Key to the Lichen Genera of the Pacific Northwest

Bruce McCune
Dept. Botany & Plant Pathology, Oregon State University, Corvallis, Oregon 97331-2902
mccuneb@oregonstate.edu

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This is a draft key that I am willing to share with you as long as you realize that it represents a slice in time in a rapidly evolving document. Almost every week I find new information from publications and from the field and lab work of my students and colleagues that needs to be incorporated. Some of these remain to be incorporated, e.g. changes in the Verrucariaceae and Teloschistaceae. Comments, corrections, or suggestions are appreciated.

This key attempts to include all lichenized fungi known from the Pacific Northwest or North America. This is the region from the Pacific Coast inland to the Continental Divide in Montana, extending north to include coastal southeast Alaska, and south to northern California. It includes most of British Columbia, Washington, Oregon, Idaho north of the Snake River Plain, and western Montana. Coverage for northern California is not comprehensive, but most of its species can be keyed here. Peripheral species not yet known from the Pacific Northwest, but likely to be found there, are given in parentheses (...). Most of these are from California, Alaska, and Colorado.

Genera of non-lichenized lichenicolous fungi are not included in the key, with few exceptions, such as genera traditionally treated by lichenologists rather than mycologists.

Colors are for dry specimens unless stated otherwise. "Spores" refers to ascospores unless stated otherwise. Crustose species that typically occur in sterile form are keyed separately. At endpoints in the keys, key characters are separated from supplemental characters by a period.

For now I have omitted most references, except the collection of general references in the back. A few not-so-obvious sources are mentioned in the text. I plan to incorporate complete references into the keys to species. These keys are slowly accumulating.

CONTENTS

INTRODUCTORY KEY ...................................................................................................................................................... 2

ACKNOWLEDGMENTS .................................................................................................................................................. 78

OTHER REFERENCE WORKS USEFUL IN THE PNW ............................................................................................... 78

GLOSSARY ........................................................................................................................................................................ 80

INDEX ............................................................................................................................................................................... 84
INTRODUCTORY KEY

1a Fungus a basidiomycete; fruiting structures mushroom-like or club-shaped ........................................ Key A, Page 4
1b Fungus an ascomycete; fruiting structures various but not mushroom-like or fruiting structures not apparent
   2a Thallus GELATINOUS, black to brown or gray, photobiont blue-green except in two intertidal species; thallus not filamentous ................................................................. Key B, Page 4
   2b Thallus STRATIFIED (or too finely filamentous to tell), color various, photobiont blue-green and/or green

3a CRUSTOSE lichens

4a Thallus fertile
   5a Fruiting structure a MAZAEDIUM (spores in a loose powdery mass) and/or minute and on a very thin stalk .................................................................................................................... Key C, Page 7
   5b Fruiting structure apothecia, perithecia, or lirellae
      6a Fruiting structure elongate, narrow LIREFLAE, or ascocarps sometimes stellate, elliptical, or irregular ............................................................................................................ Key D, Page 9
      6b Fruiting structures roundish ascocarps
         7a Perithecia: Ascocarps forming PERITHECIA, or perithecia-like; black, flask-shaped..........
            ............................................................................................................... Key E, Page 11
         7b Apothecia: Ascocarps forming APOTHECIA, or apothecia-like; disc shaped
            8a Primary photobiont blue-green ................................................................. Key F, Page 16
            8b Primary photobiont green (cephalodia with blue-green photobionts may be present) or thallus not apparent
               9a Apothecia lacking both thalline and proper margin, the hymenium extending to the edge of the apothecium ................................................................. Key G, Page 18
               9b Apothecia with thalline margin and/or proper margin
                  10a Apothecia with a thalline margin (generally containing the photobiont and colored similarly to the thallus); sometimes with a pseudothalline margin (colored like the thallus rather than the disk, but not containing the photobiont); proper margin present or not ......................................................... Key H, Page 24
                  10b Apothecia with a proper margin only
                     11a Spores nonseptate .................................................................. Key I, Page 32
                     11b Spores septate ........................................................................ Key J, Page 38

4b Thallus STERILE
   12a Thallus ORANGE, YELLOW, or yellow green ......................................................... Key K, Page 38
   12b Thallus another color
      13a Photobiont blue-green (cyanobacteria); thallus bluish gray or brownish gray; STERILE CYANOLICHEN CRUSTS ................................................................................ Key L, Page 40
      13b Photobiont green; thallus gray, white, cream, brownish, olive, etc.
         14a Thallus wholly LEPROSE or completely ecorticate ..................................... Key M, Page 40
         14b Thallus CORTICATE, even when almost entirely sorediate at least some parts corticate (in a few cases forming a discontinuous leprose crust, the nonsorediate part of the thallus being endophloedal)
            15a On BARK OR WOOD or bryophytes over bark or wood .................... Key N, Page 42
            15b On ROCK or SOIL or bryophytes over rock or soil ............................ Key O, Page 51

3b MACROLICHENS (thallus squamulose, foliose, or fruticose, including minutely filamentous species)
   16a Thallus SQUAMULOSE ............................................................................. Key P, Page 56
   16b Thallus foliose or fruticose
      17a Thallus FOLIOSE, with dorsiventral lobes (if ± crustose with marginal lobes, key as crustose or squamulose)
         18a Thallus UMBILICATE (with central holdfast), on rock .............................. Key Q, Page 61
         18b Thallus not umbilicate, more broadly attached, or if centrally attached then not on rock
            19a Primary photobiont blue green (STRATIFIED CYANOLICHENS); upper surface usually
some shade of dark gray, brown, or black ............................................... Key R, Page 61
19b Primary photobiont green (look for grass GREEN ALGAL layer); upper surface variously colored.......................................................... Key S, Page 64

17b Thallus FRUTICOSE, only rarely with dorsiventral lobes
20a Thallus BLACKISH FILAMENTOUS, prostrate or erect, minute or large....... Key T, Page 70
20b Thallus not of black filaments; color various
21a Thallus of HOLLOW STALKS (podetia) that are ± round and pointed or tipped with apothecia or cups ................................................................. Key U, Page 73
21a Thallus not of hollow stalks (thallus either not stalked or not hollow); OTHER FRUTICOSE lichens ................................................................. Key V, Page 73
Key A: BASIDIOMYCETES

1a Fruiting body with stalk and cap (typical mushroom form), tan or brown, with thin decurrent gills; the lichenized portion is dark green to gray green and granular to small squamulose. — On rotten wood and peaty soil; widespread, common

   Lichenomphalia
   Omphalina, Botrydina

1b Fruiting body short, clavate, pinkish brown, yellowish, tan, or whitish; thallus granular or membranous. — On soil and rotten wood; widespread, occasional

   Multiclavula

Key B: GELATINOUS, BLACKISH, NONFILAMENTOUS

Thallus gelatinous, non-stratified (homoiomerous); black to brown or gray, photobiont mostly blue-green

(Also see Schultz & Büdel’s key to the Lichinaceae (Lichenologist 34:39-62).)

1a Plants aquatic or in rocky intertidal areas

2a Plants in freshwater; photobiont blue green; ascocarps apothecia

3a Lobes 2-15 mm broad, loosely attached. — Lower surface veined; thallus foliose, with medium-sized lobes; locally common in Cascades, rare in RM, typically in small spring-fed streams having little fluctuation in water level

   Peltigera hydrothyria
   Hydrothyria venosa

3b Lobes < 2 mm broad, coalescing and tightly attached in dark, thin rosettes that are very difficult to remove from rock. — In mountain streams

   Scytinium rivale

2b Plants in the rocky intertidal; photobiont green; lower surface not veined; thallus foliose, taking the form of the algal partner; ascocarps perithecia

4a Spores elongate ellipsoid, 11-18 x 3-5 µm; gelatinous matrix enclosing asc in center of ascocarp; thallus with short thin lobes to 1 cm wide, shiny greenish gray. — Algal partner (Prasiola borealis) Reed, algal cells often in regular groups, the groups separated by fungal mycelium; chloroplasts shallowly stellate; see photos in Brodo (1976); Aleutian Islands to s BC; also on coasts of Chile and Siberia

   Mastodia tesselata Hook. f. & Harvey
   Kohlmeiera complicatula (Nyl.) S. Schatz
   Turgidosculum complicatulum (Nyl.) Kohlm. & Kohlm.
   Guignardia alaskana Reed

4b Spores ellipsoidal, 10-13 x 3.5-7 µm; gelatinous matrix filling only the ostiole; thallus of tubular to flattened lobes. — Algal partner Blidingia minima var. vexata (Setch. & Gardner) Norris; algal cells irregularly arranged in surface view; fungal hyphae layered between algae; chloroplasts single, parietal, not stellate; QCI to Monterey, California

   Turgidosculum ulvae (Reed) Kohlm. & Kohlm.
   Guignardia ulvae Reed

1b Plants mostly not aquatic, although sometimes in persistently damp places; lower surface not veined or not easily inspected; thallus form various, minute to large

7a Thallus umbilicate, small (generally 1-2 (8) mm wide), often finely granular isidiate; spores nonseptate; on rock

8a Thallus monophyllous to polylephalous, the upper surface divided by ridges

9a Apothecia "thallincarps" (thallus colored with expanded disk-like surface); hymenium sometimes with inclusions of thalline tissue (seen in section under LM); photobiont sheaths yellow brown — Photobiont cells about 9-11 µm diam

   Lichinella

9b Apothecia sunken in the thallus or slightly swollen, with a pinhole opening; hymenium lacking thalline tissue; photobiont sheaths red brown. — Photobiont of the Chroococcus type, cells uniformly large (ca. 20-27 µm diam), 1-2 cells per thick gelatinous sheath, the sheath 2-5 µm thick, hyaline to
reddish); Thallus glossy, black; spores nonseptate, 7-11 x 4-5 µm; on occasionally wet siliceous rock; widespread, Alaska to Oregon mainly w Cascades

*Phylliscum demangeonii*

8b Thallus lobed to polyphyllous; photobiont of *Gloeocapsa* or *Xanthocapsa* type (sheaths red-brown or yellow-brown at the margins, cells in colonies of 2-8, often with many layers of sheaths, one inside the other); on dry limestone, soil, or soft rock

12a Apothecia with expanding disks; thallus small umbilicate to squamulose or crustose

13a Thallus blackish, umbilicate to squamulose, often shallowly lobed; on calcareous rock. — Spores nonseptate, hyaline, 8/ascus; photobiont *Xanthocapsa* type; thallus often pruinose; apothecia partly sunken or sessile with an open lecanorine disk; hymenium I+B; California; poorly known

13b Thallus red-brown, granular-crustose or granular-squamulose; on rock or alpine sod. — Widespread but mainly oceanic to suboceanic

*Anema*

12b Apothecia with sunken disks with punctiform openings; thallus umbilicate, often deeply lobed

14a Spores > 8/ascus; lobes seldom pruinose. — Rosettes often crowded and turf-like; lobes to 3 mm wide, irregularly divided, the lobe ends shell-like; photobiont *Gloeocapsa*-like; surface often with small spherical granules or isidia; on calcareous rock or calcareous seeps; widespread in N Am

*Lichinella nigrilenta*

14b Spores 8/ascus; lobes usually bluish gray pruinose. — Thallus ecorticate, smooth, granular or isidiate; lobes sparsely branched to unbranched; apothecia immersed or semi-immersed; spores simple, ellipsoidal to globose; on calcareous rock

*Thyrea confusa*

[See also *Digitothyrea* in Sonoran Flora I, which has lobes deeply divided, tongue-shaped; apothecia sessile to stipitate; thallus ecorticate, smooth or isidiate; spores simple, ellipsoidal to globose; on calcareous or siliceous rock]

7b Thallus not umbilicate, small or large, isidiate or not; spores septate or not; substrate various

18a Thallus granular, minutely squamulose, crustose, or minutely fruticose (note: small filamentous species are in Key T)

19a Thallus dwarf fruticose over a flattened thallus or squamulose-warty or umbilicate-polyphyllous; photobiont *Nostoc*; spores nonseptate. — On rock or moss or soil over rock; widespread, rarely collected

*Lempholemma*

19b Thallus granular to obscurely squamulose or dwarf fruticose; photobiont various; spores nonseptate or septate

20a Photobiont filamentous (*Calothrix* or *Nostoc* or *Stigonema*)

21a Photobiont *Stigonema*

See “blackish filamentous” key

21b Photobiont *Calothrix* or *Nostoc*

22a Photobiont filaments not distinctly beaded, *Calothrix*; on moist rock, often by streams or lakes; spores nonseptate

23a Epihymenium deep green. — Alaska and Colorado

23b Epihymenium brown or reddish brown. — Alaska and Colorado

*Thelignya lignyota*

22b Photobiont distinctly beaded, *Nostoc*; substrate various; spores 1-septate to muriform

*Porocyphus*

[Including *Blennothallia, Enchylium, Lathagrium, Rostania*, and *Leptogium callopismum*]

20b Photobiont colonial or single-celled, nonfilamentous (*Gloeocapsa* or *Chroococcus* type); spores nonseptate

24a Spores very small, mostly < 6 µm long, about 4-5 x 2 µm, many per ascus; disk deeply sunken. — On moist noncalcareous rock; Arctic

24b Spores larger

25a Spores 3-4-septate, narrowly cylindrical. — Thallus membranous, with colonies of

*Pyrenopsis grumulifera*
**Gloeocystis** (similar to *Gloeocapsa* in general appearance but a green alga); apothecia initially immersed and closed, then opening to a deeply concave disk; disk yellow brown to reddish or rarely dark brown; thalline exciple lacking; spores 20-30 x 1.5-2 µm; Alaska, Michigan, and Europe

*Gloecapsa* (likewise with *Gloeocystis*, but thalline exciple lacking; substrate varied)

*Bryophagus gloeocapsa*

25b Spores nonseptate, mostly ellipsoidal
26a Photobiont *Chroococcus* type (cells in colonies of 2-4 with a clear, thin, uniform sheath); mostly on wet rock. — Reported from Colorado, but undoubtedly more widespread

*Pterygiopsis*

26b Photobiont *Gloeocapsa/Xanthocapsa* type (cells in colonies of 2-8 with thick sheaths, the sheaths at the margin yellow to yellow brown, red brown, orange brown, purplish, or dark violet; substrate and habitat various
27a Photobiont sheaths at the upper surface reddish brown to purple to dark violet (when on more alkaline substrates), rarely yellowish brown; photobiont cells small, the interior cells with lumen ca. 3-6 µm diam and wall ca. 2-3 µm diam; hymenium IKI-; spores 16 or more per ascus. — Thallus of club-shaped terete lobes forming small cushions; widespread

*Synalissa*

27b Photobiont sheaths at the upper surface red brown, orange brown, or yellow brown; photobiont cells usually larger, interior cells with lumen usually > 5 µm; hymenium IKI+B (often fading to greenish yellow); spores 8/ascus
28a Thallus fruticose or lobate squamulose or with short club-shaped erect lobes. — Apothecia with thalline margin, lacking proper exciple; photobiont sheaths orangish brown

*Peccania*

28b Thallus squamulose or crustose
29a True proper exciple very thin or lacking; paraphyses not distinctly moniliform. — Photobiont sheaths yellowish brown; substrate mostly calcareous

*Psorotichia*

29b True proper exciple thin but distinct; paraphyses usually becoming moniliform (but apparently not in *P. furfurea*, the most common local species). — Disk narrowly exposed or expanded; on noncalcareous rock; widespread

*Pyrenopsis*

18b Thallus foliose or fruticose
33a Spores nonseptate; thallus tiny; upper cortex of interwoven hyphae
34a Apothecia lacking thalloid margin; thallus granulose to subfruticose

*Leciophysma*

34b Apothecia with thalloid margin; thallus of flat, interlaced lobes with fruiting warts, small knobby clusters, or fruticose with cylindrical branches. — Widespread, rare

*Lempholemma*

33b Spores septate; thallus tiny to large; upper cortex various
35a Thallus without a cortex, the upper surface of interwoven hyphae (whole-thallus mount viewed from above through compound microscope, but note, however, that the thalline exciple can be corticate); thallus often dull, black or olive-black. — Widespread, common

*Collema* s.l. (including *Blennothallia, Enchylium, Lathagrium, Rostania*)

35b Thallus with a cellular cortex, generally of ± isodiametric cells; thallus often faintly shiny, brown, gray or black
36a Upright hyaline hairs on very margin of thallus; spores 2-celled, 18-26 x 5-9 µm; on moss and soil or soil over rock; photobiont *Rhizonema*. — Widespread, fairly common in moist to arid environments

*Leptochidium albociliatum*

36b Hairs lacking on upper surface or if present then spores muriform; photobiont *Nostoc*
37a Spores 2-celled; thallus fruticose with terete branches, richly branched. — On various substrates, but common on moss over rock

Polychidium

37b Spores > 2-celled; thallus fruticose or foliose, habit various. — Thallus small or large, various in form; spores parallel septate or muriform; widely distributed and common

Leptogium and Scytinium

Key C: CRUSTOSE, MAZAEDIA
OR MINUTE WITH VERY THIN STALKS

1a Mazaedia sessile, immersed in thallus, or on short, broad stalks

2a Mazaedia sessile or immersed in the thallus

3a On soil or old animal dung; spores with a very thick cellular-appearing wall, obscuring the internal septation; on soil in dry, open habitats. — Mazaedium with a fine but distinct yellow-green edge (calycin); rare; Washington, Idaho, and Oregon to San Diego

Texosporium sancti-jacobi

3b On bark, wood, or rock; spores without a thick cellular covering; habitat otherwise

4a Mazaedia immersed in distinctly protruding areoles; lateral part of exciple very thin and hyaline; spores 0-1-septate. — On fenceposts and other bare wood (one species on rock), exposed sites; widespread

Thelomma

4b Mazaedia immersed in flat to bullate areoles; lateral part of exciple dark brown or black and well developed; spores 1-septate or submuriform. — On wood and bark, widespread, common

Cyphelium

2b Mazaedia on broad-based, short stalks or on short hollow podetia

5a Mazaedia on short hollow podetia. — Spores 1-septate; on twigs, mainly subalpine conifers but occasionally at lower elevations and occasional on angiosperms (e.g. Betula); uncommon w Cascades, NWT and Yukon s to n California, inland to e BC;

Tholurna dissimilis

5b Mazaedia on broad-based short stalks

6a Mature spores pale green-brown, 0- to 3-septate, cylindrical; thallus indistinct, not lichenized. — On conifer bark and wood; se Alaska to California

Microcalicium disseminatum

6b Mature spores dark brown, ellipsoidal to barrel shaped or ± cylindrical, 1-septate; thallus distinct, obviously lichenized. — On bark and wood; common and widespread

Cyphelium

1b Mazaedia or other fruiting bodies on slender stalks, or the length of stalk generally > width of mazaedium

9a Stalked bodies are pycnidia or synnemata (a group of erect and fused conidiophores or hyphophores)

10a Stalked bodies are pycnidia and contain long, slender, septate conidia. —Thallus clearly visible, thin, granulose, grayish yellow-green to olive brown; hyperoceanic areas from se Alaska to OP; on bark

Szczawinskia tsugae

10b Stalked bodies are synnema or hyphophores

11a On rock or soil

12a Stalk brown, only slightly longer than the head is broad; spores 12-13 µm diam. — Conidia spherical, coarsely knobby, 12-13 µm diam; conidial head ca. 150 µm wide, spherical; thallus not apparent; apparently nonlichenicolous but sometimes lichenicolous, on soil in seasonally damp sites

Leightonomyces phillipsii (Berk. & Leight.) D. Hawksw.& B. Sutton

Doratomyces phillipsii (Berk. & Leighton) F. J. Morton & G. Sm.

12b Stalk shiny black, about 2X as long as the head is broad; spores 6-8 µm diam. — Spore mass brown, appearing like a minute Chaenotheca brunneola; stalk about 0.12-0.20 mm long, 25-35 µm diam at base, 20-25 µm near head; conidial head 50-100 µm wide, spherical to slightly elongate or slightly flattened vertically; conidia spherical, brownish, papillose, about 6-8 µm diam; thallus thin or not apparent, membranous to slightly verrucose; possibly lichenized with chlorococcoid algae (examples: McCune 25760, in Picea sitchensis forest on Oregon coast; Cascade Range, Rosso 891b)
unknown calicioid (*Leightoniomyces* sp?)

11b On moss, bark, or wood
13a Stalked bodies are hyphophores

[Also consider *Gomphillus*, apparently unknown from w N Am.]
13b Stalked bodies are synnemata
14a On dried resin of conifers

unknown hyphomycetes (non lichenized)

14b On conifer twigs, branches, and trunks
15a On conifer twigs; lichenized. — Stalks 1-2 mm high and 60-145 µm thick at the base and tapering to 24-40 µm near the head; on conifer twigs in oceanic forests; se Alaska to Oregon

*Gyalideopsis epicorticis*

15b On Cupressaceae (e.g. *Calocedrus*, *Juniperus*); not lichenized. Forming thick felty mats of dark brown filaments; synnema short, thickish, dark brown; filaments short celled, beaded, variable in diameter (mostly 3-25 µm)

*Metacapnodium*

[J. Rikkinen (2007, in litt.) conveyed the following. Many blackish fungi grow on resin and may be associated with resinicolous *Chaenothecopsis* species. These can include *Metacapnodium* species and other sooty moulds, but often the most conspicuous one is the synnematus fungus that has been called *Pycnostysanus resinae* or *Sorocybe resinae* (apparently the latter is the correct name). The synnemata resemble those of *Pycnostysanus azaleae*, which is common on old fruits of *Rhododendron* in PNW forests. Information on several other genera and species, including e.g. *Cladosporium resinae* (the 'kerosene fungus') and *Strigopodia resinae*, can be found in various papers by Stanley Hughes and others.]

9b Stalked bodies are apothecia
18a Spores simple
19a Spores spherical
20a Mazaeodium brown; spores brown. — Widespread and common

*Chaenotheca*

20b Mazaeodium pale; spores pale
21a Stalk pale, often light yellow; thallus endophloedal; photobiont *Trentepohlia*. — Widespread, infrequently collected

*Sclerophora*

21b Stalk black or greenish yellow; thallus various; photobiont not *Trentepohlia*
22a Stalk greenish yellow; on soil in sheltered sites (beneath undercut banks, on tip-ups). — Widespread and common

22b Stalk black. — Widespread, occasional

*Chaenotheca furfuracea*

19b Spores ellipsoidal or cylindrical
23a Spores cylindrical, appearing nonseptate or more usually with 1(-3) indistinct septa
24a Mazaeodium dark, greenish tinged. — Over green algae and leprose lichens on overhanging, shaded cliffs or sheltered rootlets; rare

*Microcalicium arenarium*

24b Mazaeodium brown; exciple generally yellowish pruinose — Widespread

*Chaenotheca laevigata*

23b Spores ellipsoidal or spherical, nonseptate
25a Ascocarp shaped like a bowling pin, cylindrical but with a submedian swelling containing the hymenium; thallus not lichenized. — Ascocarps black; spores extruded from the tip in a mazaeodium; on bark, especially *Populus*

*Caliciopsis calicioides* (Ell. & Ev.) Fitzp.

25b Ascocarp swollen at the head like a typical pin lichen, the stalk without a swollen lower or middle section; thallus lichenized or not
26a Apothecia extruding a brownish spore mass (mazaeodium)
27a Thallus lichenized or not; asci cylindrical; ascus wall thin and disintegrating early in development; spores various in shape; substrate various

*Chaenotheca*

27b Thallus not lichenized; asci clavate; ascus wall thick and persisting until spores are nearly mature; spores ellipsoidal; substrate conifer resin

*Bruceomyces*

26b Apothecia black, not forming a thick spore mass

29a Stalks whitish; hypothecium and stalk K+ green (LM)

*Chaenothecopsis viridialba*

29b Stalks black; hypothecium and stalk K-; thallus mostly endoxylic, not apparent, probably not lichenized. — Widespread and common on bare wood in sheltered microsites, especially snags and old wood buildings

*Mycocalicium subtile*

18b Spores septate

34a Apothecia without a well-developed mazaedium, the spores mostly retained in asci and not forming a powdery mass on the surface

35a Mature spores < 10 µm long; asci 35-45 µm long

*Chaenothecopsis*

35b Mature spores > 10 µm long; asci 70-100 µm long

36a Spores 1-septate or nonseptate, rarely 3-septate

36b Spores 3-or more septate, rarely 1-septate

34b Apothecia with a well-developed mazaedium

38a Mazaedium black; mature spores dark brown, ellipsoidal, 1-septate, the septum distinct

39a Stalks unbranched, very fine, < 0.5 mm diam; mainly on bark and wood, rarely on rock

*Calicium*

39b Stalks branched, erect, 0.5-2 mm diam and 2-20 mm tall; on rocks and wood, mainly wood in N Am. — Widespread but rare; sw BC to n Cascades, disjunct to Mexico, also in Asia and s hemisphere

*Acroscyphus sphaerophoroides*

38b Mazaedium dark or brown; spores with 1-3 indistinct septa, ellipsoidal-cylindrical

40a Spores light brown; exciple yellow pruinose

40b Spores pale, with a greenish tinge; exciple not yellow pruinose

*Chaeotheca laevigata*

[See also *M. ahlneri*, with shorter stalks and mazaedium with sclerotized hyphae.]

Key D: CRUSTOSE, APOTHECIA LIrellAE OR IRREGULAR

1a Spores simple

2a Exciple dark brown to black throughout

3a On rock; thallus areolate, whitish to pale gray-brown. — Apothecia black, almost rounded or short lirellate, simple, straight to slightly curved; disk slit-like, not opening; medulla K+R (norstictic acid); Bering Strait to BC

*Lithographa tesserata*

3b On wood; thallus mainly within the substrate

4a Apothecia persistently narrow and elongate; spores 8.5-13 x 4.5-6.5 µm; hymenium often with lengthwise partitions of dark sterile tissue. — On wood; w Cascades

*Psychographa xylographoides*

4b Apothecia initially narrow, soon becoming triangular or quadrangular; spores 6-8 x 3-5 µm; hymenium simple or often irregularly partitioned as the exciple becomes gyrose. — Disk brown to black, with a shiny black margin; exciple black, even, incurved over the edges of the hymenium;
on wood; se Alaska, BC, Idaho, and Washington

Elixia flexella

2b Exciple light to dark brown at the edge, pale within; hymenium not partitioned
5a Epithecium brown, rarely olive brown, N-; exciple not pruinose; conidia slender, falcate. Apothecia elliptical to elongate, pale brown, brown, or dark brown; exciple hyaline or nearly so within; common on wood, widespread

Xylographa

5b Epithecium intensely greenish, N+ reddish; exciple pruinose; conidia bacilliform. — On wood of conifers, BC, Montana, and North Dakota s to Arizona

Lignoscripta atroalba

1b Spores septate
6a Spores muriform
7a Apothecia round to irregular. — Common on hardwoods; w Cascades

Arthothelium (see Arthonia)

7b Apothecia linear or elongate
8a Lirellae not typically curved; on wood; spores < 8 µm wide. — Thallus immersed, whitish; spores brown, 20-38 x 6-8 µm, 1(2) per ascus; BC

Xyloschistes platytropa

8b Lirellae elongate and often sinuose; on bark; spores > 8 µm wide. — Similar in external appearance to Graphis scripta, but apothecia often longer and/or broader, sometimes pruinose; spores ca 44 x 16-18 µm; on hardwoods; Coast Range

Graphis pergracilis

6b Spores only transversely-septate or 1-septate
9a Exciple lacking or weakly developed

Arthonia

9b Exciple present (carbonaceous, brown, or hyaline)
10a Spores 1-septate, constricted, colorless or finally darkening; on rock
11a On limestone; thallus ± thick (to 0.6 mm), chalky white to grayish, continuous to areolate; asci Rhizocarpon type, clavate; spores hyaline becoming violet black, remaining hyaline around the septum, 12-20 x 8-13 µm. — Apothecia angular to short-lirelliform; rare; RM in BC

Poeltinula cerebrina

11b On noncalcareous rock; thallus barely apparent, pale greenish gray to pale brownish; asci having an apical dome with a narrow ocular chamber; spores hyaline but old spores brown, unequally 1-septate, 17-23 x 9-12 µm. — Rare; sw Oregon

Melaspilea interjecta

10b Spores 3 or more septate, hyaline or darkening; substrate various (Note: some non-lichenized fungi with lirellae may also key here, such as Hysterographium and Hysterium)
12a Ascocarps visible as brownish black thalline cracks or slits; spores 3 septate

Fissurina

12b Ascocarps with well-developed labia bordering the slit or an exciple bordering the disk; spores 3- or more septate
13a Proper exciple thin, hyaline to brown, within a thalline margin. — Spores 5(7) septate, halonate; on Picea twigs and foliicolous on ericaceous shrubs and Picea; California to BC

Enterographa oregonensis

13b Proper exciple dark brown black, olive black, or carbonaceous, lacking a thalline margin
14a Mature spores brown. — On bark; coastal California to Oregon; apparently rare

Phaeographis

14a Mature spores hyaline
15a Spore walls thickened to form lenticular or rounded lumina, 7- or more septate; common w Cascades, more rarely inland, on bark of broad-leaved woody plants (especially conspicuous on Alnus)

Graphis

15b Spore walls not markedly thickened, with cylindrical lumina; 3 to 5 septate. — On hardwoods; w Cascades; a few species are known from rock; a number of species are non-lichenized
Key E: CRUSTOSE, PERITHECIA

1a Photobiont blue-green (cyanobacteria) or a brown alga; on rock or barnacles (this can be very difficult to discern when the thallus is immersed in the substrate; in that case, the substrate is shell or soft calcareous rock.)

2a Seashore habitats; on rock or barnacles; ascocarps true perithecia

3a Photobiont a brown alga [Petroderma maculiforme (Wollny) Kuckuck]; ascospores 1-celled. — On rock, middle to upper intertidal, on rocky shores in central California

3b Photobiont cyanobacteria; ascospores 1-2-celled. — Common

2b Other habitats; on rock; ascocarps true perithecia or not

5a Ascocarps perithecia; on rock in or by fresh water. — Widespread, but apparently not yet reported from the PNW

5b Ascocarps actually perithecia-like apothecia; substrate various

see Pyrenopsis and Euopsis below

1b Photobiont a green alga (but various in color, including reddish, yellowish, brownish, and green) or not apparent; substrate various

8a Spores simple

9a Spores small, 50-300/ascus; ascocarp an apothecium with narrow opening (peritheciod). — On decaying organic matter, rock, rotten wood, and lichens (especially Peltigera, Solorina, and Baeomyces)

9b Spores larger, 8 or fewer per ascus; ascocarp a true perithecium or not

10a Ascocarp with a pale or hyaline wall. — Spores large (mostly > 20 µm long) and thick-walled; ascocarp not a true perithecium but often with a narrow opening (peritheciod)

10b Ascocarp with a brown, dark brown, or black wall

11a Paraphyses persistent, distinct; on soil or rock

12a On soil or rock. — Thallus dull greenish or soil colored, continuous, membranous; spores elongate ellipsoidal, 18-25 x 5-10 µm; rarely collected and inconspicuous but present in many open habitats, including the coast, steppe, and recently disturbed soil in forested areas

12b On rock (calcareous). — Thallus endolithic; perithecia globose, with a fragile dark brown wall, semi-immersed or sessile; hymenial gelatin I-; paraphyses present in ostiole; asci broadly cylindric to clavate; spores ellipsoid to narrowly ellipsoid, biseriate to irregularly arranged, elongate, 12-29 x 4.5-13 µm; photobiont chlorococcoid; Montana to Texas, e to Missouri

12b Paraphyses disintegrating; mostly on rock, a few species occur on bark

13a Thallus with black dots (other than perithecia) or columns of dark involucrellum like tissue, sometimes forming as narrow columns extending upward from the involucrellum; spores mostly < 18 µm long; thallus with a black basal layer. — Amphibious on siliceous rock; widespread

13b Thallus lacking black dots other than perithecia or columns in the thallus; spores various; thallus with or without a black basal layer

14a Habitat rocks by the ocean; spores relatively short, usually < 12 µm long; medulla poorly differentiated or absent; thallus greenish or olive greenish. — Common in its restricted habitat

14b Habitat aquatic or terrestrial, but not exclusively marine; spores often > 12 µm long; medulla various; thallus color various. — Widespread and common

8b Spores septate to muriform
17a Spores muriform; paraphyses or paraphysoids often disintegrating or lacking (but periphyses often present)

18b Hymenial green algae present, included within the perithecium; spores brown

19a Thallus squamulose, on soil or rock. — Widespread, fairly common in arid areas and outcrops in RM

19b Thallus crustose, on rock. — Fairly common in many habitats; widespread

Endocarpon

Staurothele

18a Hymenial algae lacking; spores hyaline or brown

20a Thallus squamulose or minutely squamulose

21a Squamules slightly umbilicate, cortical cells not papillate (LM). — Thallus brown, dull or shiny; perithecia globose, black, ca. 0.25 mm diam, sparse and inconspicuous on the under surface of the squamules or on the stipe, sometimes on the upper surface; on HCl- rock; w Montana

Henrica americana

21b Squamules not umbilicate; cortical cells papillate (LM). — Thallus gray-green to brownish, with fine lobes to 1 mm long or smaller and granular to coralloid; perithecia rough, black, superficial; true exciple 3-layered, the outermost brown black, the inner two hyaline or light brown; on moss or soil over rock and on bark

Agonimia

20b Thallus crustose or poorly developed or not apparent

22a On bark, mossy bark, or rock

23a On calcareous and siliceous rock in many habitats, including alpine and shaded forest floor. — Spores hyaline or brown; rarely collected and inconspicuous

Polyblastia (including Sporodictyon)

23b On bark or mossy bark

24a Spores < 35 µm long. — Thallus smooth and continuous to uneven or granular, green when wet, dull green, brown, or gray green when dry; perithecia 0.15-0.35 mm diam; true exciple blackened; spores 27-35 x 10-16 µm, hyaline, muriform; on bark and wood of hardwoods

Agonimia allobata

24b Spores > 35 µm long

25a Spores 35-50 µm long. — Proper exciple visible from above as a broad, pale brownish ring around a brown pore, all of this surrounded by a greenish thalloid exciple; spores 35-50 x 14-19 µm, 4-8/ascus; on conifer twigs near the ocean

Thelenella modesta

25b Spores > 50 µm long, commonly to 100 µm. — Thallus inconspicuous, very thin, whitish; apothecia perithecioid, subglobose, < 0.5 mm diam, with dark gray, ± erose and fissured margin, with a small white-rimmed denticulate apical pore; spores 2/ascus, to 100 x 30 µm; on bark and mossy bark, coastal BC and OP

Melanotopelia toensbergii

22b On mosses or lichens or soil, rarely rock; spores hyaline or pale greenish

26a Exposed portion of perithecium pale yellowish to orangish; spores 30-43 x 11-15 µm. — Paraphyses disappearing; hymenium I+B, then immediately wine red; spores I+ yellow orange; on soil and moribund mosses; arctic Alaska

(Psoroglaena biatorella)

26b Exposed portion of perithecium black or dark brown; spores various

27a Ascus tip I-; photobiont chlorococcoid. — On lichens, mosses over tree bases, rock, and soil; steppe habitats and w Cascades

Thelenella muscorum

27b Ascus tip I+B; photobiont Elliptochloris. — Damp habitats in mountains to arctic-alpine; Washington and BC to Arctic

Protothelenella

18b Spores cross septate only, without lengthwise septa

32a Ascomata containing multiple chambers (locules)

Tomasellia americana (Willey) R. C. Harris
[Reported from BC, on *Sorbus* bark in Vancouver. See Harris (1975) for description. Apparently not a lichenized.]

