

LIRELLIFORM KEY

After Grube (1998), Poelt & Vezda (1981; only partly translated),
Harris (1990), Tehler (1993), and Purvis, et al. (1992)

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I.

Ascocarp with pale or carbonaceous exciple (often rudimentary when ascocarps immersed), mostly elongated to branched, of stripe-form.

1. **Asci unitunicate.** Ascocarps ascohymenial. 2
1. **Asci bitunicate. Spores I-, the cells cubical to rectangular (or ellipsoid in simple-spored genera), the walls evenly thin.** 3
 2. **On leaves.** GRAPHIDALES: GOMPHILLACEAE: Aulaxina
 2. **On other substrates (usually bark).** Spores I+ purple, the cells lens-shaped to spherical, the walls irregularly thickened. KEY A. GRAPHIDIALES: GRAPHIDIACEAE.
3. **Spores usually 1-septate [rarely to 5-7-septate, e.g., in "M. octomera"].** Ascocarps ascohymenial. Asci bitunicate. Spores becoming brown. LECANORALES: INCERTAE SEDIS: Melaspilea
3. **Spores usually several to many septate.** 4
 4. **Thallus with protococcoid algae (sometimes endoxylous and appearing unlichenized).** Ascocarps ascohymenial. 5
 4. **Thallus usually with Trentepohlia.** Ascocarps ascolocular. Asci bitunicate, I-. B. ARTHONIALES: OPEGRAHACEAE, etc.
6. **Exciple carbonaceous, brittle. On wood or rock.** 7
6. **Exciple pale to dark but not carbonaceous or brittle. On wood.** AGYRIACEAE: Xylographa
 7. **On wood.** AGYRIACEAE: Ptychographa
 7. **On rock.** 8
8. **Spores 2-celled, with dark inner wall around each lumina and hyaline, thick outer wall.** RHIZOCARPACEAE: Poeltinula (cerebrina)
8. **Spores simple, hyaline, the wall uniform.** RIMULARIACEAE: Lithographa (tesserata)

ADD: **Spores brown when mature.** Asci lecanoralean. Thallus dirty white to yellowish white, thick crustaceous, becoming rough and thickly sprinkled with small soredia, \pm marginally zonate, with poorly defined hypothallus. Apothecia black, circular to elongate and difform, with slightly developed white exciple. Spores 3-septate, 4-7.5 x 12.5-18 μ m. On bark. California. "Sclerophyton" occidentale Herre

II.

Ascocarp entirely without exciple, roundish to mostly elongated or branched, rarely narrow stripe-form.

1. Asci clustered free, not bound by gelatin to the ascocarp, extremely thick-walled. Thallus (and ascocarps?) ephemeral, growing primarily on mosses, secondarily overgrowing other substrates. Ascocarps ascohymenial. Asci amyloid, bitunicate. Photobiont (usually?) Leptosira. LECANORALES: VEZDAEACEAE. (Vezdaea)

1. Asci bound by gelatin in the ascocarp, thinner walled. Thallus (if evident) and ascocarps perennial. 2

2. Ascocarps ascohymenial, usually rounded, mostly convex. Photobiont small, "micareoid". Thallus often goniocyst-like in form. Spores one or several celled. On various acidic substrates. (LECANORALES: MICAREACEAE: Micarea)

2. Ascocarps ascolocular, more often irregular or branched, mostly flat. Photobiont Trentepohlia, or at least not "micareoid". Thallus not goniocyst-like. Spores always several septate or muriform. KEY B. ARTHONIALES.

