

**Lecidella** Körber  
(LECANORALES)

After Knoph & Leuckert, Poelt & Vezda, and others

Rev. 4/96

Thallus immersed or superficial, ecorticate, whitish, grayish or yellowish, continuous to verrucose-areolate, smooth, warty or sorediate, not areolate-squamulose.

Apothecia usually black (or red-brown in shade), lecideine or biatorine, usually constricted at base, sessile; thalline exciple absent; true exciple usually thick, of radiating hyphae, dark green, blue-black or brown, at times crystalline, not black and friable; hypothecium hyaline to yellowish, orange-brown or red-brown; hymenium colorless to pigmented, I+ blue; epihymenium usually blue-green, at least when young, later sometimes green-black-brown; paraphyses Lecidella-type, mostly simple and easily freed (in water, and especially in K), 1.5-2  $\mu$ m wide, the ends usually slightly clavate thickened, rarely capitate; asci 8-spored, clavate, Lecanora-type, the tholus strongly amyloid, the wall thick, I+ orange-red in concentrated iodine; spores simple or rarely 1-septate, broadly ellipsoid, 11-19 x 6-10  $\mu$ m, rather uniformly thick-walled, lacking a distinct perispore.

Pycnidia immersed; pycnospores filiform, 11-27  $\mu$ m. Thallus I-, sometimes C+ orange (xanthones); prothallus absent or black to blue-black. Photobiont chlorococcoid. Atranorin, chloratranorin, zeorin, diploicin and a range of xanthones frequent (not all in the same species); psoromic acid in one species. On various substrates, often nitrophilous. Widely distributed.

Many of the descriptions of saxicolous species need to be expanded and modified, especially using Hertel (1977, 1984, etc.), Rambold (1989), etc., and there are some other bugs to be worked out. Personally I don't care for choices involving different kinds of xanthones, which are very difficult to identify by TLC.

TLC Characteristics of Some Major Substances  
(See Knoph, 1990 for more info.)

		A	B	C	UV before charring	color after charring
Aeotarone		[see Knoph, 1990]				
Arthothelin	4	4	4-5	+ r-bry-ish		
Asenone		[see Knoph, 1990]				
Atranorin		7	7	7	+	y
Capistratone		6	(5)6	6	+ y-br	-/y-ish
Chodatin		6	6	6	+ r-ish	-
Demethylchodatin		5	5	5	+ r-ish	-
Diploicin		6	6	6	+ y-wh	-
Granulosin		[See Knoph, 1990]				
Isoarthothelin		5	5-6	5	+ r-bry-ish	
Lichexanthone		7	7	7	+ y-o o	
Thiophanic acid	5	6	5	+ br		
Thuringione	5	6	5(6)	+ o-br		p. y-sh
Zeorin		5	5	5	-	purplish
2,5,7-trichloro-3-O-methylnorlichexanthone	6	6	6	+ y-br		-(p. y)

**GROUP I-A. On rock.**  
**Thallus sorediate**  
**C+ orange or red (xanthones)**  
Hypothecium yellow-brown to red-brown.

After Knoph & Leuckert, 1994

**1. Thallus usually rimose to rimose-areolate. Atranorin almost always present.** Thallus C+ orange, K+ yellow; arthothelin, with or without thuringione. Always sorediate. Inland areas of the West; coastal areas of the East (the report from the coast of Washington State needs to be confirmed). Soralia distinct. Thallus pale to dark gray-green; thin, with soralia scattered or  $\pm$  confluent, yellowish white to gray-green, efflorescent, round, with granular soredia (often paler when rubbed). Apothecia rather infrequent, to 1.6 mm diam., sessile, concave, to somewhat irregular or convex, often convoluted, occasionally subgyrose; true exciple well developed, shiny, becoming excluded, dark brown at edge, paler within, K+ brighter red-brown, crystalline; epihymenium brown-black to blue-black (bright green to black-green according to Knoph & Leuckert, 1994); hypothecium dull yellow- to red-brown; hymenium 50-80  $\mu$ m. Spores 10-15(-18) x 6-8(-10)  $\mu$ m. On siliceous or slightly basic rocks, occasionally on dry and often dust-impregnated wood, or bark or wood. .... L. scabra (Taylor) Hertel & Leuckert [syn. L. prasinula]

**1. Thallus usually areolate. Atranorin mostly lacking.** Apothecia frequent. Soredia only occasionally present. L. subincongrua s. lato. .... see L. meiococca, L. asema s. lato, and L. effugiens

**GROUP I-B. On rock.**  
**Thallus not sorediate.**  
**Hypothecium yellow-brown to red-brown, K+ brown-orange.**  
Hymenium not interspersed.  
Not or rarely facultatively lichenicolous

After Knoph & Leuckert, 1994

**1. Hypothecium center yellow-brown, laterally usually reddish brown; excipulum reddish brown, never hyaline. Diploicin present, atranorin present (very rarely absent), thuringione present or absent. Apothecia to 1.0 (rarely 1.8) mm diam.; epihymenium black-green to blue-green; hymenium 60-70-85  $\mu$ m thick; spores 8-16 x 5-9  $\mu$ m. Thallus whitish, C-, KC- (rarely + orange-red), P-. On usually exposed, siliceous or weakly basic, nutrient-enriched rocks and walls, also slate, mainly in boreal or mountainous regions, usually not directly on the coast. Alaska to Mexico, east to Quebec in the north. Very common, at least in the West. Also see Carbonea latypizodes, which has asci lacking an amyloid xzone above the masse axiale and a rather thin outer amyloid ascus wall, and which usually has a thinner excipulum and hypothecium. ....**  
L. carpathica Körber

**1. Excipulum and/or hypothecium yellowish to reddish brown; excipulum sometimes hyaline. Diploicin absent, atranorin present or absent; xanthonenes present. Thallus often yellowish, (usually?) C+, KC+ orange or orange-red. Usually growing on the coast (except sometimes L. effugiens). .... 2**

