

V-C. On Calcareous Rock

Thallus effuse, K-

1. Epihymenium N+ red. Thallus crustose, effuse, superficial, gray to ochraceous brown, matt, rimose, not corticate, to 200 μm thick but sometimes \pm evanescent. Photobiont cells 7-12 μm diam. Apothecia 0.15-0.3 mm diam., immersed, aspcilioid; disc concave, blackish (tinged blue-green when wet); true exciple to 12 μm wide at top; hymenium 60-70 μm tall, colorless below, pale to dark blue-green above, K-, I+ dark blue; hypothecium colorless. Paraphyses (1-)1.5-1.7 μm wide, to 3 μm wide at apices. Ascospores 12-18 x 7-9 μm , ellipsoid. Pycnidia 30-50 μm diam.; conidia 3-4 x 0.8-1 μm . Thallus P-, K-, KC-, C-, UV-. On calcareous rocks, especially pebbles along the coast. Eiglera flavida

1. Epihymenium N \pm green (never red), or apothecia absent. 2

2. Spores globose or subglobose, (17-)20-30 x 13-25 μm , often fewer than 8 per ascus. 3

2. Spores oblong-ellipsoid to ellipsoid or subglobose, under 16 μm wide, mostly to 8 per ascus, or apothecia lacking or spores not developed. 4

3. Thallus usually rather pale, whitish or grayish, thin to thick; apothecia \pm small, the margin thin or indistinct. Usually on calcareous substrates. Paraphyses thin. Asci large. V-C-1-a (A. calcarea group)

3. Thallus usually rather dark or deep brownish, thick; apothecia large, (0.5)1-3.5(5.5) mm diam., rounded, with very thick thalline margin; usually common; immersed 1 to several per areole. Usually on calcareous rock, but also on \pm non-calcareous rocks, in desert areas exposed to calcium dust. V-C-1-b (A. desertorum group)

4. Thallus blackish gray, dispersed. Spores 11-17 x 7-10 μm . Thallus very thin, of discrete, scattered areoles or verrucae, blackish gray, to 0.5 mm broad with broadened bases; cortex 25 μm thick, transparent. Apothecia 1(-2) per areole; proper margin very thin; disc concave, black, epuriose, small; epithecium olive, HCl+ green; "hypothecium" thin, pale; hymenium 85-90 μm , I+ wine red; paraphyses coherent, simple, moniliform, the upper cells globose. Epihymenium olive green to brownish, HCl+ green. Spores 8, subglobose. On calcareous rocks. Alaska. [If spores 10-11 x 7-7.5 μm and medulla K+ yellow, see A. narssaquensis]. A. ryrkaipiae

4. Thallus whitish to \pm pale gray, continuous to rimose-areolate or areolate to verrucose but contiguous. (If thallus of contiguous verrucae but dark, see A. desertorum group). 5

5. Thallus indeterminate, not orbicular. Hymenium to ca. 100 μm . Discs weakly to strongly pruinose. Specimens of the A. calcarea group without apothecia or without spores may also key out here. 6

5. Thallus determinate or orbicular. [If lobes very distinct, see Key IV: A. disserpens and A. alboradiata] 9

6. Paraphyses distinctly moniliform towards tips. Thallus white or grayish white. Discs black. Epihymenium rather brownish. (see more complete descriptions of the

following two species under Key V-D) 7

6. Paraphyses not moniliform. 8

7. Spores 12-13(-14) x 7.5-8.5 um, ellipsoid. Hymenium 75-80(-85) um. Apothecia to 0.7 mm. Thallus areolate. Rock type? Eastern Arctic. (L. (Aspicilia?) canadensis)

7. Spores 17-20(-25) x (12-)13-16 um, often broadly ellipsoid or even subglobose, 14-16 um. Hymenium 100-120 um. Apothecia (discs) 0.7-1(-1.6) mm diam. Thallus verrucose. On at most slightly calcareous rock, arctic (Alaska to Greenland). (A. pergibbosa)

8. Spores 16-20 um long, ellipsoid, 8 per ascus. Thallus white, rimose-areolate, thin, soft. Apothecia simple, to 0.5 mm, discs slightly pruinose, margin raised. Hymenium 80-100 um. Paraphyses not moniliform. Pycnospores unknown. Arctic. A. anseris