32b Ascomata containing a single locule
33a Spores brown or dark brown
   34a Spores 3-7 septate
      35a Perithecia on greenish gray squamules; spores 7 septate
         *Normandina pulchella*
      35b Perithecia not associated with squamules; spores mostly 3-6-septate
         36a Spore walls thickened, producing diamond-shaped or lens-shaped lumina. — Very common on hardwoods and shrubs, especially *Alnus rubra*; w Cascades
         *Pyrenula*
         36b Spore walls only slightly thickened, lumen ± cylindrical, not lens- or diamond-shaped
         *Eopyrenula*
   34b Spores 1-3-septate
      37a Paraphysoids persistent, branched, anastomosing. — Apothecia perithecia-like or with a broader opening and lecideine in appearance; ascocarps immersed in larger areoles or forming hemispherical mound; lichenization of thallus questionable
         *Lichenothelia*
      37b Paraphysoids deliquescing or not developing, not apparent in mature perithecia
         38a Spores 16-64 or more per ascus. — Spores < 10 µm long; parasitic fungus on many genera of crustose lichens; ascocarps perithecia, with one ostiole, sessile or immersed; periphyses present
         *Muellerella*
         38b Spores 8 per ascus. — Parasitic fungus on many genera of crustose lichens; ascocarps perithecia, with one ostiole, sessile or immersed
         *Endococcus*
   33b Spores hyaline or becoming brown when old
      39a Spore walls conspicuously thickened to form diamond-shaped to rounded lumina, the end lumina close against the ends of the spore
         *Pyrenula*
      39b Spore walls not conspicuously thickened
         40a Spores 5-septate or more, long and slender (>4X long as wide), > 25 µm long
            41a Substrate moist calcareous rock, mostly semi-aquatic. — Thallus thin, smooth, continuous to cracked, deep gray green to green; perithecia sessile, simple to compound, to 0.5 mm wide; paraphysoids persistent; spores hyaline, fusiform, (3)7(9)-septate, 25-32(45) x 5-7 µm; BC
            *Pseudosagedia guentheri*
            41b Substrate bark, moss, or soil
               42a Spores not constricted, 28-38 x 4-6.5 µm, generally 5-septate; mature perithecium with flattened apex, becoming almost disk-like as the covering layer is shed. — Thallus gray-green; Colorado, Oregon
               *Protothelenella plurisepata*
               42b Spores ± constricted at mid-septum, 25-35(50) x 5-8 µm, (4)6-7(9)-septate; mature perithecium about half immersed, partly covered by a thin layer of thallus. — Thallus thin, effuse, white to pale gray; perithecium to 0.4 mm broad; perithecial wall black, absent at the base; paraphyses simple to sparingly branched, about 1 µm wide, persistent; hymenium not inspersed with oil drops; photobiont *Trentepohlia*; on bark of hardwoods, mossy tree bases, or exposed tree roots; BC to s California
               *Strigula stigmatella*
            40b Spores 1-4 septate, relatively broad (usually ≤ 4X long as wide)
               43a Paraphysoids disintegrating, not recognizable in mature fruits
               44a On bark
                  45a Thallus filamentous; spores 3-4(5)-septate. — On conifer bark
                     *Psoroglaena stigonemoides*
               *Macentina stigonemoides Orange*
               45b Thallus crustose and thin or not apparent; spores 1-3-septate
46a Spores > 25 µm long; paraphyses gelatinizing. — Spores 1-septate (sometimes 3-septate with age), slightly constricted at the septum, one cell shorter, broader, and more pointed than the other, 27-35 x 7.5-10.5 µm; frequent on Alnus and other hardwoods w Cascades

*Mycoporum antecellens*

46b Spores < 25 µm long; paraphyses gelatinizing or persistent. — Spores 14-21 x 4-6 µm, hyaline to sometimes browning with age, 1-septate, constricted at the septum or not, one cell broader than the other, with a gelatinous epispore; not lichenized; fairly frequent on Alnus and other hardwoods w Cascades

*Naetrocymbe punctiformis*

44b On rock or soil

49a Parasitic on rock- or soil-dwelling crustose lichens in various habitats, including steppe and alpine. — Perithecia raised, black, 90-120 µm diam; asci 31-50 x 12-15 µm I+ orange; perithecial wall dark brown; spores 1-septate (often not exactly equal-celled), 6-10(13) x 3-5.5 µm, 16-64 per ascus; not lichenized

*Muellerella pygmaea*

[Other species of Muellerella are likely as well, but poorly studied in our area.]

49b On rock

*Thelidium*

43b Paraphyses (or paraphysoids or pseudoparaphyses) persistent, not disintegrating

50a On soil, plant detritus, moss, moss over rock, or rock

51a Thallus parasitic on a yellow-green thallus (Arthrorhaphis); on soil. — Spores 1-septate or 3-septate; widespread

*Cercidospora*

[including Neornorlinia trypethiliza (Nyl.) H. Sydow reported from Colorado. Cercidospora is a lichenicolous fungus that parasitizes many different genera.]

51b Thallus otherwise, on rock or plant detritus

52a Spores 3-septate

53a Thallus indistinct, the fungus apparently parasitizing green algal films

*Epigloea*

53b Thallus distinct, smooth to cracked areolate, glossy or dull, light grayish olive to deep olive brown, dark green, dark gray, or purplish gray.

54a Spores 20-30(40) x 5-8 µm. — Thallus pale ochre to deep brown or brownish green; perithecia to 0.5 mm diam, hemispherical, enclosed by a thalline exciple; Alaska and BC

*Segestria lectissima*

54b Spores 17.5-22(24) x (4)4.5-6.5 µm. — Thallus smooth to cracked areolate, glossy or dull, light grayish olive to deep olive brown, dark green, dark gray, or purplish gray; perithecia to 0.4 mm wide; paraphyses simple, coherent, persistent; on noncalcareous rock, fully exposed or deep shade, often in the supralittoral zone or ± permanently inundated; BC and Alaska

*Porina pacifica*

52b Spores 1-septate

55a Spores with a warted epispore; two cells of spore of equal size. — Spores uniseriate, with a thick septum; perithecia large (0.3-1.0 mm)

*Acrocordia*

55b Spores smooth, without a warted or granular epispore, two cells of spore equal or unequal in size

56a On algal films over lichens, bryophytes, rock, or plant detritus; spores < 15 µm long

*Epigloea*

56b On rock; spores > 15 µm long

57a Thallus brown to dark brown; paraphyses persistent and not gelatinizing. — Thallus well developed, 150-300 µm thick, areolate; perithecia 0.2-0.3 µm diam, semi-immersed; exciple
dark brown, becoming hyaline at the base; involucrellum contiguous on the upper half to two thirds of the exciple, spreading below; spores hyaline, 1-septate, cells equal or one cell slightly wider, 16-22 x 4.7-6.2 µm; perispore thin, indistinct, not ornamented; photobiont Trentepohlia; known only from the type locality on coastal rock in San Luis Obispo Co., California

(Naetrocymbe herrei)

57b Thallus medium to dark gray; paraphyses gelatinizing. — Thallus very thin, rimose cracked to almost farinose; perithecia < 0.1 mm wide; spores hyaline to light brownish, 1-septate, with one cell slightly longer and narrower than the other, sometimes constricted at the septum, 16-18 x 6-7 µm

Anisomeridium cf. carinthiacum

50b On bark or wood

54a Perithecia orange to red brown, gray green, or dark pinkish gray; spores 16-23 x 3-5 µm, 3(5)-septate

Porina (including Segestria)

54b Perithecia black; spores various in size, 1-3-septate

55a Spores typically 1-septate, but appearing 3-septate because of mid-lumina constrictions or wall thickenings; spores also constricted at the septum. — Pseudoparaphyses ± simple, persistent; spores 2-6 celled, with thin septa, in more than one row; perithecia small (0.1-0.4 mm); on bark of conifers and hardwoods

Arthropyrenia

[Most species once placed in Arthropyrenia have been moved to various other genera. See also Naetrocymbe punctiformis (above) which can have paraphyses disappearing.]

55b Spores otherwise

56a Spores 3-septate

57a Spores > 25 µm long

58a Spores about 32-37 x 10-12 µm. — Perithecia black, single or sometimes in small groups, black but sometimes with a thin veil of bark cells at the base

Anisomeridium macrocarpum

58b Spores about 25-35 x 7-9 µm. — Perithecia gregarious, large, brown black, becoming large; not lichenized; on bark

Massarina corticola

57b Spores < 25 µm long

59a Spores asymmetrically septate, the part above the primary septum wider and about 2X as long as the lower; conical pycnidia usually present. — Perithecia to 0.25 mm diam, subconical to globose, immersed to ± superficial; involucrellum scarcely differentiated; Spores 1-3 septate, 12-23 x (3)4.5-5(6) µm; photobiont Trentepohlia; humid, shady bark, wood, polypores, and dead bryophytes

(Anisomeridium polyperi)

59b Spores symmetrically septate or nearly so; conical pycnidia lacking. — Thallus thin, shiny, smooth to somewhat granular, pale brownish gray to pale greenish gray; spores 3-septate (sometimes septa obscure in water but clear in K), fusiform, hyaline; spores 16-24 x 3-5 µm; paraphyses simple to sparingly branched, coherent, persistent; on hardwoods and conifers; distribution poorly known but apparently widespread

Pseudosagedia aenea

[Arthropyrenia cerasi is also 3-septate and would key here.]

56b Spores 1-septate
60a Spores narrowly fusiform to acicular, 20-50 x 2-3 µm. — Thallus not lichenized

**Leptorhaphis**

[**Leptorhaphis epidermidis** (Ach.) Th. Fr. occurs on *Betula* and has an I- hymenium. Other species in the genus have and I+ orangish or I+B hymenium.]

60b Spores broader (mostly > 3 µm)

61a Spores with a warted epispore, the two cells of equal size. — Spores uniseriate, with a thick septum; perithecia large (0.3-1.0 mm)

**Acrocordia**

[**Acrocordia** includes both saxicolous and corticolous species. Several species are known from e N Am.]

61b Spores smooth, without a warted or granular epispore, the two cells usually unequal in size. — Spores 10-18 x 4-7 µm; paraphysoids long-celled and slender; usually on hardwoods; w Cascades, BC to California, widespread in temperate to subtropical areas

**Anisomeridium biforme**

**Key F: CRUSTOSE CYANOLICHENS WITH APOTHECIA**

1a Spores septate; apothecia lecideine

2a Spores 4-15 celled, elongate; apothecia brown; on moss over rock, mossy bark, or tundra sod. — Arctic-alpine to s Oregon; rare

**Arctomia**

2b Spores 2-4 celled; apothecia black; substrate usually rock. — Widespread, occasional

**Placynthium**

1b Spores non-septate; apothecia lecanorine; growth form variable

3a Thallus blackish, gelatinous, nonstratified (homoiomerous), various in form

3b Thallus olivaceous or brownish, stratified or not

4a Thallus olivaceous, stratified (heteromerous), rosettiform with very narrow elongate lobes; photobiont possibly *Rhizonema* (*Scytonema*-like; filamentous, with intercalary heterocysts and ± paired false branches); on rock, often where moist or seepy. — Mainly in coastal states and provinces inland to Montana

**Vestergrenopsis**

4b Thallus reddish brown or dark brown, granular to minutely squamulose; photobiont *Gloeocapsa* with or without *Trebossia* in the exciple; on dry rock or alpine sod. — Widespread but mainly oceanic to suboceanic

**Euopsis**

[**Pyrenopsis** is similar but has perithecia-like apothecia or somewhat expanded disks, a tendency to moniliform paraphyses in some spp, and clavate rather than cylindrical asci.]

**Key G CRUSTOSE, MARGINLESS**

1a Spores muriform

1b Spores simple to 1 or many septate

2a Spores thick-walled, often > 20 µm long

3a Disk black; thallus gray to white. — Mainly on bark, rarely on rock; very common, especially w Cascades

3b Disk brown; thallus brown. — On bark; abundant w Cascades, uncommon in RM

**Mycoblastus**

2b Spores thin-walled, usually < 20 µm long, if thick walled then spores < 20 µm long

4a Cephalodia present; apothecia dark brown to black; on rock. — Alaska s to BC

**Japevia**

**Pilophorus dovrensis**
[Other species of *Pilophorus* may occasionally be found with sessile apothecia, but in *P. dovrensis* this is the typical condition.]

4b Cephalodia absent; apothecia and substrate various

5a Asci free standing among the paraphyses, not embedded in a hymenial gelatin

6a Asci I- or I+ reddish brown; thallus not apparent; spores simple, ellipsoid to pear shaped. — On bryophytes, especially *Cephaloziella turneri* and other leafy liverworts; apothecia whitish or blue green

5b Asci embedded in hymenial gelatin

7a Spores spherical — Thallus thin; apothecia convex to hemispherical, dark brown; spores 5-7 µm wide, 16 per ascus; on soil, rotten wood, and detritus; Colorado; probably widespread but very inconspicuous

7b Spores not spherical

8a Thallus with dull to bright fluorescent yellowish green UV+ soredia (rhizocarpic acid)

9a Spores simple; apothecia to 0.3 mm diam, yellow green to yellow orange. — On sheltered rock, soil, and roots; widespread but seldom collected

8b Thallus lacking yellowish green soredia

9a Spores septate with one cell enlarged; ascocarps orange brown, brown black, or black, often subsessile, round to lobed or stellate. — Widespread, common, mostly on bark w Cascades or *Populus* e Cascades, but one species (*A. glebosa*) common on soil in steppe and alpine

9b Spores (1-2)3-septate; apothecia to 1 mm diam, yellow green to brownish. — Nonsorediate parts of the thallus immersed and forming a pale gray stain in the substrate; on conifer trunks, Alaska and OP

10a Spores simple to septate and then with all cells of equal size; ascocarps pale yellow; bluish, gray to black or mottled, round to somewhat irregular in outline

11a On rock; thallus white to yellowish or yellowish brown, areolate on a black hypothallus. — Mostly on noncalcareous rock; common

11b On various substrates but seldom on rock; thallus various but never areolate on a black hypothallus

12a Paraphyses branched. — Common, especially w Cascades

12b Paraphyses simple or sparingly branched, though in some cases richly branched near the surface (epithecium)

13a On soil, moss, or humus; spores (8)10-14(16) x 3-5 µm; thallus P+O or R (pannarin and terpenoids). — Rare, arctic-alpine s to BC and Alaska

13b On rock (rarely on wood or rusted iron) and usually on shaded, sheltered, noncalcareous rock; spores 5.5-12 x 1.5-5 µm; thallus P- (no lichen substances). — Infrequent

Other species of *Pilophorus* may occasionally be found with sessile apothecia, but in *P. dovrensis* this is the typical condition.
Key H: CRUSTOSE THALLINE MARGIN

1a Spores simple
   2a Spores minute, generally < 5 µm long, > 32/ascus
      3a Thallus brown, olive, grayish, or whitish.
         4a Thallus lacking a distinct cortex; asci with IKI+B tholus (but this dissolving at maturity). — On calcareous rock, grasslands to alpine
            Caeruleum heppii
         4b Thallus with a cortex clearly set off from the algal layer; asci lacking an IKI+B tholus. — On rock, less often on soil; widespread, common
            Acarospora
      3b Thallus fluorescent yellow-green
         5a Asci with I- apical dome; hymenium usually > 100 µm tall. — Apothecia ± immersed in the thallus; habitat mostly warm, low elevation sites to cold steppe; widespread, common
            Acarospora
         5b Asci with I+B and K/I+B apical dome; hymenium usually < 100 µm tall. — Apothecia ± immersed in the thallus; habitat variable, but including montane, cold steppe, and alpine; widespread, common
            Pleopsidium
      [Pleopsidium is said to have an upper cortex that is prosoplectenchymatous in contrast to a paraplectenchymatous cortex of Acarospora. But the cortical cells in Pleopsidium are typically short, so that this difference can be difficult to see. Knudsen (2008) in the Sonoran Flora pointed out that the distinction also breaks down because some species of Acarospora have a prosoplectenchymatous upper cortex.]
   2b Spores larger, generally > 5 µm long and ≤ 32/ascus
      6a Spores thick-walled (wall usually > 1 µm thick, proportionately more like an orange peel than an avocado skin) at maturity, often very large
         7a Cephalodia absent
            8a Spores 1-8 per ascus, nonseptate, not fragmenting, medium-sized to large, generally thick walled
               9a Apothecia urceolate; spores 8/ascus; epihymenium K-; thallus spot tests negative. — On bark and wood of conifers; BC, Idaho, and Montana
               Gyalectaria
            9b Apothecia without the above combination of characters. — On many substrates; a common, widespread genus with many species
               Pertusaria
         8b Spores 1 per ascus but fragmenting into two 1-celled spores, often difficult to find the two parts attached. — Medulla C+R, K-, KC+R, P-; spores huge (to 200 µm long), very thick walled; usually on bark; widespread, infrequently collected
            Varicellaria rhodocarpa
      7b Cephalodia present. — On rocks and trees on the immediate coast; locally common
            Coccotrema
   5b Spores thin-walled (wall < 1 µm thick, proportionately more like an avocado skin than an orange peel), small or large
      10a Apothecia ± immersed or level with upper thallus surface
         11a Apothecia Pertusaria-like, opening by a small pore; cephalodia present; on coastal trees and rocks; spores 45-65 x 23-39 µm, the spore wall 2-3.5 µm
            Coccotrema
         11b Apothecia with a ± expanded opening; cephalodia present or absent; substrate and habitat various; spores small or large
            12a Apothecial disk tan, yellowish, pale reddish, or pinkish; epithecium HCl-. — Common on streamside and lakeside rock, less frequent in other habitats
               Ionaspis
            12b Apothecial disk brown, black, or greenish-black; epithecium HCl+ green, purple, or HCl-
               13a Spores 30-45 x 16-30 µm
                  14a Cephalodia present; substrate rock. — Common in coastal BC and Alaska to rare in Oregon
                  Coccotrema
Amygdalaria

14b Cephalodia lacking; substrate plant detritus, mosses, and tree trunks. — Common, widespread

Megaspora

13b Spores smaller; substrate various

15a Disk black or greenish black; epithecium HCl+ green or HCl-

16a Epithecium deep bluegreen. — Asci with I+B apical dome; spores 12-18 x 7-9 µm; hypothecium hyaline; thallus pale or darkening with the same pigment in the cortex as in the epithecium; on calcareous rock in stream beds

Eiglera flavida

16b Epithecium olive green, brownish green, dark brown, or black green

17a Epithecium dark brown, HNO3-, HCl-; paraphyses even, not moniliform. — Thallus brown to gray brown; apothecia immersed to raised, the margin colored like the thallus or whitish; spores 9-13 x 6.5-8 µm; coastal BC and Alaska

Fusceidea intercincta

17b Epithecium olive, greenish brown, black green, or bluish green, HNO3 and HCl+ green or purple; paraphyses moniliform or not; spores various

18a Epithecium HNO3+ green and HCl+ green; paraphyses bead-like (moniliform); thallus some shade of white, olive, brown, or gray. — Asci with I- apical dome but with an I+B outer coat; common, mostly on rock and soil

Aspicilia

[Two genera have recently been split from the large genus Aspicilia, Circinaria and Sagedia. Superficially similar in appearance, these are keyed together for the time being. Sagedia is nested within Aspicilia, so is unlikely to be maintained as a separate genus. Circinaria is also still in question. So far the split is partial: new combinations have not been made for all species in Aspicilia that will need been reassigned to these genera.]

18b Epithecium HNO3+ purple (and HCl+ purple?); paraphyses even, not moniliform; thallus brown. — Arctic-alpine on noncalcareous rock.

Clauzadeana macula

15b Disk some shade of brown, often reddish brown; epithecium HCl-

19a Thallus distinctly lobate

Lobothallia

19b Thallus areolate or verrucose

20a On mosses or detritus in late snow-lie habitats. — Apothecia with a pseudothalline exciple that initially bursts in a star-like pattern; thallus small warts to subsquamulose areoles; apothecia dark brown to chestnut brown, usually with a paler proper exciple; spores 18-24 x 5-7 µm; BC

Ameliella andreaeicola

20a On rock in various habitats

21a Medulla and ascus wall I+B; thallus areolate. — Fairly common on rock, mainly subalpine to alpine

Bellemerea

21b Medulla and ascus wall I-; thallus areolate, nearly flat or often developing into thick, warty protruberances ("isidia" in the literature) 0.3-0.7 mm diam. — Spores 17-30 x 9-15 µm, with a thick perispore when young; spot tests negative or medulla C+R, KC+R (gyrophoric acid); on rock by water at low elevations to alpine; Alaska to Oregon, inland to e-central BC and Montana

Koeberlella wimmeriana

[Sometimes parasitized by Sagediopsis aquatica (B. Stein) Triebel]

10b Apothecia adnate or bulging above thallus surface; widespread, common, on all substrates

22a Apothecia bright yellow. — On many substrates; widespread, common

Candelariella

22b Apothecia white, tan, green, brown, to black but not bright yellow

23a Spores large, > 30 µm long; thallus typically white to cream or pinkish; hypothecium usually with a yellow layer in fresh material; thallus and or apothecia often C+R. — On many
substrates; widespread, common

23b Spores smaller, < 30 µm long; thallus color various; hypothecium rarely yellow; tissues
C+ or C-

24a Exciple and hypothecium dark; thallus white; apothecia black, often with a white false-
thalline margin; medulla I+; thallus K-. — On rock; uncommon

Porpidia speirea

24b Exciple and hypothecium not both dark, or if so, apothecia and spot tests not as above

25a Thallus white, K+Y (atranorin); disk black or dark brown
26a Hymenium violet to violet brown, ephymenium dark violet brown to violet black;
spores 9-15 x 5.5-8.0 µm; containing atranorin and alpha-collatolic, bourgeanic, and
aleuronic acids in various combinations; on rock and bark. — Common,
especially w Cascades

Tephromela atra

26b Hymenium pale or hyaline, ephymenium various; very common, especially on
bark and wood, but also on rock, soil, and moss

Lecanora

25b Thallus white or another color, but if white then K- or disk not black

27a Thallus brown, reddish brown, dark gray brown, or olive brown
28a Thallus thin, membranous, never lobate; on mosses and detritus on acidic soils;
exciple containing algae but externally often appearing lecideine; apothecia
brown; spores usually nonseptate but occasionally 1-septate. — Widespread,
subalpine to alpine, occasional in steppe

Bryonora

28b Thallus often fairly thick and ± marginally lobate; on rock or parasitic on rock
lichens; apothecia black, brown, or reddish brown; spores nonseptate

29a Thallus of small granular, umbilicate areoles, red brown above and black
below; apothecia small, to 0.3 mm diam, the disk red brown. — Spores 9-13
x 4-6 µm; on siliceous rock, mainly arctic-alpine s to Colorado and OP;
apparently uncommon

Euopsis granatina

29b Thallus of larger areoles and lobes; apothecia usually larger, variously
colored

30a Marginal lobes slight or lacking
31a Thallus with isidia or isidia-like structures, sometimes ± sorediate;
thallus containing gyrophoric acid, C+R, KC+R. — Thallus some
shade of brown; isidia 0.15-0.25 mm wide and to 0.5 mm tall,
usually with paler tips, or developing small (to 0.5 mm diam)
soralia; apothecia with swollen thalline margins, to 1.2 mm diam;
spores 15-25(30) x 10-13(14) µm; disk initially punctiform, later
broadening; on rock

Rimularia gibbosa

31b Thallus lacking isidia and soredia, C-, lacking gyrophoric acid, but
K+R (norstictic acid) or K-, often UV+ (lobaric acid). — On rock and
bark; fairly common and widespread

Protoparmelia

30b Marginal lobes distinct; not parasitic
32a Thallus K+Y to R, P+O; typically > 1 mm thick. — Thallus whitish
gray to brown or blackish; apothecia sunken to sessile; disk brown to
black; paraphyses moniliform; on rock and moss over rock;
widespread, fairly common in dry exposed habitats

Lobothallia

32b Thallus K- (protolichesterinic acid), less often with pannarin (P+
orange) or psoromic acid (P+Y), typically > 1 mm thick. —
Apothecia orange-brown, ± concolorous with the thallus; on rock;
common, especially in dry areas e Cascades s through Great Basin
and Sierra Nevada

**Lecanora pseudomellea**

27b Thallus another color

33a Thallus KC+R, C+R

34a Thallus with prominent marginal lobes; cephalodia pinkish or brownish, conspicuous. — Apothecia with true thalline margin; common on rock w Cascades

**Placopsis**

34b Thallus without prominent marginal lobes; cephalodia lacking

35a Areoles growing on a bed of dark filamentous algae (*Stigonema*); apothecia with a thalline margin. — Thallus contains gyrophoric acid; spores 23-31 x 9-14 µm; on siliceous rocks near the coast, usually exposed; coastal BC and Alaska;

**Placopsis roseonigra**

35b Areoles not intimately associated with *Stigonema*; apothecia with a pseudothalline margin. — Common on rock w Cascades

**Trapelia**

33b Thallus KC- or KC+Y; apothecia with a thalline margin

36a Disk C+ strong Y, densely white pruinose; growing on rock. — Thallus generally thick, whitish; on siliceous rock, widespread and common

**Lecanora rupicola** and **L. bicincta**

36b Disk C- or if C+ strong Y then growing on bark or wood

37a Epihymenium K+ violet; spores often 1-septate; on rock or moss over rock; apothecial margin often lecideine; disk black. — Rare, Colorado to e Oregon

**Calopla oblongula**

37b Epihymenium K-; substrate and spores various; apothecial margin generally clearly lecanorine; disk color various

38a Medulla with chalky texture; lower cortex absent; ascus tips K/IKI+B throughout, without a K/IKI- axial mass; thallus slightly to distinctly lobate, on calcareous soil — Locally common in calcareous regions

**Squamarina**

38b Medulla with a loose or cartilaginous texture; lower cortex often present in part; ascus tips K/IKI+B with a K/IKI- axial mass; substrate various, thallus lobate or not, but the lobate species most common on rock. — Widespread and common

1b Spores septate

39a Spores dark brown or dark gray at maturity

40a Spores 1-septate

41a Thallus marginally lobate, yellow-green, brown, or gray. — Widespread and common, mainly in dry habitats

41b Thallus not or only slightly lobate

**Dimelaena**

40b Spores multi-septate

42a Apothecia with a true thalline margin; spores multiseptate but not submuriform or muriform

**Rinodina**

42b Apothecia often with a false thalline margin’ spores submuriform, with a few longitudinal hyphae. — Thallus white to gray, areolate; disk black, pruinose or not; on bark or rock

**Buellia alboatra**

39b Spores hyaline at maturity, sometimes pale brownish when overmature
43a Spores polarilocular. — Apothecia often yellow, orange or red, K+ purple or red; widespread and common on many substrates

Caloplaca

43b Spores not polarilocular

44a Spores with one to many transverse septa but no longitudinal septa

45a Spores 150-200 µm long, 1 per ascus, fragmenting into two 1-celled spores. — Medulla C+R, K-, KC+R, P-; spores very thick walled; soredia often present; apothecia usually present, though often concealed by the soredia; on many substrates, but most often on acidic bark; widespread in PNW

Varicellaria rhodocarpa

45b Spores < 100 µm long, not fragmenting

46a On rotten wood, mosses, or soil

47a On rotten wood or mosses

48a Thallus greenish; apothecia large, pinkish, often short stalked, the thalline margin prominent or disappearing; spores 1-3 septate, 15-25 x 4-6 µm. — Thallus P+O, K+O, KC+O, C-, UV+ white (thamnolic and perlatolic acids); common in moist forests

Icmadophila ericetorum

48b Thallus whitish; apothecia minute (mostly 0.1-0.3 mm); thalline margin persistent; spores 1(3) septate, 11-21 x 4.5-7.5 µm. — On bark, rotting wood, and litter; subalpine; Alaska s to Idaho and w Montana

Anzina carneonivea

47b On soil

49a Thallus restricted to small triangular lobes surrounding the apothecia and formed from the exciple; disk brown to black; spores 1-septate, 8-15 x 4-5 µm. — Rare, dry areas in Alberta, BC, and Yukon

Gyalidea asteriscus

49b Thallus thin, membranous to granular, disk orange brown to paler and whitish; spores 3-septate, 12-24 x 5-9 µm. — On soil; arctic alpine in RM

Gyalecta foveolaris

46b On bark, wood, or rock

50a Apothecia bright red. — Soredia lacking; thallus thick, yellowish, on siliceous rock; subalpine to mainly alpine, occasional

Ophioparma

50b Apothecia tan to brownish or pale grayish

51a On rock; spores 3-septate

52a Thalline exciple present; photobiont chlorococcoid

Lecania nylanderiana and perhaps other Lecania spp.

52b Thalline exciple lacking but the ± immersed, concave apothecia may give the superficial appearance of a thalline exciple; photobiont Trentepohlia or Leptosira

53a Exciple black, carbonized; spores 25-31 x 4.5-5 µm. — Photobiont Trentepohlia; so far known only on serpentinite from the type locality in n California

Ramonia extensa

53b Exciple not carbonized; spores 12-16 x 5-7 µm. — Photobiont Leptosira-like; growing in damp shady places on siliceous rock; s BC

Gyalidea hyalinescens

51b On bark or wood; spore septation and habitat various

54a Thallus prominently isidiate, the isidia long and slender; spores becoming 3-5 septate, 35-50(65) x 5.5-7.5 µm. — On bark and wood; common w Cascades

Loxosporopsis corallifera

54b Thallus lacking isidia; spores various

55a Hypothecium dark brown

56a Thallus thin and sometimes endosubstratal, containing calcium oxalate crystals; apothecia with poorly developed or thick thalline margin; containing roccellie acid

Schismatomma

56b Thallus episubstratal, not containing calcium oxalate crystals; apothecia
with well-developed thalline margin; containing psoromic acid; rare; immediate coast

**Sigridea californica**

55b Hypothecium hyaline to at most pale brown

57a Apothecia minute (0.1-0.3 mm diam), ± sunken in the thallus. — Thallus whitish, thin; apothecia reddish yellow, flat to convex, with whitish thalline margin; epithecium and hypothecium nearly hyaline; spores 1(3) septate, 11-21 x 4.5-7.5 µm; subalpine

**Anzina carneonivea**

57b Apothecia larger or not immersed or both

58a Apothecia ± immersed to erumpent from the thallus

59a Spores 3- to 7-septate, 15-35 x 3.5-5 µm apothecial margin with a distinct proper exciple and ± a thin thalline-like exciple. — Thallus thin and superficial to ± immersed; disk reddish brown to orange, gelatinous; photobiont *Trentepohlia*; on hardwoods; se Alaska

**Gyalecta fagicola**

59b Spores hyaline, (30)35-50(55) x 7-10 µm, with (7)9-11(12) transverse septa; apothecia with a torn, irregular margin. — Apothecia 0.4-0.8 mm diam; thallus spot tests negative; on smooth-barked hardwoods in sheltered, damp sites; coastal BC to Oregon

**Thelotrema petractoides**

58b Apothecia otherwise

60a Spores distinctly constricted at the septum; paraphyses with dark swollen tips, K+ reddish violet. — Example: on *Populus* bark in central Montana, McCune 31518

Unknown genus and species

60b Spores not distinctly constricted; paraphyses various

61a Conidia bacilliform. — Spores 1-septate, with thick swollen perispore in K; only one species known so far in PNW, *H. viridescens*, which has minute punctiform dark green soralia and sorediate apothecial margins and is P+R (argopsin); known from coastal Washington and Oregon on *Alnus rubra* and *Salix*

**Halecania**

61b Conidia sickle-shaped or curved filiform. — Spores (0)1-3(7) septate; most common on *Populus* and *Salix* bark; widespread but rarely collected

**Lecania**

43b Spores muriform or submuriform

62b Spores persistently hyaline or pale brownish, submuriform or muriform

63a On bark or wood

64a Apothecia with a persistent prominent margin which arches over the disk. — Spores with a thick epispore 18-22 µm wide; thallus K-; on bark and wood, w Cascades

**Thelotrema lepadinum**

64b Apothecia with indistinct or poorly developed margin, immersed in the thallus, in one species soon eroding into soredia. — Thallus K+ Y to R; spores 25-45 µm wide; on bark or wood, sometimes overgrowing mosses on those substrates, rarely on rock; widespread

**Phlyctis**

63b On rock, soil, or moss over rock or soil

66a Thallus thick, white, cream, or gray, C+R, KC+R; on rock, soil, or moss in dry habitats. — Common

**Diploschistes**

66b Thallus thin, dirty white, gray, or pinkish tan, C-, KC-; substrate various

67a Hymenium and asci I+B; photobiont *Cystococcus* or *Leptosira*-like; on damp, shaded, calcareous rock, often along creeks. — Coastal BC to nw Montana

**Gyalecta jenensis**
Key I: CRUSTOSE LECIDEINE, NONSEPTATE SPORES

1a Spores thick-walled, medium-sized (> 12 µm long) to very large (> 40 µm long), hyaline or nearly so
2a Spores very large, > 40 µm long. — Apothecia black; thallus white to gray; very common, especially w Cascades, mainly on bark, rarely on rock

2b Spores medium-sized, < 30 µm long
3a Apothecia pale red brown to dark brown. — Thallus mid to dark brownish, more olive in deep shade; abundant on bark w Cascades, uncommon in RM

3b Apothecia black. — Thallus pale grayish brown to pale olive brown, often with punctiform convex brown soralia; spores (10)13-16(20) x (8)9-12(14) µm

1b Spores thin-walled, < 40 µm long, hyaline or dark
4a Spores many more than 8 per ascus, minute (generally < 6 µm long)
5a On bark or wood
6a Spores 16-24 per ascus; apothecia black. — Uncommon

6b Spores >24 per ascus; apothecia variously colored
7a Spores fusiform. — Apothecia whitish to dark greenish brown; asci Lecanora type with a tholus with a broad cylindrical "masse axiale"; paraphyses branched and interconnected; exciple poorly developed, similar to Scoliciosporum; spores 6-8(10) x 2 µm; New England and se Alaska (Spribille 2010, on Alnus)

Myrionora albidula

[A monotypic genus, the species formerly treated in Biatorella or Scoliciosporum. The species is similar in appearance to Micarea peliocarpa.]

