spores oblong to fusiform, 13-17 x 4-5 um, becoming 1-septate. Thallus gray-olive to yellow-gray, thin, granulose, K+ pale yellow, C+ pink.** Apothecia to 0.5 mm, becoming immarginate, olive-black to brown-black, epruinose. Hymenium 65-70 um. Hypothecium hyaline. Epihymenium pale yellow to yellow-brown. On bark. New York. .... L. olivascens

**I-G-2. CORTICOLOUS/LIGNICOLOUS.**

**Thallus  $\pm$  pale or immersed; non-soresiate.**

**Spores 3-5  $\mu$ m wide.**

**Hypothecium hyaline or pale**

**Apothecia at least partly pale.**

**1. Spores under 8  $\mu$ m long.** Apothecia to 0.25 mm. Thallus very thin and inconspicuous or disappearing. Apothecia very numerous, flat to strongly convex, dark brown to dull black, the margin very thin, dull black, soon disappearing. Hypothecium hyaline. Spores ellipsoid or ellipsoid-oblong, rarely 1-septate, 7-8.5 x 3-4  $\mu$ m. On old wood,

Washington. .... L. myriocarpella

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

**2. Thallus  $\pm$  distinct,** greenish, grayish, yellowish, olive, or whitish. .... 3

**2. Thallus indistinct or absent. .... 14**

**3. Apothecia mostly over 0.5 mm diam. .... 4**

**3. Apothecia under 0.5 mm, or if somewhat larger then clustered and conglomerate.**

..... 5

**4. Spores 10-16 x 5-8  $\mu$ m, ellipsoid.** Apothecia 0.5-1 mm diam.; disc flat to convex, dark reddish or nearly black; margin disappearing; hypothecium yellowish and darkening; Thallus ashy gray, thin, smooth to scurfy, obscurely chinky. On trees, Louisiana and Florida. ....(Phyllopsora furfuracea)

**4. Spores (9.5-)11-17 x 3.5-5  $\mu$ m, fusiform-ellipsoid, (0-)1(-3)-septate.** Thallus gray-green, finely to mealy granular; granules 25-70  $\mu$ m diam. Apothecia 0.4-0.8(-1.1) mm diam., at first hemispherical, later becoming  $\pm$  globose, pale to dull orange-pink, or sometimes (especially when old) pale reddish brown, in section without pigmentation. On sheltered, mature deciduous tree trunks (especially Fraxinus and Quercus), often around their bases, in old woodlands, more rarely on mossy rocks in wooded ravines or sheltered gullies. .... Biatora sphaeroides

**5. Spores short-ellipsoid to globose, 5-10 x 4-8  $\mu$ m..... (Lecanora fuscescens)**

**5. Spores longer, narrower. .... 6**

**6. Apothecia bluish to pale orange-brown. Thallus granulose. Hypothecium hyaline.** Apothecia to 0.6 mm, plane to convex, immarginate from the first. Thallus thin, greenish- to whitish- gray, K-. Epihymenium hyaline to pale yellowish, non-granular. Spores oblong-ellipsoid, sometimes 1-septate, 8-14(-17) x 3-5  $\mu$ m. On bark of conifers. Biatora vernalis will also key out here. ....Biatora helvola

**6. Apothecia yellowish, olive, olive-brown, reddish brown, or blackening. ....**

7

**7. Apothecia with algae present at least under hypothecium. Asci Lecanora-type.** Apothecia yellowish to dark brown, 0.1-0.3 mm across, immersed to adnate, flat to slightly convex. Thallus thin, yellowish, granulose. Hypothecium brownish. Spores 8-11 x 3-4  $\mu$ m. .... (Lecanora

cadubriae)

**7. Apothecia without algae. Asci otherwise. .... 8**

**8. Discs olive tinged. .... 9**

**8. Discs reddish to brownish tinged. .... 12**

**9. Apothecia to 0.3 mm diam.,** olive-green to black, immersed to adnate; disc flat to convex, the margin pale, soon disappearing. Thallus granulose, greenish to yellowish brown, on black hypothallus, the granules minute, irregularly, usually crowded and heaped forming a commonly widespread, continuous or somewhat scattered crust. Hypothecium brownish to brown. Spores simple, rarely 1-septate, oblong, (7-)9-14(-17) x 3-4  $\mu$ m. On cedar stumps. New England to Minnesota. .... (*L. flavidolivens*) (= probably *Pyrrhospora* sp.)