A. GRAPHIDIALES: GRAPHIDACEAE

1. Apothecia with brown disk, cup-like, or immersed to several in distinctly delimited, prominent stromata. 2
1. Apothecia immersed to sessile, mostly elongated with a narrow, often slit-like disk; not immersed in distinct, prominent stromata, single or in groups. 5
 2. Ascomata cup-like with a thick raised margin. Gyrostomum (scyphyliiferum)
 2. Ascomata aggregated in a pseudostroma. 3
3. Spores hyaline (to brownish in age), becoming muriform. Pseudostroma \pm distinct and raised. Hymenium and hypothecium colorless. 4
3. Spores brown, transversely 4-6-celled. Pseudostroma flattened, poorly developed, usually whitish. Hymenium and hypothecium often at least partly \pm brown. Also see Phaeographis. Sarcographa
 4. Spores under 50 μ m long and 15 μ m wide, 3-11-septate transversely, only finally muriform (transversely septate only according to Fink), hyaline becoming brownish in age. Glyphis
 4. Spores (at least in M. texana) over 100 μ m long and 50 μ m wide, over 15-septate transversely, soon strongly muriform, remaining hyaline. Medusulina (texana)
5. Paraphyses much branched and interwoven. Helminthocarpon (leprevostii)
5. Paraphyses unbranched, not interwoven. 6
 6. Spores submuriform to densely muriform. 7
 6. Spores transversely septate. 8
7. Spores brown. Phaeographina
7. Spores colorless. Graphina
 8. Spores distinctly gray-brown when ripe, but often long remaining colorless. Apothecia flat with inconspicuous, scarcely raised margins and widely expanded discs. Phaeographis
 8. Spores hyaline even when ripe, at most somewhat colored when over-aged. Apothecia with surfaces becoming longitudinally grooved or ridged, with narrow discs. Graphis

B. ARTHONIALES

Mainly after Grube (1998), with supplementary info. from other sources.

1. Asci globose to clavate or pyriform, of Arthonia, Arthothelium, or Cryptothecia-type. [If asci similar to Arthonia type and with distinct excipulum, compare Opegrapha calcarea group]. ARTHONIACEAE. Spores straight. Ascomata (often) immersed; exciple absent or at most rudimentary; never clustered in stroma. Asci united in lax groups or discrete. Ascocarps colored or overwhelmingly blackish, but not rarely pruinose, mostly flat, opened widely. Hypothecium sometimes carbonized. Thallus lichenized or saprophytic or parasitic to parasymbiotic on lichens, sometimes endophloedal. Spores never one-celled, not rarely with unequal-sized cells. Algae Trentepohlia or protococcoid. Ascocarps reddish, brownish, or blackish. Paraphyses usually branched and anastomosing. Asci mostly 8-spored. Thallus never red. The distinctions between the next two genera are strongly questioned by Harris; although Tehler's analysis supports their separation, his data are incomplete, based on few species (for example, he treats both as never being epilithic, whereas some Arthonia species do grow on rock, and he states that the ascocarps are epruinose, which is not true of all species). Grube provides further support for separating the two genera. 2

1. Asci cylindric, of Opegrapha type (s. lato). ROCCELLACEAE. Spores (\pm) curved. Ascomata (usually) adnate to sessile, with a distinct receptacle, or if immersed then often the receptacle reduced; ascomata clustered in stromata in some genera. Asci \pm clavate. Ascomata rounded to lirelliform, simple to branched; disc remaining as a slit or later opening widely. Thallus usually episubstratic, lichenized or parasitic to parasymbiotic on lichens. Algae usually Trentepohlia..... 3

2. Paraphysoids densely entwining asci, ascomata \pm stromatic and with irregular ascus development, epithecium eroding. Spores weakly to strongly muriform, mostly broadly ellipsoid and rounded at both ends. "Proper exciple" unorganized ascostromatic. Hypothecium carbonaceous, K-. Hamathecium non-amyloid. Ascomata uniascal or multiascal. Arthothelium

2. Paraphysoids \pm loosely arranged around asci, ascomata not stromatic, and with \pm synchronized ascus development, epithecium layers persistent. Spores 2- to 5-septate transversely, ellipsoid to narrowly fusiform, often one end more pointed than the other. "Proper exciple" parathecial. Hypothecium pale brown, K⁺ olive-black. Hamathecium hemiamyloid. Ascomata multiascal. Arthonia

7. Thallus cortex missing, indistinct or less than 10 μ m thick. Thallus not byssoid. Medulla without red pigment. Ascospores transversely septate. 8

7. Thallus cortex distinct, usually more than 25 μ m thick. Thallus cortex with elongate to filiform cells. Ascospores without mucilaginous appendages. Ascomata directly on a primary thallus, not on pseudopodetia. Lecanographa

8. Epithecium whitish pruinose. Thalline tissue included in ascomatal margins. 9

8. Epithecium epruinose, or if pruinose then thalline tissue not included in ascomatal margins (Lecanographa). [This is a bad choice, and is necessary only to accomodate Syncesia, for which I am not sure to make the choice in Grube's key regarding whether or not the ascomata are complex, with distinct stromatic structures separating asci]. Ascospores fusiform to acicular fusiform. Ascomata simple, without