7b Spores ± spherical
8a Exciple rudimentary, very thin to nearly absent; apothecia brown, black, or brightly colored. — Rarely collected

Strangospora and Piccolia

8b Exciple biatorine, poorly developed; apothecia pale yellowish or pinkish brown or whitish. — Infrequently collected; low elevation moist forests, especially on Populus trichocarpa

Biatoridium delitescens

5b On rock, soil, bryophytes, detritus, or decayed wood
9a Thallus areolate, distinct, dark to pale brown or gray; on rock. — Arctic-alpine to subalpine, very common

9b Thallus thin or obscure; substrate various
10a Apothecia and thallus citrine yellow. — On gypsum rock or soil; not yet known in N Am n of New Mexico
(Biatorella clauzadeana)

10b Apothecia and thallus not yellow
11a On soil, mosses, and decayed wood, apothecia pale brownish to light reddish brown; spores 6.5-8 x 2.5-3 µm
12a Apothecia with a narrow opening, perithecioid; exciple often yellow granular pruinose (LM)

Thelocarpon

12b Apothecia with an expanded opening
13a Apothecia convex, 1-2 mm wide, reddish yellow to red brown; ascus club-like, with a tholus. — On calcareous soils and mosses in rock cracks in sheltered habitats; apparently rare
Biatorella hemisphaerica

13b Apothecia concave or plane, 0.1-0.3 (0.5) mm wide, pale orangish tan; ascus cylindric thin-walled, without a tholus. — Widespread, rare, often on old fire sites; Montana, Oregon, e N Am
Sarcosagium campestre

11b On rock; apothecia entirely black or dark brown with black margin; spores 3-6 x 1-2 µm, larger (7-10 µm long) in one species
14a Apothecia < 0.5 mm; exciple swollen and convoluted, ± obscuring disc. — Widespread, occasional

Polysporina simplex

14b Apothecia ≥ 0.5 mm wide; exciple hardly raised, thin, not covering disc; often excluded.
— Widespread, occasional

Sarcogyne

4b Spores usually 8 per ascus, always < 16 per ascus, generally > 6 µm long
15a Spores dark, Buellia-like but non-septate or indistinctly 1-septate. — Thallus areolate; areoles blackish, shiny; spores 10-18 x 6-10 µm; epithecium brown, greenish brown, or green black; hypothecium brown, K+ violet; on noncalcareous rock; Arctic s to Oregon and New England
Orphniospora moriopsis

[See also Rimularia, with light brown spores when mature.]
15b Spores hyaline or pale (in a few cases light brown when mature or overmature)
16a Paraphyses free in water, ± simple; AND tholus generally I+ blue (Lecanora type)
17a Asci free standing among the paraphyses, not embedded in a hymenial gelatin; thallus not lichenized; on decaying leafy liverworts. — Apothecia whitish or blue green.

Mniaecia

17b Asci embedded in a somewhat coherent hymenium; thallus lichenized; substrate various, but rarely on leafy liverworts
18a Spores < 11 µm long; on calcareous rock. — Thallus not apparent or chinky and white; apothecia to 0.8 mm diam, black, shining; epithecium blue-green; exciple interior reddish brown; paraphyses readily separating in water, simple or sparingly branched, with swollen tips; arctic-alpine calciphile s to Colorado
Cephalophysis leucospila

18b Spores > 11 µm long; substrate various. — Very common on both bark and rock, less often on mosses or alpine sod; widespread

Lecidella

[Eiglera flavida with aspicilioid apothecia may key here. The apothecia begin immersed but eventually form a raised, dark proper exciple. Eiglera has a bright bluegreen epithecium and proper exciple edge, largish spores, and occurs on calcareous rock along streams or in dry stream beds and other damp habitats.]
16b Paraphyses coherent in water, simple or branched; OR tholus mostly I-, occasionally I+ blue, or tholus lacking
22a Exciple dark brown or reddish brown to black throughout or nearly so
23a On bark, wood, litter, or organic-rich soil
24a Spores spherical or nearly so; thallus brown to olive brown. — Infrequent
Schaereria dolodes

24b Spores ellipsoid to subglobose; thallus color various
25a Thallus dark brown, granular, areolate, or isidiate. — Epithecium, hypothecium, and exciple brown; spores 9-14 x 5-6 µm; common on peaty soils, occasionally on bark or wood

Placynthiella (in part)

25b Thallus pale gray to yellowish brown, areolate
26a Spores > 12 µm long; thallus pale grayish. — On conifer branches and cones; widespread, common on the immediate coast on Pinus, elsewhere infrequent

Lambiella

26b Spores < 12 µm long; thallus various
27a Exciple K-; — Epithymenium and exciple carbonized; spores 7-12 x 4-5 µm; on wood of conifers, BC, NWT, and Washington (Spribille & Björk 2008)

Lecidea scabridula

27 b Exciple K+ violet. Thallus pale gray to yellowish brown, pale yellowish green, pale greenish white, or grayish white, K+Y, P+Y (alectoriaic acid); hypothecium, lower hymenium, and exciple purplish brown to brown black, K+ violet; spores small (generally < 12 µm long); on conifer bark or wood; most common e Cascades

Pycnora

23b On rock or mossy rock, rarely on bark
31a Thallus parasitic on Lecanora rupicola group; thallus dark brown-black

Lambiella insularis

31b Thallus not parasitic on Lecanora rupicola group; thallus color various
32a Cephalodia present; spores often almond-shaped. — Common in coastal Alaska and BC to rare in Oregon

Amygdalaria

32b Cephalodia absent; spores various
33a Apothecia concentrically fissured (gyrose) or with a central sterile button. — Exciple dark brown, thallus brownish to gray, containing stictic ± norstictic acid or gyrophoric or psoromic acids or no lichen substances; widespread but infrequently collected

Rimularia

33b Apothecia not gyrose
34a Spores small (< 12 (14) µm long)
35a Exciple interior brown; spores subglobose to ellipsoid; exciple often contorted, gyrose, or umbonate; paraphyses branched and anastomosed

Rimularia and Lambiella; see key to Rimularia
35b Exciple interior pale brown to hyaline; spores ellipsoid or bean shaped; exciple edge circular to flexuose; paraphyses simple to sparingly branched. — Thallus some shade of brown, sometimes brownish-tinged white or gray; apothecia sessile or immersed; epithecium brown; exciple interior pale brown to hyaline; medulla mostly UV+, P- (divaricatic acid), less often UV-, P+R (fumarprotocetraric acid); on rock, except for one species on bark

Fuscidea

34b Spores medium to large (commonly > 12 µm long), ellipsoid; thallus white, tan, gray, gray-brown, greenish gray, or lacking; thallus not typically forming a mosaic
36a Thallus orange-brown, with blackening cracks and ± immersed black apothecia. — Hypothecium brown; spores 9-16 x 5-9 µm; medulla K-, C-, KC-, P-; on noncalcareous iron-rich rock; widespread

Tremolecia atrata

36b Thallus otherwise
37a On various rocks in various habitats; exciple often dark but seldom carbonaceous
38a Apothecia minute, 0.1-0.2 mm diam, embedded in the thallus,
externally nearly concolorous with the thallus and thus superficially barely recognizable as apothecia. — On damp siliceous rocks

*Rimularia actinostoma*

38b Apothecia typically > 0.2 mm diam, embedded or sessile on the thallus, usually darker than the thallus. — Thallus white, gray, greenish gray, or not apparent; apothecia black or dark reddish brown, pruinose in some species; ascus with an I+B tip with darker staining tube surrounding an unstained channel; epithecium usually dingy green, olive green, or brown; widespread, common, one of the most common lecideoid crusts on rock in shady to partly exposed habitats

*Porpidia*

37b On calcareous rock or moss over rock, mostly subalpine and alpine; exciple dark, sometimes carbonaceous

40a On moss over rock. — Thallus granular, whitish to pale gray brown or ash gray; apothecia turbinate or substipitate; spores 10-17 x 3-4.5 µm, 0(-1) septate; outer exciple greenish, dark purplish brown within; hypothecium dark purplish brown; true exciple well developed in young apothecia but becoming excluded; arctic-alpine; Alaska

*Helocarpon crassipes*

[Micarea incrassata and M. assimilata area similar but they have an indistinct exciple and cephalodia are present.]

40b On calcareous rock

41a Thallus white, distinct. — Spores 18-27 x 9-14 µm; epithecium green to black green; medulla I+B

*Farnoldia micropsis*

41b Thallus a trace of whitish or ochre white or absent

42a Spores 10-15 x 5-7 µm; hymenium 55-70 µm high; apothecia often sunken in rock. — Alpine; Colorado

*(Melanolecia transitoria)*

42b Spores 13-30 x 7-14 µm; hymenium 70-130 µm; apothecia sessile. — Epitheciunm blue green to olive or brown black; hypothecium thick, dark brown, often intensely blue-greenish in upper part; exciple and hypothecium K+ purplish; medulla I- to I+B; widespread

*Farnoldia jurana*

22b Exciple light colored in thin section or if dark then hyaline to brownish or blue-greenish translucent internally, in some cases exciple highly reduced; on all substrates

47a Apothecia orange, yellow orange, red, or reddish brown, in some species K+ purple; spores narrowly ellipsoid

48a On calcareous rock or alpine sod; apothecia orange. — Widespread, fairly common

*Protoblastenia*

48b On bark and wood; apothecia orange-red to red, deep red, or brownish red

49a Spores < 14 µm long and < 8 µm wide, thin walled; epithecium K+R or K-

50a Thallus a whitish stain on hard decorticate wood, not lichenized. — Disk brownish red; epithymenium red brown, granular, POL+, K+ deep Y or orangish red diffusion; exciple brownish, POL+, K+ reddish; hypothecium hyaline; spores ellipsoid, nonseptate, hyaline, 10-14 x 6-8 µm; common on hard snags in the Cascades, Coast Range, and near the coast

*Agyrium rufum*

50b Thallus thin or thick but lichenized

51a Epitheciunm K+R

*Ramboldia*

51a Epitheciunm K-

*Lecidea erythrophaea*

49b Spores 15-17 x 8-9 µm, thick walled; epithecium K- or brownish
Japewia carrollii

47b Apothecia usually brown, black, tan, beige, or whitish; spores commonly ellipsoid

52a Parasitic on Lecanora rupicola and L. bicincta; thallus dark brown, generally < 1 cm broad. — Spores 6-12 x 4.5-7.5 μm, subglobose to broadly ellipsoid; very common e Cascades, less common w Cascades

Lambiella insularis

52b Not parasitic on Lecanora rupicola group; thallus various

53a Thallus rust-brown, yellow-brown, dark brown or black

54a Hypothecium hyaline to pale brownish or grayish

56a Medulla I-, K+, P+O (miriquidic and stictic acids). — Thallus areolate, brown or dark brown, glossy, with a thick epinecral layer; apothecia dark brown black, to 2 mm diam; spores 12-17 x 4.5-6 μm; on siliceous rock; alpine, uncommon

Miriquidica garovaglii

56b Medullary spot tests otherwise

57a Thallus C+R, KC+R

58a Paraphyses delicate, branched, anastomosed (best seen in K); ascospores mostly > 15 μm long; ascus Trapelia type; apothecia with a thalloid veil in some spp. — Thallus variously colored, granular, areolate, verrucose, or squamulose; epithecium, hymenium, and hypothecium not all brown; exciple hyaline or pale brown; common and widespread on rock, soil, wood, moss, and plant detritus

Trapeliopsis and Trapelia

(Trapeliopsis is more or less squamulose and Trapelia is more strictly crustose. One common species of Trapelia on rock, T. involuta typically has a false thalline margin or thalline veil.)

58b Paraphyses simple or sparingly branched, anastomosed or not; spores mostly < 15 μm long (but larger in a few species); ascus Lecidea or Porpidia type; apothecia seldom with a thalloid veil

59a Spores 13-20(24) x (6)7-10(13) μm; asci Porpidia type (with an I+B tube in the tip)

Immersaria athroocarpa

59b Spores mostly < 13 μm long (to 17 μm long in one species); asci Lecidea type (outer coat I+B, apex thickened, apical dome I+ pale blue, with an I+B subapical ring)

Lecidea

57b Thallus C-

58a Exciple containing algae but externally appearing lecideine. Apothecia liver-brown, 1-3 mm diam; thallus red brown to dark gray brown, membranous; medulla K- or K+Y-R; spores 12-25 x 4.5-7 μm; on mosses and detritus on acidic soils; mainly subalpine to alpine, occasionally in steppe

Bryonora

58b Exciple lacking algae

59a Exciple turning under, becoming thin and reduced; asci Bacidia type.

— Paraphyses simple or sparingly branched, their tips with a dark hood; epithecium blue-green-black, continuous with the thin blue-green exciple edge; thallus substances variable, often containing one or more of: atranorin, usnic acid, stictic acid, and bourgeanic acid; arctic-alpine

Calvitimela

59b Exciple usually well developed; asci Lecidea type. — Paraphyses simple or sparingly branched, often with a dark tip; widespread, common

Lecidea and related genera (Fuscidea, etc.)

54b Hypothecium some shade of brown

70a Exciple brown, the edge dark brown; thallus bullate-areolate, brown to black
brown. — Thallus K+Y or R (stictic and/or norstictic acids, rarely with gyrophoric acid); medulla I-; epithecium brownish; spores 5.5-10 x 4.5-6 µm; disk flat, black, to 0.5 mm; arctic-alpine

**Lambiella impavida**

70b Exciple hyaline to pale brown, the edge various, much reduced in a few spp; thallus various

71a Thallus yellow-brown, pale brown, or orange brown, thick, with a well developed black hypothallus; exciple much reduced or essentially absent. — Hypothecium pale brown; cortex K+Y or O, KC+R, C-, P+Y or R (alectorialic, protocetraric, and ± roccellic acid; the only lecideoid species containing alectorialic acid); a facultative parasite as a juvenile on *Sporastatia testudinea*; subalpine to alpine, on siliceous rock

**Calvimitela armeniaca**

71b Thallus brown, rust brown, or black-brown; thin or thick; hypothallus present or not; exciple usually distinct

72a Paraphyses and asci easily separating in K; asci without apical dome (tholus). — Uncommon

**Schaereria**

72b Paraphyses and asci coherent; asci often with apical dome. — Widespread and common

**Lecidea**

53b Thallus lacking or some shade of white, gray, olive-gray, cream, or greenish

73a Hypothecium orange, brown, or darker

74a On rock or on lichens on rock

75a Thallus forming whitish gall-like warts on *Lecidea* or *Porpidia* on rock. — Apothecia common, black, often with a central umbo or with irregularly thickened exciple; arctic-alpine s to Colorado

**Cecidonia**

75b Thallus and substrate otherwise

76a Exciple black, carbonized; hymenium or at least upper hymenium bright blue green or emerald green. — Widespread but not often collected

**Carbonea**

76b Exciple brown or hyaline, not carbonized; hymenium various

77a Spores (5)8-11(12) x (1.5)2-3(4) µm; epithecium black-green; thallus often lacking or dispersed areolate, gray; inner exciple I+B. — Common on siliceous rock, especially granite, mainly in continental climates; widespread

**Lecidea (L. auriculata, L. promiscens, and related species)**

77b Spores (6)7-9(10) x (2)3-4(5) µm; epithecium dark blue green or green brown; thallus continuous, rimose areolate, or dispersed areolate on rock or grayish to inconspicuous on wood; inner exciple I-. — Paraphyses basally branched; exciple persistent, thin, ± raised; thallus and apothecia K-, C-, KC-, P-, UV-; uncommon on rock and wood w Cascades

**Leimonis erratica**

74b On other substrates

78a On soil, detritus, rotten wood, tree bases or bryophytes on those substrates

79a Thallus UV+ white (perlatolic acid); apothecia with a thin pale rim. — On decaying wood, burnt wood, or tree bases

**Hertelidea botryosa**

79b Thallus UV- (perlatolic acid lacking); apothecia without a thin pale raised edge

80a Hymenium often with scattered dark blue-black or green-black granules that are K+ green and weakly POL+; apothecia with or without an apparent margin; asci otherwise. — Widespread
**Lecidea berengeriana** group  
(see also key to *Mycobilimbia*)

80b Hymenium lacking dark K+ green granules; apothecia lacking an apparent margin; asci *Psora*-like, with a K/I+ B tholus and darkly staining tube. — Arctic-alpine, rare

**Protomicarea limosa**

78b On trees and shrubs  
81a Spores 13-16 x 6-7 μm; tips of paraphyses slightly clavate, olive brown pigmented. — On hardwood trees and shrubs, coastal BC s to Oregon

**Helocarpon lesdainii**

81b Spores 10-13 x 4-6 μm; tips of paraphyses not widened, hyaline. — Inner exciple and hypothecium brown to blackish brown. — On bark and wood; coastal states and provinces, rarely inland

**Lecidea albofuscescens**  
[Weakly pigmented or moribund forms of *Lecidella elaeochroma* may be confused with this.]

74b Hypothecium hyaline, grayish granular, pale bluegreen, or pale brownish  
82a Spores variously oblong or teardrop shaped and < 7 μm long; hymenium bluegreen; substrate sheltered soil, rock, roots, wood, or bark. — Widespread but seldom collected

82b Spores otherwise; hymenium various; substrate various  
85a On bark, wood, humus, or other organic substrates  
86a Thallus K+Y → R, white to gray, dirty-gray, or light tan. — Apothecia black, brown, tan, or mottled; spores 7-11 x 3-4 μm; thallus white to yellowish; occasional in moist forests e Cascades

**Psilolechia clavulifera**

86b Thallus K-  
87a Thallus distinct, C+R, KC+R, often sorediate, crustose to nearly squamulose; soredia when present often greenish or dark. — Widespread and common

**Lecanora cadubriae**

87b Thallus and spot tests various, but mostly C-; soredia sometimes present  
88a Thallus yellowish and/or rim of apothecia yellowish, containing usnic acid. — Widespread  
88b Thallus or rim of apothecia otherwise, not containing usnic acid  
89a Apothecia brown, tan, pinkish tan, yellowish, or nearly colorless  
90a Paraphyses branched and anastomosed; apothecia whitish; growing exclusively on the liverwort *Ptilidium*. — Spores 5.3-7.3 x 2.3–3.0 μm; PNW and Europe

**Puttea margaritella**

90b Paraphyses simple or sparingly branched; apothecia variously colored; substrate various  
91a Excipular hyphae densely branched and entangled, with apical cells slightly thickened and brown; ascus *Micarea* type. — Widespread

**Myochroidea**

91b Excipular hyphae weakly branched and radiating, with apical cells not thickened, hyaline; ascus *Biatora* type. — Widespread and common

**Biatora**

89b Apothecia dark brown, greenish black, bluish black, or black  
92a Spores minute, < 6 μm long; substrate conifer needles. — BC
and Montana

**Scoliciosporum abietinum**

92b Spores larger or substrate otherwise

93a Excipular hyphae densely branched and entangled, with apical cells slightly thickened and brown. — Ascus *Micarea* type; widespread

**Myochroidea**

93b Excipular hyphae weakly branched and radiating, with apical cells not thickened, hyaline

94a Ascus *Biatora* type. — Widespread and common

**Biatora** and **Lecidea**

94b Ascus *Porpidia* type. — Widespread

**Bryobilimbia**

85b On rock or soil, occasionally on moss over rock

95a Thallus K+Y \(\rightarrow\) R, white to gray, dirty-gray, or light tan; on rock

96a Thallus white to gray. — Widespread, fairly common in RM

**Lecidea lactea**

96b Thallus light brown or tan. — Occasional in RM

**Lecidea syncarpa**

95b Thallus K+Y or K- or thallus lacking; on rock, soil, or moss over rock

97a Thallus distinct, C+R, KC+R, often sorediate. — Thallus crustose to nearly squamulose; soredia when present often greenish or dark; widespread and common

**Trapeliopsis**

97b Thallus and spot tests various, but mostly C-, sorediate or not

98a Thallus yellowish and/or rim of apothecia yellowish, containing usnic acid

**Lecanora** spp, e.g. *L. stenotropa* and *L. polytropa*

[A few species of *Lecanora* lacking algae in the exciple may key here.]

98b Thallus or rim of apothecia otherwise, not containing usnic acid

99a Thallus grayish, dark blue gray, blackish, or blackish brown; apothecia immersed and often having a false thalline margin (appearing like an *Aspicilia*), black; on rock. — Habitat subalpine to alpine; infrequent

**Schaereria fuscocinerea**

99b Thallus otherwise or if dark colored then apothecia otherwise; substrate various

100a Apothecia not completely black when moist (brown to purplish black); tholus amyloid (I+B); on calcareous rock. — Rare in PNW

**Clauzadea**

100b Apothecia generally black or very dark brown, wet or dry; tholus mostly not amyloid; substrate various

101a Epiphyllum K+ violet; spores simple or occasionally 1-septate, oblong or narrowly ellipsoidal; on calcareous rock or *Grimmia* over rock. — Rare

**Caloplaca oblongula**

101b Epiphyllum K- or K+ another color; spores simple, various in size and shape; substrate various

102a Exciple K+ magenta or red from yellow crystals in exciple interior. — Epitheclum dark green to green black; exciple edge dark brown, pale within; hypothecium pale to dusky golden brown or dark
brown; spores 6-11 x 3-4.5 µm; apparently rare in PNW

Adelolecia pilati
102b Exciple K- or K+ brownish, greenish, purplish brown, or just slightly intensifying the coloration in water
103a Asci Teloschistes-type, with a thin, broad, I+B cap; apothecial and cortical pigments brown, N-, K- or K+ yellow brown; paraphyses mostly simple and ± free. — Common in coastal Alaska, decreasing s

Fuscidea
103b Asci usually otherwise; apothecial pigments often greenish, bluish, or purplish in water, K, or N; paraphyses often branched and coherent. — Widespread and common

Lecidea

Key J: CRUSTOSE LECIDEINE, SEPTATE SPORES

1a Spores dark when mature (brown, dark greenish, greenish black, or olive brown), occasionally hyaline but then spores with a gelatinous halo and thallus saxicolous

2a Thallus yellowish, parasitic on Baeomyces. — Apothecia black; epithecium olive brown; exciple and hypothecium dark brown; spores 9-17 x 6-10 µm; thallus P+Y to O, UV+O; widespread

Epilichen scabrosus

2b Thallus otherwise or not apparent

3a Spores usually with haloes; paraphyses branched and coherent; saxicolous. — Widespread, common

Rhizocarpon

3b Spores without haloes; paraphyses ± simple; saxicolous or corticolous

4a Thallus not lichenized, saprophytic on wood, bark, lichens, fungi, or bryophytes, or perhaps parasitic on lichens; upper part of exciple differentiated from the basal part in cell structure and cell size

Dactylospora

[Dactylospora has about 20 lichenicolous species, about 37 species total. It has ununicate asci with tips that have poorly developed I- caps and an outer I+ blue layer. Most species have transversely multisepate spores, but some are 1-septate or submuriform. For keys, see Lichenologist 34:361-368 (2002) and Bryologist 107:357-362 (2004).]

4b Thallus lichenized or parasitic on lichens; exciple otherwise

5a Spores submuriform or muriform; widespread, common, especially on bark in moist forests

Buellia in part, or Diplotomma according to some authors

Buellia fosteri

5b Spores 1-septate or 3-septate

6a Spore wall thin at the apices, otherwise unequally thickened such that the lumen of each locule appears ± pinched; on seashore driftwood and tree roots. — Thallus lacking to thick, gray, K+Y, P+ faint Y (diploicin and atranorin); apothecia dark brown to black, to 1.8 mm; spores 21-30 x 11-17 µm, often slightly curved; BC to Oregon

Buellia fosteri

6b Spores otherwise; habitat various. — Widespread and common

Buellia and Tetramelas (see Buellia key)

1b Spores hyaline, lacking haloes; corticolous or saxicolous

10a Spores polarilocular. — Thallus or apothecia K+ red or purple or, in species with a black disk, epithecium K+ purple or violet; widespread, common

Caloplaca

[In some species with brownish disks, e.g., C. obscurella, the epithecium is K-]
10b Spores thinly 1 septate, multisepate, or muriform (but not polarilocular)
11a Spores 1 septate (sometimes oil drops give a false impression of >1 septa)
12a Spores unequally 2-celled, one end broader than the other
13a Thallus parasitic in the hymenium of lichens. — Distribution and abundance poorly known

**Arthonia**

13b Thallus free living

14a Spores 10-15(17) x 3.5-7 \( \mu \text{m} \). — On conifer needles, small twigs, evergreen *Vaccinium* leaves, etc.; w Cascades in Oregon and n California

**Fellhanera bouteillei**

14b Spores 8-10.5 x 4-4.5 \( \mu \text{m} \). — On lignum

**Catillaria ersiboides**

12b Spores equally 2-celled or nearly so

15a Apothecia white, beige, pale yellowish, pinkish, or pale orangish, never blackening

16a Spores mostly < 4 \( \mu \text{m} \) wide

17a Photobiont *Trentepohlia*. — On tree bases and mossy trunks, rarely on mossy rock; widespread, occasional in moist forests

**Coenogonium**

including *Dimerella*

17b Photobiont chlorococcoid. — 1-septate spp not yet reported from PNW

**Absconditella**

16b Spores mostly > 4 \( \mu \text{m} \) wide

21a Apothecia large, often > 2 mm diam, pinkish. — Widespread, common in oceanic to suboceanic climates

**Icmadophila**

21b Apothecia smaller, < 2 mm diam, color various but not pink

22a On conifer needles and twigs; apothecia whitish, beige, or pale yellowish or pale orangish, hyaline in section; asci with amyloid dome with darker blue tubular ring structure; pycnidia inconspicuous, pale to brown. — Spores 1-septate, 9-15 x 3.5-6 \( \mu \text{m} \); spot tests negative; thallus whitish, beige, pale gray green, or ochraceous; widespread

**Fellhanera**

23b On bark and wood; apothecia pale or darkening; asci with I+B apical dome; pycnidia usually conspicuous and dark. — Moist forests, inland to w Montana

**Cliostomum**

15b Apothecia brown to black; or sometimes pale but blackening in part

28a Paraphyses branched and anastomosed; substrate siliceous rock, mosses, or detritus

29a On mosses or detritus; hypothecium reddish brown, at least in part; apothecia black, convex. — Widespread, common

**Micare**

29b On siliceous rock; apothecia pale brown to blue black. — QCI, BC

**Tylothallia biformigera**

28b Paraphyses mostly unbranched; substrate various

30a Thallus of convex areoles or squamules; apothecia black; on slightly to distinctly calcareous soil, rock, or other lichens, especially gelatinous cyanolichens. — Widespread, common

**Toninia**

(including *Kiliasia*)

30b Thallus various, but seldom of consistently convex areoles; apothecia brown, purplish black, or black; substrate various

31a Disk variously colored; apothecial section without bluegreen pigments; pycnidia often present. — Ascus tip with a completely amyloid tholus; paraphyses often with a strongly pigmented cap; on bark, wood or rock; widespread, occasional

**Catillaria** s.l.

(including *Catinaria*)

31b Disk purplish brown to black; epithecium or hypothecium or exciple green to blue green, K+ pure green, N+ purple red; pycnidia inconspicuous or lacking. — On bark, wood, or conifer needles, mainly in oceanic climates

**Megalaria**

11b Spores more than 1 septate (multiseptate or muriform)

35a Spores muriform
36a Apothecia with pseudothalline margins, urceolate; photobiont *Trentepohlia*; on rock
37a Hymenium and asci I+B. — Arctic-alpine; rare
37b Hymenium and asci I- or I+ orangish or red. — BC, rare

**Gyalecta**

36b Apothecia with only proper margin, urceolate or not; photobiont various; substrate various
38a On mosses and plant remains, usually on acid substrates
39a Spores 1(-2)/ascus, 50-140 x 20-50 µm

40a Apothecia black or dark brown, short stalked or sessile. — Arctic-alpine s to Alberta

40b Apothecia golden yellow or tinged olive black, short stalked or sessile. — Coastal Alaska s to BC

**Lopadium**

40b Spores 2-8/ascus, 9-40 µm long

**Gyalidea**

41a Apothecia tan, orange, brown, orangish, or pinkish tan; spores 9-30 µm long, submuriform to muriform; photobiont *Trentepohlia*. — Mostly arctic-alpine, uncommon
41b Apothecia black; spores 20-60 µm long, muriform; photobiont chlorococcoid. — Arctic-alpine; Alaska, BC, Colorado, rare

**Schadonia**

38b On bark, wood, or rock; spores 1 or 8/ascus
42a On rock. — Fairly common in coastal states and provinces

42b On bark or wood

43a Spores small, < 20 µm long. — Spores 8/ascus, hyaline; apothecia reddish(-black), < 1 mm wide; coastal states and provinces, rarely inland

43b Spores large, > 65 µm long

44a Apothecia red. — Spores (30)50-80 x 20-35 µm; moist low-elevation conifer forests, inland BC s to Montana and Idaho, w to the Cascades

44b Apothecia black

45a Thallus superficial, distinct; on bark and wood; clearly lichenized with chlorococcoid algae. — Thallus pale greenish gray to olive or brownish; spores 1/ascus, hyaline or pale brown; apothecia black, ± short-stalked; tips of paraphyses dark brown; exciple brown throughout, darker at edge; fairly common in moist conifer forests, especially w Cascades but also inland to w Montana

45b Thallus immersed, indistinct; on wood of conifers and *Arbutus*; perhaps not lichenized or loosely associated with *Trentepohlia*. — Spores 90-140(170) x 22-40 µm; apothecia dark brown to black, initially closed, becoming urceolate, the edge entire to dentate; true exciple black; rare; so far known only from Scotland and Oregon

**Xerotrema megalospora**

35b Spores only cross-septate, without lengthwise divisions

49a Spores 3-celled; asci subtly parasitic in the hymenium of *Lecidella* and some other saxicolous lichens. — Widespread

49b Spores otherwise, or if 3-celled then asci not parasitic on *Lecidella*

50a Asci often thick walled; paraphyses interwoven, netlike anastomosing; apothecia mostly black or with light-colored pruina; photobiont *Trentepohlia* (lecideoid Arthoniales)

**Subgroup J1**

50b Asci seldom thick walled; paraphyses anastomosing or not; apothecia black or not, pruinose or not; photobiont usually chlorococcoid (*Trentepohlia* in a few)
51a Spores fusiform (cigar- or banana-shaped), mostly < 5(9)-septate, the ends often ± blunt or broadly acute or with one end pointed

Subgroup J2

51b Spores long and narrow, often needle-like, straight or curled, often > 4 septate with pointed ends

Subgroup J3

Subgroup J1
Cross-septate Lecideoid Arthoniales

1a Spores frequently and characteristically fragmenting into part-spores. — Apothecia black, round, irregular, or stellate; exciple dark, carbonaceous; mainly tropical, but in w N Am from coastal Alaska to California

Bactrospora

1b Spores intact or occasionally fragmenting, not routinely broken

2a Exciple thick, with deep radiate cracks or crenate. — Spores 3-septate, often with a thin perispore; paraphyses weakly branched; on calcareous rock or acidic litter; rare

Sagiolechia

2a Exciple thick or thin but not deeply cracked or crenate

3a Spores 11-17 µm long, somewhat thick walled, the locules ± rounded; pycnidia immersed to subimmersed; paraphysoids simple to sparingly branched, not or little anastomosed; thallus white or greenish, continuous and smooth or indistinct; subhymenium hyaline; hypothecium blackish. — Spores ovate to fusiform, often wider at one end, 3-septate; on bark or wood, conifers or hardwoods, ne N Am, California, and sporadic n along the coast

Cresponea chloroconia

3b Spores >17 µm long, thin walled, the locules rectangular; pycnidia in protruding warts; paraphysoids irregularly branched, ± anastomosed; hypothecium dusky or dark