**9. Apothecia mostly over 0.3 mm diam.. .... 10**

**10. Hymenium under 40  $\mu$ m.** Discs  $\pm$  olive, or yellowish. .... 11

**10. Hymenium 65-70  $\mu$ m.** Spores becoming 1-septate. Thallus gray-olive to yellow-gray, thin, granulose, K+ pale yellow, C+ pink. Apothecia to 0.5 mm, becoming immarginate, olive-black to brown-black, epruinose. Hypothecium hyaline.

Epihymenium pale yellow to yellow-brown. Spores oblong to fusiform, 13-17 x 4-5  $\mu$ m, becoming 1-septate. On bark. New York. .... *L. olivascens*

**11. Epihymenium yellowish- or reddish brown, K $\pm$  olivaceous-brown. Spores ellipsoid, 8-11 x 4-5  $\mu$ m. Asci  $\pm$  *Catillaria*-type. Discs epruinose. Spores non-septate.** Hymenium 25-40  $\mu$ m. Apothecia to 0.6 mm, convex, pale olive to olive-brown or black, the margin usually thin, often disappearing. Thallus absent or thin, white to greenish-gray or olivaceous, smooth to subverruculose, K-, P-, C-, KC-. Hypothecium hyaline (or  $\pm$  brown above?). Exciple hyaline within, outer edge  $\pm$  pale brown. Paraphyses simple or sparsely branched; apical cells brown and swollen to 3-4  $\mu$ m wide. Ascus walls  $\pm$  evenly thickened throughout; outer layer and the shallow apical dome K/I+ uniformly blue, Pycnospores 14-18  $\mu$ m long, arcuate. On wood, New York. .... *L. hypopta*

**11. Epihymenium hyaline to brown-black or blue-green, K- or K+ green intensifying, Spores oblong to oblong-ellipsoid, 7-13 x 3-5  $\mu$ m. Asci *Bacidia*-type. Discs sometimes thinly white pruinose, with bluish bloom when wet. Spores sometimes 1-septate.** Discs pale olive to brown or black. Thallus whitish to olivaceous, K-, P-, C-, KC-, poorly developed, membranous to minutely granular or verrucose, or absent. Apothecia 0.2-0.5(-0.6) mm diam., sessile or (on wood) partly immersed; margin often disappearing. Hypothecium hyaline to pale brownish. Hymenium 30-40(-45)  $\mu$ m, streaked violaceous (K+ green) or brownish to greenish (K+ intensifying). Epihymenium also with minute pale granules that dissolve in K. Exciple usually of coherent (in K) radiating hyphae, hyaline to dark greenish or brownish, I $\pm$  pale violet. Paraphyses 1.3-2  $\mu$ m wide, sparingly branched and anastomosed, the tips scarcely swollen but sometimes with a dark brownish hood to 5  $\mu$ m wide. Pycnidia ca. 100  $\mu$ m diam., black,  $\pm$  immersed in substratum, the wall green-brown, K+ green intensifying; conidiogenous cells catenate, subcylindrical; conidia arising laterally and terminally, 3-3.5 x 1.5-1.8  $\mu$ m, bacilliform. Thallus containing placodiolic acid. On wood or less often bark, usually on conifers.