8. Spores 9-17 x 5.5-12.5 um (according to Esnault). Hymenium 80-100 um; Apothecia in wart-like elevations to 0.8(-1) mm diam.; disc 0.1-0.4 mm diam., 1-7 per areole, immersed, irregular, usually pruinose; thalline margin little visible. subhymenium 40-70 um; hypothecium 30-50 um; epithecium brown to greenish, N± green (never very bright). Paraphyses thick, coherent, little branched but anastomosing, scarcely moniliform. Spores 8/ascus, broadly ellipsoid, biseriate or monoseriate. Pycnospores 4.5-7 um. Thallus white, farinose, 0.5-2.5 mm thick, continuous to rimose, well delimited, the margin sometimes very finely fringed. Pycnospores immersed, punctiform, simple. Cortex 20-50 um, scarcely cellular, opaque from pruina; algal layer continuous, 40-80 um, extended under the apothecia. Thallus K-, without lichen substances. On calcareous rocks, in fissures or north-facing surfaces. [Need to check Esnault again; some parts of this description are based on someone else's quite different concept.] A. farinosa sensu Esnault

9. Thallus ± radiate and sometimes lobed. (see Key IV for more complete descriptions). 10

9. Thallus distinctly orbicular but at most weakly radiate. 11

10. Thallus broad (to as much as 15-20 cm across, but may be smaller); lobes not distinct. Discs ± pruinose. Exciple I-. Spores (14-)18-21(-24) um x (10-)11.5-14(-16) um. (A. candida--acid deficient strain)

10. Thallus small (to 2 cm across); lobes short but rather distinct. Discs epruinose. Exciple I+ blue. Spores 9-16 x 7-10 um. (A. lesleyana)

11. Discs pruinose. 12

11. Discs epruinose. 14

12. Paraphyses distinctly moniliform with globose end cells and those below swollen ellipsoid. Thallus thickish, at most partly indistinctly radiate. Spores 13-20 x 8-13 um. Hymenium 85-110 um. Paraphyses unbranched, with oil drops, Hypothallus not visible. Thallus verrucose-areolate, thin at the edges and partly indistinctly radiate; areoles flat or slightly convex; fertile areoles verruciform; surface pale gray or whitish gray with a yellowish tinge. Cortex opaque. Apothecia to 0.8 mm broad, 1(-2-3) per verruca; margin

prominent, not darkened; disc concave, black, \pm pruinose. Epithecium olive brown. "Hypothecium" pale. Spores 8, ellipsoid. On calcareous rocks. Arctic (Alaska to Ellesmere Island).A. polychroma v. polychroma

12. Paraphyses at most submoniliform. 13

13. Thallus verrucose-areolate. Pycnosporos 22-25 μ m. Paraphyses not moniliform. Thallus pruinose, chalky white, thicker in center, irregular, orbicular (but apparently not zonate or radiate). Apothecia 1-2 mm, numerous and crowded, becoming adnate; disc blackish, bluish pruinose; margin slightly pruinose. Spores 16-22 x 9-10 μ m. Hymenium ca. 100 μ m. Exciple K+ yellow. On hard calcareous rock. Arctic.A. caesiopruinosa

13. Thallus rimose-areolate. Pycnosporos 12-16 μ m. Spores (14-)16-24 x 10-16 μ m, 8 per ascus, broadly ellipsoid. Thallus chalky white, soft, thick; lobes if present very indistinct. Thallus K-. Apothecia 1-5 in prominent verrucae 0.5-1 mm diam., discs innate, concave, black, often white pruinose; margin thick, prominent, often farinose. Epithecium brown, HCl+ green. "Hypothecium" with vertical hyphae, brownish. Hymenium (75-)85-100(-110) μ m. Paraphyses coherent, the upper part only slightly moniliform, the tip cells globular. On calcareous rocks. Arctic (Alaska to Greenland).A. nikrapensis

14. Apothecia elevated on subcolumnar verrucae. Paraphyses distinctly moniliform; Thallus pale rosaceous (grayish on reddish substrate?). On somewhat calcareous siliceous rock. Arctic (Greenland; NW Territories). See Key V-D for more info.(A. nathorstii)