4a Spores 17-25 µm long, 3-septate. — On bark and wood; w Washington

Lecanographa amylacea

4b Spores > 25 µm long, 3- or more septate. — Mostly on bark or wood

Lecanactis

Subgroup J2
Multiseptate fusiform-spored crusts with proper exciple

1a Spores mostly non-septate. — Widespread and common

Biautora

1b Spores mostly septate

2a Spores < 3 µm wide

3a Spores 1.5-2 µm wide; disk yellow brown to dark brown; on bryophytes over soil. — Thallus membranous, weakly structured, with colonies of Gloeocystis (similar to Gloeocapsa in general appearance but a green alga); apothecia to 0.5 mm diam, initially immersed and closed, then opening to a deeply concave disk; disk yellow brown to reddish or rarely dark brown; spores 3-4 septate, 20-30 x 1.5-2 µm; Alaska, Michigan, and Europe

Bryophagus gloeocapsa

3b Spores 2-3 µm wide; disk black; on bark or wood. — Epithecium greenish black; spores 16-23 x 2.5 µm; thallus thin or disappearing

Bacidia circumspecta

2b Spores > 3 µm wide; apothecia black or otherwise

4a Proper exciple usually thin or reduced, poorly developed, or absent. — Paraphyses usually branched; photobiont green, often with paired cells ("micareoid"); apothecia white, gray, brown, bluish gray, or black; spores often variable in septation within a single apothecium; most often on wood, bark, or bryophytes; widespread and common

Micarea
36

[See *M. lignaria, M. peliocarpa, M. ternaria*, and *M. turfosa*]

4b Proper exciple usually distinct, though often turned under when apothecia are strongly convex

5a Spores mostly > 3-septate AND apothecia brown to black

6a Hypothecium dark brown or reddish brown

7a On noncalcareous rock; thallus some shade of brown. — Proper exciple concolorous with the disk; dark brown at edge, brown or mottled brown within; epithecium reddish brown to violet brown; hypothecium pale yellowish to red brown; spores transversely 5-7-septate, (17)35-48(50) x 4-7 µm, often curved and often narrowly pointed at one end; thallus K-, C-, P-, UV-; on exposed steep rock faces; Arctic to se Alaska and New England

*Ropalospora lugubris*

7b On moss or soil; thallus some shade of gray or white. — Widespread, occasional

*Bilimbia sabuletorum*

6b Hypothecium pale or hyaline

8a Spores 3-5-septate, 11-18 x 3-5 µm; epithecium brownish, purplish, or greenish; hypothecium pale; thallus greenish or gray green; on *Populus* and *Salix*. — Great Plains and boreal

*(Arthrosporum populorum)*

8b Spores 3-8 septate, 20-35 x 3-5 µm; epithecium pale to dark brown or blue green tinged; hypothecium pale; thallus dark greenish to blackish, granular; on many kinds of bark and wood — widespread, especially common in urban and suburban environments

*Scoliciosporum chlorococcum*

5b Spores mostly ≤ 3-septate OR apothecia brown, tan, yellowish, pink, orangish, or hyaline

9a Apothecia dark brown to black; on exposed siliceous rock in subalpine or alpine. — Thallus unusual for *Stereocaulon* in being crustose and lacking cephalodia; thallus white or dirty white, warty areolate (field appearance similar to a *Lecidella* or *Buellia*); exciple and hypothecium dark brown; spores 3(5-7) septate, often slightly constricted at septa when fresh; se Alaska to Oregon Cascades

*Stereocaulon nivale*

9b Apothecia pale (tan, orangish, pink, yellow, brown, nearly hyaline) or black; substrate or habitat otherwise

10a On damp, shaded, rock, or moss over rock

11a Spores 12-16(-24) x 5-7 µm, 3(4)-septate, occasionally with the middle cell divided lengthwise; apothecia pale tan to yellowish; with a pseudothalline margin; proper margin yellowish, becoming yellow brown or blackening; thallus gray, thin, membranous continuous to cracked and granular. — On damp siliceous rock; BC

*Gyalidea hyalinescens*

11b Spores 15-22 x 3-4.5 µm, 3-septate; apothecia pale orange, broad; thallus thin, continuous to occasionally granulose. — On rock or mossy rock in damp, shaded overhangs; BC

*Gyalecta friesii*

10b Habitat otherwise; spores various; thallus usually thicker, membranous or granular or subareolate

12a Apothecia pink, large, constricted at the base or short stalked; thalline margin often present; thallus greenish; on rotten wood. — Spores 13-27 x 4-6 µm, 1-3-septate; widespread, common in moist conifer forests

*Icmadophila ericetorum*

12b Apothecia and thallus not as above; substrate various

13a Exciple composed of loosely tangled hyphae (visible at least in K), the surface sometimes tomentose. — Spores 3-septate, 12-18 x 3-5 µm; hypothecium dark brown; apothecia brownish to almost black, usually with a bluish tinge; exciple persistent and paler than the disk; n California to BC; on *Alnus rubra* and *Picea sitchensis*

*Byssoloma*

13b Exciple of radiating hyphae in a gelatinous matrix

14a Disk milky gray to dark gray or pure black. — Epithecium greenish or blue green, POL+; hypothecium hyaline; exciple thin, hyaline; spores mostly 3-septate, averaging 15-23 x 3-6 µm; fairly common in a wide range of habitats, w Cascades

*Micarea peliocarpa*

[see *Micarea cinerea* is similar but has 7-septate spores. Both have epithecium and...
exciple POL+ and C+ pink.]
14b Disk some shade of beige, brown, orangish, whitish, or yellowish
15a Disk minute (mostly < 0.25 mm diam), flat, urceolate, or concave
16a Ascus wall I+B and thin throughout, the tip not noticeably differentiated; spores ≥ 16 per ascus; apothecia minute to small; photobiont Trentepohlia. — On bark; rarely collected

_Gyalecta fagicola_

16b Ascus wall I- or rarely bluish, with an apical dome; spores 8 per ascus; apothecia minute to small; photobiont chlorococcoid. — On wood, rock, soil, or moribund mosses or lichens, sometimes where heavy metals have accumulated

_Absconditella_

15b Disk minute or larger, becoming convex
16a Apothecia arising as an appressed cushion of tissue, remaining appressed or eventually ± constricted at the base. — Widespread, common

_Biatora_

16b Apothecia arising as a subspherical to spherical projection from the thallus, very soon constricted at the base to substipitate. — Widespread, common

_Mycobilimbia_

[See also _Waynea californica_: thallus squamulose, olive-green to brown green; spores 3-septate, 13-19 x 3-4 µm; soralia developing; on trees; California, rarely to BC.]

**Subgroup J3**

Multiseptate needle-spored crusts with proper exciplex

1a Paraphyses anastomosing; spores curled, curved, or sigmoid; exciple reduced. — Apothecia light to dark brown or black; on bark, wood, rock, metal, etc.; widespread and common

_Scoliciosporum_

1b Paraphyses not anastomosing; spores straight, sigmoid, or spiraled; exciple usually well developed (LM)
2a Hypophores present, black, forming a flange with lateral projections; apothecia brown black to red brown, pale and translucent when wet, to 0.6 mm diam. — Spores 48-55 x 2-3 µm, 15-20-septate; on mossy trunks or rocks in damp microsites, including the supralittoral zone; BC

_Gyalideopsis muscicola_

2b Hypophores lacking; apothecia various
3a On seacoast rocks
   4a Spores 3-5 septate, 32-48 x 1.5-2 µm; thallus granulose isidiate; apothecia light brown to dark reddish brown, usually sparse or absent. — On shady coastal rocks, BC

_Bacidia scopulicola_

4b Spores 0-3-septate, 22-25(30) x 2.5-3(4.5) µm; thallus cracked areolate; apothecia black, common. — Pycnidia common; se Alaska s to Oregon

_Herteliana alaskensis_

3b Substrate otherwise
5a Apothecia black or nearly so
   6a Thallus yellow to yellowish green; on soil, mosses, and detritus. — Widespread; fairly common

_Arthrorrhaphis_

6b Thallus white to gray or greenish, on bark or rock
   7a Thallus whitish or some shade of gray; spores often > 35 µm long, needle-like, straight to strongly spiraled; apothecia brown, tan, orange, or black; on bark, rock, or soil. — Widespread, common

_Bacidia_

7b Thallus usually dark green, gray, or gray green; spores < 35 µm long, banana shaped or ± straight; apothecia black to brownish; on bark or rock. — Widespread, common

37
Scoliciosporum

5b Apothecia brown, red, orange, pinkish, yellowish, or paler
   8a Spores extremely long, to 350 x 1-2.5 µm or even longer; apothecia deeply sunken, rough-edged craters containing a yellowish or brown disk. — Not lichenized

Stictis

8b Spores < 100 µm long; apothecia various but never deeply sunken in a rough-edged crater
   9a Apothecia deep red, with distinct, paler margin. — Thallus cream, pale yellowish, or yellowish green, of roundish corticate granules; epithecium K+ intense blue then violet; mainly on wood; uncommon in moist conifer forests

Ophioparma rubricosa

9b Apothecia tan, orange, brown, or darkening
   10a Spores 30-35(42) x 3-4.5 µm; paraphyses much branched and anastomosed. — Thallus pale greenish gray or gray, thin; exciple hyaline; hypothecium brown, K-; commonly seen without apothecia but with groups of pycnidia, the pycnidia about 200 µm diam and to 300 µm tall, globose to elongate; conidia filiform, to 45(65) µm long; on bark or bryophytes or lichens over bark, especially on Alnus rubra at low elevations; Washington

Fellhaneropsis vezdae

10b Spores various; paraphyses simple or nearly so
   11a Apothecia tiny, pale, deeply concave; on bryophytes over soil. — se Alaska

Bryophagus gloeocapsa

11b Apothecia otherwise; substrate various. — Widespread, fairly common, especially w Cascades

Bacidia and Bacidina

Key K: CRUSTOSE, STERILE; ORANGE, YELLOW

1a Thallus K+ cinnamon brown, violet, violet blue, or purple-red; sorediate
   2a Thallus K+ cinnamon brown or orange brown. — Thallus dispersed to almost continuous, consisting of yolk yellow heaped or branched granules, which sometimes develop into deeply concave soralia up to 1 mm broad and concolorous with the thallus, crater-like; lobes very short, rounded and lifting from the substrate; on soil, mosses, and loosely attached to noncalcareous rocks; apparently rare in RM and intermountain valleys

Lecanora reagens

2b Thallus yellow to yellow-orange, K+ purple-red or violet blue
   3a On calcareous soil
      4a Soredia present on upraised thallus margins or laminal; thallus unlobed except in the largest specimens. — Widespread, common

Caloplaca erichansenii

   4b Thallus esorediate, becoming lobed. — Apothecia often present; spores one-celled; widespread and fairly common on soil; exposed habitats; w and Arctic N Am

Gyalolechia (formerly in Fulgensia)

3b On another substrate
   5a Thallus wholly a leprose crust; on bark
      6a Thallus K+ purple or red, always completely leprose; apothecia never present. — Fairly common w Cascades

Caloplaca citrina

   6b Thallus K+ violet blue, areolate to completely leprose; apothecia fairly common, the margin sorediate. — On deciduous trees; widespread but rarely collected

Caloplaca chlorina

5b Thallus corticate at least in part; substrate various
   7a Thallus minutely foliose or fruticose. — Widespread, common

Xanthoria

7b Thallus crustose. — Widespread, common
**Caloplaca**

1b Thallus K- or K+Y or O
   9a Thallus vibrant lemon yellow to yellow green
      10a Thallus UV-
         11a Thallus P+O; soralia yellowish green. — On shaded, sheltered bark in humid sites, oceanic to suboceanic forests

**Cliostomum flavidulum**

11b Thallus P-; soralia bright yellow to yellow green or vivid green. — Soralia developing from and often replacing the grayish thallus; thallus P-, K±Y (atranorin, planaic acid, and usnic acid in soralia); on plant detritus, wood, and acid rock; few reports from the PNW

**Mycoblastus alpinus**

10b Thallus weakly to strongly longwave UV+ yellow, orange, or red brown
   12a Thallus squamulose or areolate
      13a On sheltered rock, areoles soon producing soredia
         14a Areoles highly convex, the upper surface bursting into soralia; thallus containing epanorin, rhizocarpic acid, and zeorin. — On steep sheltered faces of iron-rich rock; widespread but rarely collected, probably overlooked

**Lecanora epanora**

14b Thallus leprose granular to granular areolate; thallus containing rhizocarpic acid. — Thallus often completely dissolving into soredia; apothecia uncommon, biatorine; disk pale yellowish or tan; on sheltered rock, soil, and roots; widespread

**Psilolechia lucida**

[Sterile *Arthrorhaphis citrinella* can be similar, but *P. lucida* is more diffuse and powdery overall, and more directly saxicolous, while *A. citrinella* forms small dense colonies, usually on moss over rock.]

13b On soil; areoles or squamules esorediate. — Apothecia frequent, lecanorine; disk brown; spores minute, many per ascus; widespread, fairly common

**Acarospora schleicheri**

12b Thallus granular or completely leprose; spores > 4 x 2 µm
   15a Thallus usually in small patches
      16a On bark or wood; thallus granular — On bark and wood; widespread, fairly common

**Chaenotheca chrysocephala**

16b On soil or moss over rock; thallus areolate or often dissolving into soredia. — Spores multiseptate, borne in black apothecia; widespread; fairly common

**Arthrorhaphis**

15b Thallus usually extensive, completely leprose
   17a Thallus dull yellowish; substrate bark or wood. — Thallus UV+O

**Pyrrhospora quernea**

17b Thallus bright yellow or yellow green; substrate various
   18a Thallus bright yellow or fluorescent yellow with a greenish tint; containing calycin, vulpinic, or pinastric acids; rhizocarpic acid lacking
      19a Thallus containing vulpinic acid. — Producing tiny stalked mazaeidia; widespread

**Chaenotheca chrysocephala.**

19b Thallus containing calycin or pinastric acid or calycin + vulpinic acid. — Widespread and common

**Chrysothrix**

18b Thallus vibrant yellow-green; containing rhizocarpic acid or vulpinic acid
   20a Spores borne in a stalked mazaeidium; thallus UV+ Y or pale O, containing vulpinic acid and pulvinic acid; spores nonseptate, 2.5-5 µm; photobiont *Stichococcus*. — On acidic soil and tree roots in sheltered microsites; widespread, common

**Chaenotheca furfuracea**

20b Spores borne in an apothecium, 4-6 x 2-2.5 µm; thallus UV+O or red-orange, containing rhizocarpic acid; photobiont usually *Trebouxia*-like, rarely *Stichococcus*. — On sheltered rock and soil; circumpolar s at least to Oregon, Idaho, and Montana

**Psilolechia lucida**

39
[Sometimes indistinguishable by eye from *Chaenotheca furfuracea* when sterile]

9b Thallus pale yellow, yellow, or deep yellow, long-wave UV-27a On soil, plant detritus, or moss. — Widespread and common

27b On bark or wood (rarely rock)

28a Thallus granular isidiate to isidiate, pale yellow or greenish yellow

29a Propagules are gray green to yellow green coralloid granules; esorediate. — On deciduous trees with nutrient-rich bark; uncommon w Cascades

29b Propagules are pale yellowish isidia on a continuous to rimose-cracked thallus. — On bark or rock, coastal Alaska s to Washington Cascades

*Candelariella*

28b Thallus otherwise

30a Thallus yellow to deep yellow, generally corticate at least in part. — Widespread, common

30b Thallus pale yellow to yellow green, sorediate

31a Pycnidia present, black, irregular, 0.2-0.6 mm diameter. — Thallus pale yellowish, yellowish white, or pale greenish yellow, granular or scurfy; thallus K+Y, P+ pale Y, C- (atranorin and caperatic acid); apothecia pale yellowish to brownish; on conifer bark; coastal states and provinces inland to Montana

31b Pycnidia lacking or inconspicuous

32a Thallus thin and chinky or becoming entirely sorediate, pale yellow gray to yellow-green; C+ orange (usnic and thiophanic acids, zeorin). — On smooth bark and wood, especially driftwood on the coast, also inland on fences and conifers

32b Thallus entirely sorediate, C- or C+ orange

33a Thallus dull yellow, with a blackish delimiting prothallus; K+ orange-yellow or K+R in spots (incipient apothecia), P- or somewhat yellow (containing isoarthothelin and thiophanic acid), UV+ orange. — On bark and wood; California to BC, mainly near the coast, often in exposed sites

*Pyrrhospora quernea*

33b Thallus yellow green to sulfur yellow (usnic acid), with a white cottony prothallus, K+Y, P+Y (also containing atranorin, porphyrilic acid, and zeorin). — On rock, walls, and bark; not yet reported from N Am

*(Haematomma ochroleucum var. ochroleucum)*

**Key L: CRUSTOSE, STERILE, CYANOLICHENS**

1a Thallus with elongate fan-tipped lobes

See *Placynthium, Steineropsis*, and *Vestergrenopsis*, stratified cyanolichen key

1a Thallus squamulose or leprose, without elongate lobes

*Fuscopannaria*

**Key M: LEPROSE OR ECORTICATE CRUSTS, NOT YELLOW-ORANGE**

Green photobiont; leprose or completely ecorticate thallus

Morphological difference among most of the species are so subtle that TLC is essential for confident identification.

1a Thallus with granules organized into weak to distinct marginal lobes. — Widespread and common

*Lepraria*
1b Thallus not at all lobate
   2a Thallus producing white sporodochia with masses of conidia, otherwise thallus indistinct but containing chlorococcoid algae. — On bark, BC and se Alaska

   Cheiromycina

2b Thallus leprose, lacking sporodochia
   3a Thallus P+O or R
   4a Thallus K+Y or K+R

   5a Thammolic acid present; thallus K+ deep Y, P+ deep O

   6a Thallus minutely fruticose, at least in some places, though the leprose granules are often confluent and not obviously differentiated into a stalk. — Thallus typically only a few mm tall, whitish, containing atranorin and thammolic acid in the most common chemotype

   Lepraria subalbicans

6b Thallus truly leprose

   Lepraria

5b Thammolic acid absent; thallus K+ weak or strong Y, P+O or R

   7a Thallus containing oxypannaric acid (or 4-oxypannaric acid and 4-oxypannaric acid 2-methyl ester); C+Y or C-, K- to K+Y or O, P+ brownish red

   Lepraria diffusa

   7b Thallus lacking oxypannaric acid; C-, K- or K+, P+O or P+R

   8a Thallus yellowish green. — Thallus P+Y to R (fumarprotocetraric acid + atranorin); apothecia occasional yellowish or often darkening with gray mottles to nearly black; common on conifer trunks w Cascades

   Cliostomum flavidulum

   8b Thallus whitish, grayish, or greenish gray

   Lepraria

3b Thallus K-

   9a Thallus bluegreen or bluish gray, similar in color to Fuscopannaria cyanolepra. — On soil and soil over rock; California to s Oregon

   Leprocaulon adhaerens and L. santamonicae

   9b Thallus some shade of white, cream, or gray

   10a Thallus truly leprose; apothecia never found

   Lepraria

   10b Thallus often with confluent soralia but not truly leprose; apothecia sometimes present

   11a Thallus and soralia intense but pale green, forming small patches on conifer bark; common in mountains w Cascades — Thallus P+Y to R (fumarprotocetraric acid); on conifers

   Cliostomum flavidulum

   11b Thallus and soralia dull greenish gray; common in large cities. — Apothecia with sorediate margins often present; thallus P+R (fumarprotocetraric acid); on bark, wood, rock, rubber, etc. in cities and polluted areas

   Lecanora conizaeoides

3b Thallus P- or P+Y

   14a Thallus K+Y

   15a Thallus P+ pale Y or P-, KC- (atranorin)

   16a Thallus pale yellowish or yellowish gray. — Oceanic to suboceanic, occasional

   Cliostomum leprosum s.l.

   16b Thallus some shade of white, greenish, grayish, or bluish gray. — Widespread and common

   Lepraria

   15b Thallus P+Y, KC+ reddish orange (alectorialic acid). — Widespread and common

   Lepraria

14b Thallus K-

   17a Thallus UV+ bluish white or UV+O.

   18a Thallus UV+ bluish white. — Thallus dull greenish gray, usually bluish tinged, rarely brownish orange; granules to 0.1 mm diam; thallus with divaricatic acid and zeorin, traces of nordivaricatic acid; P-, rarely K+ purple when an anthraquinone pigment is present, C= pink, KC+ pink; on shaded bark, rarely on noncalcareous rock; w N Am, primarily coastal states and provinces
18b Thallus UV+ orange or orange red. — Coastal

Micarea xanthonica

17b Thallus UV-
19a Thallus P+Y, containing psoromic acid. — Widespread and common chemotype of Lepraria neglecta

19b Thallus P-, psoromic acid lacking
20a Thallus containing usnic acid (though yellowish tint often very subtle) — On rock; common w Cascades

Lepraria pacifica

20b Thallus lacking usnic acid
21a Thallus C+ rose or violet-tinged pink (gyrophoric and/or 5-0-methylhiascic acid); on bark and wood

Biotora aureolepra, B. chrysantha, & B. chrysanthoides
[Also giving a C+R reaction, reported from Arizona (Tønsberg 2004) and California (Kocourkova et al. 2008) is Lepraria lecanorica Tønsberg. It contains lecanoric acid.]
21b Thallus C-. — Thallus bluish green, changing to pale greenish gray in the herbarium; on rock and moss in sheltered sites; widespread

Botryolepraria lesdainii

Key N: OTHER STERILE CRUSTS ON BARK OR WOOD
OR ON BRYOPHYTES OVER BARK OR WOOD

1a Pycnidia raised, black, barrel-shaped. — Pycnidia black or white pruinose, with extruding white pycnospores (like a frothy mug); pycnospores banana shaped or ellipsoidal, one or both ends often pointed, 12-16 x 2-3.5 µm; thallus thin, whitish gray; on sheltered bark of conifers; BC to Oregon, w Cascades

Lecanactis megaspora

[Many Micarea species also have prominent raised pycnidia, often with pale tips]
1b Pycnidia lacking or if present then ± immersed
2a Thallus blackish brown or brown
3a Thallus of minute, brown coralloid granules or isidia; esorediate. — Usually on wood, bark, or soil; widespread, common

Placynthiella

3b Thallus ± areolate with discrete soralia
4a Soralia orange-yellow when fresh, fading to cream in herbarium, punctiform; containing gyrophoric acid. — On Alnus near coast; Washington

Opegrapha sorediifera

4b Soralia yellow, brown, or greenish, discrete or confluent; with or without gyrophoric acid
5a Medulla UV+ bluish white (thallus usually greenish in shade but dark brown in exposed sites)
6a Soralia whitish to brown. — Very common on hardwood trees and shrubs w Cascades

Rinodina disjuncta

6b Soralia yellowish to brown. — On bark; see below

lobaric acid chemotype of Japewia subaurifera

5b Medulla UV-
7a Soralia often of mixed yellow-brown and brown granules; soralia almost discrete or sometimes becoming confluent; thallus often KC+ flash yellow or orange (secalonic acid and derivatives, eumitrin); otherwise spot tests negative. — Thallus brown, greenish brown, or greenish in deep shade, of discrete to somewhat fused areoles; fairly common in moist conifer forests, Coast Ranges inland to c Montana

Japewia subaurifera

7b Soralia dark brown but abrading to green; soralia C+R, KC+R (gyrophoric, 5-O-methylhiasic and ± lecanoric acids). — Spores broadly ellipsoid to subglobose, 13-16 x 9-12 µm, with a gelatinous epispore; on Alnus and Betula; Alaska to California, BC and Montana
Schaereria corticola

2b Thallus some shade of gray, white, dirty white, greenish, yellowish, or olive gray or in some cases thallus not apparent (greenish brown thalli should be tried both here and the opposing lead)

9a Thallus isidiate

10a Isidia (thallus granules) roundish

11a Thallus yellowish to cream; thallus UV+. — On wood (usually) or bark; coastal states and provinces inland to Montana

Ophioparma rubricosa

11b Thallus dark to pale gray green, bluish gray, or gray brown; thallus UV-

12a Thallus P- or P+ pale Y, K- or K+ pale Y

13a Thallus K-, P-, KC- (thallus granules often K+ violet under LM, but appearing K- with usual method). — Thallus dark gray or bluish gray; most often on Populus bark, also on conifers and other trees and shrubs; widespread

Rinodina colobina

13b Thallus K+ pale Y or K-, P- or pale Y, KC- (atranorin, sometimes only a trace). — on hardwoods, less often on conifers; rare in PNW

Bacidia rubella

12b Thallus P+O or R, K- or K+R

14a Thallus K+R (norstictic acid). — On old wood and mossy rock in dry climates

Sagedia mastrucata

14b Thallus K-. — Thallus of separate to heaped corticate granules, the granules bursting or eroding to produce greenish soredia; thallus P+R (argopsin), KC+R (gyrophoric acid), K-, UV-; not yet known from PNW

(Micarea leprosula)

10b Isidia cylindrical; thallus white to gray or yellowish

15a Isidia very fine (< 0.2 mm diam) and long (up to 2 mm long). — Thallus K-, P-, C-, UV+ white (divaricatic acid); fairly common on bark mainly on the immediate coast, also in the Coast Range, Alaska to Oregon

Loxosporopsis corallifera

15b Isidia mostly > 0.2 mm diam, short or long; or isidia < 0.2 mm diam but short and granular

Pertusaria, and Caloplaca

[Several isidiate species of Caloplaca may key here when sterile, including C. chlorina (on bark or rock, isidiate or lobulate to ± bluish sorediate) and C. furfuracea (on bark; isidia short, granular, gray).]

9b Thallus sorediate (or blastidiate)

17a Soralia elongate-linear or elliptical; thallus ± immersed within substrate

18a Thallus P- or P+ weak Y, containing gyrophoric or placodiolic acid

19a Thallus K-, P-, C+R, KC+R (gyrophoric acid). — Soralia elliptical or round; rare but locally abundant in humid coastal areas, mostly on Alnus but also on conifers and shrubs; BC and Washington

Opegrapha fumosa

19b Thallus K+Y, P- or weak Y, C-, KC- (atranorin and placodiolic acid). — Soralia discrete, rounded to ellipsoid, flat to crateriform, often distinctly bluish; on hard and smooth wood of conifers; w Montana and BC, infrequent

Buellia arborea

18b Thallus K-, K+Y, or K+R P+Y, O or R, C-, KC- (stictic, norstictic, or fumarprotocetraric acid)

20a Soralia pale cream gray to ash gray or dark bluish gray. — Thallus containing atranorin, norstictic acid, ± stictic acid group; soralia K+Y or K+R, sometimes weakly so, P+Y, O, or R; soralia pale yellowish when abraded (when strongly yellowish pigmented then C+O, UV+O); widespread but infrequently collected

Buellia griseovirens

20b Soralia cream, brown, pale greenish, or pale yellowish green. — Thallus containing fumarprotocetraric or stictic acid; soralia K-, K+Y, or K+ brownish, P+ deep Y, O, or R; widespread and common

Xylographa

17b Soralia ± roundish or diffuse; thallus conspicuous
22a Thallus grayish to dark gray or dark gray green; soredia C+R, KC+R
   23a Soralia P+R (argopsin). — Not yet known from PNW
      (Micarea leprosula)

23b Soralia P-. — Soralia cream, brownish, greenish, or dark gray green; on detritus, mosses, soil, rotten wood or on hard wood; widespread and common

   Trapeliopsis

22b Thallus not dark gray, or if dark gray, then soredia C-; on bark or wood
   25a Thallus KC+ instantly rose-violet, K- or dingy brownish, P±R (picrolichenic acid, with or without protocetraric acid), giving a distinctive bitter taste with a touch of the tongue (often with a delayed reaction of 15 seconds or more). — Common w Cascades, rare inland to w Montana
      Variolaria amara

   25b Thallus spot tests in some other combination; thallus without strong bitter taste
      Group N1

   26a Thallus K+Y or K+R

   26b Thallus K- or faintly K+Y or K+ brownish
      27a Thallus or soredia KC+R, C+R, P-
         Group N2

      27b Thallus and soredia KC- or KC+Y, C-
         28a Thallus or soredia P+Y to O or R (fumarprotocetraric acid, protocetraric acid, argopsin, or pannarin)
            Group N3

         28b Thallus and soredia P- or faintly P+Y
            29a Thallus or medulla UV+ blue white (perlatolic acid, sphaerophorin, alectoronic, or lobaric acid) or UV+ pink
               Group N4

            29b Thallus and medulla UV- or weak yellowish
               Group N5

   Group N1
   Thallus K+Y or K+R

1a Cephalodia to 1 mm diam, dark pink to gray, irregular or hemispherical, sometimes becoming constricted at base.
   — Thallus creamy to pale yellowish or greenish white; soredia cream to orangish or pinkish; soralia K+ deep Y to O (stictic acid), KC- or still Y, P+Y, UV- or UV+ weak whitish; common on conifers and hardwoods on the immediate coast
      Coccotrema

1b Cephalodia absent
   2a Thallus K+Y to O or R, P+Y or O (norstictic, stictic, or thamnolic acid)
      3a On mossy bark or mossy rotten wood; thallus greenish with concolorous soredia, P+O, K+O, KC+O, C-, UV+ white (thamnolic and perlatolic acids). — Usually fertile but sometimes seen sterile; widespread, common in oceanic to suboceanic forests
         Icmadophila ericetorum

      3b On bark or wood; thallus another color or with contrasting soredia; thallus K+ deep Y to O or R (norstictic and/or stictic acid or thamnolic acid), P+Y or O, KC-, C-, UV-
         4a Thallus indistinct to sparsely areolate, with discrete pale green to grayish or grayish blue soralia. — Thallus containing atranorin, chloroatranorin, zeorin, and stictic acids; on deciduous trees and shrubs at low elevations w Cascades
            Rinodina stictica

            [Xylographa vitiligo may key here if the soralia are not particularly elongate. It commonly develops blue-gray soralia from a barely apparent thallus and contains stictic acid.]

   4b Thallus definite, white, cream, or gray; soralia large, scattered or confluent, granular or powdery, whitish, gray, or yellowish soredia
      5a Thallus K+Y to R (norstictic acid)
6a Soralia dark bluish gray, contrasting with the whitish gray, pale greenish gray, or pale brownish gray thallus. — Prothallus indistinct or distinct and brownish or bluish; on bark and wood; widespread but infrequently collected

**Buellia griseovirens**

6b Soralia pale greenish white, pale yellowish white, or grayish, similar in color to the thallus

7a Soredia powdery to granular; soralia pale greenish white to yellowish white. — Soralia roundish, elongate, or irregular; prothallus white, distinct; mainly on hardwood trees and shrubs; common

**Phlyctis argena**

7b Soredia coarsely granular; soralia grayish or whitish gray. — Although usually on moss over rock, rock, or plant detritus over rock, this species occasionally appears on wood in dry habitats; widespread

**Aspicilia mastrucata**

5b Thallus K+ deep Y to O (stictic or thamnolic acid)

8a Thallus K+ deep Y (thamnolic and elatinic acids); soralia forming powdery mounds or becoming confluent, very pale yellowish green, yellowish, or yellowish gray; cephalodia lacking. — Thallus thin and continuous or becoming warty, pale gray or whitish; se Alaska to Oregon; on bark

**Loxospora elatina**

8b Thallus K+Y to O (stictic or norstictic acids); soralia discrete; cephalodia normally present. — On bark and wood; coastal

**Coccotrema**

[See also Xylographa vitiligo (above), which may key here when the soralia are hardly elongate.]

2b Thallus K+Y, P-, P+ pale Y (atranorin), P+Y (alectorialic acid), or P+ orange-red (fumarprotocetraric acid)

9a Thallus P+ orange-red (fumarprotocetraric acid)

10a Thallus often indistinct but with large whitish to pale grayish or pale bluish gray soralia. — Thallus K+Y, KC-, P+R or P- (atranorin, zeorin, and usually fumarprotocetraric acid); usually on mossy bark, less often on mossy rock or soil; OP

**Megalaria pulverea**

10b Thallus distinct; soralia various

11a Thallus grayish or bluish gray, smooth to uneven, becoming granular sorediate, the soralia diffuse or well defined; containing atranorin and fumarprotocetraric acid (K- or K+ brownish). — On bark; se Alaska

**Violella fucata**

11b Thallus whitish, of small corticate granules or areoles, often with discrete soralia; containing atranorin and fumarprotocetraric acid (K+Y). — On bark and wood; widespread but infrequent in PNW

**Ramboldia cinnabarina**

9b Thallus P-, P+ pale Y, or P+Y (atranorin and/or stictic or alectorialic acid)

12a Thallus yellowish tinged (usnic acid present, KC+Y)

13a Thallus containing usnic acid and atranorin, ± trace of stictic acid; cortex and soralia K+ pale Y, KC+ still Y, C-, P+ pale Y, UV-. — Areoles flat to ± convex, contiguous when well developed, with punctiform yellowish soralia; on bark of shrubs, low elevations to (more often) subalpine; Alaska to Oregon

**Biatora flavopunctata**

13b Thallus containing thiophanic and usnic acids, zeorin, C+ deep Y, O, or R; K+Y, P-. — Thallus greenish to pale greenish yellow; on bark and wood; widespread

**Lecanora expallens**

12b Thallus not yellowish tinged from usnic acid

14a Thallus K+ strong Y, P+ strong Y (alectorialic acid)

15a Thallus pale brownish gray to brown; soralia pale greenish to cream colored, becoming confluent and brownish. — Usually on rock but occasionally on trees; distribution poorly known

**Fusciidea praeruptorum**

15b Thallus pale grayish white, pale greenish white, yellowish green, or pale yellowish brown,
with concolorous or paler soralia
16a Areoles yellowish green, to 0.6 mm diam, often completely dissolved into soredia. — On wood of conifers, rarely bark; Alaska to Manitoba, South Dakota and Colorado

Pycnora sorophora

16b Areoles grayish white to yellowish brown or pale greenish white, to 1 mm diam, usually not completely dissolved into soredia. — On bark; Alaska, BC, and Montana

Toensbergia leucococca

14b Thallus K- or K+Y, P- or P+ weak Y (atranorin), alectorialic acid lacking; thallus various but not incised-subsquamulose
17a Soralia initially linear, marginal on the areoles, sometimes beneath the slightly raised edges of the areoles. — Thallus light colored, gray white to gray green, containing atranorin and zeorin; soralia whitish; on both conifers and hardwoods, especially Alnus; ne US, se Canada, Great Lakes, rarely in PNW (BC)

Rinodina degeliana

17b Soralia roundish or broadly confluent
18a Soralia punctiform, usually < 0.2 mm diam, occasionally confluent into larger sorediate patches. — Containing atranorin and zeorin; on eutrophic bark of hardwoods, often in cities; lowlands w Cascades

Rinodina griseosoralifera

18b Soralia becoming larger
19a Thallus dissolving into soredia. — Thallus containing atranorin, zeorin and porphyrilic acid; on bark or rock; BC, Washington, Colorado

Haematomma ochroleucum var. porphyrium

19b Thallus with yellowish sorediate patches
20a Soredia farinose, in flat to hemispherical mounds, usually discrete; apothecial margins generally not sorediate. — Thallus whitish to gray, thin, continuous to areolate or slightly warty; apothecia rare, disks pale greenish brown; thallus containing 2-O-methylsulphrellin and atranorin ± usnic acid; spot tests negative or K+ weak Y; BC to n California

Lecanora jamesii

[The sorediate form of L. allophana (f. sorediata) will also key here.]