Widespread. .... *L. turgidula*

- 12. Hymenium 40-55 um.** Thallus obsolete to thin, verruculose-uneven, subgranulose, greenish to whitish, lacking distinct hypothallus. Apothecia 0.2-0.4 mm, from the first hemispherical to subglobose and immarginate, white to flesh-brown to red-black or brown-black, commonly the center darker. Exciple hyaline to pale yellowish, of radiating hyphae. Hypothecium reddish or brownish above, hyaline or pale below, upper part K+ reddish. Epihymenium hyaline to pale red-brown. Hymenium upper part pale, lower merging into hypothecium, I+ blue turning red. Paraphyses simple, tips slightly thickened, coherent. Spores biserial, simple to sometimes 1-septate, oblong (ellipsoid according to Thomson 1997), 7-13 x 3-4 um. On bark or wood of deciduous trees. NW Territories. .... L. sphaerella (= possibly related to Lecania cyrtella)
- 12. Hymenium over 50 um.** ..... 13
- 13. Discs pale to testaceous (pale yellow to red-brown or blackening according to Fink), 0.4-0.8 mm diam., Hymenium ca. 60-80 um.** Spores (10-)12-19 x 3.5-5 um, ellipsoid to fusiform, sometimes 1-septate. Thallus whitish to green-white, greenish gray, or ashy, usually with discrete or coherent granules; granules 80-150 um diam., irregular or hemispherical, sometimes compacted into a smoother, less granular, chinky crust. Thallus often with a varnish-like sheen, ± membranous in part but mostly granular verrucose or with discrete (but never loose) granules. Apothecia at first top-shaped, later convex-adpressed to subglobose, often clustered and conglomerate, without distinct pigmentation in section, except for a pale straw (K+ yellowish) hypothecium. Thallus K-, C-, KC-, without substances. On mossy tree trunks (especially oak), or rarely wood, northeastern, west to Minnesota. .... Biatora vernalis
- 13. Discs darker, blackening, to 0.4(-0.6) mm diam.; hymenium to 60(-70) um.** Spores non-septate. Thallus whitish to greenish or olive, thin and fibrous or thicker and granulose-verruculose, K-, C-, P-. Apothecia adnate to strongly constricted, 0.3-0.6 mm, ± plane, usually ± red-brown or brown-black, the margin darker than disc, thickish, sometimes disappearing. Exciple with yellow-brown outer layer, interior hyaline. Hymenium 50-65 um, upper part yellow-brown, I+ blue; paraphyses separable, 2-2.5 um, tips to 4 um. Hypothecium hyaline or pale yellowish, hyphae irregular, or upper part of vertical hyphae. Epihymenium yellowish brown, often coarsely granulose. Spores oblong to ellipsoid or subfusiform, simple, 9-14(-16) x 3-5 um. On bark, New York; California. .... L. erythrophaea (position unclear)
- 14. Spores ovoid or ellipsoid.** On wood. .... 15
- 14. Spores ± oblong. Discs sometimes thinly pruinose.** ..... 16
- 15. Apothecia 0.5-1.5 mm. Spores ovoid, 9-14 x 4-7 um. Discs rusty red to blackish, flat to convex; margin thick.** ..... (L. holopolia)
- 15. Apothecia to 0.6 mm. Spores ellipsoid, 8-11 x 4-5 um. Discs pale olive to olive-brown or black, convex, the margin usually thin, often disappearing.** On wood, New York. .... (L. hypopta; possibly related to L. symmictella)
- 16. Hypothecium hyaline.** Thallus brown, thin, on black hypothallus. Apothecia to 0.3 mm, sessile, the disc convex, brown to blackish, the margin disappearing. Spores oblong, 10-15 x 3-5 um. On bark, Washington. .... (L. furvonigrans; = Fuscideaceae)
- 16. Hypothecium at least partly pigmented.** ..... 17
- 17. Discs pale olive to brown or black, Spores sometimes 1-septate.** Apothecia 0.2-0.5(-0.6) mm diam., sessile or (on wood) partly immersed; discs sometimes thinly white pruinose, with bluish bloom when wet; margin often disappearing. Hypothecium hyaline to pale brownish. Spores sometimes 1-septate, oblong to oblong-ellipsoid, 7-13 x 3-5 um. On wood or less often bark, usually on conifers. Widespread. .... (L. turgidula; = ascus type intermediate

between Biatoraceae and Micareaceae)

**17. Discs  $\pm$  yellowish, whitish, or reddish (to brown or blackening). .... 18**

**18. Apothecia pale yellow or pinkish brown to red-brown or black, plane to convex, the margin thin, usually soon disappearing. Spores non-septate.** Thallus absent or rudimentary, very thin and scattered, greenish gray to brownish. Apothecia 0.2-0.6 mm across, adnate. Discs sometimes faintly pruinose; margin darker than disc. Hypothecium usually pale brownish above. Epihymenium  $\pm$  brown or almost hyaline. Hymenium I+ blue. Paraphyses conglutinate. Spores oblong-ellipsoid to ellipsoid or ovoid-ellipsoid, 7-11 x 3-4.5  $\mu$ m. On old wood. New England to Iowa and Minnesota; Washington. .... L. carnulenta (position unclear)

**18. Apothecia white to flesh-brown to red-black or brown-black, from the first hemispherical to subglobose and immarginate; Spores sometimes 1-septate.** Apothecia to 0.4 mm. Hypothecium hyaline to reddish or brown. Spores oblong, 7-11 x 3-4  $\mu$ m. On bark or wood of deciduous trees. .... (L. sphaerella; = possibly related to Lecania cyrtella)