14. Apothecia not elevated. Paraphyses at most submoniliform. Thallus not rosaceous. 15

15. Hymenium 100-115(-150) μ m. Paraphyses \pm richly branched. Spores (15-)17-20(-25) x (9-)10-12 μ m. Cortex opaque, 35-45 μ m. Thallus chalky white with bluish or grayish shade, determinate but not distinctly radiating, to 1-2 cm across, very thin towards circumference and with a narrow \pm dark hypothallus, rimose-areolate towards center or only rimulose; areoles 0.5-0.7 mm across, ca. 0.2 mm thick, plane and smooth, subfarinose. Cortical cells indistinct. Apothecia solitary or generally 2-4 per areoles, some approaching though not confluent; disc 0.2-0.3 mm, impressed, black, plane, epruinose; thalline margin obtuse, not very prominent; proper margin indistinct. "Hypothecium" 40-50 μ m. Epithymenium dark olive, K+ brown; Paraphyses scarcely moniliform, the tips 2.5(3) μ m wide, with some subglobose cells, then only constrictedly septate with \pm oblong cells. Asci swollen clavate. Spores 8, ellipsoid. Pycnosporos (11-)16-18 x 0.6 μ m.L. (Aspicilia?) permutata

15. Hymenium 70-100 μ m. Paraphyses rarely branched. Spores 12-17 x 7-10 μ m. Cortex transparent, ca. 25 μ m. Thallus \pm gray, clay-ashy, very thin, rimose but not areolate, not radiate but partly fimbriate, epruinose; Fertile verrucae prominent, vertical-sided or slightly narrowed at base, with prominent wall (concolorous with thallus), giving ring-like appearance. Apothecia to 0.5 mm; disc concave, black, or brownish black when wet. Epithymenium brown, HCl+ green. "Hypothecium" hyaline. Hymenium brownish yellow in upper part. Paraphyses fairly free in K, slender, upper part submoniliform, the cells constricted at septum but elongate. Spores 8/ascus, ellipsoid. Arctic (Alaska to Greenland). A. annulata

ADD? (chemical reactions and most anatomical characters unknown):

Spores 10-14 x 5-8 um. Thallus thin, greenish gray to ashy, finely whitish pulverulent, rimose-areolate; areoles small and flat, rarely lobed toward margin. Apothecia 0.25- 0.7 mm diam., immersed to adnate, 1-2 per areole; disc slightly concave to flat, light to darker brown to blackish, beneath a persistent grayish white pruina; margin entire, becoming somewhat flexuous, concolorous with the thallus or darkening. "Hypothecium" and hymenium hyaline. Paraphyses distinct, stout, enlarged and rarely branched towards the tips; asci clavate. Spores 8, oblong-ellipsoid. Reaction with K unknown. On calcareous rock, Iowa, Kansas. Fink compares the species to "L. calcarea" (= Aspicilia calcarea), but also to L. dispersa. The \pm brown discs and oblong-ellipsoid spores suggest that this taxon may not belong in Aspicilia.A.? iowensis

V-C-1-a. A. calcarea group

Hymenium high. Spores 20-30 x 13-25 um, often fewer than 8 per ascus. Thallus not at all radiate or lobate; apothecial margins, if present, not dark gray to black.

This group is another trashbag.

1. Thallus continuous or usually rimose-areolate, chalky white to slightly greyish (particularly towards center), sometimes brownish or ochraceous or rarely rusty, with chalky-mealy layer, not much (if any) greener in acids. 2

1. Thallus dispersed to subcontiguous, areolate, yellow-gray to medium olive-brown, usually pruinose at least around disc, but not chalky white. Apothecia \pm round to irregular, 1 per areole; disc black, \pm pruinose, especially when young, to ca. 0.5 mm. (The distinctions between the next spp. are unclear) 3

