

\ **Arthonia** Ach.

(ARTHONIALES: ARTHONIACEAE)

After Fink, Willey, Almborn, and others

Rev. 5/94

(Need to add more info. from Fink and other sources)

Thallus crustose, ecorticate, uniform, often partly or wholly immersed in the substrate, effuse or delimited (usually by brown lines), or absent; thallus hyphae usually I+ red or bluish and K/I+ blue.

Ascomycetes pseudothecia, apothecia-like to lirelliform, rounded to irregular, stellate, elongate, simple to  $\pm$  branched, sessile to immersed; emerging apothecia on bark often with a thin rim of thallus tissue and bark cells; disk flat to convex, usually dark; thalline exciple absent; true exciple absent (rarely rudimentary and developed only laterally), giving the ascomycetes a somewhat "rubbed down" appearance [this is hard to describe, and doesn't always apply, but it can be rather characteristic when you see it]; hypothecium  $\pm$  absent to conspicuous, usually dark, often poorly delimited from the hymenium; hymenium usually I+ blue or red and K/I+ blue; epihymenium colorless to red- or dark brown; paraphysoids sparingly to richly branched and anastomosing, indistinct, in a gel matrix, often more richly branched above and there often thickened by pigment (or intermixed with crystals); apices often with thin, well-defined, dark caps, 2-4  $\mu$ m wide; asci globose to pyriform or obovoid or clavate, semi-fissitunicate, I-, with large apical dome and usually distinct ocular chamber; apical dome K/I- or K/I+ bluish in lower part near apex of the ocular chamber; 2-8-spored (usually 8); spores very variable, mostly ovoid to oblong-ovoid or asymmetric, sometimes fusiform, often constricted at the mid septum, transversely 1-8-septate, often with very unequal locules, usually hyaline and smooth, but old spores often becoming brown and then usually warted; young spores often with a thin perispore (in most species under 1  $\mu$ m thick in K).

Pycnidia often present, laminal, usually immersed, very small and inconspicuous; fulcrum exobasidial; pycnosporangia, colorless, simple, mostly bacilliform, sometimes ellipsoid or thread-like; stylospores also form. Arthoniaic acid, emodin, fallacinal, lepranthin, rocellaric acid, teloschistin, or often no substances. Photobiont Trentepohlia, less often Phycopeltis, or some species with protococcoid algae; some species saprobic, weakly lichenized, or lichenicolous. On trees, rocks and soil, mostly at lower elevations.

Many of the species in N. America are still poorly known, and a modern revision is badly needed.

**I-A. On soil or moss. Thallus not sorediate. Ascomata black.**

**1. Thallus squamulose**, pale brownish, thickish; squamules bullate, separate or connected and plicate, convex and rounded. Apothecia black, roundish or oblong, convex, smooth, interspersed and becoming conglomerate between the squamules; epithecium subcontinuous, light brown; hymenium light brown, 48-52  $\mu\text{m}$  high, I+ orange to coppery brown; hypothecium dark brown and thick; paraphyses intricately interwoven; asci subinflated-clavate, the membrane slightly thickened above, 36-38 x 12-15  $\mu\text{m}$ . Spores 8/ascus, 10-16 x 5-6  $\mu\text{m}$ , constricted in middle, ovoid or oblong-ovoid; upper cell round or ovoid, lower one narrow and slightly longer. On rock or soil among mosses. California, Colorado, Washington. ....A. glebosa

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

**2. Spores 8-12(-14) x 2.5-4  $\mu\text{m}$ , ovoid; upper cell broader and shorter than lower one.** Thallus effuse, usually forming small patches (< 5 mm wide) among other crusts, dull olive-gray, olive-brown or gray-brown, thin, minutely scurfy-granular; granules when discrete 20-50  $\mu\text{m}$  diam. Photobiont 6-14(-17)  $\mu\text{m}$  diam.; cells chlorococcoid (not Trentepohlia), with many small "autospores" forming within the cells (at least in Queen Charlotte Islands material). Apothecia 0.05-0.25(-0.3) mm diam., rounded, convex, black, not pruinose; in section 60-100  $\mu\text{m}$  tall; epithecium 5-7  $\mu\text{m}$  tall, greenish-or reddish brown, K+ greenish, composed of 2-3 rows of periclinally arranged, dark-walled hyphae 1.5-2  $\mu\text{m}$  wide; hymenium 25-30  $\mu\text{m}$  tall, colorless or pale greenish; "hypothecium" 30-70  $\mu\text{m}$  tall, reddish brown (hyaline in upper part), K+ dull olive-brown. Paraphysoids 0.5-1  $\mu\text{m}$  wide, very scanty. Spores upper cell broader and shorter than lower but often with a slightly pointed apex; halonate according to Poelt & Döbbeler. Pycnidia rare, ca. 40  $\mu\text{m}$  diam., the wall brownish, K+ olivaceous; conidia bacilliform, 3-4 x 0.5  $\mu\text{m}$ . No substances. Usually on moss, bark, or wood, less often on shaded,  $\pm$  acid rocks. British Columbia. .... A. muscigena Th. Fr. (syn. A. leucodontis)

**2. Spores 11-12.5 x 3-4  $\mu\text{m}$ , oblong-ovoid, hyaline to pale brownish, 1-septate; cells equal.** Apothecia 0.06-0.08 mm across. Thallus gray-brown, thin, inconspicuous, widepread. Apothecia round, brownish black, flat to slightly convex; hymenium tinged brown; hypothecium light brown. On soil. Massachusetts. ....A. terrigena Nyl.

**I-B. On rock. Thallus not sorediate. Ascomata black.**

After Egea & Torrente (1995)

- 1. Ascomata lecideoid, roundish, sessile, black, epruinose. .... 2**
- 1. Ascomata not lecideoid,  $\pm$  elongated and very irregular, immersed or semi-immersed in thallus, pale to dark. .... 7**
  - 2. Spores mostly 3- or more-septate. .... 3**
  - 2. Spores 1- or rarely 2-septate. .... 3**
- 3. Spores 17-27 x 6-8  $\mu$ m. Hypothecium hyaline or pale. Thallus yellowish- to grayish- brown or dark brown or rosaceous, continuous to rimose. Growing in the spray zone on the seashore. Apothecia 0.2-0.3 mm, hemispherical, black, epruinose. Hymenium I+ red, K-. Ascospores 3-5-septate. Pycnospores 3-5 x 1-2  $\mu$ m. Algae protococcoid. No substances. On hard, siliceous rocks, mesic-supralittoral zone, Maine and Pacific Northwest. .... A. phaeobaea**
- 3. Spores averaging less than 17  $\mu$ m long. Hypothecium  $\pm$  dark. Thallus whitish or grayish. .... 4**
  - 4. Ascospores (1-)3(-4)-septate, 11-14 x 4-5(-7)  $\mu$ m. Thallus whitish (or pinkish when fresh), usually effuse; when on rock, usually thickish (to 1 mm), soft and scurfy, sometimes dispersed into soft verrucae to 0.8 mm diam.; when on bark, mostly immersed; hyphae K/I-, loosely entwined around distinct filaments of Trentpohlia. Apothecia 0.15-0.6 mm diam., rounded and  $\pm$  convex, or (especially on bark) somewhat elongate to 1.2 x 0.2-0.5 mm, black, not pruinose; in section 140-350  $\mu$ m tall; epithecium dark brown, K+ greenish; hymenium 30-40  $\mu$ m tall, pale reddish brown; hypothecium 100-300  $\mu$ m tall, dark brown, K- or dulling. Paraphysoids 1-1.5  $\mu$ m wide, thickened in epithecium by pigment, often with brown apical caps. Spores ovoid-oblong, the upper cell enlarged. Thallus P-, K-, or K+ faint yellowish, KC-, C-. No substances. On acid rocks and roots in dry underhangs, also dry undersides of trees (Betula, Ilex, Quercus, Sorbus, Pinus). .... A. arthonioides (Ach.) A. L. Sm. (syn.: A. aspersa)**
  - 4. Ascospores 1-septate. .... 5**
- 5. Spores 8-12(-14) x 2.5-4  $\mu$ m, ovoid. Usually on moss, bark, or wood, less often on shaded,  $\pm$  acid rocks. British Columbia. .... (A. muscigena Th. Fr.)**
- 5. Spores averaging over 12  $\mu$ m long and 4  $\mu$ m wide. On calcareous substrates. .... 6**
  - 6. Spores 10-15 x 4.5-6  $\mu$ m, upper cell larger. Thallus very thin, widespread, smooth, pale green-gray to ashy. Apothecia 0.1-0.25 mm, adnate, round to irregular, convex, black; hypothecium tinged brownish; hymenium hyaline; paraphyses indistinct, appearing interwoven and branched; asci broadly clavate to subovoid; spores oblong, irregularly arranged, hyaline, constricted at septum. Algae**

- trentepohlioid. On limestone, Ohio. ....A. rupicola Fink
- 6. Spores 8-13(-15) x 2-3(-4) um, cells equal.** Apothecia 0.1-0.3 mm across, brown-black, rounded,  $\pm$  plane (to somewhat convex); tinged pale brownish within. Asci pyriform. Spores oblong-ovoid, hyaline or tinged brown, 1-septate. Hymenium I+ red. Algae protococcoid. No substances (or unknown substance). Thallus thin and disappearing, ashy white to olive brown. On calcareous rocks and mortar, including loose stones, or sandstone, mostly in open habitats. Northeastern and midwestern. Easily mistaken for a member of the Lecideaceae s. lato. ....A. lapidicola (Tayl.) Branth. & Rostr.
7. Thallus C+ red (unknown substance, not detected by TLC), P-. Ascospores 14-17 x 6-7 um, 3-4(-5)-septate. Ascocarps immersed. Hymenium 60-75 um. Asci 45-65 x 20-25 um. Coast of south-central California. ....A. infectans Egea & Torrente
7. Thallus C-, P+ or P-, with psoromic and/or confluent acid. .... 8
8. Thallus P-. Ascospores 11-15 x 4-5(-5.5) um, 1-3-septate. Asci 33-45 x 15-18 um. Hymenium 50-60 um. With confluent acid. South-central coast of California. .... A. madreana Egea & Torrente
8. Thallus P+ yellow (psoromic acid). Hymenium 70 um or more high. Asci over 18 um wide. Baja California Norte. .... 9
9. Thallus to 1.5 mm thick. Ascocarps brown to red-brown, not in thalline verrucae. Asci 50-65 x 20-25 um. Ascospores 15-18 x (5.5-)6-7 um, 2-3-septate. Hymenium 80-100 um. With confluent acid. .... A. gerhardii Egea & Torrente
9. Thallus to 0.6 mm thick. Ascocarps dark brown to black, immersed or semi-immersed in thalline verrucae, brown-black to black. Asci 40-50 x 18-23 um. Ascospores 14-17 x (5.5-)6-7 um, 2(-3)-septate. Hymenium 70-80 um. Without confluent acid. .... A. verrucosa Egea & Torrente