20b Soredia granular, in excavate roundish patches coalescing into larger, continuous patches; apothecial margins becoming sorediate. — Thallus thin to thick, with yellowish sorediate patches; apothecia allophana type, rare; thallus K+Y, KC-, P- or pale Y, C-, containing atranorin only; widespread in more continental climates of N Am, fairly common in PNW

Lecanora impudens

Group N2

Thallus or soredia K- or faintly K+Y, KC+R, C+R, P-

1a Thallus white or cream, pale greenish white, or pale grayish white
2a Thallus long-wave UV+ Y or O (xanthones)
  3a Apothecia usually present, though often obscured by soredia; spores 2-celled in ascus but fragmenting into two 1-celled parts, each cell thick walled and large, resembling a Pertusaria spore; containing lecanoric acid. — Usually on bark; widespread, infrequently collected

Varicellaria rhodocarpa

3b Apothecia usually lacking; spores simple; containing gyrophoric and lecanoric acid. — Thallus thin; on bark; n temperate to boreal, mostly e N Am

Ochrolechia arborea

2b Thallus UV+ weak white or UV-
4a Soralia irregularly elongate, sometimes roundish but appearing in short rows; thallus thin, membranous.
   — On Alnus, conifers, and shrubs; rare but locally abundant in humid coastal areas, BC and Washington

Opegrapha fumosa
4b Soralia roundish; thallus thin or thick

5a Thallus membranous, with discrete soralia; thallus C-, only soredia C+R; apothecia commonly present, pruinose to pruinose-scabrous, margins C-; contains variolaric acid. — On bark and wood, mainly conifers; widespread in PNW

  **Ochrolechia gowardii**

5b Thallus thin or thick and verrucose, C+R (even when thin); apothecia rare; margins C+R (cortex); lacking variolaric acid. — On many substrates; widespread, common

  **Ochrolechia androgyna s.l.**

1b Thallus gray, olive, greenish, or brownish

6a Thallus gray, olive brown, or brownish

   **Trapeliopsis**

   [**Rinodina sheardii** may key here when the C+O substance is present in the soralia.]

6b Thallus greenish, continuous, granular, subareolate, or of small coalescing areoles; soralia paler than the thallus

7a Soralia UV+ orangish, C+ persistent orange. — Thallus granular, yellowish green to pale yellow green, often coalescing into a leprose crust; apothecia whitish to pale straw, margin soon disappearing; spores 9-14 x 3.5-4.5 µm, (0)1(-3) septate; on bark, wood, and bryophytes, rarely on rock, in sheltered microsites; Alaska to Oregon, mainly near the coast

  **Micarea xanthonica**

7b Soralia UV-

8a Soralia raised, punctiform, convex to almost spherical, (0.1-)0.2(-0.4) mm diam. — Thallus of inconspicuous greenish to greenish brown areoles; soralia punctiform, convex, pale buff to pale greenish buff; apothecia rare, pinkish brown, with nonseptate ascospores; soralia KC+C+R (gyrophoric acid); on shady rotten wood and bark and wood of acid-barked trees including *Alnus* and *Quercus*, also on bryophytes over roots, tree bases, and rotten wood; coastal BC to Oregon, occasional

  **Trapelia corticola**

   [**Micarea coppinsii** Tønsberg, known from SE Alaska, would key here. It forms small roundish soralia developing from sparse, discrete, grayish or grayish green strongly convex areoles; soralia green of flecked with darker bluish green (N+R pigment under LM), to 0.3(0.5) mm diam; soredia fine, 12-25 µm diam; thallus with 5-O-methylhiascic acid (major) and traces of lecanoric and gyrophoric acids, C+O or R, KC+O, K-, UV-, P-]

8b Soralia irregular or initially punctiform but coalescing, 0.2-1.6 mm diam

9a Soralia irregular, pale green, to 0.2 mm diam. — Thallus appearing similar to nonlichenized granular green algae; when fertile with S-shaped, multisepitate ascospores; on hardwood bark in urban areas; thallus KC+C+R, C+R (gyrophoric acid, but usually in low concentrations so spot tests weak or failing); California to BC, w Cascades

  **Scoliciosporum sarothamni**

9b Soralia greenish white, sometimes orange pigmented, initially convex and discrete, often 1 mm diam or more, then fusing. — On plant debris, mosses, and tree bases; scattered orangish spots that are K+ purple (an anthraquinone) are common in Europe, but infrequent in N Am; containing gyrophoric acid; on plant debris, mosses, rotting wood, bark, and tree bases; Alaska to Oregon, w Cas, rarely inland to Montana

  **Trapeliopsis pseudogranulosa**

**Group N3**

  Thallus K-, KC- or KC+Y, C-, P+Y to O or R

1a Thallus P- but soralia P+ immediately rust red (argopsin). — Soralia greenish yellow (greener in shade), when well developed confluent into a thick leprose crusts; on *Alnus, Populus, Salix*, and conifers, less often on other hardwoods, sometimes spreading onto adjacent bryophytes; coastal Alaska to w Oregon

  **Biotoria efflorescens**

1b Thallus P+Y to O or R

2a Thallus of small areoles or granules; containing pannarin, argopsin, or fumarprotocetraric acid

3a Containing fumarprotocetraric acid; thallus coarsely or finely granular
4a Thallus yellowish green, becoming a leprose crust; soredia finely granular. — Apothecia occasional; disk yellowish or often darkening with gray mottles to nearly black; common on conifer trunks, occasionally on shrubs or hardwoods; w Cascades

*Cliostomum flavidulum*

4b Thallus greenish or greenish gray, corticate parts present; soredia medium to coarsely granular. — Apothecia occasional; disk tan to brown; on bark and wood and many other substrates in cities and other polluted areas; with apothecia sorediate margins are often present

*Lecanora conizaeoides*

3b Containing argopsin or pannarin; thallus of minute, often fragile areoles

5a Containing pannarin; areoles less fragile, 0.1-0.5 mm diam; soralia 0.1-0.4 mm diam. — Thallus of small brown-white to brown-gray or greenish tinged areoles; soralia scattered, often developing on the margins of the areoles (but not from the underside as in *Rinodina degeliana*), plane to convex and roundish, then becoming confluent, whitish to greenish or greenish yellow, often tinged brown; on bark; low elevations, coastal PNW

*Rinodina efflorescens*

5b Containing argopsin; areoles fragile (disintegrating when touched with a needle), 0.05-0.1 mm diam; soralia (0.1)0.2(-0.3) mm diam. — Apothecia with sorediate thalline margin; soralia dark green; on hardwoods and shrubs; near sea level in Washington and Oregon

*Halecana viridescens*

2b Thallus continuous or occasionally ± areolate; containing fumarprotocetraric and trace of protocetraric acid

6a Atranorin and chloroatranorin present, so normally K+Y. — On bark and wood; widespread but infrequent in PNW

*Ramboldia cinnabarina*

6b Atranorin and chloroatranorin absent, K- or K+ brownish

7a Soralia brownish (gray brown to brownish green), ± diffuse. — On conifers and hardwoods but especially on *Alnus* and *Betula*; coastal Alaska

*Lecidea praetermissa*

7b Soralia pale green gray, bluish, yellowish, or white, discrete and convex

8a Usually on wood; soralia roundish to somewhat elongate; thallus containing fumarprotocetraric acid. Thallus endosubstratal to distinctly convex areolate; BC to Montana, s to Arizona

*Xylographa soralifera*

8b Usually on bark; soralia roundish

9a Thallus mostly immersed in the substrate in the non-sorediate parts; soralia concave to flat; thallus lacking succinprotocetraric acid. — On smooth bark, hardwoods and conifers, less often on wood; BC and Alaska inland to w Montana

*Pertusaria pupillaris*

9b Thallus superficial to occasionally immersed in the substrate in the non-sorediate parts; soralia ± convex; trace of succinprotocetraric acid present. — On conifers and hardwoods; circumpolar s to Oregon

*Pertusaria borealis*

**Group N4**

Thallus K-, KC- or KC+Y, C-, P-, UV+ blue white or pink

1a Thallus of cream to yellowish corticate granules, not truly sorediate. — Mainly on wood; uncommon in moist conifer forests

*Ophioparma rubricosa*

1b Thallus variously colored but not entirely of corticate granules; with true soredia

2a Soralia yellow, yellow brown, pale brown, or greenish, discrete or fused or diffuse

3a Thallus UV+ pink (coronaton and unidentified xanthones); pycnidia when present white pubescent. — Thallus thin, rimose and finely granular, often appearing felty, pale bluish green or gray green; prothallus white, forming a distinct border; soralia irregular, effuse, yellowish green; on bark of conifers, hardwoods, and rock; OP

*Bacidia viridifarinosa*
3b Thallus UV+ white or bluish white; pycnidia when present not white pubescent

4a Soralia of mixed yellowish and brown granules, occasionally yellowish green. — Thallus areolate to continuous; thallus often KC+ flash Y or O, ± lobaric acid (UV+ with lobaric acid, otherwise UV-); on bark and wood; coastal states and provinces inland to w Montana

**Japevia subaurifera**

4b Soralia greenish, green tinged with brown, or yellowish green

5a Soralia granular or in consoredia (or blastidia) which effloresce into lighter soredia. — Thallus dull gray-greenish or brownish green or pale grayish green; areoles often ± constricted at the base; containing sphaerophorin and isosphaeric acid; usually on hardwoods; widely distributed in oceanic w N Am

**Rinodina disjuncta**

5b Soredia powdery, discrete or coalescing

6a Soralia discrete, persistently punctiform, mostly 0.1 mm diam, some to 0.3 mm diam; prothallus bluish or brownish, distinct; thallus containing sphaerophorin (usually major), ± isosphaeric acid. — Thallus thinly areolate or indistinct in the esorediate parts; soralia greenish or green tinged with brown, mostly discrete but occasionally coalescing; soredia fine, 20-30 µm diam; apothecia sometimes present, to 0.6 mm diam, bluish, brownish, or rarely blackish; on smooth bark and wood of conifers, shrubs, and hardwoods

**Frutidella pullata**

6b Soralia discrete or confluent but not persistently punctiform; prothallus whitish, brownish or indistinct; thallus containing perlatolic or lobaric acid

7a Soredia pale greenish to pale brownish, 20-40(50) µm diam; thallus containing lobaric acid. — Thallus brownish or greenish; soralia small and irregular at first, expanding and coalescing to form a nearly leprose crust; apothecia occasional, reddish brown, the margin lecideine; exciple brownish, pale brownish adjacent to the hymenium; hypothecium hyaline, inspersed with oil drops; epithecium brown, POL-, K+ olive brown; thallus K-, KC-, C-, P-, UV+ blue-white; widespread but infrequent

**Myochroidea porphyrospoda**

7b Soredia greenish or less often yellowish, about 20-30 µm in diameter; thallus containing perlatolic and hyperperlatolic acids. — Soralia discrete or confluent; thallus grayish green, of small convex areoles, but the areoles not constricted at the base; areoles greenish, discrete or contiguous; apothecia rare; on bark or wood of *Betula*, conifers, or other acidic-barked trees in damp sites; BC, Washington, and Montana

**Ropalospora viridis**

2b Soralia white to gray, pale greenish, or black, discrete or coalescing

9a Thallus C+Y, KC+Y, containing variolaric acid. — Thallus whitish with coarse granular soredia. — On wood, soil, and moss over rock; widespread

**Ochrolechia turneri**

9a Thallus C-, KC-, containing divaricatic, alectoronic, or perlatolic acid

10a Thallus containing alectoronic acid; cephalodia present. — So far known only from Kodiak Island, Alaska

**Coccotrema minutum**

10b Thallus containing divaricatic or perlatolic acid; cephalodia absent

11a Thallus containing divaricatic acid

12a Areoles and soralia pale bluish gray, whitish (shaded), gray, or gray brown, immediately dissolving into soredia and thus largely appearing leprose. — Apothecia uncommon, reddish brown, plane to convex; esorediate areoles when present bluish gray to tan-gray, but often indistinct or absent, soon bursting to form soredia; soralia bluish gray, greenish, or whitish (shaded), sometimes tinged with brown, discrete or coalescing into a leprose crust; soredia fine; thallus containing divaricatic acid (K-, C-, KC-, P-, UV+ white); spores globose, 5-7.5 µm diam; widespread

**Lecidea nylanderi**

12b Areoles grayish green to green, more persistent and thus bearing ± discrete soralia. — Coastal Alaska to s Washington Cascades and in e N Am

**. Fuscidea pusilla**

11b Thallus containing perlatolic acid
13a On wood or bark of conifers; soralia soon coalescing into a thick leprose crust, beginning 
from coarse corticate granules that are covered with fine soredia. — Thallus pale greenish 
gray, gray, or brownish gray, occasionally strongly convex areolate, the areoles with a coarsely 
cracked whitish necrotic layer; prothallus not apparent; apothecia common, the disk flat, often 
arranged in dense botryose clusters; disk reddish brown, dark gray, or black, often with a thin 
pale whitish rim when young; spores 7-12(13) x 2.5-4 µm, 0(1)-septate; w Cascades inland to 
at least w Montana

**Hertelidea botryosa**

13b On smooth bark of hardwoods, less often on conifers; soralia discrete or ± fused, irregularly 
sized and spaced; prothallus bluish gray to bluish black, visible at the edge of the thallus and/or 
between areoles. — Thallus continuous to areolate or warty, gray to bluish gray; Alaska to n 
California

**Mycoblastus caesius**

### Group N5

Thallus K-, KC- or KC+Y, C-, P-, UV- or UV+ pale yellowish

1a Soralia yellow, yellow brown, pale brown, or greenish, discrete or fused or diffuse

2a Blastidia present, elongate to flattened, breaking into soredia. — Thallus thin, gray to gray brown, continuous 
or areolate, soon developing blastidia about 0.1 mm broad to 0.45 mm long; no lichen substances; on 
hardwoods, less often on conifers; low elevations w Cascades, sw BC to w Oregon

**Rinodina thomsonii**

2b Blastidia absent

3a Soralia yellow to yellow green or vivid green. — Thallus gray, thin to warty, often becoming consumed 
by the soralia; soralia containing atranorin, planaic acid, and usnic acid; on plant detritus, wood, and 
noncalcareous rock; cool forests to alpine; few reports from the PNW

**Mycoblastus alpinus**

3b Soralia yellowish, yellow brown, pale yellowish green, pale brown, or greenish

4a Soralia whitish with pale yellowish to greenish tints; thallus containing a trace of gyrophoric acid by 
TLC but spot tests normally negative. — At least a few apothecia normally present; spores elongate, 
sigmoid-curved

**Scoliciosporum sarothamni**

4b Soralia more yellowish or yellow-brownish; thallus containing atranorin, secalonic acid A, thiomelin, 
and xanthones (C- or C+O, KC-, but sometimes substances absent and all spot tests are negative). — 
Thallus very thin or endosubstratal, barely discoloring the bark or with very thin areoles; soralia 
discrete, plane to ± convex; spores *Physcia* type, 22-26 x 11.5-13.5; on *Alnus*; coastal Alaska

**Rinodina sheardii**

[Rinodina flavosoralifera is a similar species known from deciduous trees in coastal Alaska. It has 
yellowish areoles and brownish soralia, owing to the presence of xanthones.]

1b Soralia white to gray, pale greenish, or black, discrete

5a Thallus of thick greenish gray bullate areoles tipped with blackish soralia. — Apothecia rare; spores 2-celled, 
22-28 x 12-15 µm; on bird perches of old wood, especially fenceposts; common e Cascades, rarely w 
Cascades, BC to California inland to Montana and Idaho

**Thelomma ocellatum**

5b Thallus thin, whitish to gray or greenish gray; soralia white to gray or blue-gray

6a Soralia tiny (generally < 0.3 mm diam)

7a Soralia brownish or greenish, barrel-shaped, distinctly delimited by a white circular rim. — Soralia to 
0.3 (0.5) mm diam; apothecia rare, rust red; containing roccellic acid; on shrubs (*Alnus, Salix, 
Sorbus*); subalpine to alpine; BC to Montana, s to Colorado

**Caloplaca sorocarpa**

7b Soralia variously colored but not surrounded by a white rim

8a Atranorin present (though usually K- or weakly K+Y). — Thallus areolate, dull greenish white to 
pale gray or grayish brown, with blue-gray, mostly discrete soralia that are plane to ± 
convex; apothecia very rare; spores brown, 24-29 x 12-17 µm; thallus also containing zeorin, P- or
P+ pale Y; on eutrophic bark of hardwoods, often in cities; common in lowlands w Cascades

*Rinodina griseosoralifera*

8b Atranorin lacking

9a Thallus of scattered areoles, the areoles very thin, developing into thin soralia mostly 0.1-0.2 mm broad and occupying the whole areole. — Thallus grayish yellow white, pale greenish, or pale yellowish green, containing gyrophoric acid; apothecia inconspicuous, immarginate, adnate, grayish to pale brown; spores simple or occasionally 1-septate, 9-10 x 2-4 µm; on shrubs; low elevations to more often subalpine

*Biota vacciniicola*

9b Thallus thin and smooth or of contiguous to scattered areoles, the areoles becoming warty or irregularly verrucose and the warts bursting into crater-like soralia surrounded by a whitish or grayish cortex. — Apothecia uncommon; spores hyaline, 10-13 x 6-8 µm; on deciduous trees, often at the base; w Cascades

*Caloplaca obscurella*

6b Soralia > 0.5 mm diam

12a Thallus dark bluish gray. — Thallus becoming coarsely granular sorediate (blastidiate) to isidiate, the granules appearing corticate, K- under dissecting scope but often K+ violet under LM, diffuse rather than concentrated into soralia, sparse to abundant; apothecia black, fairly common, with thalline rim and septate spores; On bark, especially *Populus*; widespread but in PNW, most often e Cascades

*Rinodina colobina*

12b Thallus and granules not both dark bluish gray

13a On moss over bark, wood, or rock. — Thallus greenish gray or pale yellowish green; soralia diffuse; oceanic to suboceanic

*Mycobilimbia epixanthoides*

13b On bark or wood

14a Soralia irregular, forming a discontinuous leprose crust; thallus generally endophloedal; apothecia common. — Apothecia, black but bluish pruinose; thallus containing pseudoplacodiolic acid; on humid sheltered bark, associated with Caliciales and *Chrysothrix*; coastal Alaska and inland BC

*Lecidea leprarioides*

14b Soralia round, medium to large (0.5-1.2 mm diam), developing in fruiting warts; thallus generally thin to rather thick epiphloedal; apothecia common but obscured by the soredia

15a Warts of thallus small, to 1.2 mm diam; apothecial margins crenulate; disk black, commonly seen though often obscured by soredia. — Medulla with all spot tests negative; containing fatty acids by TLC; on conifers and hardwoods; widespread and common

*Variolaria ophthalmiza*

15b Warts of thallus large, to 4.5 mm diam; apothecial margins smooth; disk black but rarely seen. — On both hardwoods and conifers; mainly sw N Am; rare in PNW

*Pertusaria albescens*

**Key O: OTHER STERILE CRUSTS ON ROCK OR SOIL**

**OR ON BRYOPHYES OVER ROCK OR SOIL, PARTLY CORTICATE**

1a Thallus isidiate or granular-isidiate, greenish or olive brown or dark brown

2a Thallus brown to dark brown; substrate various

3a Photobiont cells 6-12 µm diam; lichenicolous on rock or directly on rock. — Thallus minutely isidioid or granular; containing gyrophoric acid (K-, C+R, KC+R); widespread and fairly common

*Rinularia* and *Lambiella*; see key to *Rinularia*

[Rinodina parasitica can also form a dark brown granular crust over lichens on rock. Check carefully for apothecia. It contains no lichen substances.]

3b Photobiont cells 5-9 µm diam; on soil or detritus, rarely on rock. — Widespread and common

*Placynthiella*

2b Thallus greenish, olive, gray, or brownish gray; on rock
4a Thallus brownish gray; habitat shoreline noncalcareous rock; isidia coarse, 0.3-0.7 mm diam. — Alaska to Oregon, inland to e-central BC and Montana

   Koerberiella wimmeriana

4b Thallus greenish, olive, or olive brown; habitat various; isidia granular or finely cylindrical, < 0.3 mm diam

5a Thallus with elongate very narrow lobes, forming olivaceous rosettes; photobiont blue green. — On siliceous rock, in and w Cascades

   Vestergrenopsis, Placynthium, and Steineropsis— see key to stratified cyanolichens

5b Thallus not lobate, greenish, granular isidiate; photobiont green. — Habitat shaded, maritime

   Bacidia scopalicola

1b Thallus sorediate or isidiate, but if isidiate then color otherwise

6a Thallus K+R (norstictic acid), white to gray; hypothallus dark gray to black, often distinct

8a Soralia and upper cortex whitish to cream, not at all gray. — Normally on bark or wood but occasionally on rock; widespread

   Phlyctis argena

   (Baeomyces carneus)

9b Thallus sorediate, areolate; substrate various

10a Soredia coarse, granular; soralia often poorly delimited. — On moss (especially Grimmia) over rock, rock, and old wood, usually in dry sites e Cascades

   Sagedia mastrucata

10b Soredia powdery; soralia often neatly delimited

11a Thallus yellowish white to pale gray; soralia black or white to pale yellow. — On rock cf. Porpidia sensu Gowan (1989)

   Bellemerea subsorediza

6b Thallus K- or K+Y, color various; hypothallus various

12a Thallus sorediate, papillate, with coarsely granular soria or lacking soria and areolate to warty

13a Thallus areolate to warty, esorediate; on soil and moss

14a Thallus P+Y to O, UV-. — Widespread, common

   Baeomyce

14b Thallus P+Y, UV+. — Arctic and northern

   (Dibaeis baeomyces)

13b Thallus papillose or coarsely granular sorediate

16a Thallus KC+R

17a Thallus thick, of swollen areoles. — Thallus containing gyrophoric acid (K-, C+R, KC+R); widespread, infrequent

   Rimularia gibbosa

17b Thallus thin, cracked areolate, when sterile often with whitish spots which are immature apothecia. — Common but often overlooked, especially in coastal states and provinces

   Trapelia

16b Thallus KC-

18a Thallus cracked areolate, granular, scurfy-isidiate to granular sorediate. — Thallus K-; mainly on supralittoral rocks; rarely reported

   Circinaria leprosescens

18b Thallus entirely papillate. — Thallus pinkish-gray; on HCl- supralittoral rock; apparently uncommon in PNW (BC, Washington)

   Lecania aipospila

15b Thallus sorediate

19a Thallus with prominent pinkish to brown cephalodia; marginal lobes conspicuous. — Upper surface and medulla C+R, KC+R; abundant on rock w Cascades, rarely inland

   Placopsis

19b Thallus lacking cephalodia; margins not or slightly lobate

20a Thallus K+Y (atrnorin, alectorialic, or stictic acid present), KC- or KC+ orange red or KC+
violet
21a Thallus with orange or yellow tints

22a Thallus gray, brownish gray, ochre, to rusty colored, with gray to blackish soralia. — On iron-rich rock, and often occurring with Acaenospora sinopica and Tremolecia atrata; containing stictic acid; medulla I-; soralia creriform to tubercular; prothallus gray or black; occasional in the coastal states but rarely reported

*Miriquidica atrofulva*

[See also *Porpidia tuberculosa*, which can appear similar but lacks stictic acid, containing instead confluent acid, and has an I+B medulla. *Porpidia soredizodes* also has stictic acid and an I- medulla, but is cream to gray with pale soralia.]

22b Thallus otherwise

23a Thallus creamy yellow orange to brownish orange, often with gray patches or margins.
— Thallus continuous to finely cracked; medulla I-; soredia white or flecked gray, rarely darker; cortex K- (or Y from diffusion), medulla K+Y (stictic acid); on semi-inundated rocks; arctic-alpine s to Colorado

*Porpidia ochrolemma*

23b Thallus yellow-green. — Thallus areolate on a well-developed black prothallus; soralia developing on the edges of the areoles, coarsely granular, green black to yellow green, becoming convex; apothecia very rare; cortex K+Y, KC+Y (atranorin and usnic acid abundant), also containing rangiformic and norrangiformic acids; on siliceous rock, Arctic to s Appalachians, not yet known from PNW

*Calvitimela talayana*

21b Thallus white to gray, cream, brownish, or yellow-green

24a Thallus mostly ecarticate and sorediate. — White prothallus distinct; cortex K+Y, medulla K- (atranorin, zeorin, porphyrilic acid); BC, Washington, Colorado

*Haematoma ochroleucum* var. *porphyrium*

24b Thallus usually with extensive cortex

25a Thallus KC+O, R, purple, or violet

26a Thallus P+ deep Y (alectoriarial acid)

27a Thallus containing barbatolic acid?, dirty white, cream or pale tan. — On sheltered noncalcareous rock faces; n RM

Unknown species, not seen fertile; perhaps *Lecanora cavicola* which also keys here, although barbatolic acid is not reported from that. See the sorediate section of the *Lecanora* key for more detail.

27b Thallus lacking barbatolic acid, pale to mid brownish. — On sheltered rock and bark; apparently rare

*Fuscidea praeruptorum*

26b Thallus P- or pale Y (gyrophoric acid)

28a Thallus UV++ blue white (lobaric acid); areoles with darker centers contrasting with the margins, at least in part (i.e. as in *Stereocaulon vesuvianum*). — Alaska s to Oregon Cascades

*Stereocaulon leucophaeopsis*

28b Thallus UV+ weak whitish (gyrophoric acid); areoles more uniform in color, not having darker centers. — Soralia C+R, KC+R; thallus areolate, pale greenish gray; soralia greenish white, ± discrete, farinose, to about 0.5 mm wide; on exposed siliceous rock, near sea level

*Rinodina aspersa* (Borrer) Laundon

25b Thallus KC-

30a Stictic acid present; atranorin lacking

31a Soralia gray to blackish, forming craters or raised craters. — Occasional in the coastal states but rarely reported

*Miriquidica atrofulva*

31b Soralia white, greenish white, or grayish. — Medulla I-, K+Y (but often difficult to see clearly); thallus pale greenish white, dirty cream-gray to olive or brownish, subcontinuous to rimose or subareolate; soralia discrete, elevated in
warts, developing a distinct rim; prothallus black, often visible; apothecia rare, similar to *P. crustulata*; scattered localities in w N Am; on rock

*Porpidia soredizodes*

30b Stictic acid lacking; atranorin present; habitat steep sheltered faces of noncalcereous rock

32a Apothecia, when present, of the *Lecanora rupicola* type, with whitish disk. — Soralia in discrete (or coalescing), convex soralia; thallus thick and uneven, white to gray; cortex and medulla K+Y, C- (atranorin and rocellic acid); on siliceous rock, often beneath overhangs or in other sheltered microsites

*Lecanora rupicola* var. *efflorens*

32b Apothecia, when present, with brown to black disk

33a Apothecia, when present, with black disk (*Tephromela atra* type); thallus containing lichesterinic acid (with atranorin). — Soralia coalescing into a thick gray crust; n Europe, Scandinavia, Asia, not yet known from N Am

(*Tephromela grumosa*)

33b Apothecia, when present, with reddish brown to brown disk (*Lecanora subfuscus* group)

34a Thallus containing terpenoids (with atranorin). — Widespread, uncommon

*Lecanora umbrosa*

34b Thallus containing fatty acids (with atranorin). — Widespread, rarely collected

*Lecanora caesiosora* and *L. pannonica*

20b Thallus K-

35a Thallus KC-, C-

36a Soralia P+R. — Thallus areolate to subcontinuous, pale brownish gray. Example: J. Davis 2788

Unknown sterile crust

36b Soralia P-

37a Thallus lobate, forming small tightly appressed rosettes. — Hypothallus indistinct or lacking; thallus K-, C-, KC-, P-, UV-; on sheltered siliceous rock; widespread in semiarid climates; fairly frequent throughout the PNW but often inconspicuous and difficult to collect

*Caloplaca demissa*

37b Thallus not lobate

38a Thallus UV+ yellow or orangish (xanthone). — Thallus of small whitish areoles with greenish powdery diffuse soredia coalescing into a leprose crust; spot tests negative; on sheltered basalt at low elevations (Example: Oregon, Clackamas Co., Clackamas River bluffs, 100 m, McCune 28606)

Unknown sterile crust

38b Thallus UV- or UV+ whitish

39a Thallus brownish, dark brown, or dark gray

40a Soralia punctiform, dark to lilac-mauve-white; habitat shaded noncalcereous rock. — Thallus containing confluent acid, 2'-O-methylmicrophyllinic and 2'-O-methylperlatolic acid; soralia UV ± blue white; apothecia black, conical, perithecia-like; on shaded, sheltered, noncalcereous rock (rarely on bark)

*Enterographa zonata*

40b Soralia marginal or extensive, often eventually covering the whole thallus

41a Thallus dark gray to blackish, containing miriquidic acid. — Thallus often parasitic on other lichens

*Miriquidica*

41b Thallus gray or brown, lacking lichen substances

43a Thallus grayish areolate with blackish soralia or becoming completely blackish sorediate. — Apparently rare in PNW

*Rinodina obnascens*
43b Thallus gray brown (shaded) or more often dark brown, granular to areolate — Widespread, occasional

*Rinodina parasitica*

39b Thallus gray, whitish gray, olive gray, or greenish gray
44a Thallus greenish gray or pale yellowish green; soralia diffuse; on mosses over bark, wood, or rock. — Oceanic to suboceanic

*Mycobilimbia epixanthoides*

44b Thallus gray, whitish gray, or olive gray; soralia discrete; on rock
45a Areoles with distinctly paler edges, at least in part; thallus containing atranorin and lobaric acid by TLC but giving negative spot tests when in low concentration. — Alaska to Oregon, infrequently collected

*Stereocaulon leucophaeopsis*

45b Areoles more uniform in color; thallus substances various
46a Soralia linear, blackish, excavate. — Soralia along the edges of the areoles or minute squamules; areoles dispersed; thallus lacking lichen substances, P-, K-, KC-, C-; on concrete

*Acarospora moenium*

46b Soralia punctiform or roundish-convex, white to bluish gray or blackening
47a Medulla I-; thallus containing 2'-O-methylsuperphyllinic and glaucophaeic acids; thallus of thick, white, convex areoles; soralia white or very pale greenish. — On noncalcareous rock; rare; coastal e Canada and sw Alaska

*(Porpidia rugosa)*

47b Medulla I+B; thallus containing confluent and 2'-O-methylmicrophyllinic acids, rarely with stictic and/or norstictic acids; thallus moderately thick, medium gray, subareolate to areolate. — On noncalcareous rock

*Porpidia tuberculosa*

[A test for confluentic acid: Mount section or fragment in water on microscope slide, apply coverslip, suffuse with K, after a few seconds, a stream of minute droplets (4-O-methylolivetonicide) will come from the tissue, forming a dull halo.]