2. Discs not or slightly white-pruinose. Epihymenium dark green (N+ indistinctly green to clear blue-green). Spores mostly 4 per ascus, (18-)25-28(-35) x 14-27(-30) um, ellipsoid to subglobose, with a thin perispore. Thallus continuous or usually rimose-areolate, chalky white to slightly greyish (particularly towards center), sometimes brownish or ochraceous or rarely rusty, with chalky-mealy layer, not much (if any) greener in acids. Thallus to 30 cm diam. or more, rather thick but little projecting from rock, forming \pm circular patches, well delimited; periphery often zonate and even very indistinctly lobed; areoles mostly radiately oriented at least in outer part of thallus; black hypothallus usually well visible at periphery. Prothallus dark green or sometimes lighter. Apothecia black, usually \pm bare, generally numerous, 0.3-1 mm diam., 1 or several per areole, with slightly prominent margin, rounded or often irregularly angular to elongated and branched, \pm confluent, immersed, but sometimes slightly projecting at the end; disc black, thalline margin slightly raised. Cortex hyaline, 20-60(-89) um thick, \pm cellular, rather regular; brownish pigment layer present in upper part, 6-19 um thick, or absent; crystal layer of calcium oxalate, sometimes very conspicuous, on surface. Algal layer continuous, 40-80 um. Areoles 0.5-3 mm. Hymenium to about 200 um. Cortex and medulla (usually?) K-, P-, containing aspicilin. Hymenium 0.3% I+ blue, soon blue-green, brown-red when more iodine is added. Paraphyses narrow, clearly branched, not thickened at apex; asci cylindrical; spores 2-6(-7) per ascus, uniseriate, rounded or almost cubic. Distinguished from A. contorta and A. coronata by the dark prothallus. On calcareous rocks, especially hard limestones, rarely on bark. Most reports of this species from North America are probably misidentifications. A. calcarea \pm s. str.

2. Discs usually whitish pruinose. Epihymenium yellowish brownish. Spores (usually not developed) (2-)6(-8) per ascus, 16-25 x 14-22 um, ellipsoid, ovoid, subglobose, or globose, uni- to bi-seriate. Thallus determinate or becoming effuse, chinky areolate; areoles contiguous, angular, appearing uniform to the naked eye; surface \pm rough-crumbly; at the circumference often somewhat effigurate, determinate or subdeterminate; color from bluish and light gray to pure white. Hypothallus pale. Apothecia numerous, sunken, finally plane, at first punctiform then larger; disc black under pruina, concave, round or angular. Paraphyses slender, agglutinate or subcoherent, moderately coarse, septate, the septa quite close, especially in upper part (visible after K).

"Hypothecium" colorless. Asci ventricose. Hymenium ca. 200 μ m, I+ blue (then reddish according to Hasse). On calcareous and other rocks in the mountains (calcareous sandstone above 2000 ft. according to Herre) California coast. A. calcarea sensu Hasse, and sensu Herre, pro parte

3. Paraphyses very branched. Epithecium green. Cortex 30-80 μ m thick. On calcareous rocks, and especially on mortar and concrete. Spores (18-)20-30(32) x 14-20(-26) μ m, uniseriate, globose to broadly ellipsoid. Similar to A. calcarea but thallus reduced to scattered (rarely crowded and \pm angular, but never radially oriented) verrucae or areoles which are squamule-like (often elevated in center and thinner at the edge), dispersed at periphery, \pm contiguous in center, plane to convex, 0.5-1.2(-3) mm diam., ca. 1 mm thick, often raised and paler on the margins, roundish, greenish gray to gray or brownish, often bluish-whitish pruinose, sometimes chalky white from dense pruina; prothallus indistinct, never delimiting. Apothecia common, 1(-3) per areole, 0.2-0.6(-1) mm, immersed, concave (urceolate, craterform or weakly sunken), usually densely whitish to blue-gray pruinose, but sometimes epruinose; margin mostly distinct, often radiately striate. Cortex \pm cellular, 15-35 μ m thick, pigment layer 5-10 μ m thick or absent; crystal layer conspicuous; algal layer regular, 30-70 μ m. Hymenium 70-200 μ m, 0.3% I+ blue, soon blue-green; subhymenium 30-70 μ m; hypothecium not visible; epithecium 20-50 μ m, dark green, N+ very bright green, green or slightly blue-green. Paraphyses anastomosed and moniliform in upper 3-6 cells. Asci cylindrical; spores 3-7 per ascus, uniseriate, rounded or almost cubic. With or without aspicilin. Pycnidia always slightly projecting, 1/areole; pycnospores 7-12 μ m. Apparently common, especially in western North America, but many reports, especially from siliceous rocks, are probably misidentifications. (A. hoffmannii, with contiguous, mostly epruinose, greenish or brownish areoles, on siliceous rock, is very similar; it is not yet positively confirmed from N. America). A. contorta [ssp. contorta]