**2. Thallus rimose-areolate, K-, I+ slightly blue, C+ orange. Labrador. .... (see Lecidea labradorica)**

**2. Thallus  $\pm$  granular to verrucose, rounded-squamulose or squamulose-areolate.** Thallus coarsely granular-papillate, rather thick, often strongly verrucose, coarsely cracked-areolate, pale ochre to yellow-green or rarely pale gray in shade. Apothecia 0.5-1.5 mm diam., black, at first flat, later becoming convex, often shiny, at least when young; true exciple becoming excluded, gray-green to gray-blue at edge, pale brown to red-brown within, inner part crystalline; epihymenium blue-green; hymenium  $\pm$  crystalline, the crystals dissolving in K; hypothecium yellowish to deep red-brown, K+ intensifying. Spores (9-)10-13(-20) x 6-9(-11)  $\mu$ m. Thallus K+ yellow, C+ orange (xanthonenes,  $\pm$  atranorin). L. subincongrua s. lato [may not apply to L. meiococca]. .... 3

**3. Growing along the west coast. Thallus C+ orange. .... 4**

**3. Growing well inland, in continental climates, or if coastal then in the Arctic or eastern North America. Thallus C+ orange or C- (according to Poelt & Vezda). 2,5,7-Trichloro-3-O-**

methylnorlichexanthone present as a major compound. Excipulum mostly darker colored than hypothecium, usually thinner than 55 µm lateral of the hymenium; apothecia to 0.4-1.0 mm (0.6 mm average) diam. Thallus usually thinner than 0.5 mm. Atranorin usually deficient, thiophanic acid usually deficient or minor. Without blastidia. Epihymenium green to black-green; hymenium 55-70 µm thick. Spores 10-16 x 6-9 µm. Alaska to Arizona; southeast coast of Canada. .... L. effugiens [syn. L. albidocinerella, L. incongruella]

**4. 2,5,7-Trichloro-3-O-methylnorlichexanthone present as a major compound.** Excipulum usually more weakly colored than hypothecium, usually thinner than 55 µm lateral of the hymenium; apothecia 0.9-1.6 mm (1.2 mm average). Thallus usually thicker than 0.5 mm diam. Atranorin present; thiophanic acid usually present as major compound. Often with blastidia. Epihymenium olive-brown or green-brown to black-green; hymenium (55-)60-80 µm; spores 10-17 x 6-10(-11) µm. Northern coast of California. [Need to check British checklist to see what the British report was based on. Possibly this is the unknown taxon referred to by Poelt & Vezda under L. subincongrua] ..... L. meiococca

**4. 2,5,7-Trichloro-3-O-methylnorlichexanthone deficient or present only as a minor compound.** Knoph, et al., 1995 report 7 chemotypes. Apothecia to 0.5-0.8(-1.5 mm) diam. Epihymenium green-black to bluish green; hymenium (55-)65-75(-90) µm thick; spores (9-)11-16 x (5.5-)6-8(-8.5) µm. Thallus whitish-gray or yellow-greenish, usually thick, but sometimes thin. Thallus K+ yellow. Baja California Norte to southern British Columbia. . .... L. asema (including L. elaeochromoides)

**GROUP I-C. On rock.**  
**Thallus not sorediate.**  
**Hypothecium hyaline (rarely weakly pinkish brown,**  
**then inner part of excipulum hyaline), K-.**  
Thallus epilithic.

After Knoph & Leuckert, 1994

**1. Hymenium inspersed with "oil droplets" or granules.** Hypothecium and inner part of excipulum hyaline. Apothecia usually epruinose; disc usually plane. 2'O-methylperlatolic acid deficient; lichexanthone present or absent. Apothecia to 1.5(-3.0) mm diam.; epihymenium bright green to blue-green (rarely olive-brown); hymenium 65-80-110 µm thick; spores 10-17 x 6-10 µm. Medulla I-. Thallus C-, KC-. Usually with zeorin; with or without atranorin. Orophytic [\_\_\_\_\_], usually on nutrient-enriched, lime-containing substrates, on rocks near rodent latrines or bird rests or rocks containing calcium, and on on bone, foothills to alpine. Alaska to Baja California Norte, east to the Great Lakes region and Quebec in the north, east to New Mexico in the south. .... L. patavina (Massal.) Knoph & Leuckert [syn. L. inamoena, L. alaiensis, L. spitbergensis, Lecidea subauriculata]

**1. Hymenium not inspersed (but hypothecium commonly permeated with larger granules, which may persist in sections of the hymenium).** ..... 2

**2. Thallus lichenicolous on Dimelaena, small.** Apothecia to 1.7 mm diam.; epihymenium blue-green to black-green; hymenium 60-65 µm thick; spores 10-13 x 5.5-7.5 µm. Thallus C+, KC+ orange-red, or C-, KC-, K+ yellow or K-, containing thiophanic acid, chodatol and atranorin (all "±"). Thallus in small (to 12 mm diam) groups of areoles. Very similar to L. chodatii but thallus very thick. Rocky Mountains, Colorado. [See Hertel, 1977 and Thomson 1997 for more complete description]. .... L. dimelaenophila Hertel

**2. Thallus not or rarely lichenicolous on various host species, usually larger.** Inner part of excipulum hyaline or only weakly grayish brown. Spores c. 2 times longer than wide. Arthothelin and thiophanic acid, if present, not together with zeorin or vice-versa. .... 3

**3. Thallus bullate to bullate-areolate. Apothecia usually grayish pruinose. Thallus usually P+ yellow, with psoromic acid.** Thallus not effigurate. Apothecia to 1.5 (rarely to 2) mm diam.; epihymenium black-green to bluish green; hymenium 45-65 µm thick; spores 6.5-15 x 4-7.5 µm. Thallus C-, KC-, without xanthenes, K+ yellow or K-, usually with atranorin. Thallus whitish grey to dirty dark grey or blackish, brownish or rarely reddish; when grey green then mostly extensive. On siliceous, usually sheltered, rock, alpine. Colorado. .... L. bullata Körber