**II-A. On bark or wood. Apothecia not black, hymenium often K+ purple-violet to blue. [Species with brown-black apothecia are keyed by Poelt with the black-apothecia species]**

**II-A-1. Spores 1- or rarely partly 2-septate.**

**1. Disc reddish colored (flesh color to reddish brown to darker).**

..... 2

**1. Disc dark brown or brownish gray to black or rarely yellowish, usually not reddish (but see A. eckfeldtii).** ..... 3

**2a.** Thallus immersed or thinly powdery to scurfy-granular, effuse, whitish to pale fawn, or more usually stained orange-yellow, sometimes pinkish when fresh, often with dull yellowish to orange-yellow blotches, K+ purple. Photobiont Trentepohlia. Apothecia 0.2-0.5(-0.6) mm diam., rounded, convex, orange-red-brown to brown-black, usually matt, not pruinose; in section 85-140 µm tall, yellow-orange-red throughout or brown-red in upper hypothecium, K+ magenta and K+ purple with pigments dissolving; epithecium indistinct; hymenium 33-40 µm tall; hypothecium 45-100 µm tall. Paraphysoids 0.5-1(-1.5) µm wide, mostly neither swollen nor dark-walled above, a few sometimes with dark walls and apical caps. Spores 11-15 x 4-5 µm, ovoid-ellipsoid to sole-shaped, 1-septate, colorless but becoming brown and warted when old. Pycnidia frequent, 40-60 µm diam., the wall red-brown, K+ purple; conidia (3.5-)4-6 x ca. 1 µm, bacilliform or slightly curved. Thallus P-, K- or K+ purplish (pigment), C-, containing unidentified orange anthraquinone. On bark or exposed wood of old trees, especially Quercus but often also Alnus, confined to old woodland and ancient parklands. N. American report uncertain. .... A. vinosa

**2a. Not as above.** ..... 2b

**2b. Spores 1-septate, the cells equal,** 8-10 x 4-5 µm, ovoid-ellipsoid. Hymenium I+ blue. Thallus very thin, white, smooth, effuse. Apothecia reddish flesh-colored, round, convex, 0.1-0.3 mm across, adnate; tinged yellowish brown within. On wood, Washington. .... A. carneorufa Willey

**2b. Spores (1-)2-septate, one cell larger,** sandal-shaped or sole-shaped (ovoid-ellipsoid according to Fink), hyaline. Asci narrowly pyriform. Hymenium I+ red, K-. Apothecia 0.1-0.3 mm across, adnate, round to slightly irregular, epruinose, reddish or darkening, convex, sometimes confluent; tinged pale brownish within. Thallus thin, greenish gray to ashy white, smooth to slightly rough. On wood and bark of fir, New Hampshire. .... A. incarnata Kullh.

**3. Disc dark yellowish (ochre-yellow to blackish), to 0.5 mm. Thallus**

thin, ashy white, smooth. Spores 16-20 x 5.5-7.5  $\mu$ m, ovoid, 1-septate, constricted at the septum, hyaline. Apothecia adnate, round, flat to convex; tinged brownish within. Hymenium I- (but asci I+ red). Epithymenium K+ purple. Very similar to A. floridana. Florida. ....A. ochrodiscoides Nyl.

**3. Disc dark brown or brownish gray to black. .... 4**

**4. Thallus thin, smooth, greenish gray or ashy. .... 5**

**4. Thallus thicker (thin to moderately thick), rough, obscurely chinky, creamy to ashy white.** Spores 10-15 x 3.5-4.5  $\mu$ m, hyaline, 1-septate, oblong, one cell slightly larger. Hypothecium pale.

Hymenium I+ pale violet. Apothecia 0.2-0.5 mm across, adnate, round to slightly irregular, flat to convex, brownish gray to black; tinged pale brownish within. Asci pyriform. On trees, S. California. ....A. lecanactidea Zahlbr.

**5. Spores 10-15 x 4-5  $\mu$ m.** Hymenium I+ wine red. Apothecia round, brown to violet-black. Algae chlorococcoid. Thallus immersed, occasionally superficial to 35  $\mu$ m thick, effuse, pale to dark gray, green-gray, or gray-green; hyphae K/I-. Photobiont Trentepohlia. Apothecia (0.1-)0.2-1.5 mm diam., rounded, flat to slightly convex, red-brown to blackish, often slightly glossy, resembling spots of tar; in section 55-70  $\mu$ m tall,  $\pm$  uniformly orange-brown, K+ dull purplish; epithecium indistinct; hymenium 25-35  $\mu$ m tall; hypothecium 30-40  $\mu$ m tall. Paraphysoids 0.5-1(-1.5) mm wide, not swollen or pigmented at apices; apices often embedded in a thin, clear gel-like layer. Spores 7-11 x 3-4  $\mu$ m, 1-septate, ovoid or sole-shaped, colorless. Pycnidia frequent, 80-100  $\mu$ m diam., brown, the wall orange- to red-brown, K+ purplish; conidia 3-4.5 x 0.5-1  $\mu$ m, bacilliform to narrowly ellipsoid, straight or slightly curved. No substances. On very shaded bark of trunks (usually at or near base) of deciduous trees in moist woodland. Northeastern (New England, New York); California. N. American reports uncertain. .... A. spadicea

**5. Spores 16-20 x 5.5-7.5  $\mu$ m. .... 6**

**6. Thallus ashy,** very thin, smooth, inconspicuous, surrounded by a thin dark hypothalline line. Apothecia 0.1-0.2 mm across, immersed  $\pm$  in the substratum, round to oblong or irregular, flat to slightly convex, dark brown to black; hypothecium brown; hymenium hyaline; asci pyriform. Spores ovoid or fusiform-ovoid, hyaline, 1-septate, 16-20 x 5.5-7.5  $\mu$ m. On trees. Florida. ....A. floridana Willey

**6. Thallus glaucous, sometimes reddish.** Algae chlorococcoid. Spores fusiform-ovoid. Hymenium I+ blue-green, K+ violet. Apothecia round. New Hampshire. ....A. didyma Körber

## II-A-2. Spores 2-3- or more septate

1. Spores to 3-septate. .... 2
1. Spores at least partly more than 3-septate. .... 15
  2. Spores 1-3-septate. Disc yellow, flesh-colored to reddish brown. .... 3
  2. Spores constantly 3-septate. Disc reddish brown to black. .... 4
- 3a. Spores 2-septate, somewhat club-shaped, 8-12 x 3-5  $\mu$ m. Apothecia to 0.8 mm wide, reddish brown, flat, rounded to elongate or disappearing, when wet strongly orange-red; hymenium K+ purple-violet to blue. Epithecium weakly developed. Thallus without soralia. On pine and deciduous trees. Not listed by Egan. .... A. helvola (Nyl.) Nyl.
- 3a. Spores at least partly other than 2-septate. .... 3b
- 3b. Apothecia linear and  $\pm$  branched, pale or pale yellow. Hymenium I+ blue (asci I+ red). Spores ovoid-oblong, 1-3-septate, 11-12 x 3.5  $\mu$ m. Thallus thin, whitish, smooth. Apothecia 0.08-0.2 mm across, often elongated to 0.7 mm, partly immersed to adnate; hyaline within; asci pyriform; spores hyaline, one cell larger. On holly, New Jersey. .... A. impallens Nyl.
- 3b. Apothecia irregular and often elongated, gray-white pruinose. Hymenium I+ blue. Spores 3-septate, 11-16 x 3-4  $\mu$ m, oblong-ovoid. California. .... A. ochrolutea var. caesiocarpa (=? A. patellatula var. caesiocarpa)
  4. Disc not pruinose. .... 5
  4. Discs  $\pm$  pruinose. .... 11
5. Thallus greenish or indistinct. .... 6
5. Thallus ashy or ashy white. .... 8
  6. Thallus indistinct. Apothecia red-brown, elongated, plane, 1 x 0.1 mm. Spores hyaline, 3-septate, 20-21(-26) x 6(-8)  $\mu$ m, equal-celled. Hymenium I+ blue. Louisiana. .... A. neoni
  6. Thallus greenish,  $\pm$  distinct (?). .... 7
7. Thallus often intersected by black lines, greenish, thin. Apothecia 0.25 mm, adnate, round to irregular or oblong, slightly convex, brown to dull black; hyaline within. Spores hyaline, oblong (ovoid-ellipsoid according to Fink), 3-septate, 12-14 x 4-6  $\mu$ m. Hypothecium hyaline. Hymenium I+ red-brown. On trees, Texas. .... A. viridicans Willey
7. Thallus not intersected by black lines, thin, pale green, smooth. Apothecia 0.05-0.15 mm across, immersed to subadnate, pale red-brown,

rounded, oblong or angular-lobate, plane; hyaline or tinged pale yellowish within. Spores hyaline, oblong-ovoid to ovoid, 3-4-septate, 13-18 x 5-7  $\mu\text{m}$ , 3-septate. On trees, Texas. ....A. erubescens Willey

**8. Spores mostly over 13  $\mu\text{m}$  long.** ..... 9

**8. Spores 9-13 x 3-5  $\mu\text{m}$ ,** ovoid or ovoid-ellipsoid, 3-septate. Thallus thin, white. Apothecia 0.1-0.4 mm across, often to 0.6 mm long, sometimes clustered, immersed to semi-superficial, brown-black, round to oblong, angular, or irregular, plane; hyaline or tinged pale brownish within. Spores hyaline. On trees, Massachusetts. ....A. albofuscescens Tuck.