35b Thallus KC+O or R, C+R or C-
48a Thallus brown to yellowish brown; soralia pinkish tinged; uncommon, with narrow habitat requirements. — Soralia numerous, punctiform; apothecia black, rounded, ± gyrose; spores 3-septate, 20-25(27) x 4-5 µm; thallus containing gyrophoric acid; on rocks on lakeshores and seashores; coastal BC and Atlantic coast

*Opegrapha gyrocarpa*

48b Thallus white, cream, light gray or dark gray; soralia otherwise; common, widespread species
49a Thallus C-, IK+ violet, containing picrolichenic acid. — Usually on bark or wood, rarely on porous rock, including supralittoral rock

*Variolaria amara*

49a Thallus and/or soredia C+R, containing gyrophoric and/or lecanoric acid
50a Thallus whitish

*Ochrolechia*

50b Thallus pale gray or darker

*Trapeliopsis, Trapelia*
Key P: SQUAMULOSE

1a Squamules yellow, yellow-green, or orange

2a Squamules K+ purple
   3a Lower surface corticate, occasionally rhizinate
      4a Rhizines present; spermataia bacilliform; upper cortex and thalline margin with cell walls strongly glutinized. — Widespread, common
         Xanthomendoza
      4b Rhizines absent, the thallus attached by short hapters; upper cortex and thalline margin with cell walls little glutinized. — Widespread, common
         Xanthoria
   3b Lower surface ecoricate or too closely appressed to discern, lacking rhizines
      5a Thallus pale to clear yellow; on calcareous soil; thallus squamulose, often marginally lobate. — Fairly common in cold or dry exposed sites
         Gyalolechia (formerly in Fulgensia)
      5b Thallus yellow to orange; substrate various; thallus more often foliose to dwarf fruticose. — Widespread, common
         Caloplaca

2b Squamules K-
   7a Thallus yellowish green, LW UV-. — Apothecia sessile; disk brown; spores > 6 µm long, 8/ascus; on calcareous soil; occasional in steppe and desert
         Squamarina
   7b Thallus vibrant yellow to yellow green, LW UV+ (rhizocarpic acid)
      8a Apothecia immersed; disks brown to almost black; spores minute (< 6 µm long), 1-celled, hyaline, many/ascus. — On rock and soil; widespread, common
         Acarospora
      8b Apothecia sessile to ± stalked; disks black; spores 11-17 x 7-10 µm, 2-celled, dark, 8/ascus. — Thallus with marginal lobes to 1 cm long, areolate-squamulose in the interior, on soil and moss in rock crevices; arctic-alpine s to Colorado, rare
         Catolechia wahlenbergii

1b Squamules another color
   10a Thallus greenish, ear-shaped with a raised lip at the margin, the interior generally sorediate; always sterile; cortex and medulla K-, P-, C-, KC-. — Often on moss or other lichens; widespread; common w Cascades, rare (or overlooked) e Cascades
         Normandina pulchella
   10b Thallus variously shaped and colored but without a raised lip at the margin; often fertile; spot tests various
      11a Ascocarps forming perithecia; usually fertile
      12a Spores nonseptate, hyaline; hymenial algae absent
         13a On bark
            14a Upper cortex Catapyrenium-type, with thin-walled roundish cells and a gradual transition to the algal layer. — On Quercus bark; sw US and California to sw Oregon
               Catapyrenium psoromoides
            14b Upper cortex Placidium-type, with thick-walled cells near the surface, grading to thinner wals, then abruptly transitioning to the algal layer. — On Quercus bark; sw US to n California (Placidium fingens)
         13b On rock or soil or detritus
      15a Thallus thickly crustose areolate to subsquamulose, on rock
         16a Thallus initially parasitizing Staurothele areolata, eventually free living, becoming a subsquamulose crust. — Widespread but infrequent, usually on calcareous rock
            Heteroplacidium zamenhofianum
         16b Thallus not parasitic on Staurothele
            17a Lower or lateral cortex with cells arranged in vertical columns or prosoplectenchymatous
               18a Lower or lateral cortex with cells arranged in vertical columns. — On
noncalcareous rock; dry sites; Idaho to California

Dermatocarpon leptophyllodes

18b Lower or lateral cortex prosoplectenchymatous, of densely interwoven filamentous hyphae. — On calcareous rock; known only from type locality in Colorado

(Placopyrenium coloradoense)

17b Lower cortex non-columnar paraplectenchymatous or lacking

19a Lower and lateral cortex paraplectenchymatous; areoles with a short stipe-like holdfast. — On rock; Columbia Plateau, rare

Placopyrenium conforme

19b Lower cortex lacking, areoles broadly attached. — Widespread and common as a genus but squamulose species infrequent

Verrucaria

15b Thallus squamulose, mostly on soil

20a Upper cortex of ± blocky cells arranged in vertical columns; squamules tinged gray, greenish, or whitish pruinose on a brownish background; rhizohyphae hyaline or brown. — Widespread; montane to mostly subalpine and alpine

Catapyrenium

20b Upper cortex of roundish cells not aligned into columns; squamules some shade of brown, epruinose; rhizohyphae hyaline. — Widespread; deserts to alpine

Placidium

24b Spores septate, hyaline or brown; hymenial algae present or absent

25a Spores hyaline, 1-septate (ours, sometimes septum obscure in water but obvious in K). — Hymenial algae lacking; widespread but rare

Placidiopsis

25b Spores muriform

26a Hymenial algae present; spores brown in almost all species. — On soil and rock; common in steppe and desert to alpine

Endocarpon

26b Hymenial algae absent; spores hyaline or brown

27a Squamules umbilicate; cortical cells not papillate; on rock. — Arctic-alpine and low elevations in w Montana, rare

Henrica

27b Squamules not umbilicate; cortical cells papillate; on moss, lichens, rock, or soil over rock or bark. — Widespread but infrequent in coastal states and provinces

Agonimia

11b Ascocarps forming apothecia or if sterile then often sorediate; thallus usually epruinose

28a Photobiont blue-green

29a Thallus umbilicate (peltate), with sorediate margins

30a Thallus 1-2 mm diam, thin (0.2-0.3 mm), dark olive green. — On rock; Mexico to n California and Nevada

(Peltula bolanderi)

30b Thallus to 10 mm or more diam; 0.2-0.5 mm thick, tan to olive. — Uncommon in PNW, more common in California

Peltula euploca

29b Thallus not umbilicate

31a Apothecia sunken in the thallus, the disk expanded and reddish

32a Spores 14-24 x 6-11 µm, 8 per ascus. — On soil; occasional in desert and steppe, usually where calcareous

Heppia lutos a

32b Spores < 10 µm long, > 100 per ascus. — On calcareous soil, or soil over rock, or rock; s California to ne Montana and s Saskatchewan

Peltula patellata

31b Apothecia sessile; corticolous or saxicolous or on moss over rock, rarely on soil

33a Spores warty, large (25-30 x 9-12 µm); apothecia with beaded thalline margin. — Thallus pale bluish gray to dark brown, fresh material dark bluish when wet; lower surface of apothecia margin lacking hairs; on shady soil, logs, tree bases, and mossy rocks;
33b Spores uneven to smooth, mostly < 25 µm long; apothecia various

34a Apothecia lecanorine; isidia absent or, if present, then not dense and fingerlike. — Widespread, common

34b Apothecia lecideine; isidia present or not

35a Thallus isidiate; apothecia often absent. — Widespread, occasional in coastal states and provinces

35b Thallus of small squamules with incised margins; apothecia usually present. — Widespread, very common w Cascades, rare inland

Fuscopannaria

28b Photobiont green

40a Thallus sorediate or sterile; substrate various

41a Apothecia generally not borne directly on the squamules; squamules often with black, raised pycnidia and/or immature podetia. — Substrate various; widespread, common

Cladonia

41b Apothecia, if present, on or between the squamules; squamules lacking pycnidia and/or immature podetia

42a Thallus of microsquamules that become isidiate and granular sorediate, becoming delicately compound and suberect, to about 0.15 mm broad, greenish to grayish; spot tests negative except UV+; cortical cells with small papillae (LM). — on mosses, soil, or bark; widespread, rare

42b Thallus of appressed to ascending squamules, the color and spot tests various; cortical cells lacking papillae

43a On soil, moss, or rock

44a Thallus C-, KC-. — Squamules white, thickly pruinose, to 3 mm diam, appressed or with edges slightly raised, forming white to grayish brown soredia on the edges of the squamules; thallus K-, C-, KC-, P-, UV-; on calcareous silt in dry grassland, w side of Jasper Lake, Alberta, 1000 m

Unknown genus and species. P. Williston Site K15

44b Thallus C+R, KC+R. — Widespread, common

Trapeliopsis

43b On bark or wood; thallus spot tests various

45a Squamules bursting open to form a soredia-lined pocket; on bark. Thallus pale greenish gray, olive green, to brown green, of roundish to lobate squamules to about 1 mm broad, the squamules typically developing one or two suberect to erect lobes with sorediate pockets; on trees; California to BC

45b Squamules with marginal soredia; most common on charred wood but also on tree bases

46a Squamules K+Y or O, P+Y or O, C- (thamnolic acid with accessory alectorialic acid); squamule margins crenulate. — Arizona and California to s Oregon

Fulgidea sierrae

46b Squamules K-, P- or P+O, C- or C+R; squamule margins ± entire

47a Squamules C+R, KC+R (lecanoric acid), ascending, greenish or brownish green; apothecia uncommon, black, often pruinose; soredia present. — Widespread, common

Hypocenomyce scalaris

47b Squamules C-, KC-, adnate or ascending, grayish green, greenish brown, to rich brown; apothecia strongly convex, brown; soredia commonly present, though often sparse or lacking. — Widespread, occasional

Carbonicola
40b Thallus usually fertile, esorediate; on rock, moss, detritus, or soil
48a Asci polysporous; spores small, ≤ 5 µm long; cortex often KC+R; thallus generally brown OR whitish pruinose. — Widespread, common

Acarospora

48b Asci 8-spored; spores > 5 µm long; cortex KC+ or -; thallus color various
49a Apothecia with thalline margin, although the thalline margin may be lost with age
50a Saxicolous
51a Spores 1-3 septate. — Widespread, infrequently collected
      Lecania
51b Spores nonseptate. — Widespread, common
      Lecanora

50b Terricolous or muscicolous
52a Apothecial margin lobulate, persistent; spores hyaline, simple. — Widespread and very common
      Psoroma hypnorum
52b Apothecial margin not lobulate, often diminishing with age; spores brown, septate.
— Lower surface felty-black; upper surface pale brown, yellowish brown, or gray pruinose; common on soil and detritus; desert, steppe, and alpine
Phaeorrhiza

49b Apothecia with proper margin or without a distinct margin
51a Spores simple
53a On bark or wood, commonly where charred
54a Apothecia brown. — Squamules with edges ascending, gray green, greenish brown, to rich brown; widespread, occasional
      Carbonicola
54b Apothecia plane, black, marginate
55a Thallus K+Y, KC+R (rarely KC-), C+R (rarely C-), P+R; containing alectorialic acid and usually thamnolic acid, rarely just thamnolic acid. — Widespread; infrequent
      Fulgidea oligospora
55b Thallus K-, KC-, C-, P-; containing friesiic acid. — Widespread, locally common
      Xylopsora friesii

53b On soil, thin soil over rock, rock, or detritus
56a Thallus pale yellowish green or yellowish tan
57a Epithecium K+R; medulla P-; spores 9-14 x 5-7 µm; thallus containing usnic and gyrophoric acids. — Arctic-alpine; rare
      Psora rubiformis
57b Epithecium K-; medulla P+Y; spores 10.5-12.5 x 6-7 µm; thallus containing alectorialic acid. — Alaska; rare
      (Anamylopsora pulcherrima)
56b Thallus brown, gray, cream, brownish green, or whitish
58a Thallus pale gray, creamy, or whitish above, C+R, KC+R. — On soil and mosses over rock; uncommon in PNW, common in California
      Trapeliopsis glaucopholis
58b Thallus tan, brown, brownish green, or dirty gray above; spot tests various
59a Squamules grayish to brown-gray, on a thick fibrous black hypothallus; apothecia brown, deeply set in a gray to brownish thallus. — Epithecium K-; spores 11-15 x 5-6 µm; no lichen substances; closely appressed to soil and detritus, widespread and common, especially subalpine to alpine
      Lecidoma demissum
59b Squamules brick red to brown or greenish brown although sometimes completely white pruinose; hypothallus inconspicuous or absent; apothecia brown to black, sessile or immersed
60a Ascocarp irregular in shape, lacking both proper and thalline exciple, eventually covering the entire squamule; ascocarp reddish brown. — Thallus olive brown; spores 13-17 x 7-9 µm; on gypsum soils, occurring with calciphiles, open habitats

Gypsoplaca macrophylla

61b Ascocarp generally circular in outline, delimited with a proper exciple; ascocarp reddish brown, brown, or black

62a Epithecium brown to orange brown, K+R (under compound microscope); hypothecium hyaline to pale brown, often with calcium oxalate crystals. — On soil or soil over rock in various habitats; widespread and common

Psora

62b Epithecium greenish, K-; hypothecium dark brown, lacking calcium oxalate crystals

63a Squamules convex; spores subspherical. — thallus warty-areolate to globose-squamulose or lobate squamulose, sometimes ± stalked, gray to dark brown or red brown; apothecia black, sessile; paraphyses free; epithecium clear blue green, discoloring to brown; spores about (6)7-9(10) µm diam, uniseriate; on siliceous rock; arctic-alpine s to Colorado, New England, and Oregon

Schaereria cinereorufa

63a Squamules concave, with raised edge; spores elliptical

64a Thallus squamulose; apothecia never lecanorine. — Overgrowing Spilonema on rock. — Widespread but rarely collected.

Psorula rufonigra

64b Thallus ± crustose, of peltate areoles; apothecia lecanorine when young; overgrowing a black hypothallus; thallus containing miriquidic acid; California, Alberta, and Saskatchewan

Miriquidica scotopholis

51b Spores 1- or several septate

65a Spores dark, 1- to several-septate. — Widespread, occasional

Buellia badia

[Crustose to subsquamulose species of Buellia are relatively common.]

65b Spores hyaline; thallus various

66a Spores unequally 1-septate, hyaline; paraphyses coherent, interwoven; thallus brown; apothecia black. — Hypothecium brown; epithecium greenish black and brown; on soil; common in dry or cold open habitats

Arthonia glebosa

66b Spores symmetrically septate, generally > 1-septate; thallus color various; apothecia dark or black

67a Thallus not delicate, whitish-edged squamules; spores 1-3 or more septate; hypothecium various. — Squamules pruinose or not; common on soil and rock in a wide variety of habitats

Toninia

67b Thallus of delicate, imbricate, whitish-edged squamules that are grayish, brownish, or olive gray; spores 3-septate, 13-24 x 4-6 µm; hypothecium red-brown. — Epithecium blue-green black or olive or mottled with both; common on soil and moss over calcareous rock; forested mountains and steppe

Bilimbia lobulata
Key Q: UMBILICATE, FOLIOSE

1a Photobiont blue-green; thallus often ≤ 1 cm wide. — Margins sorediate; upper surface olive to brownish gray; on steep sheltered rock faces; widespread in w N Am but rare n of California

*(P. euploca is the largest member of a mainly squamulose to crustose genus.)*

1b Photobiont green; thallus generally > 1 cm wide

2a Ascocarps forming perithecia (visible as black dots on the surface) or fruiting structures lacking

3a Perithecia present

3b Perithecia lacking

4a Isidia or soredia present

4b Isidia and soredia lacking

5a Habitat usually semi-aquatic (streamside rocks, trickle lines on cliffs, seepy cracks in outcrops, etc.)

5b Habitat various but seldom semi-aquatic

2b Ascocarps forming apothecia

6a Thallus white to gray, pruinose, appearing areolate, KC+R; apothecia brown, sunken in the thallus; spores minute, spherical, 2-4 µm diameter, many per ascus. — On calcareous rock in continental climates

6b Thallus and apothecia otherwise; spores larger, 8/ascus

7a Thallus yellowish to greenish, occasionally whitish; apothecia lecanorine; widespread and common, mainly e Cascades

7b Thallus brown to black, occasionally grayish or whitish; apothecia lecideine

8a Upper surface conspicuously blistered or warty, the warts typically 1-5 mm diameter and 1 mm or more high; rare disjuncts

8b Upper surface variously textured (often rugose) but not conspicuously warty; common

Key R: STRATIFIED CYANOLICHENS

Foliose or placodioid crustose, lower surface sometimes veined

1a Thallus with veins on the lower surface (occasionally the veins ± obscure); lower cortex absent (appearing dull and fibrous under lens)

2a Medulla white; lower surface never orange. — Common and widespread

2b Medulla orange; lower surface orange with brown veins. — On soil, subalpine to alpine, rarely at low elevations; widespread

1b Thallus without veins on the lower surface or too closely appressed to the substrate to tell; lower cortex present or not

3a Thallus minutely foliose or subfoliose; lobes ≤ 2 mm wide

4a On bark or wood or bryophytes or lichens over those substrates

5a Spores slender and ± twisted, ca. 43 x 1.5-2 µm. — Thallus of blackish-olive appressed lobes; isidia laminal, cylindrical, simple or branched; apothecia dark brown black with a brownish proper margin; California and sw US

*Peltula euploca*

*Dermatocarpon*

*Umbilicaria*

*Glypholecia scabra*

*Rhizoplaca*

*Lasallia*

*Umbilicaria*
5b Spores ellipsoidal to somewhat elongate, broader than 5 µm
6a Spores septate; thallus brown
7a Spores 4-15 septate; thallus cortex of a single layer of cells. — Arctic-alpine to s Oregon; rare
   **Arctomia**
7b Spores 1-3 septate; thallus cortex of several layers of cells. — Common in a wide range of climates and substrates, from treetops in old-growth rainforest to mosses on soil in steppe
   **Massalongia carnosa**
6b Spores simple; thallus brown or more often some shade of gray
8a Cortex and/or medulla usually P+O; apothecia with thalline margin. — Coastal states and provinces, uncommon
   **Pannaria** sens. str.
8b Cortex and medulla P-; apothecia various. — Widespread and common
   **Fuscopannaria** and **Parmeliella**

4b On rock, or bryophytes or humus over rock
12a Lower surface thickly covered with a dark hypothallus that become distinctly bluish black
   see **Degelia**, **Coccocarpia**, and **Placynthium** below
12b Lower surface otherwise
13a On mosses or humus over rock or bark; thallus brown; lobes never longitudinally ridged
14a Thallus brown or dark brown; lobes isidiate to lobulate; spores septate
   15a Spores 4-15 septate; thallus cortex of a single layer of cells. — Arctic-alpine to s Oregon; rare
   **Arctomia**
15b Spores 1-3 septate; thallus cortex of several layers of cells. — Common in a wide range of climates and substrates, from treetops in old-growth rainforest to mosses on soil in steppe
   **Massalongia carnosa**
14b Thallus gray or brownish gray; lobes isidiate becoming sorediose; spores simple. — Widespread and common
   **Fuscopannaria** and **Parmeliella**
13b On rock; thallus blackish, gray green, or olive colored; lobes often longitudinally ridged or striate
15a Lower surface dark, often with bluish black rhizohyphae. — Spores septate; widespread, occasional
   **Placynthium**
15b Lower surface pale, without bluish rhizohyphae; thallus green-gray; without bluish black rhizohyphae
   16a Thallus lacking isidia and lobules, usually fertile. — Thallus forming rosettes 2 cm diam or more; lobes flat, appressed, often minutely grooved, about 0.4-0.5 mm broad; apothecia to 1 mm diam, with thalline margin; disk brown or dark brown; on damp rock; rare in coastal states and provinces, s to Washington Cascades, more common n into Alaska
   **Vestergrenopsis elaeina**
16b Thallus isidiate or lobulate, rarely fertile
   17a Lobes laterally fused; lower cortex lacking but with the lower part of medulla densely prosoplectenchymatous; lobules globular to cylindrical, becoming flattened and constricted at the base, leaving pits as scars when detached. — Rare; coastal Alaska, subalpine to alpine
   **(Steineropsis)**
   17b Lobes contiguous or separate, but not laterally fused; lower cortex present, if rudimentary; isidia very slender and cylindrical but sometimes becoming lobulate, where detached not becoming regularly pitted-scarred. — Mainly in coastal states and provinces inland to Montana
   **Vestergrenopsis**

3b Thallus medium to large foliose; lobes > 2 mm wide
20a Lower surface with white or yellow spots or pores (cyphellae or pseudocyphellae) < 2 mm diam
21a Lower surface with broad (generally 0.5-2 mm) whitish craters (cyphellae). — On bark, wood and less often rock; almost entirely w Cascades
Sticta

21b Lower surface with small (generally < 0.5 mm) white or yellow spots (pseudocyphellae or papillae)
22a Spots on lower surface white or yellow, concave to slightly convex (pseudocyphellae); apothecia, if present, on the upper surface; upper surface dark brown, brown, gray, or greenish gray.
   xa Upper surface strongly reticulate-ridged, similar to Lobaria pulmonaria. — Common on bark and wood (rarely rock) w Cascades, uncommon e Cascades
   xb Upper surface not or only weakly ridged. — Common on bark and wood (rarely rock) w Cascades, uncommon e Cascades

Lobaria anomala and L. anthraspis

Pseudocyphellaria

22b Spots on lower surface white, raised (papillae); apothecia on the lower surface of the lobe tips; upper surface brown to gray brown. — Common on bark and wood at low elevations w Cascades, occasional inland to w Montana

Nephroma resupinatum

20b Lower surface lacking discrete white or yellow spots or pores, but in some spp with whitish patches > 2 mm diameter
23a Lobes large, usually > 1 cm broad; lower surface with fine tomentum interrupted by naked, white patches; upper surface weakly undulating or with a network of prominent ridges. — On bark, wood, and rock; very common w Cascades, uncommon e Cascades to w Montana

Lobaria

23b Lobes smaller, usually < 1 cm broad; lower surface without naked, white patches or without tomentum; upper surface weakly or not at all ridged (sometimes strongly ridged in one rare species)
24a Apothecia on lower surface of lobe tips; thallus brown to gray brown; soredia or lobules present or not. — On bark and wood; widespread, common w Cascades, most spp uncommon e Cascades

Nephroma

24b Apothecia absent or not on the lower surface; thallus gray, brownish gray, olive, greenish gray, or yellowish; soredia or lobules present
25a Lobules or apothecia present, soredia lacking
   26a Lobules present, containing green algae, thallus otherwise with a blue-green photobiont; soredia absent. — Thallus to 2 cm diam; rare on conifer branches in old-growth forests w Cascades, BC to Oregon

Lobaria oregana (blue-green photomorph)

26b Lobules present or not, the whole thallus containing cyanobacteria; apothecia present, 27a Spores dark and septate; lower surface lacking bluish or blue black rhizohyphae and tomentum. — On soil and moss, especially in calcareous areas, mostly subalpine and alpine

Solorina

27a Spores hyaline, nonseptate; lower surface often with bluish or blue black rhizohyphae and tomentum
28a Lower surface thickly covered with a dark felty hypothallus and rhizines that becomes distinctly bluish black; thallus P-. — Arctic-alpine, Alaska and OP

Coccocarpia erythroxyli

28b Lower surface with whitish or bluish rhizohyphae; thallus P+O (eriodermin). — Alaska

Erioderma pedicellatum

[Also in this group, but not yet known from the PNW is Degelia plumbea (Lightf.) P. M. Jørg. & P. James. Lobes shallow, such that the thallus appears nearly monophyllous; apothecia, if present, with a prominent margin (proper and/or thalline exciple) in surface view. upper surface gray, brown, or black; thallus thick and rigid, forming roundish, lobate-margined patches to 10 cm diam; upper surface with longitudinal ridges and concentric, lateral, crescent-shaped curves; rare, on mossy rocks, soil, and trees; coastal Alaska, also in e N Am and n Europe]

25b Lobules absent, soredia present
31a Soredia mainly laminal; lower surface smooth and bare or faintly pubescent; upper surface yellowish tinged when dry, bluish gray when moist. — Old-growth forests w Cascades, BC to Oregon
31a Soredia mainly marginal; lower surface tomentose; upper surface grayish, not tinged with yellow
32a Upper surface glabrous or marginally scabrous; veins usually prominent although occasionally faint in some small specimens; widespread and common. — On bark, wood, and rock

**Peltygera collina**

32b Upper surface with matted or erect tomentum; veins lacking; rare coastal species
33a Upper surface with stiff prominent hairs; with lichen substances (P+O, eriodermin); upper cortex with ± irregular thick-walled cells. — On bark or moss over bark; rare, immediate coast

**Erideroma sorediatum**

33b Upper surface arachnoid tomentose, never with stiff hairs; usually without lichen substances (P-); upper cortex paraplectenchymatous, with regular, thin-walled cells. — On bark or moss over bark; rare, immediate coast

**Leioderma sorediatum**

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**Key S: OTHER GREEN-ALGAL FOLIOSE**

Thallus stratified foliose, green-algal photobiont, non-umbilicate)

1a Thallus bright yellow or orange
   2a Thallus K+ purple. — Widespread, common, on all substrates
   **Xanthoria** and **Xanthomendoza**

   2b Thallus K-
      3a Lobes generally < 0.3 mm wide and < 2 mm long. — Thallus usually sterile, sorediate; spot tests negative (calycin); bright yellow, yellow green, to green; widespread, mainly on bark and wood
      **Candelaria**

      3b Lobes generally > 2 mm wide

1b Thallus white, green, yellow-green (especially pale yellow-green) or brown
   4a Lobes hollow, partially hollow, or solid but distinctly appearing inflated
      5a Lobes solid but swollen and appearing inflated; medulla P-. — Generally on rock, occasionally on moss over rock; subalpine to alpine, fairly common
      **Brodoa oroarctica**

      [Uncommon forms of **Hypogymnia imshaugii** with solid lobes will key here.]

   5b Lobes hollow; substrate and spot tests various
      6a Upper surface perforate; thallus closely flattened to the substrate. — Frequent w Cascades, especially on **Alnus**
      **Menegazzia**

      6b Upper surface not perforate, but lobe tips often perforate; thallus appressed or loosely attached to the substrate

   4b Lobes neither hollow nor appearing inflated
      7a Lower surface with distinct or diffuse veins. — Cephalodia often present as superficial grayish warts on the upper surface
      **Peltigera**

      7b Lower surface not veined, though often variously textured (smooth, wrinkled, warty, etc.)
      8a Lower surface mottled with pale to brownish tomentum and irregular bare patches; thallus usually large
      **Lobaria**

      8b Lower surface variously patterned or smooth but not mottled as above; thallus size various
      9a Thallus yellow-green to greenish (containing usnic acid) when dry, but often darkening in exposed habitats. — Thallus medium to small; lobes medium to narrow

**Group S1**

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**Nephroma occultum**
9b Thallus white, gray, greenish gray, brown, or blackish (usnic acid lacking or not apparent)

10a Lobes narrow, ≤ 1.5 mm wide; thallus small, generally < 3 cm broad (Note: occasional narrow lobed forms can be found for most medium- to broad-lobed species; these should be keyed in Group 4)

11a Upper cortex K+Y or K+ dirty Y, light colored; lower surface generally white, occasionally brown or black; upper surface mostly white to gray

**Group S2**

11b Upper cortex K- or cortex too dark to see the K reaction; upper and lower surfaces various

**Group S3**

10b Lobes generally broader, generally ≥ 1.5 mm wide; thallus medium to large, often > 3 cm

**Group S4**

**Group S1**

Medium to small foliose, with faint yellowish tint (usnic acid)

1a Soredia present

2a Upper surface with whitish pores (pseudocyphellae); soredia laminal and marginal

*Flavopunctelia*

2b Upper surface lacking pores; sorediate or not

3a On rock

4a Medulla UV+ white, K-. Lobes often > 2 mm wide; medulla KC+R (aleuronic acid); lower surface often purplish to black. — Arctic and boreal, rare in PNW

*Arctoparmelia*

4b Medulla UV-, K+Y to R; lobes narrow, to 0.5 mm wide; medulla KC-; lower surface black. — Soralia orbicular, capitata; rare

*Xanthoparmelia mougeotii*

3b On bark and wood

5a Lobes largely free of the substrate; thallus pale greenish or yellowish green above, whitish below

*Evernia prunastri*

5b Lobes ± appressed to the substrate; thallus brown or black below or too tightly appressed to tell

6a Soredia marginal and/or terminal

7a Lobes narrow, < 2(3) mm broad; lower surface black; rhizines dichotomously branched and abundant; medulla C-, KC-; substrate various, usually deciduous spp. — Common w Cascades

*Hypotrachyna sinuosa*

7b Lobes medium, > 2 mm broad; lower surface brown; rhizines generally simple, sparse; medulla C+R, KC+R; substrate various. — Mainly e Continental Divide

*Flavopunctelia soredica*

6b Soredia laminal

8a Lobes < 2 mm broad, tightly appressed. — Lower surface so tightly appressed as to make it difficult to observe; soralia laminal, orbicular; widespread, common, especially e Cascades

*Parmeliopsis ambiguia*

8b Lobes > 2 mm broad, loosely appressed. — Lower surface black (brown at margins), sparsely rhizinate; upper surface greenish wet or dry; photobiont green; not yet known from our area but common east and s of PNW

*Flavoparmelia caperata*

1b Soredia lacking

9a On bark or wood

10a Thallus suberect, pale greenish; pycnidia mainly marginal and submarginal, black; at low elevations

*Cetraria pallidula*

10b Thallus closely appressed, pale greenish in shade to nearly black where exposed; pycnidia laminal, black; mainly subalpine. — Spores ± spherical; apothecia typically present; on conifer branches; mainly subalpine

*Ahtiana sphaerosporella*

9b On soil or rock

11a Lobes broad (usually > 3 mm wide). — Tundra to boreal forest
Nephroma

11b Lobes narrow to medium (usually < 3 mm wide). — Widespread
12a On rock, moss over rock, or occasionally soil; thallus erect or appressed; upper surface yellow green or greenish to blackish, lower surface pale tan, brown, or black but differing in color from the upper surface

Xanthoparmelia

12b On soil or alpine sod; thallus erect or suberect; upper and lower surfaces of lobes similar in color
*Cetraria nivalis* and *C. cucullata*.

Group S2

Narrow-lobed foliose, pale above, cortex K+Y, usnic acid lacking

1a On soil in semiarid sites; apothecial margin lecideine; thallus closely appressed to calcareous soil, upper surface K+ dirty Y. — Uncommon e Cascades

Buellia elegans

1b Not on soil; apothecial margin lecanorine; thallus and substrate various; upper surface K+Y
2a Isidia present; thallus closely appressed to bark. — Widespread but uncommon

Imshaugia aleurites

2b Isidia lacking; thallus and substrate various
3a Lower surface densely pock-marked with tiny pits (use lens). — Mainly w Cascades

Hypogymnia
*Cavernularia*

3b Lower surface not pitted or thallus too closely appressed to easily tell
4a Lower cortex partly or entirely lacking; thallus suberect or loosely attached or appressed; marginal cilia present
5a Cortex lacking only near the lobe tips; soredia, if present, only near the lobe tips

Physcia

5b Lower cortex completely to partially lacking; soredia various. — Soredia generally present; medulla K+Y to R (salazinic acid and zeorin); coastal BC to California, coastal, uncommon to rare in our area

Heterodermia

4b Lower cortex present or too closely appressed to tell; marginal cilia present or not
6a Soredia present
7a Soralia orbicular and laminal; thallus tightly appressed to bark; spores hyaline, nonseptate. — Thallus K+Y or K-, P-; widespread, common, on bark and wood

Parmeliopsis hyperopta

7b Soralia otherwise or, if orbicular and laminal, then growing on rock; spores brown, septate. — Medulla K+Y or K-; widespread and common on all substrates

Physcia

6b Soredia absent
8a Disk pale brown to medium brown; spores hyaline, nonseptate; medulla P+ deep Y (thamnolic acid). — e Montana to s RM

*(Imshaugia placorodia)*

8b Disk dark brown to black (or white pruinose); spores brown, septate; medulla P- or P+ pale Y

Group S3

Narrow-lobed foliose; gray (or whitish pruinose), brown or black; cortex K-

1a Thallus brown or brownish black AND on rock
2a Pycnidia marginal, often protruding isidia-like; pseudocyphellae, if present, marginal; lobes often ascending; mostly subalpine to alpine
3a Thallus black below; medulla P+Y-O (often weak), UV-

Melanelia hepatizon
3b Thallus cream to tan below; medulla P-, UV+

*Cetraria commixta*

2b Pycnidia immersed, mainly laminal if present; pseudocyphellae, if present, laminal; lobes and habitat various
4a Lower surface lacking rhizines; lobes narrow and thick, often nodulose; pseudocyphellae lacking; mostly alpine

*Allantoparmelia*

4b Lower surface rhizinate; lobes thin to moderately thick; pseudocyphellae present or not; widespread
5a Upper surface gray to brown, often with pale angular markings. — Widespread, common

*Parmelia*

[Dark forms of normally pale gray spp, e.g. *P. omphalodes* and *P. saxatilis*, will key here.]
5b Upper surface a rich brown to almost black, lacking angular markings or angular markings very subtle
6a Cortex N+ dark blue-green; thallus with globular isidia that often become sorediose; pseudocyphellae lacking. — Widespread, common

*Neofuscelia*

*Xanthoparmelia* subg. *Neofusca*

6b Cortex N-; isidia present or not; pseudocyphellae present or not
7a Medulla C+R, KC+R

8a Pseudocyphellae abundant and conspicuous (though often dark) on the upper surface. — Widespread, fairly common

*Montanelia*

8b Pseudocyphellae lacking or obscure on the upper surface. — Widespread and common

*Melanelixia*

7b Medulla C-, KC-

9a On bark or wood. — Widespread and very common, often abundant

*Melanohalea*

9a On rock

10a Isidia present, cylindrical. — Widespread and common

*Melanohalea*

10b Isidia absent or present but sometimes becoming lobulate, spatulate, or inflated

11a Lobes usually distinctly convex, but sometimes flat or terete; isidia and soredia lacking. — Widespread, occasional in the mountains

*Melanelia stygia*

11b Lobes ± flat; isidia sometimes present. — Widespread and common

*Montanelia*

1b Thallus another color OR on another substrate

12a Lower surface white to pale brown

13a Soredia lacking

14a Thallus with few or no marginal rhizines. — Uncommon to rare; on calcareous rock, moss over rock, and alpine sod

*Anaptychia*

14b Thallus with abundant long, pale marginal rhizines or cilia; on bark or rock

15a Lower cortex lacking; on bark. — A common boreal species in e N Am with disjuncts in Alaska and n BC and the immediate coast of w Oregon

*Anaptychia crinalis*

*Anaptychia setifera*

15b Lower cortex present; on rock or moss over rock. — Lobe tips lacking hyaline cortical hairs; algal layer ± continuous, the upper surface ± uniformly colored; uncommon e Cascades, most often in crevices in calcareous rock, subalpine to alpine

*Phaeophyscia constipata*

13b Soredia present

16a Lobes very narrow and linear, generally < 0.3 mm broad, with sparse granular soredia or isidia on some lobe tips and margins; lower cortex paraplectenchymatous; occasional (generally overlooked) on bark and rock e Cascades