**3. Thallus rimose, rimose-areolate to areolate. Apothecia usually epruinose. Thallus P-, without psoromic acid.** Disc pruina (if present) not P+ orange-red. .... 4

**4. Zeorin present.** With or without atranorin; with or without lichexanthone; without other xanthones. Excipulum C-. .... 5

**4. Zeorin absent.** Caloplocin deficient; atranorin present or not. .... 6

**5. Hyphae in the inner part of excipulum to ca. 8 µm diam.; hymenium to 110 µm, inspersed in places or throughout; excipulum and/or hypothecium usually densely inspersed with crystals. Thallus endolithic or up to 2 mm thick. Apothecia to 3 mm diam.; epihymenium bright green to blue-green (rarely olive brown); spores 10-17 x 6-10 µm.** ..... (*L. patavina*)

**5. Hyphae in the inner part of excipulum to c. 6 µm diam.; hymenium to 85 µm, not inspersed; excipulum and/or hypothecium not or only weakly inspersed with crystals. Thallus endolithic or up to ca. 0.5 mm thick. Apothecia to 1.2 (rarely to 2) mm diam.; epihymenium usually olive-green to reddish brown (rarely black-green); spores 11-17 x 6-9 µm.** On calcareous or non-calcareous rocks, sea level to alpine. Alaska to California, east to the Great Lakes region and Newfoundland in the north, east to Colorado in the south. .... *L. stigmatea* (Ach.) Hertel & Leuckert [syn. *Lecidea lacus-crateris*]

**6. Thiophanic acid and capistratone present; chodatol and/or demethylchodatol usually present. Apothecia to 0.5 (rarely to 0.8) mm diam.; epihymenium green to gray-green; hymenium 55-70 µm; spores 10-13 x 6-7 µm.** Thallus K- or + weakly yellow, with traces of atranorin, C+, KC+ orange-red or C-, KC-. Thallus rather thin, relatively large; areoles relatively large, ± coherent. Discs black. Thallus yellowish grey to mostly distinctly greenish-yellow, very finely granular, forming small patches among other lichens. Wyoming to Mexico, southwest to central California. .... *L. chodatii* (G. Samp.) Knoph & Leuckert (syn. *Lecidea goniophiloides*)

**6. Capistratone, chodatol and demethylchodatol absent; thiophanic acid present or not.** .... 7

**7. Thallus K+ yellow, with atranorin.** .... 8

**7. Thallus K-, without atranorin.** .... 10

**8. Apothecia usually partly immersed in the thallus, to 0.5(-0.7) mm diam.; hymenium 45-70 µm; excipulum to 70 µm thick; spores 8-13 x 5-8 µm. Zeorin absent.** Epihymenium usually pale. Thallus ..... 9

**8. Apothecia usually not immersed, to 3.0 mm diam.;**

**hymenium 60-110 um; excipulum to 150 um thick; spores 10-17 x 6-9 um. Zeorin usually present.** Epihymenium dark or bright. Thallus C-, KC-, without xanthones (except sometimes lichexanthone). ..... (see L. patavina and L. stigmatea)

**9. Diploicin absent, thuringione present or absent, arthothelin present as a major compound. Epihymenium pale olive brown to brown (rarely black-green); hymenium 45-60 um.** Thallus continuous and finely rimose to areolate. Thallus K+ yellow, C+, KC+ orange-red, with atranorin. On exposed siliceous rock. Mexico, north to Arizona, northeast to Kansas and Pennsylvania. .... L. enteroleucella (Nyl.) Hertel

**9. Diploicin usually present, thuringione present, arthothelin absent or rarely present as a minor compound. Epihymenium pale grayish blue-green; hymenium (45-)50-65(-70) um.** Thallus usually K+ yellow, with atranorin, C-, KC- (rarely + orange-red). California to Texas, south to Costa Rica. .... L. latypiza (Nyl.) M. Choisy (syn. Lecidea xzahlbruckneri)

**10. Apothecia rarely more than 0.4 mm diam.; discs sometimes greenish gray. Arthothelin and thiophanic acid present, zeorin absent. Epihymenium pale gray-green, olive-brown to brown; hymenium 55-65 um; spores 9-13 x 5-6.5 um.** Areoles small, dispersed, granular; thalli usually small. Thallus C+, KC+ orange-red. Thallus scurfy or finely granular, pale yellow-green or grey-yellow, thin, usually forming small patches between other lichens, often wide-spreading in cracks and fissures. Apothecia 0.2-0.3(-0.5) mm wide, scattered to crowded,  $\pm$  flat; true exciple persistent, often gray-green pruinose, dark (brown to gray-green) only at the edge (if at all), paler within. Hypothecium colorless to pale straw. Hymenium 50-60 um, not interspersed (but hypothecium occasionally with large granules, and epihymenium granular). Epithecium dark brown, brown-green or green-gray; crystals dissolving in K. Paraphyses tips clavate, brown. Spores 9.5-12 x 5-7 um. On hard, non-calcareous rocks in warmer regions, Arizona to Texas. .... L. viridans (Flotow) Körber

**10. Apothecia to 3.0 mm diam.; disc usually black. Arthothelin and thiophanic acid deficient; zeorin usually present.** ..... (L. patavina and L. stigmatea)



## Alternative Key I-C, De-emphasixzing TLC

**1. Hymenium inspersed.** ..... L. patavina

**1. Hymenium not inspersed.** ..... 2

**2. On Dimelaena.** ..... L. dimelaenophila

**2. Not lichenicolous.** ..... 3

**3. Thallus bullate to bullate-areolate. Apothecia usually grayish pruinose. Thallus usually P+ yellow, with psoromic acid.** .....

