

ARTHONIALES

After Grube (1998), with supplemental information from Tehler and Egea & Torrente

Rev. November 18, 1998

Ascomata ascolocular. Hamathecium of \pm branched and anastomosing paraphysoids. Hypothecium and/or true exciple usually dark, \pm black and friable, or if pale then true exciple absent. Asci with hemiamyloid (K/I+) layer in endotunica, bitunicate.

1. **Thallus yellow (pulvinic acid derivatives).** Chrysothrix
1. **Thallus of different color, but some species with yellow pigments in medulla.** 2
 2. **Asci globose to clavate or pyriform, of Arthonia, Arthothelium, or Cryptothecia-type.** [If the asci similar to Arthonia-type and with distinct excipulum, compare Opegrapha calcarea group]. 3
 2. **Asci cylindric, of Opegrapha-type (s. lato).** 6
3. **Well developed ascomata missing, asci loosely scattered in thallus; if asci aggregated in distinct thallus patches, then always separated by hydrophobic plectenchyma.** 4
3. **Well developed ascomata or ascostromata present; ascomata usually hydrophilic and well delimited towards thallus. Without carbonized excipulum. Not on leaf lamellae of Dawsonia spp. Ascospores > 6.5 μ m long.** 5
 4. **With transversely septate ascospores, septa straight.** Stirtonia
 4. **With muriform ascospores, septa wavy.** Cryptothecia
5. **Paraphysoids densely entwining asci, ascomata \pm stromatic and with irregular ascus development, epithecium eroding. Ascospores weakly or strongly muriform, mostly broadly ellipsoid and rounded at both ends. Epithelial hyphae reticulately branched. Hamathecium I-. Hypothecium dark brown to carbonaceous, K-. Exciple unorganized ascostromatic, the plectenchyma coalescently intricate. Ascocarps uniascal or multiascal, roundish. On bark or wood.** Arthothelium
5. **Paraphysoids \pm loosely arranged around asci, ascomata not stromatic, and with \pm synchronized ascus development, epithecium layers persistent. Ascospores 1-7-septate, ellipsoid to narrowly fusiform, often one end more pointed than the other. Epithelial hyphae sparsely branched. Hamathecium I+ blue or red. Hypothecium pale brown, K+ olive-black. Exciple parathecial, the plectenchyma laxly intricate. Ascocarps multiascal, usually stellate or elongated. Spore cells often unequal. Pycnidia rounded and symmetric, conidiogenous layer symmetrically arranged, conidia < 70 μ m long. On bark, wood, rock, soil, or lichens.** Arthonia
 6. **Paraphysoids easily separated, poorly anastomosing. Asci Bactrospora-type, cylindrical, with a large amyloid apical dome, easily separated from ascogenous hyphae when squashed in K. Ascospores acicular, cylindrical, or biclavate, fragmenting in some species. On bark, rarely rock, in humid areas.** Bactrospora.
 6. **Paraphysoids conglutinated, frequently anastomosing.** 7
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 mucilagenous appendages. Ascomata directly on a primary**