**9. Apothecia often over 0.3 mm long or wide.** Southeastern U.S. .... 10

**9. Apothecia 0.09-0.3 mm across.** Spores hyaline, ovoid-ellipsoid, (1-)3(-4)-septate, upper cell larger, 11-16 x 6-7  $\mu\text{m}$ . Hymenium I+ red. Spermatogonia large, conspicuous, subglobose, black. Pycnosporos 5-6  $\mu\text{m}$ . Thallus thin, ashy white, smooth to slightly rough, becoming powdery. Apothecia partly immersed to adnate, round to slightly irregular, flat to convex, dusky to black; hyaline with; asci pyriform. Northeastern U.S. (New Hampshire). ....A. cinereopruinosa Schaerer

**10. Apothecia 0.09-0.3 mm wide, to 0.5 mm long, flat,** erumpent, brown-black, epruinose, linear, dendritically branched; hyaline within. Hypothecium hyaline. Spores hyaline, ovoid, 3-septate, 14-18 x 4.5-5.5  $\mu\text{m}$ , one end cell larger. Asci globose-ovoid. Thallus thin, ashy, inconspicuous, often absent. Hymenium I+ blue. On trees. Florida. ....A. varia (Ach.) Nyl.

**10. Apothecia 0.3-0.6 mm wide, becoming convex,** red-brown to black,  $\pm$  pruinose, closely adnate, round to irregular. Spores hyaline, oblong-ellipsoid, 3-septate, 13-16 x 4.5-6  $\mu\text{m}$ . Hypothecium brownish. Asci broadly ellipsoid. Thallus thin, white and shining or grayish, continuous, smooth to sometimes slightly powdery, sometimes bordered by a thin, obscure hypothalline line. On trees. Florida, Louisiana. .... A. eckfeldtii Müll. Arg.

**11. Thallus rust colored,** granulose-leprose, with chlorococcoid algae. Apothecia brown, gray pruinose, round. Spores 3-septate, cells equal. Hypothecium dark. Hymenium K-. ....A. caesia

**11. Thallus not rust colored.** ..... 12

**12. Spores more than 16  $\mu\text{m}$  long.** ..... 13

**12. Spores less than 16  $\mu\text{m}$  long.** ..... 14

**13. Thallus green, uneven, without soredia,** becoming chinky and subareolate. Spores oblong-ovoid (slipper-shaped), 3-septate, 18-28 x 5.5-7



um, hyaline, one end cell larger. Asci clavate. Hypothecium dark brown. Hymenium paler, I+ red. Apothecia 0.2-0.6 mm across, immersed to adnate, round, plane or  $\pm$  convex, brown to black or grayish-greenish pruinose. On trees. New England to Maryland, west to Iowa and Minnesota. ....A. lecideella Nyl.

**13. Thallus dull greenish white to greenish gray, often bearing small, white, mealy soredia, sometimes disappearing.** Apothecia 0.75-1.25 mm across, immersed, rounded, plane, thinly white pruinose to brown or blackish, with thickish thalline margin; hyaline or tinged pale yellow within. Spores hyaline, oblong-ovoid, 3-septate, 20-30 x 5.5-9  $\mu$ m. Hymenium I+ blue then red. On trees, Massachusetts and North Carolina. ....A. glaucescens Nyl.

**14. Apothecia round to slightly irregular,** convex, pale to dark brown or blackish, greenish pruinose when young, 0.2-0.5 mm across, partly immersed to adnate; hyaline within. Thallus thin, white, smooth to slightly rough, becoming powdery, effuse. Spores hyaline to slightly colored, oblong or oblong-ovoid, 3-septate, constricted at middle septum, two cells at one end larger, 1-16 x 3-5  $\mu$ m. Hymenium I+ blue. On wood of white cedar, Massachusetts. ....A. cupressina Tuck.

**14. Apothecia oblong to elongated,** red-brown,  $\pm$  white pruinose, partly immersed, plane, becoming confluent into radiate-stellate pseudostroma, 0.15-0.2 x 0.4-0.6 mm; hypothecium dark brown; hymenium tinged pale yellowish. Thallus effuse, white, mealy. Spores hyaline, oblong-ovoid, 12-16 x 5-7  $\mu$ m, 3-septate, extreme cells larger, middle ones sometimes becoming divided longitudinally. Hypothecium dark. Hymenium I+ red. On trees, Texas. ....A. (Arthothelium?) leucastraea Tuck.

**15. Spores 3-5-septate.** ..... II-A-2-a

(This part of key needs re-working; also see A. subrubella)

**15. Spores at least partly more than 5-septate.** .... II-A-2-b

## **II-A-2-a On bark or wood; discs colored; spores 3-5-septate**

**1. Disc yellow, red, flesh-colored to reddish brown. .... 2**

**1. Disc reddish brown to black. .... 6**

**2. Disc yellow to light brown or flesh colored to brownish black,** white-pruinose when young. Spores hyaline, ovoid-ellipsoid, 4-5-septate, 18-20 x 6-7  $\mu$ m, upper cell larger. Thallus K-, C+ red. Hymenium I+ blue then red. Apothecia 0.4-0.9 mm across, adnate, round-flexuous to irregular, or finally lobed; disc concave to flat; hyaline or tinged faintly brownish within. Asci pyriform. On trees, southern California. .... A. gyalectoides Müll. Arg.

**2. Disc red or reddish brown or darker. .... 3**

**3. Disc with an ochre-red margin,** white pruinose, subrotund to irregular, or elongated and curved, sometimes clustered; disk flat to somewhat convex, dull black or obscurely whitish pruinose; tinged pale yellowish within; asci pyriform. Spores hyaline, ovoid-ellipsoid, 3-5-septate, one and rarely both end cells longer, 18-23 x 4-6  $\mu$ m. Thallus thin, gray to whitish, smooth or slightly rough. Apothecia 0.15-0.25 x 0.3-1 mm, adnate. Very similar to A. tumidula except for the color of the apothecial margin. On trees, Florida. .... A. ochrocincta Willey

**3. Disc without a margin,** reddish brown or violet-brown to black, or pink-white to red-white pruinose at the margin. Apothecia frequent, scattered, irregular to  $\pm$  lirelliform, 1-2 x 0.2 mm, sometimes bluntly stellate. Thallus immersed or thin, white, grayish or rose, shiny in parts, slightly roughened in others, indeterminate (or determinate, with well-defined dark prothalline line according to Galloway). Hymenium I+ blue then red, K+ violet. Spores ovoid, 3-5-septate, upper cell larger, 13-24 x 5-9  $\mu$ m. Usually on smooth bark, in sheltered situations, mainly in old woodlands. Eastern and west coast. Coppins accepts A. cinnabarina as the name for this species. .... 4

**4. Apothecia with crimson granules. .... 5**

**4. Apothecia without crimson granules,** elongate or stellate, blackening. New York and Oregon. .... A. tumidula var. anerythraea

**5. Apothecia reddish brown to black; margin not pruinose. .... A. tumidula var. tumidula**

**5. Apothecia violet-brown; margin white pruinose;** obtuse or sublobate. Spores 20-23 x 7-8  $\mu$ m, 4-septate. On trees, Florida, Louisiana. .... A. tumidula var. adspersa (Mont.) [= A. arthonioides?]

**6. Spores 25-35  $\mu$ m long. .... 7**

**6. Spores less than 25 um long. .... 8**

**7. Spores 25-43 x 10-15 um (according to Fink; 42-50 x 16-22 um according to Nylander and Müll. Arg.).** Thallus inconspicuous (according to Nylander), or thin, greenish gray to ashy white, rough, becoming granular or chinky. Apothecia red-brown and blackening, innate, slender, flexuous and branched, 0.1-0.2 x 0.5-1.5 mm, flat; tinged faintly brownish within; asci pyriform. Spores hyaline, ovoid-ellipsoid to oblong-ovoid, 3-5-septate, end cells larger. Hymenium I+ blue, asci I+ red. On trees, S. Carolina to Florida. Identification somewhat tentative.

..... A. (Arthothelium?) rubella (Feé) Nyl.

**7. Spores 40-48 x 17-22 um.** Thallus ashy white, slightly rough, surrounded by a black line. Apothecia pale to medium brown or brownish black, dendritically branched, 0.5 x 0.05-0.15 mm, or to 1 or 2 mm long, immersed; hyaline or pale yellowish within; asci broadly pyriform. Spores hyaline, ovoid or oblong-ovoid, 5-septate, Hymenium I+ blue, asci I+ red. Thallus thin. On trees, Texas, Florida ("doubtful record"). .....A. caribaea (Ach.) Massal.

**8. Apothecia irregular to oblong. .... 9**

**8. Apothecia round to irregular. .... 11**

**9. Spores 12-15 x 4-5 um, 3(-4)-septate, ovoid or oblong-ellipsoid, hyaline to pale brownish.** Thallus thin, whitish, smooth to slightly rough, bordered  $\pm$  by a narrow, inconspicuous dark line. Apothecia 0.1-0.2 x 0.4-0.8 mm, irregular and variously elongated, curved and branched, immersed; disk flat, reddish brown and finally darker; hyaline within. Hymenium I+ blue then red. On trees, northeastern (New England, and doubtfully New York and Illinois). .....A. pyrrhuliza Nyl.

**9. Spores 16-22 um long. .... 10**

**10a. Spores 3(-4)-septate, .... 10b**

**10a. Spores (3-)5-septate.** Thallus inconspicuous. ....A. conferta

**10b. California or Florida.** Spores ovoid, hyaline, 16-22 x (5-)7-8 um wide. Thallus thin, rough, becoming powdery, ashy white, K+ yellow then red, C-. Apothecia 0.1-0.3 mm across, often elongated to 0.8 mm, somewhat immersed, irregular to oblong, sometimes stellate, scattered or clustered; disk flat, brown-black, thinly pruinose; tinged pale yellowish within; asci pyriform. Hymenium I+ blue then red. On trees, S. California, Florida. ....A. polygramma Nyl.