L. bullata Körber

**3. Thallus rimose, rimose-areolate to areolate. Apothecia usually epruinose. Thallus P-, without psoromic acid. Disc pruina (if present) not P+ orange-red.** ..... 4

**4. Apothecia mostly to 0.5 mm diam. Epihymenium pale (except perhaps sometimes in L. viridans). Thallus C+, KC+ orange-red, with xanthones. Mostly in warm areas of the Southwest (except sometimes L. enteroleucella).** ..... 5

**4. Apothecia mostly over 0.5 mm diam. Epihymenium dark or bright. Thallus C-, KC-, without xanthones (except sometimes lichexanthone). Widely distributed, north to the Arctic.** ..... 7

**5. Thallus K-, without atranorin. Epihymenium pale gray-green, olive-brown to brown. Spores 9-13 x 5-6.5 um.** ..... L. viridans

**5. Thallus K+ yellow, with atranorin. Apothecia usually partly immersed in the thallus. Epihymenium pale. Spores 8-13 x 5-8 um.** ..... 6

**6. Epihymenium pale olive-brown to brown (rarely black-green).** ..... L. enteroleucella

**6. Epihymenium pale grayish blue-green.** ..... L. latypiza

**7. Hyphae in the inner part of excipulum to ca. 8 um diam.; hymenium to 110 um, inspersed in places or throughout; excipulum and/or hypothecium usually densely inspersed with crystals. Thallus endolithic or up to 2 mm thick. Apothecia to 3 mm diam.; epihymenium bright green to blue-green (rarely olive brown); spores 10-17 x 6-10 um.** ..... (L. patavina)

**7. Hyphae in the inner part of excipulum to c. 6 um diam.; hymenium to 85 um, not inspersed; excipulum and/or hypothecium not or only weakly inspersed with crystals. Thallus endolithic or up to ca. 0.5 mm thick. Apothecia to 1.2 (rarely to 2) mm diam.; epihymenium usually olive-green to reddish brown (rarely black-green); spores 11-17 x 6-9 um.** ..... L. stigmatea

7.

## GROUP II. On soil or moss.

**1. Apothecia from the beginning convex to almost globose, immarginate. Paraphyses coherent.** ..... (see Lecidea caesioides and others)

**1. Apothecia mostly marginate at the beginning. Paraphyses free.** ..... 2

**2. Thallus C+ orange.** Spores ellipsoid, 7-16 x 7-8  $\mu$ m, ellipsoid. Thallus whitish, smooth. Apothecia soon high-convex and immarginate. Epithecium dark brown-black or blue-green, crystalline. Hypothecium pale red-brown above, darker below. True exciple dirty drab black at edge, reddish within. On mosses overgrowing  $\pm$  calcareous substrates. [see Anderson's description, below] ..... L. wulfenii (Hepp) Körber (syn. Lecidea heppii)

**2. Thallus C- (possibly Anderson's C was bad, since he also stated that "Lecidea heppii" [= Lecidella wulfenii] was C-).**

Spores ovoid to ellipsoid, 9-18 x 4-7  $\mu$ m. Thallus verrucose, whitish green or whitish gray, K+ yellow, P+ yellow. Apothecia olive-brown to olive-blackish, glaucescent when wet, to ca. 1 mm diam., roundish to weakly sublobate, sessile; disc convex; margin absent except at first. Excipulum pale or nearly colorless externally, pale golden-brown inside, K-, C-, P-. Hypothecium golden or golden-brown below, pale or colorless above. Hymenium colorless, mostly 60-80  $\mu$ m, K-, C-, P-. On moss mats in the alpine, Colorado. "Possibly just a variant of Lecidea heppii". ..... "Lecidea sp. 27" of Anderson

Thallus small, diffusely limited, verruculose to verrucose, in places or at times membranous-verrucose, whitish to greenish-gray or sordid grayish; verrucae to 0.5-0.6 mm diam., or long, mostly less than 0.25 mm diam., dispersed to contiguous or somewhat confluent, sometimes glomerate or  $\pm$  heaped, roundish to usually irregular in outline, usually irregularly convex, surface smooth, matt to weakly subnitid, C-, K+ yellow, P+ weak yellow (atranorin) or sometimes apparently K-, P-. Hypothallus not evident. Apothecia black, sometimes glaucescent, to 0.5-1 mm diam., irregularly dispersed to several contiguous, roundish to rarely sublobate, sessile, weakly to strongly constricted; disc plane to slightly convex at first, remaining plane for some times or soon convex to strongly convex or convex-undulate, smooth, matt to subnitid, epruinose; margin distinct or indistinct at first, moderately elevated or not,  $\pm$  persistent or sometimes excluded. Excipulum pale externally, golden or yellow brown internally, K-, C-, P-. Hypothecium yellowish to golden brown below, usually colorless above. Hymenium 60-100  $\mu$ m; epithecium pale to dark blue-green. Spores ovoid to ellipsoid, 9-18 x 4.5-9  $\mu$ m. On moss mats, plant detritus, other epimusci lichens, or most commonly on Selaginella mats, lower montane to alpine. Colorado; widely distributed in the arctic; probably also in higher mountains of western U.S.

and New England. .... "Lecidea heppii" sensu Anderson

### GROUP III. On bark or wood.

**1. Thallus sorediate to uniformly sorediate-scurfy; C+ orange.** (also see L. scabra and L. prasinula, which are usually on rock). ..... 2

**1. Thallus not sorediate or scurfy; C+ orange (L. elaeochroma) or C-.** Hymenium not inspersed. Spores 10-16 x 6-9 um. .... 4