- distinct stromatic structures separating asci. 10
- 9. Ascomata pseudomonocarpocentral.** Syncesia
- 9. Ascomata monocarpocentral.** On bark, usually in open and \pm dry habitats. Schismatomma
- 10. Ascomata with poorly developed excipulum.** 11
- 10. Ascomata with \pm well developed excipulum.** 12
- 11. Ascospores hyaline, ascus with distinct ring.** Enterographa
- 11. Ascospores brown, ascus without distinct ring.** On bark, wood, or rock. Sclerophyton (I presume Grube treats this as “p. p.” because S. occidentale does not belong in this genus or even in the Arthoniales)
- 12. Thalline tissue included in ascomatal margins.** 13
- 12. Thalline tissue not included in ascomatal margins.** 14
- 13. Ascomata crater-like, immersed in thallus but erumpent, margin rupturing or disappearing during the ontogeny of ascomata.** On leaves. Mazosia
- 13. Ascomata with different ontogeny.** Cortex of thallus margin [this may be a lapsus for thalline margin (of the apothecia)] absent; thallus P- (roccellic acid present). On bark, usually in open and \pm dry habitats. Schismatomma
- 14. Discs covered by persistent whitish, grayish or yellowish pruina. Ascomatal margin matt, pruinose. Some excipular hyphae differentiated in margin. Base of excipulum extending towards medulla or substrate. Ascomata pluricarpocentral, with hymenial bands. Excipulum and pseudoepithecium with granules and/or crystals. Asci clavate, grumulosa-type. Perispore absent.** [If ascomata sessile with constricted base, see Lecanactis). Lecanographa
- 14. Discs epruinose. Ascomatal margin shiny, epruinose. Excipular hyphae not differentiated. Base of excipulum delimited in medulla or substrate. Ascomata monocarpocentral, without hymenial bands. Excipulum and pseudoepithecium without granules and crystals. Asci clavate-cylindrical, vulgata-type. Perispore thick and very reactive.** Opegrapha

ARTIFICIAL KEYS TO LIRELLIFORM GENERA

(somewhat preliminary)

I-A. Spores hyaline, non-septate.

- 1. Exciple lacking. Veizdaea
- 1. Exciple present. 2
 - 2. On rock. Lithographa
 - 2. On wood. 3
- 3. Exciple pale to dark but not carbonaceous and brittle. Xylographa
- 3. Exciple carbonaceous, brittle. Ptychographa

I-B. Spores hyaline, transversely 1-several-septate.

- 1. Asci unitunicate. Spores I+ violet, with rounded to lenticular cells.2
- 1. Asci bitunicate. Spores I-, with cubical or rectangular cells. 3
 - 2. Apothecia aggregated in a pseudostroma. Spores under 50 um long and 15 um wide, 3-11-septate transversely, only finally muriform (transversely septate only according to Fink), hyaline becoming brownish in age. (Glyphis)
 - 2. Apothecia not aggregated in a pseudostroma. Graphis
- 3. Exciple absent or rudimentary. 4
- 3. Exciple distinct. 10
 - 4. Photobiont "micareoid". (Micarea)
 - 4. Photobiont not "micareoid". 5
- 5. Ascocarps ascohymenial. Photobiont Leptosira. Veizdaea
- 5. Ascocarps ascocular. Photobiont trentepohloid or chlorococcoid. 6
 - 6. Without real ascocarps. Stirtonia
 - 6. With real ascocarps. 7
- 7. Ascocarps crowded, immersed together in round-irregular, black, often pruinose stromata. 8
- 7. Ascocarps single, or at least not combined in a carbonaceous stromata. 9
 - 8. Ascomata perithecioid or lirelliform, with \pm closed, epruinose discs.
Chiodecton
 - 8. Ascomata discothecial (rounded to sometimes \pm elongated), with exposed, pruinose discs. Synchesia (myrticola)
- 9. Ascocarps (if present) yellowish. Paraphyses simple to dichotomously furcate at apices, the terminal cell subglobose. Asci 12(rarely 8- or 16-)spored. Thallus sometimes (C. rubrotincta, which is sterile) with bright red margin. Spores hyaline, 3-many-septate or muriform. Cryptothecia
- 9. Ascocarps reddish, brownish, or blackish. Paraphyses usually branched and anastomosing. Asci mostly 8-spored. Thallus never red. Arthonia
 - 10. On leaves. Photobiont Phycopeltis. Mazosia
 - 10. On other substrates. 11
- 11. True exciple thin, brown or colorless. Enterographa
- 11. True exciple thick, black. 12
 - 12. Ascomata surrounded by white swollen part of thallus, such that exciple is

scarcely exposed; spores (1-?)3-septate. Schismatomma

12. Ascomata not surrounded by a thalline margin (rarely with a thin pseudothalline margin); true exciple usually prominent from the beginning; spores to 15-septate. 13