- thallus, not on pseudopodetia. 18
8. With perithecioid ascomata. Chiodecton
8. With apothecioid to lirellate ascomata. 9
9. Epithecium whitish pruinose. Thalline tissue included in ascomatal margins. 10
9. Epithecium epruinose, or if pruinose then the pruina greenish, orangish or reddish (Cresponea), or 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. 11
10. Ascomata pseudomonocarpocentral. Syncesia
10. Ascomata monocarpocentral. On bark, usually in open and \pm dry habitats. Schismatomma
11. Ascomata with poorly developed excipulum. 12
11. Ascomata with \pm well developed excipulum. 13
12. Ascospores hyaline, ascus with distinct ring. Enterographa
12. 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)
13. Thalline tissue included in ascomatal margins. 14
13. Thalline tissue not included in ascomatal margins. 16
14. Ascomata crater-like, immersed in thallus but erumpent, margin rupturing or disappearing during the ontogeny of ascomata. Mazosia
14. Ascomata with different ontogeny. 15
15. 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
15. Cortex of thallus margin present; thallus P+ yellow (psoromic acid present) or P-. On bark of various trees and shrubs, in coastal or near-coastal areas. California. Sigridea
16. Ascomata lirellate. Without crystals in excipulum. Opegrapha
16. Ascomata roundish. 17
17. Without crystals in excipulum. Ascocarp margin shiny, epruinose (excipulum surface smooth, without crystals). Excipulum hyphae in K not differentiated. Paraphysoids scarcely branched and somewhat anastomosing. Ascospores thick-walled, with thick and very reactive perispore, and with differentiated endospore. Pseudoepithecium with granules and/or crystals soluble in K. Asci abietina-type. With lecanoric or gyrophoric acids only. On bark, rarely rock, in humid areas. Cresponea
17. With crystals in excipulum. Ascocarp margin matt, pruinose (excipulum surface smooth or verrucose, with or without crystals soluble in K). Excipulum hyphae differentiated in the margin. Paraphysoids moderately to strongly branched and anastomosing. Ascospores thin-walled, with at most thin perispore and scarcely differentiated endospore. Excipulum and pseudoepithecium with granules and/or crystals insoluble in K. Ascospores fusiform to cylindrical. Often with other lichen substances in addition to lecanoric or gyrophoric acids. On bark, wood, or rock. 18
18. Ascus abietina-type, with only a relatively wide amyloid structure at the tip of the endoascus. Ascocarps sessile, constricted at base. Spores oblong-fusiform to

- curved, sometimes fragmenting, without gelatinous halo, perispore present, thin and reacting in mature spores. Excipulum surface verrucose, with or without crystals soluble in K. Without erythrin, confluent acid, and anthraquinones; with leprarie acid. Paraphysoids \pm branched and anastomosing. On bark, rarely rock, in humid areas. Lecanactis
18. Ascus grumulosa-type, with at most a very tiny amyloid structure. Ascocarps immersed to sessile, not or scarcely constricted at base. Spores oblong-fusiform to cylindrical, not fragmenting, with gelatinous halo, perispore absent. Excipulum surface smooth or verrucose, without crystals. With erythrin, confluent acid, anthraquinones, and unidentified substances; without leprarie acid. On bark or rock, in \pm arid areas. Lecanographa
19. Thallus fruticose or subfruticose. 20
19. Thallus crustose, placodioid, or with (sub)fruticose outgrowths from distinct crustose thallus. 24
20. Cortex with periclinal hyphae. Cortex hyphae verrucose, brown; fumarprotocetraric acid present. Dendrographa
20. Cortex with irregularly arranged to anticlinal hyphae. 21
21. Ascomata terminal; schizopeltic acid present. Ascospores brown, verrucose; hymenial strands present. Schizopelte
21. Ascomata lateral, only occasionally terminal; without schizopeltic acid. 22
22. Ascomata roundish, sessile. Medulla white; without simonyellin. Thalline margin with algae. 23
22. Ascomata lirellate, immersed. Ascomata branched. Hypothecium with dark brown extension towards medulla. Thallus worm-like, with broadly rounded tips, hollow, very fragile. Erythrin and lecanoric acid present. Hubbsia
23. Thallus fruticose. Roccella
23. Thallus subfruticose. Roccellina
24. Carbonized excipulum distinct, ascospores with gelatinous sheath. 25
24. Carbonized excipulum missing; ascospores without gelatinous sheath. Ascomata simple. 26
25. Thalline margin present. On rock. San Luis Obispo Co., California. Llimonaea
25. Thalline margin missing. On bark or rock, in \pm arid areas. Lecanographa
26. Cortex hyphae anticlinally arranged, thallus always crustose, lower medulla not brown. Cortex hyphae often obscured by crystals. Hypothecium sharply defined towards the completely white medulla. On rock. Dirina
26. Cortex hyphae irregularly arranged, thallus placodioid to subfruticose; lower medulla brown. Cortex usually translucent and without crystals. Hypothecium extending to the substrate or fusing with the lower brown part of the medulla. On bark or rock. Roccellina

Literature

Grube, M. 1998. Classification and phylogeny in the Arthoniales (lichenized Ascomycetes). *The Bryologist* 101: 377-391.