**2. Thallus becoming almost entirely sorediate-scurfy.**

Hypothecium gold-brown. Hymenium 80-110 um. Thallus thin to thick, fine, powdery, dissolved into small blastidia to 0.1 mm diam., coarsely areolate, forming a continuous, wide-spreading crust. Spores 8-12 x 4-5(9) um. Chem.: 2,7-Dichlor-6-Q-methylnorlichexanthone major; other xanthonenes in smaller amounts. On wood, especially worked timber and fence rails. Resembling L. elaeochroma except for the thallus morphology. The identity of this species is unclear; it shows affinities with Pyrrhospora quernea. ..... L. pulveracea (Schaerer) H. Sydow

**2. Thallus with distinct, ± rounded yellowish soralia.** ..... 3

**3. Thallus distinctly yellowish, with ± scattered, rarely confluent, often somewhat irregular soralia.** Apothecia often present, scattered. Hymenium above often pale violet. Spores 10-14 x 6-8 um. Chem.: arthothelin major; granulysin often also major; various other xanthonenes in smaller amounts. .... L. flavisorediate (Vezda) Hertel

**3. Thallus grey, with large, round soralia.** Apothecia scattered, mostly flat, black. Soralia 0.5-1 mm diam., bright yellow-green, punctiform to efflorescent, ± discrete, ± scattered over, or, at times, restricted to only part of thallus. Soralia contain lichexanthone. In similar habitats to, and usually with, f. elaeochroma. .... L. elaeochroma v. soralifera (Erichsen) D. Hawksw.

**4. Thallus C-, K+ yellow or K-, P+ yellow (atranorin or unknown) or rarely K-, P-.** Thallus thin, ± continuous to rimose-areolate or verrucose to verrucose-areolate, whitish gray to greenish gray or greenish to somewhat pale yellow green, sometimes almost absent, usually under 3-4 cm across, to 0.2-0.3(-1) mm thick; areoles to (0.3-)0.8-0.9 mm diam., dispersed to contiguous or sometimes confluent, roundish to usually irregular to rarely angular in outline, subplane or weakly convex to convex; surface smooth, matt, epruinose, Black hypothecium evident or not. Apothecia black, sometimes weakly pruinose or commonly glaucous (especially evident when wet), to 1 mm diam., dispersed to dense, roundish to roundish-angular, sessile, broadly adnate to slightly constricted at base; disc plane, soon slightly to strongly convex, smooth, usually matt; margin moderately thick to thin, not much elevated, ± persistent

or commonly excluded. Hypothecium usually golden brown, often  $\pm$  colorless above in a thin layer; hymenium 65-100  $\mu$ m; epithecium blue-green; spores ovoid to ellipsoid, 8-16 x 4-9  $\mu$ m. On bark and wood of conifers and hardwoods, lower montane to subalpine. Widely distributed in western N. America, from Arizona and New Mexico north to S. Dakota, the Canadian Rockies and Alaska; also known from the Great Lakes region and New York. . . . . L. euphorea (Flörke) Hertel

**4. Thallus C+ orange, K+ yellowish, KC+ yellow (reactions often faint), containing arthothelin, granulysin and  $\pm$  4,5-dichloronorlichexanthone.** Apothecia few to many, 0.5-1 mm (or occasionally more) wide, sessile, closely adpressed, rounded to irregular, at first flat and marginate, later often convex and immarginate, black (in shade blue-grey or brown-red or  $\pm$  piebald with a darker true exciple), matt or shining. True exciple black, persistent, entire and flexuous to irregularly crenate, finally  $\pm$  excluded; epithecium and edge of exciple bluish green to dull gray-blue, crystalline, crystals dissolving in K; hymenium 40-70  $\mu$ m tall, at times with inclusions towards lower part of thecium and hypothecium; hypothecium  $\pm$  brownish orange or red-brown, rarely colorless, K $\pm$  bright red-brown. Asci ca. 50 x 15-18  $\mu$ m; tholus 7-8  $\mu$ m thick. Spores (10-)12-15(-17) x (5-)6-7(-9)  $\mu$ m. Thallus rather smooth, even and continuous or wrinkled,  $\pm$  granular-verrucose or plicate, often  $\pm$  subareolate, yellow-gray to yellow-green in sunny, exposed sites, becoming gray-green in shade, at times forming extensive mosaics, 1-5 cm diam., intersected by black or bluish black prothallus; sometimes reduced to scattered areoles (especially on wood). Two main chemotypes: "a", with aotearon, isoarthothelin, and 2,5,7-trichlor-3-O-methylnorlichexanthone major, sometimes with other xanthenes, and occasionally atranorin, and "b", with arthothelin major, sometimes with thuringione, atranorin, or both. (Material of chemotype "a" is known from Arizona). On well-lit, smooth bark, especially twigs and small branches, and wood. . . . . L. elaeochroma (Ach.) M. Choisy f. elaeochroma

## ADDITIONAL SPECIES ON ROCK:

Various Lecidella spp. .... [ Lecidea enteroleuca auct.]

Excipulum dark brown inside, greenish black at the margin, 50-70  $\mu$ m thick. Thallus  $\pm$  endolithic, or thin,  $\pm$  scurfy, indistinctly areolate to  $\pm$  granular, continuous, wide-spreading or a thin, film-like covering, pale to dark gray or greenish. Apothecia sessile, 0.4-0.7 mm, flat to slightly convex, with thick, often wavy or crenate, persistent margin. True exciple mostly opaque, paler towards hypothecium. Epihymenium green-black to brownish, non crystalline. Hypothecium colorless or pale brown, red-brown when old, often K+ faintly reddish. Paraphyses free to slightly coherent. Spores 9-15 x 7-8  $\mu$ m. On shaded, often vertical,  $\pm$  damp, siliceous rocks, often in wooded situations or sheltered gullies. Listed by Esslinger, but not mentioned by Hertel & Leuckert (1994). .... L. anomaloides (Massal.) Hertel & Kilius

Thallus verruculose-areolate, yellowish glaucous to greenish gray. Apothecia to 0.4 mm, black, finally convex and immarginate. Spores rarely developed, in KOH 10-12 x 6-7  $\mu$ m. Hypothecium hyaline or pale. Paraphyses subdiscrete. Epihymenium sordid bluish green. Asci clavate; apices alone I+ dark sordid blue. Smoky Mts. .... L. (Lecidella?) deminutula Magnusson in Degel.