*Phaeophyscia nigricans*

16b Lobes broader (mostly > 0.3 mm), with discrete laminal, marginal, or terminal soralia; mainly on *Populus* trunks e Cascades
17a Upper surface mostly white pruinose; substrate calcareous rock or thin soil or moss over calcareous rock  
   *Anaptychia elbursiana*

17b Upper surface weakly or not at all pruinose; substrate usually bark or wood
18a Lobe tips lacking pale cortical hairs; lower surface always pale below; lower cortex prosoplectenchymatous
   *Physciella*
18b Lobe tips with pale cortical hairs (inspect protected areas of the thallus -- the hairs are fragile and often rubbed off); lower surface pale or dark below; lower cortex paraplectenchymatous
   *Phaeophyscia hirsuta*

7b Lower surface brown to black or thallus too closely appressed to tell
24a Lobes suberect or erect
   *Cetraria*
24b Lobes ± appressed
25a Thallus firmly adnate to the substrate
   26a On rock; lower cortex and rhizines lacking but similar in appearance to a minute *Phaeophyscia*, but actually crustose
   *Caloplaca demissa*  
   26b On bark; lower cortex and rhizines almost lacking. Pycnoconidia filiform, generally > 15 µm long; Colorado, Great Plains, and California, at least as far n as Humboldt Co.
   *Hyperphyscia*
25b Thallus adnate to loose on the substrate but generally easy to separate from it; pycnoconidia otherwise; substrate various
28a Rhizines squarrosely branched (one exception); upper cortex frequently heavily pruinose; apothecia lacking a corona of rhizines; pale cortical hairs lacking. — Widespread, common, on all substrates
   *Physconia*
28b Rhizines simple or sparsely dichotomously branched upper cortex occasionally pruinose; apothecia with a corona of dark rhizines; pale cortical hairs often present on lobe tips, exciple, or isidia. — Widespread, common, on all substrates
   *Phaeophyscia*

**Group S4**

Medium- to broad-lobed foliose; not yellowish (usnic acid lacking)

1a Thallus brown, greenish brown, olive-brown, or brown-black
2a Thallus erect or suberect, loosely or partially attached or ± free from substrate; rhizines not abundant
3a Thallus free-living on arctic-alpine tundra, curled into balls when dry, opening when moist. — Lower surface with conspicuous grayish patches (pseudocyphellae); upper surface brown; barely reaching our area in n BC
   *Masonhalea richardsonii*
3b Thallus basally attached, prostrate to erect
   *Cetraria*
2b Thallus broadly attached to substrate; rhizines generally abundant
4a Cortex N+ dark blue-green; isidia present, globular, often sorediose; pseudocyphellae lacking; on rock. — Common, particularly in dry exposed habitats
   *Neofuscelia*  
   Xanthoparmelia subg. *Neofusca*
4b Cortex N-; isidia present or not; pseudocyphellae present or not; substrate various
   *Melanelia, Montanelia, Melanelixia,* and *Melanohalea*
1b Thallus gray, greenish gray, or bluish gray, sometimes with browned edges and lobe tips
7a Thallus erect or suberect, loosely or partially attached or ± free from substrate; rhizines absent to moderately abundant
8a Upper surface with pseudocyphellae OR lobe margins with black cilia; primarily w Cascades
9a Upper and lower surfaces lacking pseudocyphellae; marginal cilia generally present; lobes medium to broadly rounded, with short crescent-shaped to roundish marginal soralia. — Common near the coast, unknown e Cascades

**Parmotrema**

9b Upper and/or lower surface with small white pseudocyphellae; lobe margins lacking cilia

10a On bark or wood; upper surface gray to greenish gray;
11a Pseudocyphellae on lower surface, prominent; lower surface tan or whitish; lobes very broad (often > 2 cm), lobulate and/or isidiate. — Upper surface pale grayish often with a faint bluish-green tinge; uncommon on bark in old growth conifer forests, w Cascades

**Pseudocyphellaria rainierensis**

11b Pseudocyphellae on both upper and lower surfaces, small, ± subtle; lower surface black with brown margins; lobes 0.5-1.5 cm broad, the ends broadly rounded and the edges sorediate. — Medulla K-, C-, KC- or KC+ pink (+ perlatolic and imbricaric acids); cortex K+Y (atranorin); w Cascades, uncommon, mainly on riparian *Alnus*

**Cetrelia cetrarioides**

10b On rock, moss, and humus; upper surface yellowish tinged (usnic acid), mottled or edged with black. — Medulla K-, C-, KC+ pink (alectoronic ± alpha-collatolic acid); cortex K+Y (atranorin); arctic-alpine s to n BC

**Asahinea**

8b Upper surface lacking pseudocyphellae AND margins lacking cilia; common inland and on the coast

13a On boulders or humus in tundra; upper surface whitish to tan, black mottled, or mainly black isidiate. — Containing atranorin, alectoronic, and alpha-collatolic acids (medulla KC+ pink); arctic-alpine s to n BC

**Asahinea scholanderi**

13b On bark or wood, rarely on rock; upper surface white to gray or brownish in exposed sites, with or without marginal soredia or isidia

14a Lobes thick; thallus KC+R and/or P+O (physodic and/or physodalic acids); rhizines absent. — Lower surface black, brown near the edges

**Hypogymnia**

14b Lobes thin (like most foliose lichens); spot tests various but always KC- (physodic and physodalic acids lacking); rhizines sparse

15a Lower surface black (edges may be brown); marginal pycnidia abundant; lobes < 4 mm broad; apothecia or incipient apothecia commonly present; isidia and soredia lacking. — Common in moist forests e Cascades, less often in drier forests and treetops w Cascades

**Esslingeriana idahoensis**

15b Lower surface black, brown, or white, often mottled with those colors; marginal pycnidia apparent or not; lobes often > 4 mm broad; apothecia present or not; isidia or soredia present or not. — Widespread, common

**Platismatia**

7b Thallus broadly attached to substrate; rhizines generally abundant

16a Upper surface with pseudocyphellae or whitish angular markings
17a Lower surface pale brown or tan. — Upper surface with pores; medulla C+R, KC+R (lecanoric acid); uncommon w Cascades, more common in c RM and e N Am

**Punctelia**

17b Lower surface black (generally brown edged)
18a Upper surface with whitish angular markings (either conspicuous or subtle); isidiate, sorediate, or with neither; chemistry various. — Common and widespread

**Parmelia**

18b Upper surface with prominent roundish pseudocyphellae; soredia present; medulla C+R, KC+R (gyrophoric acid)

**Punctelia stictica** and *P. borreri*

16b Upper surface lacking pseudocyphellae

21a Soredia and isidia lacking; margins sparsely to moderately ciliate; mainly on deciduous trees; California, to sw Oregon

**Parmelina coleae**

[**Parmelina yalungana**, which is morphologically essentially identical to *P. coleae*, is present in s-}
central Alaska.]
21b Soredia or isidia present
  22a Soredia lacking, isidia present, the isidia becoming ciliate. — Medulla K+Y, C-, P+O (stictic acid); n California to BC, mainly near the coast, fairly common

  **Parmotrema crinitum**

22b Soredia present, isidia lacking; lobes with marginal cilia or cilia lacking
  23a Lobes typically > 3 mm wide; soredia generally powdery. — Lobe margins usually conspicuously ciliate; medulla K+Y or K+O and UV-(stictic or salazinic acid) or K- and KC+R (alectoronic if UV+ or lecanoric acid if UV-); common on bark, occasionally on rock, w Cascades, especially near the ocean

  **Parmotrema**

23b Lobes typically < 3 mm wide; soredia pustulate or granular
  24a Lobe margins sparsely ciliate; rhizines mostly simple. — Upper surface turning coarsely pustulate sorediate; on rock and soil; Colorado

  **Parmelinopsis swinscowii**

24b Lobe margins lacking cilia, rhizines sparsely or densely dichotomously branched

**Hypotrachyna**

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**Key T: BLACKISH FILAMENTOUS**

1a Filaments or lobes > 2 cm long and > 0.1 mm in diameter; photobiont a single-celled green alga
  2a Thallus forming black, richly branched, prostrate flat mats on siliceous rock

  **Pseudephebe**

  [Narrowly divided forms of Melanelia stygia and Allantoparmelia alpicola may key here. The former has prominent pseudocyphellae which are absent on Pseudephebe and Allantoparmelia. Allantoparmelia has thickish (0.2-1 mm), often nodulose, branches.]

  2b Thallus color various, sparsely branched, prostrate or erect; substrate various but most common on trees

  **Bryoria**

1b Filaments or lobes < 2 cm long or less than 0.1 mm in diameter; photobiont blue-green or the filamentous green alga *Trentepohlia*, often filamentous (LM needed to proceed with confidence from this point)
  3a Filaments very fine, main branches < 30 µm (= 0.03 mm) diameter

  4a Filaments 18-28 µm diam, ca 2 mm long; photobiont a single *Scytonema* filament with a gelatinous sheath permeated by hyphae; branching is frequently one-sided; range of habitats uncertain. — On rock (both calcareous and siliceous), possibly overlooked; se Alaska

  **Thermutis velutina**

  4b Filaments ca 12-20 µm diam, often > 2 mm long; photobiont a single *Trentepohlia* filament (no gelatinous sheath) enveloped by hyphae; on shaded, vertical or overhanging, moist noncalcareous rock

  5a Fungal hyphae very irregular and bent, only partly coalescing. — Widespread, possibly fairly common but seldom collected

  **Cystocoleus ebeneus**

  5b Fungal hyphae parallel and straight to somewhat knobby, coalescing. — Washington, BC and n

  **Racodium rupestre**

3b Filaments or lobes more coarse, main branches generally > 40 µm diameter
  7a Photobiont single-celled or colonial (*Gloeocapsa* or *Chroococcus*-like), not filamentous; thallus erect or cushion forming

  8a Photobiont cells surrounded by reddish, K+ purple sheaths; thallus of club-shaped, terete lobes forming small cushions; asci with 16 or more spores. — Widespread

  **Synalissa.**

  8b Photobiont cells surrounded by yellowish brown sheaths, K-; lobes various; asci with 8, 16, or more spores

  9a Lobes with a single or a few central strands in a fountain-like arrangement; apothecia concolorous with the thallus, blackish olive when wet; spored 16-32/ascus; hymenium lacking red blotches; conidia bacilliform. — Thallus cushion forming, upright, repeatedly bifurcate; on siliceous rock; Colorado and California n to Oregon

  **Synalissa.**
**Lichinella stipatula**

*Paulia caespitosa* Tretiach & Henssen, known from sw N Am, is similar but has dense branching forming a dense cushion and the branching is less clearly dichotomous than in *Lichinella stipatula.*

9b Lobes with a distinct central strand of parallel hyphae; apothecia dark reddish or black when wet; spores 8/ascus; hymenium with red blotches; conidia filiform, sigmoid or sicle-shaped. —
Mainly reported from calcareous substrates in sw deserts and Great Plains

**Peccania**

7b Photobiont filamentous (*Nostoc, Rhizonea, Stigonema, or Hyphomorpha*); thallus erect or decumbent

10a On rock, mosses over rock, soil, or moss over soil

11a Thallus a sprawling mat or cushion of fingerlike lobes about 0.1-0.2 mm thick and 1-2 mm long; photobiont *Nostoc*; branches often tipped with swellings (hormocystangia) producing vegetative propagules (hormocysts) with a few cyanobacterial cells and fungal hyphae. — On calcareous rock; Arizona, Montana

**Lempholemma cladodes**

11b Thallus a mat or cushion, the lobes either more slender or longer or both; photobiont various; branches without hormocystangia

12a Thallus mat forming; on rock

13a On calcareous rock where moist; spores generally 8-24/ascus; photobiont *Rhizonea* (*Scytonema*-like; single-rowed filaments, with paired; parallel branches with divergent tips, the tips not tapered); thallus threadlike, erect to decumbent, forming clumps or mats; hyphal cells ± angular, in rows; apothecia to 0.4 mm diam. — Rare, on calcareous rock

**Zahlbrucknerella**

13b On siliceous or calcareous rock, often where moist; spores 8-16/ascus; photobiont *Stigonema* (multiple-rowed filaments, with true branches not conspicuously paired and parallel); thallus in cushions or mats; hyphal cells and apothecia various

14a Blue-green rhizohyphae present (LM); thallus short-filamentous in cushions or mats 5-15 mm broad to 6 mm high; hyphae forming an irregular network overlaid on the much large photobiont cells. — Spores nonseptate. about 10 µm long; on moist noncalcareous rock, both coastal and interior, commonly intermixed with the olive brown squamules of *Psorula rufonigra*; widespread

**Spilonema revertens**

[Other *Spilonema* spp, e.g. *S. paradoxum* Born. are mat forming]

14b Blue-green rhizohyphae absent; thallus in cushions or prostrate mats; hyphae with angular, rounded, or elongate cells arranged in rows or netlike patterns. — On moist calcareous or noncalcareous rock

**Ephebe**

12b Thallus cushion forming; substrate various

15a Photobiont *Stigonema.* — Widespread

**Spilonema**

15b Photobiont *Nostoc* or *Rhizonea* (*Scytonema*-like)

16a Spores brown, 2- to 4-celled; on soil and mosses; arctic-alpine to montane; cushion-formed from branched cephalodia, the thallus highly reduced. — Widespread but rare

**Solorina spongiosa**

16b Spores hyaline, spores multicellular to muriform; on all substrates; cushion formed by the thallus, not the cephalodia

17a On mosses over rock; spores 2-celled; thallus densely cushion forming, richly branched, with glossy round branches; apothecia usually present. — Widespread and common

**Polychidium muscicola**

17b On various substrates including moss over rock; spores multicellular to muriform; thallus minutely fruticose or more often with fruticose projections from a dorsiventral thallus. — Widespread, fairly common

**Leptogium and Scytinium**

10b On bark

18a Hyaline hairs present on branch surfaces (LM); on bark. — Occasional, w Cascades
“Dendriscocaulon”
[“Dendriscocaulon” is catch-all name for fruticose blue-green photomorphs of multiple taxa, including a Sticta and Lobaria]

18b Hyaline hairs not present on branch surfaces; substrate various
19a Cortical cells in a jigsaw pattern. — Photobiont Rhizonema (Scytonema-like); coastal se Alaska to w Oregon; seldom collected

**Leptogidium contortum**

19b Cortical cells lacking or indistinct, irregular, or forming a mosaic, but not in a jigsaw pattern
20a Photobiont Nostoc; in short beaded chains
   21a Thallus of minutely and richly dissected squamules, becoming isidioid or in part minutely fruticose, the lobes 60-120 µm wide, ecorticate or indistinctly corticate with two layers of cells; spores nonseptate; apothecia lacking photobiont in the exciple. — Rare; Alaska, BC, and Washington

**Santessoniella**

21b Thallus various, corticate with one layer of cells; spores muriform; apothecia usually with photobiont in the exciple. — Widespread, fairly common

**Leptogium** and **Scytinium**

20b Photobiont Gloeocapsa, Hyphomorpha, Rhizonema, or Stigonema, not forming distinctly beaded short chains
22a Photobiont colonial, Gloeocapsa-like. — Surface with hyaline knobs but not corticate; branches mostly short, ca. 35 µm diam, in minute fruticose clusters; on Abies, summit of coastal mountain (Example: Oregon, Clatsop Co., McCune 26126)

**unknown Lichinodium-like**

[Initially reported as Dictyonema moorei (Nyl.) Henssen by Brodo (1995, Mycotaxon 56:135-173), this specimen was later determined by Brodo to be an unknown, perhaps undescribed species (see Goward 1999, p. 293, treated as Unknown 2).]

23b Branches round
24a Photobiont Hyphomorpha; basal portions with rhizohyphae. — Surface cells short-elongate, length:width about 2:1 to 4:1; on conifer twigs in coastal forests; se Alaska and BC to OP of Washington

**Erinacellus dendroides**

24b Photobiont Rhizonema (filaments ± paired); basal portions lacking rhizohyphae
26a Branches often somewhat constricted at the base or elsewhere; branches covered by a monolayer cortex of small cells that are not at all elongate; exciple lacking. — On bark of conifers and Betula; coastal Alaska to Oregon, very rare

**Spilonema americana**

26b Branches filamentous without constrictions; exciple smooth or lacking
27a Thallus very small, < 3 mm diam, dull blackish. — Cortical cells irregularly angular; on conifer twigs, rock, and lichens; coastal Alaska to BC

**Lichinodium**

27b Thallus usually > 3 mm diam, ± shiny gray. — Distribution in PNW poorly known

**Polychidium**
Key U: FRUTICOSE, HOLLOW STALKS

1a Stalks tipped with bright red apothecia. — Widespread, common

1b Stalks tipped with brown apothecia or apothecia lacking
   2a Stalks richly branched (generally branched more than 5 times over the length of a mature individual), the branch tips pointed. — Widespread, common
   
   Cladonia

   2b Stalks simple to few-branched, pointed, blunt or tipped with cups
   
   3a Thallus wholly of erect to prostrate stalks, lacking squamules; habitat mainly subalpine to alpine
   
   4a Thallus yellowish brown to brownish, or yellowish green, occasionally purplish brown; stalks blunt
   
   5a Thallus yellowish green; podetia branched. — Alpine, rare
   
   Allocetraria
   
   5b Thallus yellowish to brownish; podetia branched or not. — Alpine, rare
   
   Dactylina

   4b Thallus white to cream; stalks pointed or blunt
   
   6a Stalks pointed; habitat cold, periodically dry. — Apothecia absent; suberect or prostrate on alpine sod and detritus; mainly at high elevations where it is fairly frequent
   
   Thamnolia

   6b Stalks blunt; habitat wet sites in coastal bogs or damp coastal tundra. — Fairly common in coastal Alaska, rarer southward
   
   Siphula ceratites

   3b Thallus differentiated into a basal, crustose to squamulose primary thallus and an erect secondary thallus (podetia); habitat various
   
   7a Podetia unbranched, short (generally < 1.5 cm), mostly naked and ending in a brown to pinkish apothecium; primary thallus continuous, warty-squamulose. — Widespread, common
   
   Baeomyces

   7b Podetia unbranched or branched, short or tall, often bearing squamules or soredia; primary thallus squamulose, generally persistent but sometimes disappearing. — Widespread, common
   
   Cladonia

Key V: FRUTICOSE, NOT HOLLOW STALKED

1a Thallus yellow to orange
   
   2a Thallus minute (gen < 2 cm long)
   
   3a Soredia present
   
   4a Thallus dwarf erect fruticose, generally < 5 mm high; not fibrillose. — On rock, , bark, and wood; widespread
   
   Xanthoria candelaria

   4b Thallus small, prostrate to suberect fruticose, generally > 5 mm diameter; lobes ± fibrillose. — On calcareous rock in sheltered crevices in cold dry habitats
   
   Seirophora contortuplicata

3b Soredia lacking
   
   5a On seashore rocks in spray zone. — Occasional, Oregon s to Baja California
   
   Caloplaca coralloides

   5b On woody plants
   
   6a Thallus a knobby, short-branched, yellow to orange, typically forming compact globular clusters on twigs; apothecia generally present. — Abundant mainly in valleys, widespread
   
   Xanthoria

   6b Thallus of short, branched, orange filaments, the filaments erect and forming a mat generally < 5 mm high; apothecia absent. — Common in many habitats
   
   Trentepohlia (an alga)

2b Thallus medium to large (gen > 2 cm diameter)
   
   7a Thallus orange. — On conifers; rare, immediate coast, Oregon and California
   
   Teloschistes flavicans
7b Thallus bright yellow to fluorescent green. — On bark and wood; common, especially in drier conifer forests, savannas, and isolated trees

Letharia

1b Thallus another color
11a Thallus of compact, massed, stalked squamules, branches, or lobes, not filamentous
12a Thallus straw-colored, cream, or white
13a Stalks (actually long isidia) white, very slender (generally < 0.2 mm diam), unbranched or sparingly dichotomous branched, to about 2 mm long, closely set but not forming a continuous mass. — On bark and wood; common in Coast Range

Loxosporopsis corallifera

13b Stalks thicker than 0.2 mm, straw-colored, cream, or white, thickish, forming a continuous mass; substrate various
14a On inland rock, montane to alpine

Lecanora argopholis and L. swartzii

14b On seacoast rock
15a Thallus whitish; medulla tough, cartilaginous, algae present throughout, the inner parts green; apothecia terminal. — Thallus of short, thick, blunt, often branched stalks about 0.5-1 mm wide and mostly < 1 cm tall; surface usually thickly white pruinose; disk pinkish tan with whitish pruina; on rock; coastal California to Oregon

Cladidium bolanderi

[Cladidium bolanderi has the general appearance of an exuberant Ochrolechia, while the next species, L. phryganitis, looks macroscopically like a giant Leprocaulon americanum.]

15b Thallus pale yellowish green; medulla solid but rather soft, algae restricted to near the surface, the inner part white; apothecia lateral. — On steep rock faces and soil, coastal California

(Lecanora phryganitis)

12b Thallus brown, dark brown, or blackish green
16a Spores minute (< 6 µm long), many/ascus; thallus brown above, black below, of stalked, flat-topped squamules; cortex KC+R. — On rock; fairly common steppe to alpine

Acarospora thamnina

16b Spores larger, < 8/ascus; thallus and spot tests various
17a Spores hyaline, septate or nonseptate
18a Spores septate; on rock

Lecania

18b Spores nonseptate; on siliceous rock or moss over rock
19a On moss or detritus over rock; thallus light brown, gray, or dark gray. — Areoles swollen-verruculose to stalked, apothecia black ± grayish pruinose, convex; spores (11)15-19(26) x 5-7(9); medulla UV+ blue white; on cushion-forming bryophytes on rock; montane to subalpine or alpine; Alaska to Montana and Oregon

Frutidella caesioatra

19b On siliceous rock; thallus dark green, black, or dark brown
20a On sheltered siliceous rock, especially beneath overhangs; thallus dark greenish black to brown black; apothecia not obviously differentiated externally but blending smoothly with the contour and color of the lobe tips; medulla K+Y and/or P+Y. — Occasional, Cascades and RM

Lecanora pringlei

20b On exposed siliceous rock; thallus dark brown to black or olive black; apothecia readily recognizable in form but similar in color to the thallus; spot tests negative. — Occasional on ridges and mountaintops mainly in the Cascade Range

Cornicularia normoerica

17b Spores brown, septate; on rock or moss over rock
21a Spores 1-septate, in apothecia sessile on the thallus; thallus dark brown, of stalked areoles. — Apothecia black, sessile; widespread but only occasional

Buellia badia

21b Spores muriform, in perithecia embedded in the thallus; thallus brown to grayish brown, of massed lumpy and twisted fingerlike lobes. — Occasional in RM

Endocarpon
11b Thallus not of massed, stalked squamules
   22a Thallus free-living (loose) on soil
      23a Branches dorsiventral but tightly rolled, gray or brown above, brown to black below; spores borne in perithecia but mostly sterile. — On thin soil over rock, especially basalt; nearly flat, exposed, poorly drained areas

      Dermatocarpon

      24a Branches dorsiventral, olivaceous-brown, or greenish gray; spores borne in apothecia but mostly sterile. — Thallus prostrate, branched, mat forming or spherical and erect; widespread in semiarid steppe and grasslands

      Aspicilia
      [including Circinaria spp.]

   22b Thallus attached, substrate various
      30a Thallus brown to black, olive black, pale brown, or grayish brown
      31a On bark or wood
         32a Thallus reddish brown; soredia and isidia lacking
         33a Thallus tufted and erect. — Widespread and common, especially e Cascades

      Nodobryoria abbreviata

      33b Thallus pendent
         34a Pseudocyphellae present, small punctiform; medulla and pseudocyphellae C+R, KC+R (olivetoric acid). — Coastal Alaska and BC

      Bryocaulon pseudosatoanum

      34b Pseudocyphellae absent; medulla with all spot tests negative. — BC to San Diego; common, especially Cascades and moist conifer forests e Cascades

      Nodobryoria oregana

      32b Thallus olive, brown, black, or grayish brown; soredia or isidia present or not
      36a Thallus pendent or subpendent
         37a Branches flattened and twisted, distinctly furrowed, dull brown to yellowish brown; isidia and soredia lacking; cortex K+Y (atranorin), P+ pale Y diffusing onto paper. — On well-lit trees at low elevations; OP (extirpated?) to n California; rare

      Sulcaria badia

      37b Branches and chemistry otherwise
         38a Main branches with very long (often > 2 mm long), slender, pale pseudocyphellae. — Coastal, rare

      Sulcaria

      38b Main branches with long to short pseudocyphellae or lacking pseudocyphellae — Widespread, common

      Bryoria

      36b Thallus tufted
         39a Thallus a delicate tuft, on trees or shrubs near the coast; thallus color pale to dark olive brownish or olive black. — Occasional in its restricted habitat

      Cetraria californica

      39b Thallus and habitat otherwise; color various. — Widespread and common

      Bryoria
31b On soil, rock, or alpine sod
  40a Thallus of erect, ± flattened lobes (though sometimes channeled or tubular). — Fairly common, mainly at mid to high elevations

  **Cetraria (islandica group)**

  40b Thallus of branches that are ± round or angular in cross section
    41a Thallus reddish brown
      42a Pseudocyphellae absent; medulla C-, KC-; thallus decumbent. — Uncommon, alpine, RM and Cascades

      **Nodobryoria subdivergens**

      42b Pseudocyphellae present; medulla C+R or C-, KC+R or KC-; thallus decumbent or erect
        43a Medulla C+R, KC+R; thallus forming loose turfs or sprawling; mainly arctic

        **Bryocaulon divergens**

        43b Medulla C-, KC-; thallus often forming ± compact turfs. — Common in arctic-alpine to exposed subalpine habitats

        **Cetraria aculeata** and related species

    41b Thallus olive, brown, tan, or black

    44a Thallus forming compact tufts of thick branches, dark brown to black or olive black; spot tests negative; attached firmly to subalpine or alpine rocks — Occasional on ridges and mountaintops mainly in the Cascade Range

    **Cornicularia normoerica**

    44b Thallus of slender branches, color and spot tests various; on soil, alpine sod, or rock

      45a Thallus generally black, pale brown or straw-colored at the base; cortex and medulla KC+R, P+ yellowish (alectorialic and barbatolic acids). — Rare in our area; arctic-alpine s to New Mexico and Washington

      **Gowardia (Alectoria) nigricans**

      45b Thallus color various; spot tests otherwise. — Infrequent, mainly subalpine to alpine

    **Bryoria**

    30b Thallus some shade of gray, green, yellow-green, or whitish (sometimes with dark mottles)

    47a Cortex lacking; thallus whitish or pale yellowish green, of minute, delicate pseudopodetia forming a short, leprose-appearing turf

      48a Thallus containing usnic acid, lacking atranorin. — Seldom collected; coastal rocks; reported inland to S Dak but inland records need to be confirmed

      **Leprocaulon americanum**

    48b Thallus lacking usnic acid, containing atranorin. — Widespread, common

    **Lepraria**

    47b Cortex present; thallus color various

      49a Thallus white, gray, olive gray, or brownish white (usnic acid lacking)

        50a Thallus of mostly unbranched stalks, generally < 2 cm long

        51a Ascocarp a mazaedium produced at the tips of a short stalk.

          52a Thallus white or pale yellowish white; stalks often > 1 mm diam; medulla deep yellow to orange. — On bark or wood, less often on rock; rare

          **Acroscyphus sphaerophoroides**

          52b Thallus pale gray to greenish gray; stalks < 1 mm diam; medulla white. — Usually on conifer twigs in exposed subalpine habitats; infrequent; Alaska to Oregon

          **Tholurna dissimilis**

        51b Ascocarp not forming a mazaedium or ascocarps not found

          53a Stalks (actually long isidia) < 2 mm high and < 0.2 mm thick, white. — On bark or wood; Coast Range, rarely in Cascades; Alaska to n California

          **Loxosporopsis corallifera**

          53b Stalks generally > 5 mm high or > 0.5 mm thick, grayish to greenish gray, sometimes brownish in exposed habitats; on rock, wood and soil

            54a On rock (rarely wood); stalks commonly tipped with black apothecia. — Common w Cascades, uncommon to rare e Cascades, inland to n Idaho

            **Pilophorus**
54b On soil and organic mats; stalks never with apothecia. — Coastal bogs and wet tundra; BC, Alaska

_Siphula ceratites_

50b Thallus otherwise: branched, mostly > 2 cm long

55a Spores produced in apothecia; stalks lumpy and/or fuzzy, with minute cauliflower-like outgrowths and conspicuous or obscure cephalodia; mostly on rock or moss over rock.

— Widespread, common

_Stereoaulon_

55b Spores produced in a mazaedium; stalks smooth and glossy, without cephalodia; mostly on trees

56a Stalks distinctly flattened in cross section. — Rare, Alaska s to OP near the coast

_Bunodophoron melanocarpum_

56b Stalks roundish to irregular or slightly flattened in cross section. — Common on conifers w Cascades, uncommon e Cascades to Idaho, where it is rare

_Sphaerophorus_

49b Thallus yellowish green to pale green (containing usnic acid)

60a Main branches with a tough central cord; most spp with numerous perpendicular branchlets. — Widespread, common

_Uneea_

60b Main branches without a central cord; most spp with few or no perpendicular branchlets

61a On alpine sod. — Branches soft, the cortex often cracked and eroding; RM

_Evernia divaricata_

61b On bark or wood, rarely on rock

62a Branches greenish above, whitish below, flat, dorsiventral. — Mainly on trees and shrubs; abundant at low elevations w Cascades, occasional e Cascades

_Evernia prunastri_

62b Branches not differentiated into an upper and lower surface

63a Branches becoming black spotted, relatively soft and flaccid even when dry. — Soredia present; on coastal trees, occasionally rock; rare

_Niebla cephalota_

63b Branches not black spotted, except when parasitized or diseased, ± tough and cartilaginous when dry

64a Thallus flat to irregular in cross section; isidia lacking

65a Main branches irregularly perforate into a ± hollow interior, slender, the tips often intricately divided; thallus generally < 4 cm long. — Common w Cascades, uncommon e Cascades in moist forests;

_Ramalina_ (subg. Fistulariella)

65b Main branches not perforate into a ± hollow interior (although sometimes forming nets at the tips of the branches), narrow or broad, generally not intricately divided at tips; thallus generally 2-100 cm long.

— Common on woody plants w Cascades, infrequent e Cascades to w Montana

_Ramalina_

64b Thallus roundish in cross section

66a Branch tips tightly curled into a tiny fiddlehead with minute terminal soralia; main branches generally < 1 mm, without prominent elongate pseudocyphellae. — Occasional, conifer forests near streams in mountains

_Ramalina thrausta_

66b Branch tips curved or straight but not curled; main branches becoming thick (often > 1 mm), with subtle to obvious elongate spiraling pseudocyphellae

_Alectoria_

[Some Bryoria species are occasionally pale enough to key here, including some forms of _B. trichodes_ (K-, P+R, KC-) and _B. capillaris_ (thallus K+ strong Y, P+Y, KC+ pale O)]
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OTHER REFERENCE WORKS USEFUL IN THE PNW


Brodo, I. M., S. D. Sharnoff, & S. Sharnoff. 2001. *Lichens of North America.* Yale University Press, New Haven and London. 795 pages. (A total of 805 species received main entries, while an additional 700 species were keyed or mentioned. That sums to 1505, 42% of the species in the sixth North American checklist. Excellent photographs and descriptions.)


Fink, B. 1935. *The Lichen Flora of the United States.* (Very impressive for its time, it contains descriptions and keys. The keys range from ok to terrible but the descriptions are better. A major problem is that no information on spot tests or chemical content is given. Ranges are often very vague or incorrect. Despite being badly outdated, it is still a valuable historical reference.)


Hale, M. E., Jr. 1979. *How to Know the Lichens, 2nd ed.* Wm. C. Brown, Dubuque, Iowa. 246 pp. (Includes many of the macrolichens in the U. S. The keys are fairly workable once you understand what is meant by certain words, such as "yellow" and "brown". Detail in species descriptions ranges from a word or two to fairly good. Many species are illustrated.)