**10b. Washington state.** Thallus immersed, usually delimited by a brown line and forming irregular patches, 5-20 mm diam., sometimes larger on tree trunks, whitish with green or gray tinge, or pale fawn. Photobiont Trentepohlia. Ascomata linear or more usually irregularly branched to

stellate, and to 2 mm diam., with "arms", 0.08-0.15 mm wide, reddish brown to blackish, not pruinose but sometimes covered by a thin layer of bark cells; in section 60-95 µm tall; epithecium reddish brown, K+ greenish; hymenium 40-50 µm tall, colorless or pale red-brownish above; hypothecium indistinct or to 20 µm tall, colorless or pale red brownish, K+ greenish in patches. Paraphysoids 1(-1.5) µm wide, brown-walled and to c. 2 µm wide in the epithecium, sometimes with dark apical caps; spores (2-)3- or 4-septate with an enlarged upper cell, (13-)16-22(-24) x (5-)6-7(-9) µm, ovoid to oblong-ovoid, old spores brown and warted. Pycnidia rare, immersed, 40-60 µm diam., the wall red-brown, K+ greenish; conidia 4.5-5.5 x 0.5-1 µm. Thallus P-, K-, KC-, C-, UV-. Containing "stellaris unknown" and an additional minor compound at R<sub>F</sub>-classes A 3(-4), B 3(-4), C 2-3. On smooth bark of Alnus rubra, coast of Washington State. .... A. stellaris Krempf.

**11. Spore cells equal.** ..... 12

**11. Spore cells unequal.** ..... 13

**12. Apothecia 0.1-0.3 mm across**, clustered, round or more commonly somewhat irregular, adnate to semi-immersed, flat, dirty blackish or obscurely to densely pruinose. Spores 3-5-septate, ovoid to ovoid-oblong, 16-27 x 7-9 µm. Hymenium I+ red. Thallus thin to moderately thick, greenish gray to ashy white, smooth to slightly rough and finally chinky. On trees, Louisiana, Texas. .... A. chiodectella Nyl.

**12. Apothecia 0.2-0.9 mm across**, round to irregular, pale, pruinose. Thallus distinctly rose when fresh, K-, C+ red. Hymenium I+ blue then red, K-. Spores 14-20 x 6-8 µm, ovoid, 3-5-septate. On dry bark of tree trunks, especially maple and oak, rarely on wood. Washington, California. .... A. impolita (Ehrh.) Borr. in Hook. & Sowerby (= ? A. pruinata; including var. chiodectonoides, with smaller apothecia and I- hymenium)

**13. Apothecia round to irregular or often elongated, plane to convex**, white-margined, to 0.5-0.7 mm across, adnate, dark brown to blackish, sometimes pruinose; tinged faintly red within; hypothecium darker; asci ovoid-ventricose. Hymenium I-. Spermatogonia large, conspicuous. Spores oblong-ovoid, 12-24 x 6-9 µm, 3-5-septate, one end cell larger. Thallus thin, whitish, smooth, becoming powdery. On trees, Massachusetts and New Hampshire. .... A. byssacea (Weig.) Almqu.

**13. Apothecia not elongated, ± convex**, dark red-brown to black, round, sometimes pruinose. Thallus white to ashy, thin, smooth, indeterminate, continuous. Asci I+ red. Spores oblong-ovoid, (3-)4(-5)-septate, 16-23 x 5-6 µm, upper cell larger. Apothecia numerous, 0.1-0.2 mm across. On trees, Florida. .... A. tuckermanniana Willey

## **II-A-2-b. On bark or wood; discs colored; spores over 5-septate**

**1. Spores 8- or more septate. .... 2**

**1. Spores 3-7-septate. .... 4**

**2. Spores 13-15 x 3.5-5  $\mu$ m, oblong-ovoid, 8-9-septate.** Discs pale, flesh-color-fuscos, pruinose, 0.2 mm wide, lanceolate, erumpent, surrounded by thallus. Thallus thin, white. Florida and Texas. .... A. erupta Nyl.

**2. Spores over 40  $\mu$ m long. .... 3**

**3. Spores 8-11-septate, 50-55 x 19-23  $\mu$ m, oblong-ovate. Discs brown-black, stellately branched,** 0.2 mm wide, concave when dry. Thallus grayish, rimose, limited by dark zone. Spore cells subequal. Florida. .... A. atrata (Feé) Müll. Arg.

**3. Spores 9-15-septate, oblong, 40-44 x 10-15  $\mu$ m. Discs pale (whitish or pale yellow), angular.** Thallus whitish green. Florida. .... A. vernans Willey

**4. Spores over 30  $\mu$ m long. .... 5**

**4. Spores less than 30  $\mu$ m long. .... 6**

**5. Disc red, crimson, or reddish brown to darker,** irregular to linear, often angular-flexuous,  $\pm$  unbranched, innate, plane, 0.2-0.4 mm across, to 1 mm long, sometimes clustered, immersed, flat; tinged pale reddish within. Spores hyaline, 5-7-septate, oblong, 30-36(-54) x 15(-18)  $\mu$ m. Hymenium l+ red. Thallus thin, ashy white, smooth to slightly rough, determinate. On trees, New England, North Carolina, Florida. .... A. pyrrhula Nyl.

**5. Disc pale to dark reddish brown to black,** linear, irregular,  $\pm$  simple (often much-branched according to Fink), appressed, 0.07-0.15 mm across, adnate; hypothecium tinged brown; hymenium hyaline; asci ovoid. Spores (3-)5(-7)-septate, ellipsoid to slightly ovoid-ellipsoid, sometimes curved, 45-54 x 16-18  $\mu$ m. Hymenium l+ blue. Thallus scarcely visible (according to Nylander), or grayish white, moderately thick, becoming rough and chinky. On trees. Florida. .... A. subrubella Nyl.

**6. Thallus white or ashy white. .... 7**

**6. Thallus pale yellow,** thin to very thin, widespread, effuse. Apothecia 0.08-0.15 mm across, dark brown and blackening, paler when wet, adnate, rounded to irregular or rarely becoming oblong, plane; hypothecium hyaline. Spores fusiform-oblong, 5-6-septate, 18-23 x 4-5.5  $\mu$ m. Asci l+ red. On trees, Florida. .... A. perminuta Willey

**7. Apothecia irregular and often elongated, pale to red-brown,**

plane, depressed, naked or whitish pruinose, 0.5-1 mm across and often 3 mm long, immersed, sometimes clustered; tinged brownish within. Thallus determinate, thin, ashy white, often surrounded by a brownish black line. Spores oblong or ovoid-ellipsoid, (3-)7-septate, 22-30 x 9-11  $\mu$ m, hyaline. Hymenium I+ blue. On trees, Mexico, Florida. ....A. platyspilea Nyl.

**7. Apothecia elongated, usually curved and rarely branched, plane, dark red-brown to black,** 0.5-1.5 x 0.1-0.2 mm, immersed; tinged faintly reddish within. Thallus thin, whitish, smooth to obscurely rough. Spores hyaline, ovoid-ellipsoid to oblong-ovoid, 3-7-septate, 15-23 x 7-9  $\mu$ m, upper cell larger. Asci I+ red, outer parts of apothecium I+ blue. On trees, Louisiana and Texas. Differs slightly from material from Mexico.....A. ravenelii Tuck.

**II-B. On bark or wood.**  
**Thallus not sorediate. Apothecia black (under pruina if any).**

**II-B-2. Spores 1- to 2- septate.**

**1. Apothecia ± round, usually not becoming elongated. .... 2**

**1. Apothecia becoming elongated (or stellate or irregular) ..... 10**

**2. Disc commonly pruinose.** (also see A. granosa) .....  
3

**2. Disc not pruinose. .... 4**

**3. Apothecia 0.15-0.5 mm across,** from grayish white pruinose to naked and black; spores 12-17 x 5-6 µm. On trees, S. California. ....A. patellulata var. caesiocarpa (= ? A. ochrolutea var. caesiocarpa)

**3. Apothecia 0.1-0.15 mm across,** numerous, flat, black or mostly thin white pruinose. Epithecium granulose, dark ashy gray. Paraphyses indistinct. Asci oblong-ovoid, 28-36 x 12-16 µm, the membrane thick especially above. Hymenium I+ blue (pale wine red according to Hasse). Spores 8/ascus, 3-septate, ovoid-oblong, 11-14 x 4-5 µm; epispore thin. Contents of asci I+ pale yellowish. Thallus thick, epiphloedal, white to pale cream color, of rounded patches 1.5 cm or less wide, furfuraceous. Spermatia straight, staff-shaped, 8-10 x 1 µm. On bark of Cordia, California. ....A. pruinosa Nyl. in Hasse

**4. Spores with cells equal. .... 5**

**4. Spores with one cell larger. .... 7**

**5. Disc flat to convex, smooth.** Thallus thin, whitish, rough, often mealy, becoming chinky, sometimes disappearing. Apotheci 0.15-0.5 mm across, adnate, round, black; hypothecium pale brown; hymenium hyaline; asci subpyriform. Hymenium I+ red. Spores 1-septate, ovoid or oblong-ovoid, hyaline, 9-15 x 3-5 µm. On trees, Massachusetts, Illinois, Iowa and Minnesota; and California. ....A. patellulata Nyl.

**5. Disc strongly convex and irregular or rough. .... 6**

**6. Thallus smooth to powdery, dull white, thin to moderately thick, C-. Hymenium I+ blue.** Apothecia 0.2-0.6 mm across, partly immersed to adnate, round to somewhat irregular, flat to irregular or strongly convex, black; tinged brownish within. Spores 1-septate, 10-11 x 3 µm, oblong-ovoid, lower cell attenuate. Algae protocoid. On trees. West Virginia. ....A. aleuromela Nyl.