Thallus indeterminate, gray to dirty whitish, areolate or verrucose-areolate, thin, K+ yellow or K-, I-; areoles contiguous to approximate, 0.4-0.6 mm wide, ca. 0.3 mm thick, irregular in size and shape, convex with sloping edges, smooth, strongly adnate, separated by thin cracks or  $\pm$  isolated, slightly shiny; surface very uneven. Apothecia numerous, often between areoles, not or scarcely prominent, 0.4-0.6 mm diam., circular; disc black (unchanged wet), sometimes thinly pruinose, plane or slightly convex; margin concolorous with disc, indistinct, hardly prominent, thin or often excluded. Excipulum sordid blue-green, ca. 50  $\mu$ m thick below the upper margin; epihymenium green-black; hypothecium hyaline, 50  $\mu$ m thick or more; hymenium 60-80  $\mu$ m; paraphyses tips not or only slightly thickened; spores 8-14 x 5-6  $\mu$ m, ellipsoid. On N-facing granitic rocks, New York. .... Lecanora placidensis (syn. Lecidella granulata, L. placidensis, Fuscidea placidensis)

Connecticut; Mexico; etc. .... Carbonea latypiza (Nyl.) Knoph & Rambold [syn. Lecidea subcontinuior, L. evansii, L. amabilis]

ADD (both of these may actually be C+ orange--Anderson's C may not have been working):

Thallus verrucose, uneven, grayish. Soralia pale greenish, to 1 mm diam., composed of a roundish, irregularly convex mass of soredia; verrucae to ca.

0.25 mm diam.. Thallus and soredia C-, K+ yellow, P+ weak yellow. Black hypothallus not evident. Apothecia brown-black, glaucescent, to 1.5 mm diam., roundish to sublobate, sessile; disc soon convex, matt; margin moderately thick at first, persistent, or  $\pm$  excluded in strongly convex apothecia. Excipulum blue-green in outer half or at least externally, sometimes violet-purple above, brownish or golden-brown inside, I-, K+ more intensely blue-green, C-, P-. Hypothecium brownish or golden brown except for a colorless layer above. Hymenium  $\pm$  colorless or faintly sordid blue-green, 80-100  $\mu$ m, K-, C-, P-; epithecium pale blue-green, interspersed or covered with granules; paraphyses branched and anastomosed, 1-2  $\mu$ m thick, not thickened apically, swelling or  $\pm$  free in K. Spores ovoid to ovoid-ellipsoid, 9-15 x 4.5-8  $\mu$ m. On streamside rock wall in subalpine, Colorado. .... "Lecidea sp. 13" of Anderson (Roger told me this is Lecidella scabra, but I that species is supposed to be C+ orange)

Thallus verrucose to verrucose-glomerate, greenish to somewhat yellow-green, I-, C-. Black hypothallus absent. Apothecia black, often slightly whitish pruinose, to 0.8 mm diam., densely dispersed to several-contiguous, roundish to lobate, immersed-sessile; disc  $\pm$  plane or undulate; margin moderately thick, distinct, slightly elevated, persistent. Excipulum pale to moderately blue-green or sordid blue-green throughout, sparsely interspersed with a granular material, C-, the granules dissolving in K, apparently P+ weakly yellowish. Hypothecium colorless. Hymenium colorless below, blue-green to blue-green mixed with yellow-brown (from granules) above, to 70  $\mu$ m. Spores ovoid to ellipsoid, 6-14 x 3-8  $\mu$ m. On massive outcrops in montane zone. Colorado. Superficially similar to L. viridans and L. subincongrua. .... "Lecidea sp. 15" of Anderson

## Detailed Descriptions

### **L. bullata Körber** (Lecidea sp. 11 of Anderson).

Thallus usually thick bullate-areolate, areoles to 1.5(-3) mm wide,  $\pm$  glomerate in appearance, irregular outline, constricted at base to stalked and sometimes almost Toninia-like; whitish or pale greenish; surface verrucose to rugose-plicate, K+ yellow, P+ yellow-orange, C-. White hypothallus present below the areoles. Apothecia to ca. 1.3 mm diam., roundish to sublobate, sessile on the areoles; disc soon convex or convex-subtuberculate, dark, grayish pruinose, at least when young; margin moderately thick, not much elevated, persistent. Excipulum pale to moderately dark blue-green throughout, gradually darker towards surface, interspersed with streaks of a sordid to yellowish granular material, C-, the granular material dissolving in K (producing a faint yellow wash), P+ bright yellow. Hypothecium colorless. Hymenium colorless, 60-70  $\mu$ m, I+ red-brown, K-, C-, P-; epithecium pale blue-green, granular. Spores ovoid to ellipsoid, 7-15 x 3.5-8  $\mu$ m. On vertical, non-calcareous, often metal-rich rocks, also beneath underhangs, and on protected surfaces of talus boulders in the upper montane and lower subalpine. Colorado.

### **L. carpathica Körber**

Thallus usually well developed, verrucose to incipiently or unevenly coarsely granular or warty-squamulose, the verrucae mostly crowded, whitish to bluish or greenish grey or yellowish or occasionally dark gray; areoles rather friable, bullate, scattered, 0.1-0.3 mm thick, 0.5-1.0 mm wide; in scattered patches 1-3 cm diam.; prothallus absent. Apothecia scattered to  $\pm$  crowded, rounded, (0.2-)0.5-1 mm diam.,  $\pm$  immersed (sessile on areoles according to Galloway), black, at first flat, later becoming  $\pm$  convex; disc matt; true exciple thin, entire to wavy, shiny, prominent, persistent or later excluded, in section greenish or blackish blue at edge, brown to red-brown within; epithecium blue-black to partly greenish black, brownish tinged, crystals absent; hypothecium semi-opaque. Hymenium 50-75  $\mu$ m tall, blue in upper part, colorless below. Paraphyses simple, rarely branched or anastomosing, rather conglutinate, apical cell spherical, ca. 5  $\mu$ m. Asci 50-55(-60) x 10-12  $\mu$ m. Spores (10-)12-16 x (5-)6-8.5  $\mu$ m, ellipsoid. Thallus K+ yellow, KC+ yellow, C- (atranorin, diploicin, thuringione and chloratranorin).