Hale, M. E., Jr. and M. Cole. 1989. *Lichens of California.* (This was quite useful for students in the Pacific Northwest, however, many of our species are not represented and, even in California, not all species were included. Many of the species are illustrated. Some crustose species were included. See also Sharnoff 2014)


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Noble, W. J. 1982. The Lichens of the Coastal Douglas-Fir Dry Subzone. PhD Thesis, Univ. British Columbia, 942 pp. (This is the only attempt at a complete flora, including crustose lichens, for a region of the Pacific Northwest. This impressive and mammoth work has lots of excellent, original information. It is very useful for areas west of the Cascade crest. It contains keys and full species descriptions. Part II was reprinted and updated in 1997.)
Noble, W. J., T. Ahti, G. F. Otto, and I. M. Brodo. 1987. A second checklist and bibliography of the lichens and allied fungi of British Columbia. Syllogeus 61. (This is a useful but skeletal list of lichens reported for BC. Specific citations are not given for individual entries, so it is difficult to track down the source of the entry. Nevertheless it has a good local bibliography.)
Poelt, J. 1969. Bestimmungsschlussel europäischer Flechten. (Historically a very useful work, critical for Europe, but now largely superseded by Wirth et al. (2013). See also its two supplements by Poelt and Vězda (1977 and 1981). It includes keys and partial species descriptions. In German. A complete translation into English of the first volume and both supplements was done by D. Anderegg, Moscow, Idaho. These volumes continue to be valuable for serious lichenologists.)
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Wirth, V., M. Hauck & M. Schultz. 2013. Die Flechten Deutschlands. 2 vols. Ulmer, Stuttgart, Germany. 1244 pp. (In German; even bigger and better than the preceding version (Wirth 1995); containing keys and excellent color photographs of a large number of species in Germany.)
GLOSSARY

*acicular:* Long, very slender, and pointed, needle-like.
*adnate:* Closely appressed to a surface.
*amyloid:* Reacting positively (blue, violet, or black) to iodine solutions (IKI or Melzers) and therefore containing certain polysaccharides.
*anastomosing:* Fusing and interwoven hyphae, branches, or veins; making a network.
*anisotomic:* Applied to dichotomous branching with unequal-sized branches.
*apothecium:* A sexual reproductive structure of the fungus; usually a disk- or cup-shaped structure lined with, at maturity, an exposed spore producing surface.
*arachnoid:* Cobwebby.
*areolate:* Divided by cracks into small areas, often forming a mosaic.
*asci:* See ascus.
*ascocarp:* (= ascoma) The sexual reproductive body of an ascomycete, usually consisting of covering or supporting layers and the hymenium.
*ascomycete:* An organism in the Class Ascomycetes (or Subdivision Ascomycotina) producing spores in sacs (the asci).
*ascospore:* A spore produced in an ascus.
*ascus (asci):* A sac-like structure, usually opening at the tip, in which sexually produced spores are borne.
*bacilliform:* Short rod-shaped, with rounded ends, like *Bacillus* bacteria.
*basidiomycete:* An organism in the Class Basidiomycetes (or Subdivision Basidiomycotina) producing spores at the tips of specialized, usually club-shaped cells, the basidia.
*biliatorine:* An apothecium with a reduced true exciple when mature and generally pale colored and convex to strongly convex.
*bifurcate:* Dichotomously branched or forked.
*bitunicate:* (= fissitunicate) An ascus having two functional wall layers, the ascus discharging by extension of the inner wall layers which rupture the outer wall.
*blastoidea:* Asexual propagules containing both the photobiont and fungus, rather like soredia, but relatively coarse, partly corticate, and budding like yeast.
*bullate:* Bulging upwards, usually applied to areoles that are thick and convex, or bubble-like.
*buffoid:* Cottony, made up of very fine threads.
*calcareous:* Substrates rich in calcium carbonate (lime), usually applied to rock, especially limestone (fizzes in 1 M HCl) and dolomite (fizzes in 6 M HCl).
*capitate:* An expanded head- or cap-like structure at the tip of a stalk or nearly sessile, usually applied to apothecia and soralia.
*carbonaceous:* Carbon- or charcoal-like: blackened and often easily broken.
*cephalodia:* Cyanobacteria-containing structures in otherwise algal-containing lichens, usually appearing as irregular warts or inclusions, occasionally squamulose or minutely fruticose.
*cilia:* Hair-like projections, usually applied to threadlike multicellular marginal hairs.
*clavate:* Club shaped.
*concolorous:* Having the same color.
*confluent:* Running together or merging.
*coralloid:* Coral-like, having dense, repeated branching of fine segments.
*cortex:* The outer "skin" of lichens, generally ± smooth, often glossy, composed of closely packed fungal hyphae.
*corticulate:* Having a cortex.
*corticulose:* Growing on bark, or, more loosely applied to growing on bark or wood.
*crustose:* A crust-like growth form of lichens that is closely applied to the substrate, like paint, generally attached by all of the lower surface and lacking a lower cortex and rhizines.
*cyanoacteria:* Prokaryotic photosynthetic organisms formerly known as "blue-green algae", generally having a blue-green tint and lacking chloroplasts.
*cyphellae:* Crater-like pores, usually in the lower surface of lichens, that open into the medulla and are lined with differentiated cells; characteristic of the genus *Sticta*.
*decorticate:* Lacking a cortex but formerly with one.
*decumbent:* Reclining, but not closely appressed to a surface, often with the ends upturned.
*decurrent:* Lamellae (gills) in basidiomycetes that taper gradually as they extend down the stipe.
*dichotomously branched:* Y-shaped branching.
*disk:* In surface view of an apothecium, the central part enclosed by, but not including, the margin. Anatomically the disk is the upper surface of the hymenium in apothecia.
*dorsiventral:* Having differentiated upper and lower surfaces.
*endolithic:* Growing immersed in rock, with only the fruiting structures protruding.
*endophloedal:* Growing within bark, with only the fruiting structures protruding. (Although the name implies growing within the phloem, the term is used more broadly.)
*epihymenium:* A layer on the surface of the hymenium,
sometimes applied strictly as a layer of branched and interwoven hyphae above the tips of the asci, but interpreted more broadly by most lichenologists to refer to any surface differentiation of the hymenium. Often used synonymously with "epitheciunm".

epinecral: A surface layer composed of dead cortical cells with indistinct lumina.

epitheciunm: The surface layer of the hymenium, sometimes applied strictly to the branched ends of paraphyses above the asci, but interpreted more broadly by most lichenologists to refer to any surface differentiation of the hymenium, usually consisting of the tips of the paraphyses embedded in a colored gelatinous substance. Often used synonymously with "epitheciunm".

epruinose: Lacking pruina.

exciple: (= excipulm) The usually cup-shaped part of an apothecium or walls of a perithecium that contains the hymenium.

excipuloid: Like an exciple but not a true exciple.

fibril(s)(ose): A small fiber projecting from the thallus, roundish in cross section, usually produced at ± right angles to the direction of growth, usually applied in Usnea.

fissured: Having fissures or vertical cracks.

folioid: A "leaf-like" growth form with dorsiventral lobes that is usually loosely to tightly appressed, 2-dimensional or weakly 3-D, and usually with a cortex on upper and lower surfaces.

foveolate: With delicately pits or shallow surface depressions

fruticose: A 3-dimensional growth form not differentiated into upper an lower surfaces, including pendulous and stringy, upright, or bushy, or with a 2-part thallus of primary squamules and upright stalks.

fusiform: Long, narrow, cigar-shaped or spindle-shaped, tapering toward the ends.

glabrous: Smooth and not hairy.

gyrodisk: An apothecial disk with numerous concentric fissures.

halo: see halonate.

halonate: Spores with a faint to prominent halo (transparent coating), external to the cell wall.

hapters: Short, peg-like attachments of the lower surface of lichens to the substrate.

heterocysts: In cyanobacteria the cells specialized for nitrogen fixation and usually clearly differentiated and bulging as compared to the surrounding cells.

heteromeros: A thallus that is distinctly layered, usually with a white layer, with the photobionts in a distinct band, as opposed to homioimorous where the photobiont is spread throughout the cross-section of the thallus and a white medullary band is lacking.

homoimorous: A thallus where the fungus and photobiont are not separated into distinct bands; most of these have a dark, gelatinous texture.

hyaline: Transparent and colorless.

hymenium: The spore-bearing layer of fungal reproductive structures.

hypha(e): Fungal filaments.

hyphophores: small, erect, asexual, spore-producing bodies that may be peltate, fringed, top-shaped, or simple and awl shaped; commonly found in the genus Gyalideopsis.

hypothallus: (used here = prothallus) A thin, tightly appressed fungal layer differentiated below the main portion of the thallus. A more restrictive use refers to a spongy tissue on the underside of certain lichens, while the prothallus is the initial hyphal mat from which a lichen develops, and often visible as an appressed fringe along the edges of the thallus or areoles.

hypothecium: (= medullary excipulm) The fungal layer just below the subhymenium, but often applied more loosely to any tissues below the hymenium, including the subhymenium.

intercalar: Inserted between two cells.

intemontane: The region of valleys, plateaus, and hills occurring between the main masses of the Rocky Mountains and the Cascade Range.

isidial: Asexual reproductive structures that are minute and finger-like or globular, branched or not, covered with a cortex, and containing the photobiont.

isodiametric: Having approximately equal diameters in all directions.

isotomic: Applied to dichotomous branching with equal-sized branches.

laminal: Occurring on the lobe surface, as oppose to the lobe margins.

lecanorine: (= thalline) Apothecial margins that are colored like the thallus and usually unlike the disk and usually contain the photobiont.

lecideine: (= proper) Apothecial margins that are colored like the disk and unlike the thallus and usually lack the photobiont.

lecideoid: Lecidea like (sens. lat.).

lenticular: Lens-shaped (double convex).

leprose: A thallus that is entirely composed of granular or more often powdery soredia and without any cortex, even in young stages.

lichenicolous: Growing on lichens.

lichenized: A fungus that has an intimate mutualistic association with a photosynthetic partner.

lignicolous: Growing on lignum (bare wood).

lirella(e): An form of an ascocarp that is elongate and narrow, branched or not, rather than disk-like.

lobe: Having lobes.

lobe: A flattened branch or projection. Measure lobe width away from branch points, and away from lobe tips.

locule: Individual cells or cavities in septate fungal spores.

lobulate: Bearing lobules.
lobule: Tiny lobe-like, usually dorsiventral, asexual reproductive structures.

lumen (lumina): The interior of a cell, contained by the cell wall.

maculate: Having small light-colored spots on the upper surface of a thallus, often caused by differences in the thickness of the cortex or clumping of algae beneath the cortex.

marginal: Situated on the margin of a lobe or apothecium or other structure.

mazaedium: A modification of the hymenium of ascomycetes whereby the asci quickly disintegrate, producing a loose powdery spore mass that is added to from below and sloughed off at the top.

medulla: The interior layer of most lichens, composed mainly of fungal hyphae.

morph: A form without any implied taxonomic rank.

morphotype: see morph.

muriform: Spores that have both internal crosswalls and longitudinal walls (= dictyospores).

muscicolous: Growing on mosses.

mycelium: A mass or body of fungal hyphae.

ocular chamber: The "chambre oculare" in the ascus tip, consisting of a non-amyloid area embedded in the lower part of the tholus and above the spores, usually applied to bitunicate asci.

orbicular: Round.

ostiole: The pore or opening into a perithecium or pycnidium.

palmately branched: Several to many branches or lobes radiating from a single point.

papilla(e): Minute, discrete, usually rounded bumps.

paraphyses: Sterile filaments (simple or branched) in the hymenium and usually surrounding the asci.

paraplectenchyma: A tissue type with compactly massed hyphae having ± isodiametric lumina; essential the fungal equivalent of parenchyma. (Contrast with prosoplectenchyma)

pelate: Plate or shield-shaped and slightly raised, generally with a central stalk from the underside.

perithecium(s): A type of globose or flask-shaped ascocarp where the hymenium is completely enclosed by protective sterile tissue, except for a small opening at the tip, the ostiole.

phialosporic: a type of conidia produced from a particular kind of conidiophore producing a basipetal succession of conidia that develop without an increase in length of the phialide (a cell developing the conidigenous loci).

photobiont: The photosynthetic partner in a lichen, consisting of either green algae or cyanobacteria.

podetia: The upright, hollow stalk, that forms the secondary thallus in Cladonia-like lichens having a prostrate primary thallus and upright secondary thallus. (Actually an elongate apothecium in that the ascogonia are on the primary thallus.)

polariocular: Septate spores in which the two locules (cells) are connected by a channel through a thick septum.

proper margin: (= proper exciple) The "excipulum proprium", a usually cup-shaped structure of just fungal tissues that surrounds the hymenium in an apothecium.

prosoplectenchyma: A tissue type with compactly massed hyphae with elongate lumina.

pruina(ose): Superficial chemical deposits, usually whitish and usually formed from calcium oxalates, giving a frost-covered or floury appearance.

pseudocyphellae: A broad term referring to any differentiated breaks in the cortex of lichens but that lack specialized cells surrounding the opening: these may be round, irregular, angular, or a minuscule pore.

pseudopodetia: An upright generally solid stalk, similar in appearance to podetia, but the ascogonia arise on the stalk instead of giving rise to the stalk.

punctiform: Punctate; with small spots or hollows.

pustular: Usually applied to soredia that begin as a lump or small blister, then breaks down into (usually granular) soredia.

pycnidium(s): An asexual spore-producing structure of the fungus, usually embedded in the thallus and visible externally as a black dot, occasionally in a projecting bump from the thallus (as in Cetraria); anatomically a generally flask-shaped lined with conidiogenous cells and producing pycnoconidia (= pycnoconidia).

pycnospora(ce): Spores produced from pycnidia.

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often rounded, ear-like, or lobed.

**squarrose**: Branching by many short perpendicular branches from a single main axis.

**stellate**: Star-shaped.

**steppe**: Semiarid shrublands or grasslands, usually with cold winters and hot summers and a continental climate.

**stratified**: Differentiated into layers; heteromeric.

**subhymenium**: The generative tissue below the hymenium and above the hypothecium, thus, sandwiched between the exciple and the hymenium. Sometimes applied more loosely as equivalent to the hypothecium.

**synnema**: a conidia-bearing structure formed by a ± compact group of erect ± fused conidiophores.

**terricolous**: Growing on the ground, including mineral soil, humus, litter, and organic sods.

**thalline margin**: (= thalline exciple, = excipulum thallinum) An apothecial margin similar in color and structure to the thallus and usually containing the photobiont.

**thalloconidia**: conidia arising from the surface of a thallus or prothallus; especially applied to the lower surface and rhizines of many *Umbilicaria* species that produce black powdery conidia.

**thallus**: The vegetative body of a lichen.

**tholus**: A structure in the tip of an ascus that fills the tip like a plug or dome and is usually amyloid (I+ blue).

**tomentose**: Faintly to distinctly felty or the surface with short, fine fuzz; having a tomentum.

**tomentum**: See tomentose.

**umbilicate**: Attached by a single holdfast, the umbilicus.

**unstratified**: Without separation of the photobiont and fungus into distinct layers; homoiomerous.

**veins**: Raised branching or anastomosing strands, applied to the lower surface of foliose lichens.

**verruca(e)(ose)**: Small bumps, warts, or projections.

**weft**: A loose filamentous mat.
**INDEX**
Including Mycobionts and Photobionts

<table>
<thead>
<tr>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>abbreviata, 75</td>
</tr>
<tr>
<td>abietinum, 31</td>
</tr>
<tr>
<td>Absconditella, 33, 37</td>
</tr>
<tr>
<td>Acarospora, 18, 39, 55, 56, 59, 74</td>
</tr>
<tr>
<td>Acrocordia, 14, 16</td>
</tr>
<tr>
<td>Acroscyphus, 9, 76</td>
</tr>
<tr>
<td>actinostoma, 27</td>
</tr>
<tr>
<td>aculeata, 76</td>
</tr>
<tr>
<td>Adelolecia, 32</td>
</tr>
<tr>
<td>adhaerens, 41</td>
</tr>
<tr>
<td>Agonimia, 12, 57, 58</td>
</tr>
<tr>
<td>Agyrium, 27</td>
</tr>
<tr>
<td>Ahtiana, 65</td>
</tr>
<tr>
<td>aipospila, 52</td>
</tr>
<tr>
<td>alaskana, 4</td>
</tr>
<tr>
<td>alaskensis, 37</td>
</tr>
<tr>
<td>albescens, 51</td>
</tr>
<tr>
<td>albidula, 24</td>
</tr>
<tr>
<td>alboatra, 21</td>
</tr>
<tr>
<td>albociliatum, 6</td>
</tr>
<tr>
<td>albofuscescens, 30</td>
</tr>
<tr>
<td>Alectoria, 76, 77</td>
</tr>
<tr>
<td>aleurites, 66</td>
</tr>
<tr>
<td>Allantoparmelia, 67, 70</td>
</tr>
<tr>
<td>allobata, 12</td>
</tr>
<tr>
<td>Allocetraria, 73</td>
</tr>
<tr>
<td>allophana, 46</td>
</tr>
<tr>
<td>alpicola, 70</td>
</tr>
<tr>
<td>alpinus, 39, 50</td>
</tr>
<tr>
<td>amara, 44, 55</td>
</tr>
<tr>
<td>ambigua, 65</td>
</tr>
<tr>
<td>Ameleilla, 19</td>
</tr>
<tr>
<td>americana, 12, 72</td>
</tr>
<tr>
<td>americanum, 76</td>
</tr>
<tr>
<td>Amygdalaria, 19, 26</td>
</tr>
<tr>
<td>amylacea, 35</td>
</tr>
<tr>
<td>Anamylopsisora, 59</td>
</tr>
<tr>
<td>Anaptychia, 67, 68</td>
</tr>
<tr>
<td>andreaeicola, 19</td>
</tr>
<tr>
<td>androgyna, 47</td>
</tr>
<tr>
<td>Anema, 5</td>
</tr>
<tr>
<td>angermannicum, 11</td>
</tr>
<tr>
<td>Anisomeridium, 15, 16</td>
</tr>
<tr>
<td>antecellens, 14</td>
</tr>
<tr>
<td>Anzina, 22, 23</td>
</tr>
<tr>
<td>aquatica, 19</td>
</tr>
<tr>
<td>arborea, 43, 46</td>
</tr>
<tr>
<td>Arctomia, 16, 62</td>
</tr>
<tr>
<td>Arctoparmelia, 65</td>
</tr>
<tr>
<td>arenarium, 8, 9</td>
</tr>
<tr>
<td>argena, 45, 52</td>
</tr>
<tr>
<td>argopholis, 74</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>armeniaca, 29</td>
</tr>
<tr>
<td>Arthonia, 10, 17, 33, 34, 60</td>
</tr>
<tr>
<td>Arthopyrenia, 15</td>
</tr>
<tr>
<td>Arthothelium, 10, 16</td>
</tr>
<tr>
<td>Arthrorhaphis, 14, 37, 39</td>
</tr>
<tr>
<td>Arthrosoroporum, 36</td>
</tr>
<tr>
<td>Asahinea, 69</td>
</tr>
<tr>
<td>aspersa, 53</td>
</tr>
<tr>
<td>Aspicilia, 19, 31, 45, 75</td>
</tr>
<tr>
<td>asteriscus, 22</td>
</tr>
<tr>
<td>athroocarpa, 28</td>
</tr>
<tr>
<td>atra, 20</td>
</tr>
<tr>
<td>atrata, 26</td>
</tr>
<tr>
<td>atroalba, 10</td>
</tr>
<tr>
<td>atrofulva, 53</td>
</tr>
<tr>
<td>aureolepra, 42</td>
</tr>
<tr>
<td>auriculata, 29</td>
</tr>
<tr>
<td>azaleae, 8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>revolutionaria, 45, 52</td>
</tr>
<tr>
<td>Bacidia, 28, 35, 37, 38, 40, 43, 48, 52</td>
</tr>
<tr>
<td>Bacidina, 38</td>
</tr>
<tr>
<td>Bactrospora, 35</td>
</tr>
<tr>
<td>badia, 60, 74, 75</td>
</tr>
<tr>
<td>baemypas, 52</td>
</tr>
<tr>
<td>Baeomyces, 32, 52, 73</td>
</tr>
<tr>
<td>Bellemerea, 19, 52</td>
</tr>
<tr>
<td>berengeriana, 30</td>
</tr>
<tr>
<td>Biatora, 30, 31, 35, 37, 42, 45, 47, 51</td>
</tr>
<tr>
<td>biatorella, 12</td>
</tr>
<tr>
<td>Biatorella, 25</td>
</tr>
<tr>
<td>Biatoridium, 24</td>
</tr>
<tr>
<td>bicincta, 21, 28</td>
</tr>
<tr>
<td>biforme, 16</td>
</tr>
<tr>
<td>biformiger, 33</td>
</tr>
<tr>
<td>biformis, 62</td>
</tr>
<tr>
<td>Bilimbia, 36, 60</td>
</tr>
<tr>
<td>Blennothallia, 5</td>
</tr>
<tr>
<td>Blidingia, 4</td>
</tr>
<tr>
<td>bolanderi, 57, 74</td>
</tr>
<tr>
<td>borealis, 4, 48</td>
</tr>
<tr>
<td>borreli, 69</td>
</tr>
<tr>
<td>Botrydina, 4</td>
</tr>
<tr>
<td>Botryolepraria, 42</td>
</tr>
<tr>
<td>botryosa, 29, 50</td>
</tr>
<tr>
<td>bouteillei, 33</td>
</tr>
<tr>
<td>Brianaria, 17</td>
</tr>
<tr>
<td>Brigantiaea, 34</td>
</tr>
<tr>
<td>Brodooa, 64</td>
</tr>
<tr>
<td>Bruceomyces, 9</td>
</tr>
<tr>
<td>Bryobilimbia, 31</td>
</tr>
<tr>
<td>Bryocaulon, 75, 76</td>
</tr>
<tr>
<td>Bryonora, 20, 28</td>
</tr>
<tr>
<td>Bryophagus, 6, 35, 38</td>
</tr>
</tbody>
</table>
Bryoria, 70, 75, 76, 77
Buellia, 21, 25, 32, 43, 45, 60, 66, 74
Bunodophoron, 77
Byssoloma, 36

C

cadubriae, 30
Caeruleum, 18
caesioatra, 74
caesiosora, 54
caeus, 50
calicioides, 8
Caliciopsis, 8
Caliciumphora, 73
Calicium, 9
californica, 23, 37, 58, 75
Caloplaca, 21, 22, 31, 32, 38, 39, 43, 50, 51, 54, 56, 68, 73
Calothrix, 5
Calvitimela, 17, 28, 29, 53
campestre, 25
candelaria, 73
Candelaria, 64
Candelariella, 19, 40
caperata, 65
capillaris, 77
Carbonea, 29
Carbonicola, 58, 59
carinthiacum, 15
carneonivea, 22, 23
carneus, 52
carnosa, 62
carrollii, 28
Catapyrenium, 56, 57
Catillaria, 33
Catinaria, 33
Catolechia, 56
Cavernularia, 66
Cecidonia, 29
Cephalophysis, 25
ceratites, 73, 77
Cercidospora, 14
cerebrina, 10
Cetraria, 65, 66, 67, 68, 75, 76
Cetrarioides, 69
Cetraria, 69
Chaenotheca, 8, 9, 39, 40
Chaenothecopsis, 9
Cheiromycina, 41
chlorina, 38
chlorococcum, 36
chloroconia, 35
Chroococcus, 4, 5, 6, 70
chrysantha, 42
chryanthoides, 42
chrysocaphala, 39
chrysothalamia, 17
Chrysothrix, 17, 39
cinerea, 36
cinereorufa, 60
cinnabarina, 45, 48

circinaria, 52, 75
circumspecta, 35
citrina, 38
citrinella, 39
Cladidium, 74
cladodes, 71
Cladonia, 58, 73, 82
Cladosporium, 8
Clauzadea, 31
clauzadeana, 25
Clauzadeana, 19
clavulifera, 30
Clostomum, 33, 39, 40, 41, 48
Coccocarpia, 63
Coccotrema, 18, 44, 45, 49
Coenogonium, 33
coleae, 69
Collema, 5, 6
Collembosporium, 11
collina, 64
colobina, 43, 51
coloradoense, 57
commixta, 67
complicatula, 4
conforme, 57
Coniocybe, 8, 39
conizaeoides, 41, 48
constipata, 67
contortum, 72
contortuplicata, 73
coralifera, 22, 43, 74, 76
coralloides, 73
Cominaria, 74, 76
corticola, 15, 24, 43, 47
crassipes, 27
Cresponea, 35
crinalis, 67
crinitum, 70
crocea, 61
cucculata, 66
Cyphellium, 7
Cystococcus, 23
Cystocolleus, 70

D

Dactylina, 73
Dactylospora, 32
Degelia, 63
degeliana, 46, 48
delitescens, 24
demangeonii, 5
demissa, 54, 68
demissum, 59
Dendriscocaulon, 72
dendroides, 72
Dermatocarpon, 57, 61, 75
Dibaeis, 52
Dictyonema, 72
diffusa, 41
Digitothyrea, 5
Dimelaena, 21
Dimerella, 33
Diploschistes, 23
Diplotomma, 32
disciforme, 34
disjuncta, 42, 49
dissimilis, 7, 76
divaricata, 77
divergens, 76
dolodes, 26
Doratomyces, 7
doovrensis, 16, 17

ebeneus, 70
efflores, 54
efflorescens, 47, 48
Eiglera, 19, 25
elea, 62
elatina, 45
elbursiana, 68
elegans, 66
Elixia, 10
Elliptochloris, 12
Enchylium, 5
Endocarpon, 12, 57, 74
Endococcus, 13
Enterographa, 10, 54
Eopyrenula, 13
epanora, 39
Ephebe, 71
epicorticis, 8
epidermidis, 16
epigaem, 11
Epigloe, 14
Epilichen, 32
epithaloides, 51, 55
eritatum, 22, 36, 44
erichanseni, 38
Erinacellus, 72
Erioderma, 63, 64
eratica, 29
erisiboides, 33
erithophae, 27
erithroxyli, 63
Esslngeriana, 69
Euopsis, 5, 11, 16, 20
epiloca, 57, 61
Evernia, 65, 77
expallens, 40, 45
extensa, 22

fagicola, 23, 37
Farnoldia, 27
Fellhanera, 33
Fellhaneropsis, 38
fingens, 56

Fissurina, 10
Fistulariella, 77
flavicans, 73
flavida, 19, 25
flavidulum, 39, 41, 48
flavocorallina, 40
Flavoparmelia, 65
flavopunctata, 45
Flavopunctuella, 65
flavosoralifera, 50
flexella, 10
fosteri, 32
foveolaris, 22
friesii, 36, 59
Frutidella, 49, 74
fucata, 45
Fulgensia, 38, 56
Fulgidea, 58, 59
fumosa, 43, 46
furfuracea, 8, 39, 40
Fuscidea, 19, 26, 32, 45, 49, 53
fuscinere, 31
fuscolutea, 34
Fuscopannaria, 40, 58, 62

garovaglii, 28
gedphana, 17
gibbsa, 20, 52
glaucophol, 59
glebosa, 17, 60
gloeocapsa, 6, 35, 38
Gloeocapsa, 5, 6, 16, 35, 70
Gloeocystis, 35
Glypholeia, 61
Gomphillia, 8
Gowardia, 76
gowardii, 47
granatina, 20
granulosa, 4
Graphis, 10
griseosoralifera, 46, 51
griseovirens, 43, 45
grumosa, 54
grumulifera, 5
Guignardia, 4
Gyalecta, 22, 23, 34, 36, 37
Gyalectaria, 18
Gyalidea, 22, 24, 34, 36
Gyalideopsis, 8, 34, 37, 81
Gyalolechia, 38, 56
Gypsopla, 60
gyrocarpa, 55

H

Haematomma, 40, 46, 53
Halecania, 23, 48
halonia, 21
haydenii, 75
maculiforme, 11
malmeana, 24
margaritella, 30
Masonhalea, 68
Massalongia, 62
Massarina, 15
Mastodia, 4
mastrucata, 43, 45, 52
Megalaria, 33, 45
megaspora, 34, 42
Megaspora, 19
Melanelia, 66, 67, 68, 70
Melanelixia, 67, 68
melanocarpum, 77
Melanohalea, 67, 68
Melanolecia, 27
Melanotopelia, 12
Melaspilea, 10
Menegazzia, 64
Metacapnodium, 8
Micarea, 17, 33, 35, 36, 42, 43, 44, 47
Microcalicium, 7, 8, 9
micropsis, 27
minutum, 49
Miriquidica, 28, 53, 54, 60
Mniaecia, 17, 25
modesta, 12
moenium, 55
Monoblastiopsis, 11
Montanelia, 68
Montanelia, 67
mooei, 72
moriopsis, 25
mougeoti, 65
Muellerella, 13, 14
Multiclavula, 4
muscicola, 37, 71
muscorum, 12
Mycobilimbia, 37, 51, 55
Mycoblastus, 16, 24, 39, 50
Mycocalicium, 9
Mycoporum, 14
Mychotheca, 30, 31, 49
Myronora, 24
N
Naetrocymbe, 14, 15
neglecta, 42
Neofusca, 67, 68
Neofuselia, 67, 68
Neonorrhinia, 14
Nephroma, 63, 64, 66
Niebla, 77
nigricans, 67, 76
nigritella, 5
nivale, 36
nivalis, 66
Nodobryoria, 75, 76
Normandina, 56
normoerica, 74, 76
Nostoc, 5, 6, 71
nylanderi, 49
nylanderiana, 22
oblongula, 21, 31
obnascens, 54
obscurella, 32, 51
occultum, 64
ocellatum, 50
Ochrolechia, 20, 46, 47, 49, 55
ochrolemma, 53
ochroleum, 40, 46, 53
oligospora, 59
Omphalina, 4
omphalodes, 67
Opegrapha, 11, 42, 43, 46, 55
Ophioparma, 22, 38, 43, 48
ophthalmiza, 51
oregana, 63, 75
oregonensis, 10
oroarctica, 64
Orphniospora, 25
O
Pacifica, 14, 42
dallula, 65
Pannaria, 62
pannonica, 54
paradoxum, 71
parasitica, 55
Parmelia, 67, 69
Parmeliella, 58, 62
Parmelina, 69
Parmelinopsis, 70
Parmeliopsis, 65, 66
Parmotrema, 69, 70
patellata, 57
Peccania, 6, 71
pedicellatum, 63
peilocarpa, 36
Peltigera, 4, 17, 61, 64
Peltula, 57, 61
perigracilis, 10
Pertusaria, 11, 18, 40, 43, 48, 51
petractoides, 23
Petroderma, 11
pezizoides, 58
Phaeocalicium, 9
Phaeographis, 10
Phaeophyscia, 67, 68
Phaeorhiza, 59
phillipii, 7
Phlyctis, 45, 52
phryganitis, 74
Phylliscum, 5
Physcia, 66
Physciella, 68
Physconia, 68
scalaris, 58
Schadonia, 34
Schaereria, 22, 29, 31, 43, 60
Schismatomma, 22
schleicheri, 39
scholanderi, 69
Sclerophora, 8
Scoliciosporum, 31, 36, 37, 38, 47, 50
scopulicola, 37, 52
scopulis, 37, 52
Scytinium, 7, 71, 72
Scytonema, 6, 16, 71, 72
Segestria, 14
Seirophora, 73
setifera, 67
sheardii, 47, 50
sierrae, 58
Sigridea, 23
simplex, 25
sinuosa, 65
Siphula, 73, 77
Solorina, 61, 63, 71
soralifera, 48
sorediata, 46
sorediatum, 64
soredica, 65
soredizodes, 53, 54
sorocarpa, 50
Sorocybe, 8
speirea, 20
sphaerophoroides, 9, 76
Sphaerophorus, 77
sphaerosporella, 65
Spilonema, 60, 71, 72
spongiosa, 71
Sporastatia, 24, 29
Sporodictyon, 12
Squamarina, 21, 56
Staurothele, 12
Steineropsis, 52, 62
Steinia, 17
Stenocybe, 9
stenotropa, 31
Stereoaulon, 36, 53, 55, 77
Sticta, 63, 72, 80
stictica, 44, 69
Stictis, 38
stigmatella, 13
Stigonema, 5, 21, 71
stigonemoides, 13
stipatula, 71
Strangiospora, 24
Strigopodia, 8
Strigula, 13
stygia, 67, 70
subalbicans, 41
subaurifera, 42, 49
subdivergens, 76
subsorediza, 52
subtile, 9
Sulcaria, 75
swartzii, 74
swinscowii, 70
Synalissa, 6, 70
syncarpa, 31
Szczawinska, 7

T

talayana, 53
tavaresiae, 11
Teloschistes, 32, 73
Tephromela, 20, 54
ternaria, 36
tesselata, 4
tesserata, 9
testudinea, 29
Tetramelas, 32
Texosporium, 7
thamnina, 74
Thamnolia, 73
Thelellia, 12
Thelidium, 14
Theiligya, 5
Theilocarpus, 11, 25
Thelomma, 7, 50
Thelotrema, 23
Thermitis, 70
Tholyrm, 7, 76
thomsonii, 50
thrausta, 77
Thrombium, 11
Thyrea, 5
Toensbergia, 46
toenbergii, 12
Tomasellia, 12
Toninia, 33, 60
transitoria, 27
Trapelia, 21, 28, 47, 52, 55
Trapeliopsis, 28, 30, 31, 44, 47, 55, 58, 59
Trebouxia, 16
Tremolecia, 26
Trentepohlia, 8, 13, 24, 34, 70, 73
trichodes, 77
tristicula, 58
trypethiliza, 14
tsgae, 7
tuberculosa, 53, 55
turfosa, 36
Turgidosculum, 4
turneri, 49
Tylothallia, 33

U

ulvae, 4
Umbilicaria, 61
umbrosa, 54
Usnea, 77
Vaccinicolia, 51
Varicellaria, 18, 22, 46
Variolaria, 44, 51, 55
Velutina, 70
Venosa, 4
Verrucaria, 11, 57
Verruculosa, 21
Vestergrenopsis, 16, 52, 62
Vezdae, 38
Vezdaeae, 17
Violella, 45
Viridescens, 23, 48
Viridialba, 9
Viridifarinosa, 48
Viridis, 49
Vitiligo, 44
Vulpicida, 64

Wahlenbergiella, 11
Wahlenbergii, 56
Waynea, 37, 58
Wimmeriana, 19, 52

Xanthocapsa, 5, 6
Xanthomendoza, 56, 64
Xanthoparmelia, 65, 66, 67, 68, 75
Xanthoria, 38, 56, 64, 73
Xerotrema, 34
Xylographa, 10, 43, 44, 48
Xylographoideae, 9
Xylopsora, 59
Xyloschistes, 10

Yalungana, 69

Zahlbrucknerella, 71
Zamenhofianum, 56
Zonata, 54

ABBREVIATIONS

BC British Columbia
Cont Div Continental Divide
diam diameter
elev elevation(s)
esp especially
gen generally
occ occasional
OP Olympic Peninsula
RM Rocky Mountains
μm micrometers
Sask Saskatchewan
w Cas west of the Cascade crest
< less than, fewer than
> more than, longer than
± more or less

SPOT TEST REAGENTS

C commercial chlorine bleach
HNO₃ 6 M aqueous solution
I 0.25 g iodine in 100 ml aqueous
K 0.5% potassium iodide solution
KOH, 10% aqueous solution
KC treatment with K followed by C
lw UV long wave ultraviolet light (366 nm)
P paraphenylenediamine (alcohol solution)
sw UV short wave ultraviolet light
UV ultraviolet light (long or short wave)

SPOT TEST COLORS

B blue
O orange
R red
Y yellow