**I-G-3. CORTICOLOUS/lignicolous.**

**Thallus ± pale; non-sorediate.**

**Spores 3-5 µm wide.**

**Hypothecium dark.**

**Discs black.**

**1. Thallus squamulose.** .....(*Phyllopsora* spp., e.g., *P. parvifolia*)

**1. Thallus crustose.** ..... 2

**2. Tholus I-. Epihymenium green- to blue-black, K+ purple-violet.** Thallus pale yellowish to pale gray, K+ red-brown, warty to small squamulose, partly breaking up into granules, or almost absent. Apothecia to 0.8(-1.2) mm, flat to moderately convex, black. Hypothecium and exciple blackish. Pycnidia often common on sterile forms. On wood. ....(*Hypocenomyce xanthococca*)

**2. Tholus absent, or if present, I+, epihymenium brownish and K-, or other characters not as above.** [*L. sanguineoatra*, which is usually on soil or moss, will also key out here]. ..... 3

**3. Spores partly 1-septate, oblong to oblong-ellipsoid.** ..... 4

**3. Spores entirely (?) simple.** ..... 7

**4. On Diapensia or sometimes peaty soil.** Apothecia 0.4-0.8 mm, sessile, epruinose, usually concave to plane, olivaceous- to reddish- brown or black, epruinose, the margin rather conspicuous, usually persistent. Hypothecium olivaceous- or reddish-brown to blackish. Epihymenium ± brown. Spores partly 1-septate, oblong to oblong-ellipsoid, 11-16(-19) x 3.5-5 µm. New Hampshire. ....*L. diapensiae* (position unclear)

**4. On trees (or wood).** ..... 5

**5. Discs ± green or olive (to black).** ..... 6

**5. Discs ± red-brown to black, or paler.** ..... 7

**6. Apothecia 0.5-0.8 mm, depressed-convex, ± epruinose, discs ± green; margin thin, ashy-pale, disappearing.** Thallus thin, ± verrucose, whitish. Hypothecium brownish to violaceous. Epihymenium ± blue-green. Spores often 1-septate, ellipsoid to oblong, 6-13(-16) x 3-4 µm. On bark of conifers and hardwoods. .... (*Biatora ocelliformis* [syn. *L. atroviridis*])

**6. Apothecia to 0.3 mm, flat to convex, olive-green to black, the margin pale, soon disappearing.** Thallus granulose, greenish to yellowish brown, on black hypothallus. Hypothecium ± brown. Spores often 1-septate, oblong, (7-)9-4(-17) x 3-4 µm. On cedar stumps, New England to Minnesota. .... (*L. flavidolivens*; probably belongs in *Pyrrhospora*)

**7. Apothecia plane, with thin margin when young.** Spores 7-13 x 2.5-4.5 µm, becoming 1-septate. Thallus composed of often clustered verrucules, grayish brown to whitish. Apothecia common, (0.15-)0.2-0.3(-0.6) mm diam., plane, the discs red-brown to black. Hypothecium red-brown to black. Asci *Micarea*-like On bark or wood, including burnt substrates. British Columbia. .... (*L. botryosa*; = possibly congeneric with "*Toninia*" *cumulata*)

**7. Apothecia from the first hemispherical to subglobose and immarginate, to 0.4 mm, white to flesh-brown to red-black, orange-brown, red-brown or brown-black.** Thallus thin, verruculose-uneven, greenish to whitish or absent. Hypothecium hyaline to reddish or brown.



Hymenium 40-55 um; epihymenium hyaline. Spores sometimes 1-septate, oblong, 7-11 x 3-4 um. On bark or wood of deciduous trees. .... (L. sphaerella; = possibly related to Lecania cyrtella)

**8. Apothecia 0.5-1 mm diam.;** disc flat to convex, dark reddish or nearly black; margin disappearing; hypothecium yellowish and darkening; spores ellipsoid, 10-16 x 5-8 um. Thallus ashy gray, thin, smooth to scurfy, obscurely chinky. On trees, Louisiana and Florida. ....(Phyllopsora furfuracea)

**8. Apothecia mostly under 0.5 mm diam.** ..... 9

**9. Spores variable in shape, finally pointed ellipsoid,** 6-12 x 3-6 um. Apothecia to 0.4 mm, flat to strongly convex, sometimes slightly pruinose, dusky to blackish brown, the margin thin, darker, finally disappearing. Thallus thin, greenish gray to ashy, disappearing. Hypothecium blackish brown. On trees and wood, eastern. .... (L. peliaspsis)