### **L. dimelaenophila Hertel**

Thallus composed of numerous small or very small groups of areoles, mostly only a few mm (to 12 mm) across, to 1.3 mm thick, somewhat rosetted-effigurate at margin, dirty whitish to cream-colored to pale brown, smooth to faintly shiny; areoles 1-2.5 mm diam., irregular in outline. Thallus K-, C-, P-, I-. Apothecia numerous, to 0.7 mm diam., to 0.25 mm high, but often much smaller, single to slightly crowded, at most slightly constricted at base; discs black (dry or wet), plane to weakly or strongly convex; margin well differentiated when young, low, soon disappearing. Epiphytenium



intense (blue-)green to green-black. Hymenium 47-47  $\mu\text{m}$ . Hypothecium hyaline, or slightly yellowish when old; excipulum strongly developed, hyaline inside, green to olive-green at edge; hyphae 5-7  $\mu\text{m}$  wide at edge; spores 10-11.7-14 x 5.5-6.4-8  $\mu\text{m}$  (L:W = 1.8-1.9).

**L. effugiens (B. Nils.) Knoph & Hertel** (syn. L. incongruella, Lecidea sp. 12 of Anderson)

Containing isoarthothelin, 2,5,7-3-O-methylnorlichexanthone). Thallus K-, of very scattered verrucae or squamules. Inland. Thallus verrucose, greenish; verrucae convex to stalked, dipersed to glomerate, P-. Hypothallus a thin network of whitish hyphae. Apothecia brown-black, commonly gray-pruinose, to 0.7 mm diam., roundish to sublobate, sessile; disc becoming convex; margin thin, distinct, slightly elevated at first, persistent or  $\pm$  excluded. Excipulum brownish to brown-violet or violet-blackish throughout except where it is blue-green, K+ gray-black or blackish along the flank (blue-green above), C-, P-. Hypothecium brownish or somewhat yellow brown below, pale above in a thin layer. Hymenium colorless to somewhat yellow-streaked, 70-80  $\mu\text{m}$  thick; epithecium pale blue-green, covered with granules (in pruinose apothecia). Spores ovoid to ovoid-ellipsoid, 7-15 x 4-9  $\mu\text{m}$ . Thallus C+ orange (C- according to Anderson). On low-lying protected boulders and large cobble in talus in the alpine. Colorado.

**L. enteroleucella (Nyl.) Hertel**

Thallus very small to extensive (to 6 cm across), thin (to 0.2 mm), dirty (yellowish) whitish, pale gray, to pale yellowish-brownish or beige, smooth, matt, finely rimose to almost areolate, with at most indistinct hypothallus; areoles irregularly shaped, occasionally with undulating margin, plane, with smooth to rough surface, 0.2-0.3(-0.7) mm diam. Thallus K- or K+ yellow, P- or P+ yellow, C- or C+ orange, I-. Excipulum C- or C+ orange. Apothecia numerous, 0.1-0.3-0.8 mm diam., to 0.15 mm high, mostly solitary, slightly immersed to sessile and at most weakly constricted at base; discs dark brown to black (paler when moist), epruinose, plane to subconvex or sometimes soon rather strongly convex; margin low, often soon disappearing, black, matt. Epihymenium dirty olive-green, green or pale brown; hymenium 45-65  $\mu\text{m}$ ; hypothecium hyaline to pale yellowish-ochre; excipulum to 35  $\mu\text{m}$  wide, colorless to yellowish or yellowish gray (crystalline substance dissolving in K) inside, greenish black to olive brown at edge; hyphae 4-5  $\mu\text{m}$  thick. Spores 9-14 x 4-6.5  $\mu\text{m}$ .

**L. flavisorediata**

Thallus continuous, moderately thick, verrucose and in part chinky diffract, formed of round soralia which become confluent to make a completely sorediate thallus, yellow, C+ red, K-; algae Cystococcus.

Apothecia 0.4-0.7 mm broad, adnate; margin becoming excluded;

exciple blackish brown; disk flat but becoming convex, black, bare; hypothecium reddish brown, reddening in K; epihymenium olive-brown; hymenium 70-80  $\mu\text{m}$ , pale brownish violet, I+ blue; paraphyses simple, 1.5  $\mu\text{m}$  thick, tips thickened; spores 8, ellipsoid or oblong, 10-14 x 8  $\mu\text{m}$ . Thallus P-. On old wood. NW Territories.

### **L. patavina**

Thallus usually epilithic and continuous to rimose-warty and almost squamulose, thin to almost thick and chalky, whitish to dirty yellowish or pale grey-green, variable, up to several cm diam., unevenly areolate to verrucose-areolate or verrucose, sometimes endolithic or eroded, whitish to gray or gray-white to bluish white; areoles to 1.5 mm diam., often only 0.4 mm or less, contiguous to slightly dispersed, irregularly roundish to  $\pm$  angular, subplane to strongly convex, surface often uneven-verrucose,  $\pm$  smooth to roughened, often minutely cracked, matt, K-, C-, P- or K+ yellow, P+ yellow (atranorin). Black hypothallus lacking. Apothecia black, to 2 mm diam., to 1 mm thick, solitary and dispersed to crowded, roundish or irregularly roundish, moderately to quite strongly constricted at the base; disc plane to often soon strongly convex, smooth to minutely roughened, often irregular or undulate or even subdivided to somewhat tuberculate, matt, epruinose; margin moderately thick and distinct at first, persistent or soon disappearing. Excipulum bluish to blue-black or blue-green towards outside, paler within. Hypothecium colorless to slightly pinkish; hymenium inspersed, (65-)70(-90)  $\mu\text{m}$ ; epithecium intense bluish, bluish-black, or pure blue-green. Spores broadly ovoid to ellipsoid, (6-)12-19 x (3-)6-9  $\mu\text{m}$ . [Description based mostly on "L. alaiensis"; need to incorporate info. from descriptions of other synonyms, etc.]