**6. Thallus smooth to chinky, thin, ashy green or indistinct. Hymenium I+ red.** Apothecia convex to almost spherical, rugulose,

often obscurely rough, black, 0.2-0.4 mm diam., round or varying toward oblong. Hypothecium dark brown; hymenium lighter brown; asci subpyriform; Spores oblong-ellipsoid to oblong-ovoid, 1-septate, 12-15 x 4-6 um. On wood. Minnesota. .... Mycopor-um? sp. ("A. convexula Nyl.")

**7. Thallus dark gray, inconspicuous or indistinct. .... 8**

**7. Thallus dull white or ashy white. .... 9**

**8a. Spores 1-septate, under 17 um long. .... 8b**

**8a. Spores 2-septate, narrowly ovoid, 19-26 x 6.5-8.5 um.**

Thallus hypophloedal, indistinct. Apothecia dispersed, scarcely frequent, scarcely above substrate, round to slightly oblong, 0.2-0.4 mm diam., plane to slightly convex, rather smooth to uneven, black, rather shiny, epruinose, immarginate. Pycnidia rather numerous, dispersed, immersed, black, 0.05-0.07 mm diam., prominent. Photobiont rare or absent, trentepohloid. Hymenium 45-65 um,  $\pm$  hyaline, I+ brown, K-; epithecium 10-15 um thick, brown-black, not interspersed; paraphyses branched and anastomosing, ca. 1-1.5 um thick. Asci  $\pm$  ventricose, 35-52 x 23-30 um, thick-walled. Spores 8, the upper cell often larger, straight, constricted at septum, without gelatinous perispore. Apothecia K- inside. On bark of Viburnum. N. Carolina. .... A. bisepta Degel.

**8b. Thallus dark gray.** Spores 7-16 x 3-4(-6) um, hyaline, oblong-ovoid, one cell larger. Apothecia to 0.4 mm, rounded to slightly irregular, sometimes clustered, the disc convex to subglobose, black, adnate. Hypothecium pale brown. Hymenium hyaline, I+ brown/red. Asci pyriform. Superficial thallus thin, dark gray, inconspicuous and disappearing, on trees thicker and becoming slightly rough and chinky. On trees and old wood, Massachusetts. .... A. exilis (Flörke) Anzi

**8b. Thallus with olivaceous or brownish tinges.** Thallus effuse, usually forming small patches (< 5 mm wide) among other crusts, dull olive-gray, olive-brown or gray-brown, thin, minutely scurfy-granular; granules when discrete 20-50 um diam. Photobiont 6-14(-17) um diam.; cells chlorococcoid (not Trentepohlia). Apothecia 0.05-0.25(-0.3) mm diam., rounded, convex, black, not pruinose; in section 60-100 um tall; epithecium 5-7 um tall, greenish or reddish brown, K+ greenish, composed of 2-3 rows of periclinally arranged, dark-walled hyphae 1.5-2 um wide; hymenium 25-30 um tall, colorless or pale greenish; hypothecium 30-70 um tall, reddish brown, K+ dull olive-brown. Paraphysoids 0.5-1 um wide, very scanty. Spores 8-12(-14) x 2.5-4 um, 1-septate, ovoid, upper cell broader and shorter than lower but often with a slightly pointed apex. Pycnidia rare, ca. 40 um diam., the wall brownish, K+ olivaceous; conidia bacilliform, 3-4 x 0.5 um. No substances. On twigs, especially of Sambucus, or tree trunks (e.g., Acer, Ulmus), sometimes over bryophytes, less often on fence-posts and shaded,  $\pm$  acid



rocks. Morphs on rocks need to be carefully distinguished from A. lapidicola. ..... A. leucodontis (Poelt & Döbb.) Coppins (= ? A. muscigena Th. Fr.)

**9. Spores 8-11 x 3-4.5 um, 1-(-2)-septate, one end cell larger, hyaline, ovoid-ellipsoid.** Apothecia 0.1-0.4 mm across, partly immersed to adnate, round to irregular, substellate, somewhat oblong-lanceolate or angular; disk flat to convex, black or sometimes pale; tinged brownish within. Spermatia 6 um long. Thallus whitish, thin, maculiform, smooth to slightly rough. On bark. Florida. .... A. dispersula Nyl. [may be just a form of A. dispersa]

**9. Spores 10-13 x 3-4 um, 1-(-2)-septate, ovoid-ellipsoid, hyaline.** Thallus dull white, moderately thick, smooth to slightly rough. Apothecia 0.1-0.35 mm, partly immersed to adnate, plane to convex,  $\pm$  round to slightly irregular, black; tinged pale yellowish within; asci pyriform. Hypothecium pale. On trees, Illinois. .... A. willeyi Tuck.

**10. Spores 1-septate.** ..... 11

**10. Spores 1-2-septate.** ..... 15

11. Thallus indistinct. Apothecia slender, ramose, uneven. Spores ovoid, 11-15 x 4-5 um. Massachusetts. Very rare. .... A. subminutula

11. "Not as above". ..... 12a

12a. Spores 1-septate, 18-30 x 8-12 um. Thallus thin, light gray, without definite soralia. Algae Trentepohlia. Apothecia rounded-elongate, 0.2-0.3 mm wide, semi-immersed, blackish, delicately pruinose. Epithecium black-brown, K-. Hypothecium colorless to brownish. On bark. .... A. granosa B. de Lesd.

12a. "Not as above". ..... 12b

**12b. Spores with one end cell larger.** ..... 13

**12b. Spores with cells equal.** ..... 14

**13. Spores 9-12 x 4-5 um, oblong-ellipsoid, attenuate at one end. Hymenium I- (pale yellow).** Thallus sordid white, thin, smooth. Apothecia 0.08-0.12 mm across, slightly immersed to adnate, round, angular or oblong, to 0.3 mm long, flat, bluish black to black; brown within; asci pyriform. Spores 1-septate, tinged brownish. On stem of Leptosyne gigantea. Southern California. .... A. subdispuncta Nyl. in Hasse

**13. Spores 7-9 x 2.5-3 um, oblong-ovoid. Thallus inconspicuous. Apothecia rounded or oblong. Hymenium I+ red.** Thallus thin, ashy white, smooth. Apothecia 0.06-0.13 mm across, or reaching 0.3 mm long, adnate, flat, black; hyaline within; asci pyriform. Spores 1-septate. On pine. Massachusetts. .... A. subminutissima Nyl.

**14. Spores 19-26 x 7.5-9 um, fusiform-ovoid, 1-septate.**

Superficial thallus thin, greenish gray, smooth, inconspicuous. Apothecia partly innate to adnate, irregular to elongated, sometimes branched, stellate-ramose, uneven, 0.1-0.2 mm across; disc flat to convex, black; tinged light brown within. On bark, Massachusetts, Virginia, Louisiana, Alabama and Florida. Very rare. ....A. taedescens Nyl. in Willey

**14. Spores 11-16 x 4-5 um, obovoid-oblong, 1-septate, hyaline.** Hymenium I+ blue, K-. Apothecia frequent, 0.09-0.4 mm across, partly immersed, elongated, slender, dark red-brown to brown, rarely grayish pruinose, often in parallel lines or  $\pm$  scattered, or stellate or irregular, rarely branched, flat to convex; hyaline or pale brownish within. Epihymenium not granular. Thallus ashy white to pale gray-brown, shining, rather smooth to slightly rough, indeterminate in irregular patches. On trees. Widespread. ....A. dispersa (Schrad.) Nyl.

**15. Apothecia  $\pm$  branched or angular-irregular.** Thallus thin to very thin, effuse, whitish or silvery gray. Spores (1-)2-septate, ovoid, 9-13 x 3.5-5.5 um, hyaline. Apothecia 0.1-0.2 mm across, to 0.4 mm long, irregular to somewhat elongated, sometimes  $\pm$  branched; flat, brownish black to black, lighter when wet; hypothecium hyaline. On trees, Texas; possibly California (i.d. tentative according to Hasse). ....A. microspermella Willey

**15. Apothecia not branched,** epruinose or slightly pruinose, 0.1-0.25 mm across. Spores 1-septate, ovoid-ellipsoid to oblong-ellipsoid, 12-14 x 4.5-6 um, 8/ascus; the two septa approximate near the middle of the spores. Thallus pale pinkish to grayish, thin, effuse. Apothecia immersed, punctiform to irregularly roundish or oblong, flat, black. Asci pyriform. Epithecium granulose, blackish with a bluish tinge; paraphyses coherent and interwoven; hymenium 56-60 um high, hyaline, I+ violet-blue (including the asci, although the spores and other contents of the asci are I+ yellow to orange). Hypothecium pale. On bark of Rhus, Grevillea, Salix, Platanus, etc., southern California. ....A. rhodis Zahlbr.

## **II-B-2. On bark or wood; discs black; spores 3-many-septate.**

**1. Spores 3-septate, rarely less.** ..... 2

**1. Spores 3-5- or more septate.** ..... 17

**2. Apothecia round to irregular.** ..... 3

**2. Apothecia becoming elongated.** ..... 9

**3. Thallus indistinct.** Apothecia epruinose. Spores 1-3-septate, oblong or fusiform-ovoid. Hypothecium dark. Hymenium K-. ..... A. mediella

**3. Thallus ± distinct (?),** whitish, grayish or yellowish. .... 4

**4. Spores with cells unequal.** ..... 5

**4. Spores with cells equal, 3-septate.** ..... 7

**5. Spores 3-septate.** ..... 6

**5. Spores (1)-2(-3)-septate,** 12-15 x 3.5-4 µm, constricted, one or two upper cells commonly larger, hyaline, 8 per ascus. Thallus dull white to ashy, thin, smooth to slightly rough. Apothecia 0.1-0.3 mm across, round to more frequently irregular, solitary or rarely clustered, partly immersed to adnate, flat to slightly convex, black; hypothecium brownish; asci subpyriform. On trees. Northern U.S. east of the Mississippi River, especially the Great Lakes area. .... A. diffusella Fink

**6. Spores 8-12 x 3-4.5 µm,** ovoid-oblong, 3-septate, one ended cell often larger, hyaline. Apothecia 0.2-0.8 mm across, basally immersed to adnate, round to slightly irregular, flat to convex, black to whitish pruinose. Thallus thin, white, effuse, rough, becoming scurfy and sometimes disappearing. Hymenium I+ blue. On trees, Northeastern. .... A. diffusa Nyl.