**9. Spores ellipsoid.** ..... 10

**10. Spores 6-9 x 3-5 um.** Apothecia to 0.4 mm, flat to convex and swollen, dark brown to black, the margin thin, soon disappearing. Thallus rather thin, granulose, somewhat scurfy, olive-brown, the granules minute, irregular, usually somewhat flattened. Hypothecium brown to blackish brown. On old wood, in eastern and midwestern U.S. and California. ....L. myriocarpoides

**10. Spores 8-11 x 4-5 um.** Apothecia to 0.6 mm, convex, epruinose, pale olive to olive-brown or black, the margin usually thin, often disappearing. Thallus absent or thin, white to greenish-gray or olivaceous, smooth to subverruculose, K-. Hypothecium ± brown above. Epihymenium yellowish- or olivaceous-brown. Spores non-septate. On wood, New York. ....(L. hypopta; possibly related to L. symmictella)

**I-G-4. CORTICOLOUS/lignicolous.**

**Thallus ± pale; non-sorediate, C-.**

**Spores 3-5 µm wide.**

**Hypothecium dark.**

**Apothecia at least partly pale.**

**1. Thallus squamulose. ....** (*Phyllopsora* spp., e.g., *P. parvifolia*)

**1. Thallus crustose. ....** 2

**2. Spores partly 1-septate. ....** (see *Biatora ocelliformis*, *L. diapensiae*, *L. botryosa* and *L. sphaerella*; also, *L. sanguineoatra*, normally on moss or soil, may also key out here)

**2. Spores simple. ....** 3

**3. Apothecia pale to dark reddish brown, dark brown or brown-black, sometimes pruinose, the margin persistent or disappearing. ....** 4

**3. Apothecia pale olive to olive-brown or black, epruinose, the margin usually thin, often disappearing.** Apothecia to 0.6 mm, convex. Thallus absent or thin, white to greenish-gray or olivaceous, smooth to subverruculose, K-, P-, C-, KC-. Hypothecium hyaline (or ± brown above?). Exciple hyaline within, outer edge ± pale brown. Epihymenium yellowish- or reddish brown, K± olivaceous-brown. Spores non-septate, ellipsoid, 8-11 x 4-5 µm. Paraphyses simple or sparsely branched; apical cells brown and swollen to 3-4 µm wide. Hymenium 25-40 µm. Ascus walls ± evenly thickened throughout; outer layer and the shallow apical dome K/I+ uniformly blue, ± *Catillaria*-type. Pycnospores 14-18 x 405 µm, arcuate. On wood, New York. .... (*L. hypopta*; possibly related to *L. symmictella*)

**4. Spores ellipsoid, 10-16 x 5-8 µm. Apothecial margin disappearing.** Apothecia 0.5-1 mm diam.; disc flat to convex, dark reddish or nearly black; margin disappearing; hypothecium yellowish and darkening; Thallus ashy gray, thin, smooth to scurfy, obscurely chinky. On trees, Louisiana and Florida. .... (*Phyllopsora furfuracea*)

**4. Spores at least partly with ± pointed ends, to 5(-6) µm wide. Apothecial margin ± persistent.** Discs sometimes pruinose. .... 5

**5. Apothecia 0.4-0.8(-1) mm.** Apothecia pale to dark reddish brown, dark brown or brown-black (usually all colors on same thallus, if large enough), sometimes pruinose, the margin at first thin, ± shiny, black, usually persistent, or sometimes ± excluded. Apothecia common, often abundant, adnate, moderately constricted, round to slightly irregular, to 0.8(-0.1) mm, plane to moderately convex. Thallus green-white/gray or yellowish gray, K-, C-, KC-, P-, thin and membranous to verruculose or granulose, continuous to scattered or grouped, or absent; granules small, corticate; hypothallus absent. Hypothecium yellow-brown to medium-brown; exciple hyaline on outer edge; hymenium ca. 75 µm, I+ blue; epihymenium ± brown or light brown; paraphyses strongly coherent; spores ellipsoid to citriform or ± fusiform, (8-)11-13 x (3-)5-6 µm, simple, with pointed or rounded ends. On bark and wood. British Columbia. .... *L. albofuscescens* (belongs near *Lecidella*)