13. Discs covered by persistent whitish, grayish or yellowish pruina. Ascomatal margin matt, pruinose. Some excipular hyphae differentiated in margin. Base of excipulum extending towards medulla or substrate. Ascomata pluricarpocentral, with hymenial bands. Excipulum and pseudoepithecium with granules and/or crystals. Asci clavate, grumulosa-type. Perispore absent. [If ascomata sessile with constricted base, see Lecanactis]. Lecanographa

13. Discs epruinose. Ascomatal margin shiny, epruinose. Excipular hyphae not differentiated. Base of excipulum delimited in medulla or substrate. Ascomata monocarpocentral, without hymenial bands. Excipulum and pseudoepithecium without granules and crystals. Asci clavate-cylindrical, vulgata-type. Perispore thick and very reactive. Opegrapha

I-C. Spores hyaline, muriform.

1. On leaves. Asci unitunicate. Photobiont chlorococcoid. Aulaxina

1. On other substrates, or if on leaves then asci bitunicate and photobiont trentepohlioid. 2

2. Asci unitunicate. Ascospores I+ violet. 3

2. Asci bitunicate. Ascospores I-. 7

3. Apothecia with brown disk, cup-like, or immersed to several in distinctly delimited, prominent stromata. 4

3. Apothecia immersed to sessile, mostly elongated with a narrow, often slit-like disk; not immersed in distinct, prominent stromata, single or in groups. 6

4. Apothecia cup-like, with a thick, raised margin. Gyrostomum

4. Apothecia aggregated in a pseudostroma. 5

5. Spores under 50 µm long and 15 µm wide, 3-11-septate transversely, only finally muriform (transversely septate only according to Fink), hyaline becoming brownish in age. (Glyphis)

5. Spores (at least in M. texana) over 100 µm long and 50 µm wide, over 15-septate transversely, soon strongly muriform, remaining hyaline. Medusulina (texana)

6. Paraphyses much branched and interwoven. Helminthocarpon (leprevostii)

6. Paraphyses unbranched, not interwoven. Graphina

7. Apothecia ± many and crowded, immersed in rounded-irregular, well-delimited carbonaceous black, often white pruinose, "stromata". Minksia

7. Apothecia not in stromata. 8

8. Ascocarps (if present) yellowish. Paraphyses simple to dichotomously furcate at apices, the terminal cell subglobose. Asci 12(rarely 8- or 16-)-spored. Thallus sometimes (C. rubrotincta, which is sterile) with bright red margin. Spores hyaline, 3-many-septate or muriform. Cryptothecia

8. Ascocarps reddish, brownish, or blackish. Paraphyses usually branched and anastomosing. Asci mostly 8-spored. Thallus never red. Arthothelium

II-A. Spores brown, transversely 1-septate.

1. Asci with K/I- apical dome; hypothecium colorless to brown; ascospores turning brown, N-. Photobiont trentepohloid, chlorococcoid, or absent. Melaspilea

1. Asci with K?I+ blue apical dome; hypothecium dark reddish brown; ascospores turning gray-green to violet-black, N+ red. Photobiont chlorococcoid. Poeltinula

II-B. Spores brown, transversely several-septate.

1. Asci unitunicate. Spores I+ violet; cells rounded to lenticular.2

1. Asci bitunicate. Spores I-; cells cubical or rectangular. 3

2. Apothecia with brown disk, cup-like, or immersed to several in distinctly delimited, prominent stromata. Sarcographa

2. Apothecia immersed to sessile, mostly elongated with a narrow, often slit-like disk; not immersed in distinct, prominent stromata, single or in groups.
Phaeographis

3. Asci lecanoralean. Thallus sorediate. "Sclerophyton" occidentale

3. Asci arthonialean. Thallus not sorediate. Sclerophyton

II-C. Spores brown, muriform.

Asci unitunicate. Ascospores I+ violet. Phaeographina

III. Thallus sterile.
(very preliminary)

- 1. Thallus border bright red.** Southeastern U.S. Cryptothecia rubrotincta
1. Thallus not red. Opegrapha, Lecanactis s. lato (and others)

Literature

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