**6. Spores 11-14 x 4-5 µm,** oblong-ellipsoid. Thallus silvery white, thin, subfarinaceous, limited by thin black prothalline border. Apothecia with a delicate, spurious thalline margin, linear and variously branching, numerous. Epithecium finely granulose, bluish black; hymenium 64-68 µm high, hyaline, I+ blue soon dark orange red; paraphyses indistinct; asci pyriform, 28-32 x 12-16 µm; spores 8 per ascus, not constricted; epispore thin. On Lonicera, Santa Catalina Island, southern California. .... A. tetramera

**7. Spores 4-5 µm wide.** ..... 8

**7. Spores 12-16 x 3.5-4 µm,** ovoid-ellipsoid to narrowly oblong-ovoid, hyaline, 3-septate. Thallus thin, smooth, becoming obscurely powdery, ashy white, K+ reddish yellow. Apothecia 0.07-0.15 mm across, adnate, round to slightly irregular or oblong, flat to convex, black, [sometimes?] pruinose;

hyaline within; asci pyriform. Hymenium I+ red. On trees. Florida, S. California. .... A. subdiffusa Willey

**8. Thallus yellowish or whitish**, thin, smooth. Spores hyaline to brown, 11-14 x 4-5 um, ovoid-oblong or ovoid-ellipsoid, 3-septate. Apothecia 0.1-0.25 mm across, immersed, round to obscurely angular or oblong, flat, black, usually thinly whitish pruinose; hyaline within; asci pyriform. Hymenium I+ blue. On trees, Florida. .... A. pruinosa Nyl.

**8. Thallus silvery white.** Spores 11-14 x 4-5 um. .... (A. tetramera)

**9. Apothecia not branched.** ..... 10

**9. Apothecia ± branched.** ..... 13

**10. Thallus smooth.** ..... 11

**10. Thallus smooth to becoming warty.** ..... 12

**11. Apothecia 0.6-1 mm long, 0.2-0.6 mm wide**, partly immersed to adnate, round to angular or oblong, flat to convex, lurid blackish, gray pruinose. Thallus inconspicuous, thin, ashy white, smooth to slightly rough. Spores hyaline, oblong-ovoid to ovoid, 3-septate, 12-15 x 5-6 um. Hymenium I+ red. Hymenium pale brownish; hypothecium darker. On trees. New Hampshire. .... A. luridoalba Nyl. in Willey

**11. Apothecia 0.3 mm long and wide**, partly immersed to adnate, slightly irregular, sometimes clustered, flat to convex, black; pale yellowish within; asci narrowly pyriform. Thallus ashy white, thin, smooth. Spores ovoid-ellipsoid, 3-septate, 13-16 x 3-5 um. On trees, Florida. .... A. radiata var. epipastoides (Nyl.) A. L. Sm.

**12. Spores 16-24 x 5-7 um, 1-3-septate.** Apothecia 0.05-0.1 mm across, adnate, round to irregularly linear, to 0.3 mm long, punctiform when young; disc flat, black; hyaline within. Spores lanceolate. Hymenium I+ red or pale violet. On trees, Illinois, Massachusetts, Florida, west to the Mississippi River; California. .... A. epipastoides Nyl.

**12. Spores 14-20 x 5-7.5 um, 3-septate**, ovoid-ellipsoid to oblong-ellipsoid, 8/ascus, hyaline, not constricted; upper cell largest, the others equal in length, one end blunt, the other attenuated. Paraphyses absent. Apothecia numerous, 0.1-0.2 mm across, partly immersed to slightly erumpent or adnate, flat, black, ± whitish pruinose, round, or, as if by aggregation of several, irregular or oblong. Asci oblong-ovate, the membrane thickened at apex, 32-44 x 14-16 um. Hymenium I+ red. Thallus forming cream-colored to ashy white spots, irregular in outline and to 1-2 cm wide, smooth becoming finely furfuraceous, thin. On bark of apricot and oleander, southern

California. ....A. galactitella Nyl. in Hasse

**13. Spores 16-25 x 3-6 um**, oblong-ovoid to ovoid-ellipsoid, 1-septate, hyaline, one ended cell larger. Apothecia 0.1-0.4 mm across, immersed or partly immersed, irregular and  $\pm$  branched, or elongated; disk flat, black; tinged pale brownish within. Epihymenium not granular. Hymenium I+ blue, K-. Thallus ashy white, thin, smooth, sometimes disappearing. On trees, Massachusetts, Ohio, California. ....A. cytisi Massal.

**13. Spores not more than 20 um long.** ..... 14

**14. Apothecia stellately branched.** ..... 15

**14. Apothecia not stellately branched.** ..... 16

**15. Thallus very thin, ashy, inconspicuous, often disappearing.**

**Apothecia 0.2-0.8 mm across, to 1 mm long**, immersed to subadnate, round to irregular and obscurely stellate, or elongated, often in clusters; disk flat, uneven, dull black. Spores oblong-ovoid, 3-septate, 11-18 x 4-5 um, hyaline. Asci I+ red. On trees, Massachusetts. ....A. subastroidella Nyl.

**15. Thallus thin, greenish gray to whitish or brownish. Apothecia 0.3-1.5 mm across**, irregular to elongated, stellately branched, immersed to erumpent, often clustered, flat to slightly convex, black, epruinose; brownish within; hypothecium darker. Thallus smooth to slightly rough, rarely bordered by a dark line. Spores hyaline, 10-20 x 4-6 um, ovoid-oblong to ovoid-ellipsoid, 3-septate, the cells equal. Asci narrowly pyriform. Hymenium I+ violet or blue then red, K-. Epithecium K+ greenish. No substances. Variable. On mostly smooth bark of many kinds of trees and shrubs. Widespread. Including var. angustata Vainio (with apothecia linear, sometimes elongated to 1 mm, commonly curved, sometimes branched, on trees in southern California) and var. swartziana) ....A. radiata (Pers.) Ach.

**16. Apothecia often curved**, lanceolate-diform or substellate, to round, irregular or elongated, sometimes branched, appressed, adnate, 0.2-0.5 mm across, to 1.3 mm long; sometimes surrounded by a thalloid veil; disk slightly convex, blackish; hyaline to pale brownish within; asci pyriform. Thallus thin, ashy white, smooth. Spores ovoid-ellipsoid to oblong-ovoid, 3-septate, 12-15 x 4-5 um. Hymenium I+ blue. On trees, Massachusetts; very rare. ....A. xylographica Nyl.

**16. Apothecia not curved.** Spores 3-septate, 11-12 x 4 um, hyaline, oblong-ellipsoid, 3-septate. Apothecia 0.3-0.5 mm or elongated to 1.5 mm, irregular and usually  $\pm$  branched, slightly immersed to adnate, flat, black; brownish within with a dark hypothecium. Thallus very thin, indicated by a greenish gray to whitish coloration, often immersed. Hymenium I+ blue then red. On trees.

Massachusetts. (may be just a form of A. astroidea; also similar to A. radiata)

.....A. hamamelidis Nyl.

**17. Spores more than 5-septate.** ..... 18

**17. Spores 3-5-septate.** ..... II-B-2-a

**18. Spores 52-73 x 14-22 um**, fusiform, hyaline or tinged brown, 11-13-septate. Apothecia 0.3-0.9 mm across, rounded to slightly irregular, or often elongated to 1.5 mm, often prominent, adnate or sometimes immersed and with a pseudothalline margin (veil); disk flat to convex, brownish black to black; tinged faintly reddish within. Thallus thin, whitish to ashy, smooth to rough or rugulose, delimited by black line. Hymenium I+ blue. On trees. Mexico, Florida. ....A. platygraphidea Nyl.

**18. Spores under 40 um long.** ..... 19

**19. Spores 27-36 um long**, 5-7-septate, oblong, attenuate below. Hymenium I+ blue. Massachusetts. ....A. caudata Willey

**19. Spores 18-25(-29) x 7-11 um**, 3-7-septate, hyaline, ovoid-ellipsoid. Thallus thin, grayish to ashy white, smooth. Apothecia 0.1-0.3 mm across, immersed, sometimes clustered, irregular to substellate, flat to convex, black; pale yellowish within. Hymenium I+ red. On trees, Massachusetts to Florida. ....A. quintaria Nyl.

## Detailed description of A. radiata, and key to variations

Thallus crustose, endophloeodal or partly epiphloeodal, effuse, smooth, epruinose, thin (ca. 0.04 mm), greenish gray to whitish or brownish, smooth to slightly rough; prothallus not seen, but contiguous individuals (sometimes) have a crust-like and black margin; calcium oxalate absent. Ecorticate; surface gel absent; medulla absent or inconspicuous; thallus gel absent; hyphae indiscernible; hypomedullary plectenchyma absent; soralia and isidia not seen. Photobiont Trentepohlia; cells coccal, homiomorous (also with cyanobacteria in the epithecium).

Ascomata numerous, multiascal locules, pluricarpocentral (hymenial strands present), discothecia, developing mutually with the thallus, 0.3-1(-1.5) mm across, circular when young, becoming irregular to elongated, stellately branched, immersed to slightly erumpent, solitary but often clustered; disc exposed, flat to slightly convex, black, epruinose; thalline margin absent; proper exciple parathecial, dark brown, slightly raised above the disk (according to Tehler; Poelt considers Arthonia spp. to lack an exciple); hypothecium distinct, pale brown to brown, not extending into medulla or substrate. Hamathecium paraphysoidal; hymenium 50-70 µm; paraphysoids in parallel arrangement, not easily seprable, sparsely branched, hyaline, 1 µm diam., septate with cells ca. 5 µm. Epithecium brown to dark brown, 15 µm; gel brown and clear but at the surface (1-2 µm), granular; hyphae in parallel arrangement, sparsely branched, with tips clavate, 2-3 µm diam., finely verrucose or nearly smooth, brown; calcium oxalate absent. Spores hyaline, 10-20 x 4-6 µm, ovoid-oblong to ovoid-ellipsoid or slightly fusiform, straight, smooth, 3-septate, the cells equal, not constricted at flat septa (sometimes inconspicuous), hyaline, (16-)17-21(-24) x 5-7 µm. Asci subglobose to subclavate or narrowly pyriform, 45-50 x 15 µm.