**5. Apothecia to 0.4 mm,** dusky to blackish brown, sometimes slightly pruinose, the margin thin, darker, becoming flexuous, finally disappearing; hypothecium blackish brown; spores various in shape and size, finally pointed-ellipsoid, 6-12 x 3-6 µm. Hymenium I+ blue; paraphyses conglutinate. On trees and old wood, New England to Florida, west to Illinois and Iowa. .... *L. peliaspis* (position unclear)

ADD (somewhere):

L. coccinea Swhein. in Halsey, Ann. Lyceum Nat. Hist. New York 1: 6 (1824)  
New York, on tree trunks (type not found)

L. lividella (Arnold) Zahlbr. (Biatora lividella Arnold, Oesterr. Bot. Z. 46: 288 (1896))  
Newfoundland, on smooth bark (type not found)

L. peliaspistes Tuck., Proc. Amer. Acad. Arts 12: 1789 (1877) = probably L. peliaspis  
New Hampshire

L. populina Mull. Arg. ex Nyl., Acta Soc. Sci. Fenn. 26: 33 (1900)  
Colorado (type not found)

L. versicolor Schwein. in Halsey, Ann. Lyceum Nat. Hist. New York 1: 6 (1824)  
New York, on smooth bark. (type not found)

Biatora subduplex (see Biatora key)

L. ramulicola H. Magn., Bot. Not. 1953: 187 (1953), nom. illeg. non H. Magn. (1952) (= Lecanora cadubriae)  
California, on dead twigs of Baccharia pilularis

L. pullula (Tuck.) Zahlbr. = Lecanora sp.

#### Biatora ocelliformis

Thallus to 3.5 cm across, rimose to rimose-areolate, partly endophylodal or very thin and weakly wrinkled; areoles 0.15-0.4 mm diam., very irregular in outline, plane, surface matt, pale gray to dirty greenish gray, in herbarium beige to ochre; hypothallus dark gray, mostly absent, sometimes visible as a narrow line at thallus periphery; thallus in section 25-70(-110)  $\mu$ m thick; cortex 5-30(-45)  $\mu$ m thick, sometimes entirely absent; algal layer  $\pm$  filling the thallus, with argopsin granules.

Apothecia single, rarely 2-5 grouped, 70-200(-350) per  $\text{cm}^2$ , when young plane and appressed or sessile with scarcely narrowed base, 0.25-0.45(-0.85) mm, to 1.15 mm when tuberculate; disc dark gray to black, at least when wet with turquoise tone, rarely olive, matt to somewhat shiny, epruinose, flat to moderately or rarely strongly convex or tuberculate; margin white-gray to gray, in old specimens beige to orange-brown, sometimes olive, not or rarely very weakly raised, mostly only forming a paler zone, in flat apothecia  $\pm$  persistent, in convex apothecia crowded back or excluded; excipulum hyaline, inside or near the hymenium often turquoise to olive, laterally 30-85  $\mu$ m, basally 20-70(-120)  $\mu$ m thick; hyphae with narrowly cylindrical, rarely broadly ellipsoid lumina 1-2(-2.5)  $\mu$ m wide, apical ones (1-)1.5-2.5(-3)  $\mu$ m wide; apical cells somewhat free, with 4-10  $\mu$ m wide gelatinous sheath; hypothecium hyaline, rarely flecked with turquoise or near hymenium turquoise or dirty olive, 10-60(-250)  $\mu$ m high; subhymenium pale to intense turquoise or olive, sometimes spotty, 25-60(-90)  $\mu$ m high; epihymenium not distinguishable from hymenium, very rarely apical parts of hymenium somewhat darker; hymenium pale to bright turquoise or olive, apically usually paler than basally,

sometimes spotty, 30-40(-55)  $\mu\text{m}$  high; paraphyses with lumina (0.5-)1-1.5  $\mu\text{m}$  wide, apically 1-2  $\mu\text{m}$  wide; asci 26-38 x 7.5-11.5  $\mu\text{m}$ ; spores narrowly ellipsoid, simple, rarely 1-septate, (7.5-)9.7-14.2(-20) x (2.5-)2.8-4.2(-4.5)  $\mu\text{m}$ .

Pycnidia very rare, or inconspicuous, immersed, unpigmented,  $\pm$  pyriform, c. 50  $\mu\text{m}$  diam.; pycnospores 9.5-13 x 0.7-1  $\mu\text{m}$ .

Thallus C-, K-, P+ red; outer part of excipulum rarely also spottily P+ red; hymenium and subhymenium N+ violet. With argopsin.

On bark.