### **L. pulveracea**

Thallus thin to thick, fine, powdery, dissolved into small farinose blastidia less than 0.1 mm diam., coarsely areolate, forming a thin or thick, continuous, wide-spreading crust, becoming almost entirely soresiate-scurfy, pale yellowish white to yellowish gray; algae Chroococcaceae. Apothecia to 1 mm broad, first immersed in thallus then convex and superficial, black, often contorted; margin black, disappearing; exciple dark blue-green throughout; hypothecium gold-brown (hyaline to pale yellow according to Thomson 1997); epihymenium granular, dark blue-green. Hymenium 80-110  $\mu\text{m}$  (60-70  $\mu\text{m}$  according to Thomson 1997), containing crystals; paraphyses 1  $\mu\text{m}$ , slightly branched at tips; asci clavate, 40-60 x 12-20  $\mu\text{m}$ . Spores 8, ellipsoid to ovoid, 8-12 x 4-5(9)  $\mu\text{m}$  (13-17 x 7-8  $\mu\text{m}$  according to Thomson 1997). Soredia C+ orange, K+ yellow, KC+ orange, P-; exciple K+ dull brownish blue; hypothecium and hymenium I-; walls of asci I+ blue. Chem.: 2,7-Dichlor-6-O-methylnorlichexanthone major; other xanthenes in smaller amounts. On wood, especially worked timber and fence rails. Resembling L. elaeochroma except for the thallus morphology. The identity of this species is unclear; it shows affinities with Pyrrhospora quernea. NW Territories.

### **L. stigmatea (Ach.) Hertel & Leuckert**

Thallus extensive, directly on rock, endolithic to mostly epilithic and then continuous, faintly rimose-cracked or granular-verrucose to subsquamulose. Spores short, broadly ellipsoid, only 1.6-1.9 times as long as wide, 10-16 x 6-9  $\mu\text{m}$ . Apothecia to 1.5 mm diam., flat or rarely convex, at least when young with wide margin. True exciple well developed when young, the edge blue-black, indigo to green-black, colorless within, non-crystalline, K $\pm$  unchanged; epithecium brown to purplish brown, K+ purple intensifying; hymenium 60-80  $\mu\text{m}$  tall, not interspersed with crystals; hypothecium colorless to pale yellow-brown. Thallus white to dirty grey-green, dark grey-brown, blackish or rust-red to brown. Spores 10-16 x 6-9  $\mu\text{m}$ . Thallus K+ yellow or K-, UV- or UV+ yellow (three chemotypes: atranorin and zeorin; lichexanthone and zeorin; or zeorin). On  $\pm$  basic or calcareous rocks, or on adjacent siliceous rocks. Very common and widely distributed. Reported from Arizona, New Mexico, Colorado, Utah, Wyoming, South Dakota, Washington, and the arctic. Very variable in the shape of apothecia and thickness of the thallus. The contrasting brown to purplish brown epithecium and the thin blackish or indigo external part of the true exciple, with the colorless or pale hypothecium, are diagnostic.

### **L. viridans**

**Apothecia rarely more than 0.4 mm diam.; discs sometimes greenish gray. Arthothelin and thiophanic acid present, zeorin absent. Epihymenium pale gray-green, olive-brown to brown; hymenium 55-65  $\mu\text{m}$ ; spores 9-13 x 5-6.5  $\mu\text{m}$ .** Areoles small, dispersed, granular; thalli usually small. Thallus C+, KC+ orange-red. Thallus scurfy or finely granular, pale yellow-green or grey-yellow, thin, usually forming small patches between other lichens, often wide-spreading in cracks and fissures. Apothecia 0.2-0.3(-0.5) mm wide, scattered to crowded,  $\pm$  flat; true exciple persistent, often gray-green pruinose, dark (brown to gray-green) only at the edge (if at all), paler within. Hypothecium colorless to pale straw. Hymenium 50-60  $\mu\text{m}$ , not interspersed (but hypothecium occasionally with large granules, and epihymenium granular). Epithecium dark brown, brown-green or green-gray; crystals dissolving in K. Paraphyses tips clavate, brown. Spores 9.5-12 x 5-7  $\mu\text{m}$ . On hard, non-calcareous rocks in warmer regions, Arizona to Texas.

### **L. wulfenii**

Thallus smooth to verrucose or unevenly verrucose, continuous or dispersed, esorediate, white or grayish white; hypothallus lacking.

Apothecia often crowded or confluent and tuberculate, 0.3-1.0 mm, soon high-convex and immarginate. Epithecium dark brown-black or blue-green (blue or rarely olive-brown according to Thomson 1997), crystalline. Hypothecium pale red-brown or brown above, darker below; upper part of perpendicular hyphae. True exciple dirty drab black at edge, reddish within

(exciple bluish brown above, violet-brown or pale below, according to Thomson 1997). Hymenium 80-100  $\mu\text{m}$ , I+ blue, turning wine-red; paraphyses rarely branched above. Spores elongate-ellipsoid to oval, 7-16 x 7-8  $\mu\text{m}$ . Thallus K+ yellow, C+ orange, KC+ orange, P-. Xanthonones and atranorin. On mosses overgrowing  $\pm$  calcareous substrates, and on soil; in open habitats that are quite moist, often near small lakes or tarns. Arctic-alpine, south to New Hampshire and Colorado.

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