Pycnidia solitary, immersed, dark brown, ca. 0.1 mm diam.; microconidia filiform, straight or slightly curved, (4-)5-10 x less than 1 µm. Thallus C-, K- (slightly yellowish), I-, K/I-. Hypothecium K- (olive-black), I-, K/I- (the I and K/I reactions occasionally look blue due to influence from hymenium reactions). Hymenium K-, I+ blue (violet or blue then red according to Coppins), K/I+ blue. Epithecium K- (+ greenish according to Coppins). Asci I-, K/I+ blue dots in apical region. Pycnidial wall I-, K/I- (olive-green). No substances, or possibly traces of norstictic acid. On mostly smooth bark of many kinds of trees and shrubs (mainly deciduous). Widespread and variable.

**1. Apothecia entire, round to roundish**, large, prominent. ....  
A. radiata [var.?] swartziana

**1. Apothecia stellate-radiate or elongate-linear**. ..... 2

**2. Apothecia stellate-radiate**. ..... A. radiata v. radiata

**2. Apothecia elongate-linear, conspicuously branching and**

**curved**, sometimes elongated to 1 mm. On trees in southern California. .... A. radiata [var.?] angustata

ADD:

Apothecia 0.3 mm long and wide, partly immersed to adnate, slightly irregular, sometimes clustered, flat to convex, black; pale yellowish within; asci narrowly pyriform. Thallus ashy white, thin, smooth. Spores ovoid-ellipsoid, 3-septate, 13-16 x 3-5 um. On trees, Florida. .... A. radiata var. epipastoides



**II-B-2-a. On bark; disc black; spores 3-5- or more-septate**

**1. Spores usually more than 25  $\mu$ m long. .... 2**

**1. Spores usually less than 25  $\mu$ m long. .... 4**

**2. Apothecia  $\pm$  round. Spores 30-38 x 5  $\mu$ m, 3-5-septate, oblong, narrowed below. Thallus thin, white. .... A. hypobela**

**2. Apothecia irregular and  $\pm$  branched, or elongated. Spores over 6  $\mu$ m wide. .... 3**

**3. Apothecia irregular and  $\pm$  branched, 0.4-0.7 mm across, or elongating to 1.5 mm, partly immersed to adnate, plane to convex, dark brown; tinged reddish brown within. Spores hyaline or tinged brown, 3-5-septate, ovoid-oblong or ovoid-ellipsoid, (27-)30-36 x 9-12(-15)  $\mu$ m. Thallus thin, ashy white, smooth to slightly rough, becoming obscurely chinky. Hymenium l+ blue then red. On trees, Oregon; New York. .... A. excedens Nyl.**

**3. Apothecia rounded or sometimes elongated, 0.3-0.7 mm across, to 1.2 mm long, slightly immersed to adnate, plane to convex, black; yellowish brown within; asci pyriform. Spores hyaline, ovoid-ellipsoid to ovoid, sometimes curved, 3-5-septate, 23-32 x 6-12  $\mu$ m, one or both end cells larger. Thallus thin, greenish gray to whitish, smooth to rough and chinky. On trees. South Carolina and Florida; report from Washington State is probably erroneous. .... A. complanata Feé**

**4. Spores usually less than 17  $\mu$ m long. .... 5**

**4. Spores rarely less than 17  $\mu$ m long. .... 7**

**5. Thallus whitish** (or pinkish when fresh), usually effuse; when on rock, usually thickish (to 1 mm), soft and scurfy, sometimes dispersed into soft verrucae to 0.8 mm diam.; when on bark, mostly immersed; hyphae K/I-, loosely entwined around distinct filaments of Trentpohlia. Apothecia 0.15-0.6 mm diam., rounded and  $\pm$  convex, or (especially on bark) somewhat elongate to 1.2 x 0.2-0.5 mm, black, not pruinose; in section 140-350  $\mu$ m tall; epithecium dark brown, K+ greenish; hymenium 30-40  $\mu$ m tall, pale reddish brown; hypothecium 100-300  $\mu$ m tall, dark brown, K- or dulling. Paraphysoids 1-1.5  $\mu$ m wide, thickened in epithecium by pigment, often with brown apical caps. Spores 11-17 x 4-5(-7)  $\mu$ m, (1-)3(-4)-septate, ovoid-oblong, the upper cell enlarged. Thallus P-, K-, or K+ faint yellowish, KC-, C-. No substances. On acid rocks and roots in dry underhangs, also dry undersides of trees (Betula, Ilex, Quercus, Sorbus, Pinus). .... A. arthonioides (Ach.) A. L. Sm. (syn.: A. aspersa [adspersa?])

**5. Thallus greenish gray to whitish or olive-green. .... 6a**

**6a. Apothecia mostly 0.3 mm or more across. .... 6b**

**6a. Apothecia 0.05-0.2 mm across, immersed, irregular and finally**

stellate or shortly astroid-branched, flat to slightly convex, brownish black, epruinose. Thallus thin, smooth, greenish gray to pale olive-green or pale olive brown, bordered by black hypothalline line. Spores hyaline, 5-septate, upper or rarely both end cells larger, cylindrical-obovoid or oblong-ovoid, 13-16 x 5-6  $\mu$ m. Hypothecium dark brown; hymenium pale brown; asci globose-ovoid. On trees. Louisiana, Florida. ....A. torulosa Fée

**6b. Spores 15-22 x 5-8  $\mu$ m. Apothecia epruinose,** 0.3-1 mm across, round, angular, or very variable in shape, plane, rugose. Spores 3-5-septate, ovoid-fusiform to ovoid, brown or colorless. Hymenium I+ blue then red. Thallus white or gray-white, thin or inconspicuous. California. ....  
(A. polymorpha)

**6b. Spores , 10-15(-18) x 3.5-5  $\mu$ m.** Apothecia with pruinose to almost fuzzy gray edges. Spores 3- or 4-septate. Ascomata black, round to quite irregular, 0.2-1.0 mm diam.; hymenioid layer hyaline to brownish; hypothecioid layer brownish black, K-; thallus entirely endophloedal or with an effuse, minutely granular to leprose crust. Thallus white to light greenish, entirely or partly endosubstratic. On bark or wood of Betula and Picea. New Brunswick. .... A. leucopellaea (Ach.) Almqu.

**7a. Apothecia elongated.** ..... 8

**7a. Apothecia round to irregular.** ..... 11

**8. Thallus greenish,** thin, hypophloedal, distinctly limited. Apothecia epruinose, 0.5-1.7 x 0.1-0.2 mm, irregularly branched ( $\pm$  stellate), slightly prominent,  $\pm$  plane. Spores 3-4-septate, 17-21.5 x 6.5  $\mu$ m, narrowly ovoid to cuneiform-oblong, upper cell larger. Hymenium K-, I+ blue below, I- above. Hypothecium pale. Maine. Prothallus indistinct. Thallus well limited, greenish, thin, hypophloedal. Apothecia numerous, black, epruinose, elongate, 0.5-1.7 x 0.1-0.2 mm wide, irregularly branched (often  $\pm$  stellately divided), slightly prominent,  $\pm$  plane. Photobiont trentepohlioid, 6-10  $\mu$ m diam. Hymenium hyaline, 70  $\mu$ m, not interspersed, often sterile; epithecium brown to brown-black, ca. 20  $\mu$ m. Paraphyses branched and anastomosed, ca. 1  $\mu$ m thick, the tips  $\pm$  thickened and brown. Asci  $\pm$  pyriform, c. 40 x 20  $\mu$ m. Spores 4/ascus, narrowly ovoid to oblong-cuneiform, obtuse, hyaline, 3-4-septate, 17-21.5 x 6.5  $\mu$ m, the upper cell larger, straight or curved, often slightly constricted; membrane thin. Hypothecium ca. 20  $\mu$ m thick, pale or hyaline, confluent with hymenium, composed of thin hyphae ca. 1  $\mu$ m thick, branching. Apothecial tissues K-, I+ blue except epithecium. On bark of oak. Maine. .... A. siderea Degel.

**8. Thallus whitish or grayish.** ..... 9

**9. Spores hyaline.** ..... 10

**9. Spores dark brown,** oblong-ovoid, 3-5-septate, 22-27 x 10-13

um, upper cell largest and darker. Apothecia 0.05-2 mm across, to 0.6 mm long, innate, rounded to irregular or oblong, plane, whitish pruinose to blackish; light brownish within. Thallus white, effuse, powdery, thin. Hymenium I- (or I+ blue?). On wood, Florida. ....A. melaspora Tuck. in Willey

**10a. Hymenium I+ red;** external parts of apothecium I+ blue. Thallus ashy white, thin, smooth, finally disappearing. Apothecia 0.2-0.5 mm across, sometimes elongated to 0.6 mm, partly immersed to andnate, irregular to obscurely stellate, angular or oblong, plane to convex, black; hyaline or blackening within; asci pyriform. Spores hyaline, oblong-ovoid, 5-6-septate, upper cell larger, 18-22 x 4-5 um (4-5-septate and 14-17 x 4.5-6.5 um according to Fink). On trees, Louisiana, Texas. ....A. astericus Müll. Arg.

**10a. Hymenium (at least upper part) I+ blue.** ....10b

**10b. Spores (1-)5-septate, 16-19 x 5-6.5 um, oblong to dactyloid-oblong,** fifth and second cells narrower; slightly constricted at septum. Thallus thin, continuous, smooth, white to gray-white, K+ yellow, C-, delimited, but without black hypothalline line. Apothecia ± immersed, subtorulose-linear, simple to forked, 1 x 0.1-0.15 mm, plane, black, slightly whitish pruinose. Hymenium I+ blue, K-. Hypothecium pale. ....A. sexlocularis

**10b. Spores 4(-5)-septate, 18-25 x 6-7 um, ovoid-ellipsoid to oblong or dactyliform.** Apothecia 0.1-0.2 x 0.4-1 mm, immersed to subadnate, parallel, lirellate, black, epruinose, plane to convex; hyaline within. Hymenium ca. 60 um high, pale, I- or deep red-orange below, I+ blue above. Paraphyses intricate, indistinct; asci pyriform with a thick membrane, especially above, 60 x 20 um. Spores 8/ascus, hyaline, with both ends rounded, the loculi somewhat lenticular. Thallus whitish, epiphloedal, subnfurfuraceous. On bark of Lonicera, Santa Catalina Island, California. ....A. stictella Stizenb. in Hasse

11a. Thallus ca. 40-70 um thick, scurfy-foliose, without definite soralia. Algae Trentepohlia. Apothecia ± immersed when young, soon sessile, often stellate to irregularly grouped and coalescing, to 1 mm wide, pruinose; disc brown-black under pruina; hymenium K-. Thallus K+ yellow, KC-. Hypothecium colorless to brownish. Spores many-celled, one-sided spherical to pointed, cells at opposite ends enlarged, 15-22 x 4-6 um. On fir and spruce. Michigan [oceanic habitats according to Poelt, 1969]. .... A. fuliginosa (Schaerer) Flotow (is in Egan supplement 2; see Wetmore, 1988)  
11a. Not as above. .... 11b

**11b. Thallus ashy white and often disappearing.** .... 12

**11b. Thallus whitish to olive-green, thin and smooth, or**

**inconspicuous.** Ascocarps 0.01-0.3 mm across, adnate or erumpent, round to oblong or reniform, flat, black; light brownish within. Spores ovoid-ellipsoid, 5-septate, 12-18 x 6-9  $\mu\text{m}$  (18-23 x 5-8  $\mu\text{m}$  according to Fink). On trees, Pennsylvania and Florida. .... A. reniformis (Pers.) Ach. in Schrad.

**12. Disc grayish pruinose**, appressed, innate, rounded to  $\pm$  irregular or oblong, scattered to clustered, plane or convex, black, 0.1-0.3 mm across. Hypothecium light brownish; hymenium hyaline. Thallus ashy white, thin, smooth, inconspicuous, disappearing. Spores hyaline, ovoid-ellipsoid, 3-4-septate, 16-22 x 6-9  $\mu\text{m}$ . On trees, Massachusetts. .... A. pinastri Anzi

**12. Disc epruinose**, 0.1-0.2 mm across, partly immersed to adnate, round to slightly irregular, sometimes becoming oblong, flat to convex, black. Spores hyaline, 16-22 x 5-7  $\mu\text{m}$ , ovoid-ellipsoid, cells equal (one end cell larger according to Fink). Hypothecium hyaline or very pale brownish. Asci broadly pyriform. Hymenium hyaline, K-, I+ blue. Epithecium K+ greenish. Thallus immersed, or thin, ashy, usually smooth. No substances. Apparently not lichenized. On smooth bark of a wide variety of trees and shrubs; often on twigs. Widespread. .... A. punctiformis Ach.

#### IV. Parasitic on Other Lichens (Probably many other species than these)

**1. Parasitic on thallus of Physcia s. l.** Ascocarps 0.1-0.35 mm diam., often in clusters, black, rounded, convex; epithecium K± olivaceous; hymenium 30-35 µm tall, I+ red; hypothecium colorless (K-) to dark reddish brown (K+ olivaceous); paraphysoids 1.5-2.5 µm wide, apices thickened with dark pigment, to 4 µm wide. Spores 10-14 x (3-)3.5-5 µm, 1-septate, oblong to slipper-shaped, colorless. .... A. epihyscia Nyl.

**1. Parasitic on apothecia of crustose lichens.** ..... 2

**2. Parasitic on apothecia of Lecidella sp.** on rock. Apothecia indistinct. Spores clavate, 2(-3)-septate, 13-15 x 5-6 µm; hymenium I+ wine red. .... A. intexta

**2. Parasitic on discs of Lecanora spp.** Ascocarps black, developing in the host hymenium and blackening the disc. .... 3

**3. Parasitic on discs of Lecanora rupicola or L. carpinea.** ..... 4

**3. Parasitic on discs of the Lecanora dispersa group. Spores 1-septate, narrower. Ascocarps 0.1-0.4 mm diam.,** rounded, flat to slightly convex; epithecium dark brown, K+ olivaceous; hymenium 40-50 µm tall, colorless, I+ blue; hypothecium colorless or very pale brownish; paraphysoids 1.5-2 mm wide; apices with dark pigmented caps 2-4 µm wide. Spores 9-15 x 3-5 µm, 1-septate, narrowly ovoid to slipper-shaped, colorless. .... A. clemens (Tul.) Th. Fr.

**4. Parasitic on discs of Lecanora rupicola on rock. Spores (1-)2-3-septate, 11-17 x 5-6.5 µm. Ascocarps 0.3-1 mm diam.,** level with the host disc or slightly more convex; epithecium brown to olive-brown, K+ greenish; hymenium 45-60 µm tall, colorless, I+ blue; hypothecium colorless; paraphysoids 1.5-2(-2.5) µm; apices cemented together by dark pigment. Spores ovoid to oblong-ellipsoid, colorless. .... A. glaucomaria Nyl. (syn. A. varians)

**4. Parasitic on the discs of Lecanora carpinea.** ..... A. subfuscicola (Lindsay) Triebel in Triebel, Rambold & Nash

ADD:

ADD:

Queen Charlotte Islands, British Columbia. .... A. apatetica  
(Massal.) Th. Fr. (syn.: A. exilis auct.) (Brodo, 1995; see Coppins, 1989)

A. atomaria (Lynge) R. Kiliar (Thomson & Weber, 1992)

## **Alternate Keys**

Corticolous species growing in northern U.S. or Canada (most others are Florida to Texas or southern California):

A. cupressina

A. lecideella

A. pyrrhuliza

A. pyrrhula (p.p.)

A. impallens

A. spadicea

A. incarnata

A. carneorufa

A. impolita (p.p.)

A. byssacea

A. glaucescens

A. cinereopruinosa

A. patellulata

A. exilis

A. aleuromela

A. dispersa (p.p.)

A. willeyi

A. cytisi

A. subminutissima

A. luridoalba

A. diffusa

A. difusella

A. pinastri

A. reniformis (p.p.)

A. polymorpha (p.p.)

A. excedens

A. punctiformis (p.p.)

A. epipastoides (p.p.)

etc.



## Descriptions of Species

### **A. gerhardii Egea & Torrente**

Thallus crustose, epilithic, white to gray, effuse, ecorticate. Photobiont Trentepohlia. Ascomata brown to reddish brown, immersed, circular, 0.6-2.5 mm diam., or elongate to 1-3 x 0.5-1 mm, pruinose. Excipulum reddish brown, K+ olive. Hymenium and hypothecium hyaline, I+ blue then red. Paraphysoids branched and anastomosed. Asci fissitunicate, 50-65 x 20-25  $\mu$ m. Ascospores oblong-ovoid, rounded at one end, narrowed at other, 15-18 x (5.5-)6-7  $\mu$ m, 2-3-septate, hyaline but becoming brown-verruculose. Pycnidia immersed; pycnosporos filiform, curved, 14-20 x 1  $\mu$ m. Thallus K+ yellow, C-, P+ yellow (psoromic acid). On vertical or overhanging rocks, usually north-facing. Coastal Baja California Norte.

### **A. infectans Egea & Torrente**

Thallus crustose, epilithic, cream colored, effuse, ecorticate. Photobiont Trentepohlia. Ascomata reddish brown, immersed, circular, 0.6-2.5 mm diam., or elongate to 1-3 x 0.5-1 mm, pruinose. Excipulum K+ olive. Hymenium and hypothecium hyaline, I+ blue then red. Paraphysoids branched and anastomosed. Asci 45-65 x 20-25  $\mu$ m. Ascospores oblong-ovoid, rounded at one end, attenuated at other, 14-17 x 6-7  $\mu$ m, 3-4(-5)-septate, hyaline but becoming brown-verruculose. Pycnidia unknown. Thallus K-, C+ red, P-. Coastal California.

### **A. madreana Egea & Torrente**

Thallus crustose, epilithic, white, ecorticate. Photobiont Trentepohlia. Ascomata reddish brown, immersed, 0.5-1.2 mm diam., or elongate to 1-1.5 x 0.3-0.8 mm, pruinose. Excipulum K+ olive. Hymenium and hypothecium hyaline, I+ blue then red. Paraphyses branched and anastomosed. Asci 33-45 x 15-18  $\mu$ m. Ascospores ovoid to oblong-ovoid, 11-15 x 4-5(-5.5)  $\mu$ m, 1-3-septate, hyaline but becoming brown-verruculose. Pycnidia immersed; pycnosporos filiform, curved, 14-20 x 1  $\mu$ m. Thallus K+ yellow, C-, P- (confluent acid). On vertical or overhanging rock, coastal California.

### **A. verrucosa Egea & Torrente**

Thallus crustose, epilithic, gray-white, ecorticate. Photobiont Trentepohlia. Ascomata brown-black to black, immersed, circular, 0.5-1.8 mm diam., or elongate to 1-2 x 0.3-0.8 mm, pruinose. Excipulum K+ olive. Hymenium and hypothecium hyaline, I+ blue then red. Asci 40-50 x 18-23  $\mu$ m. Ascospores ovoid to oblong-ovoid, rounded at one end, attenuate at the other, 14-17 x (5.5-)6-7  $\mu$ m, 2(-3)-septate, hyaline but becoming brown-verruculose. Pycnidia immersed; pycnosporos filiform, curved, 13-20 x 1  $\mu$ m. Thallus K+ yellowish, C-, P+ yellow (psoromic acid). On vertical or overhanging rock, Baja California Norte.

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