3. Paraphyses unbranched. Epithecium brownish. Cortex 20-30 μ m thick. On sandstone. Spores ca. 25 μ m diameter, globose. Areoles dispersed to subcontiguous, to 1.0 mm wide, brownish, densely pruinose. Apothecia to 0.7 mm, immersed. Hymenium 100-125 μ m. Paraphyses moniliform. Pycnospores unknown. Saskatchewan. [May not belong here, if the sandstone was not calcareous]. A. albopruinosa

ADD:

Thallus areolate-verrucose; areoles widely scattered, rounded, convex, dull white, densely white pruinose. Spores 17-25 x 14-22 μ m. Apothecia numerous, sunken, finally plane; disc black, usually whitish pruinose; paraphyses slender, agglutinate; epithecium yellowish brownish; hymenium I+ blue; spores usually not developed, (2-)6(-7-8) per ascus, ellipsoid or globose. On limestone, 1000 ft. and above, Central California coast. Because of the thallus form and brownish epihymenium, this species would seem to key out near A. albopruinosa. A. calcarea sensu Herre, pro parte.

Thallus greenish-lead-colored, \pm contiguous, thin to moderately thick; fertile areoles enlarged, elevated, irregular; apothecia medium to large, urceolate. Usually on shale along the coast, central California. [May not belong here if the shale was not calcareous]. A. contorta sensu Herre

Apothecia craterform, pruinose, 0.33-0.5 mm diam., with a pale to white rim, finally becoming somewhat lecanorine; spores 15.2-19 x 14.3-16.3 μ m, 4-6 per ascus, very broad to subglobular; thallus gray to olive-gray. Rock type? Rare, mountains of Alberta. A. cf. hoffmannii

Thallus of contiguous or discrete verruciform squamules, falttish at the circumference and rising craterform toward the middle of the squamule, gray, sordid greenish gray, or pale testaceous; disc not seldom black, epruinose. Santa Cruz Peninsula, California (based on a Herre specimen, but not mentioned under this name by Herre; presumably included by him under A. contorta); Mohave Desert. A. hoffmannii sensu Hasse

Thallus verrucose, discrete and scattered; verrucae white, mealy, concex; apothecia small, immersed; disc concave, pruinose; spores not found. On sandstone, mountains of southern California. "Lecanora calcarea f. monstruosa" sensu Hasse

Thallus areolate, effuse; areoles usually dispersed or somewhat contiguous, roughly circular or occasionally subcrenulate, plane to slightly convex, or raised in the middle, 0.5-1.2 mm wide, light (green-) gray to dark gray-black, typically completely white pruinose. Hypothallus absent. Apothecia common, 1(-2) per areole, immersed, sometimes becoming more elevated and then the entire areoles resembling a small volcano. Thalline margin thin becoming thick, raised, \pm radially cracked, persistent, white pruinose or occasionally the sides epruinose and then gray-black although top of margin still pruinose. Disc plane, round to a little elongated, black and epruinose or thickly white pruinose. Paraphyses coherent, thin; epithecium pale sordid green; hymenium 140-170 μ m, I+ blue or yellow-green. Spores 6 per ascus, subglobose, 19-27 x 15-21 μ m. On calcareous sandstone, and on limestone. Maritime and inland. British Columbia. (Probably true A. contorta) A. contorta sensu Noble

ADD?:

Spores 21-23 x 18 μ m, 1-4 per ascus. Thallus effuse, whitish farinose, irregularly rimose in places, especially towards periphery where it becomes yellowish gray, -.5-0.8 mm thick, covered by an amorphous layer 30-50 μ m thick. Apothecia numerous, minute, solitary or 2-3 together in a wart-like leevation; disc 0.3-0.8(-1.0) mm diam., plane, orbicular or irregular, black, usually pruinose; hypothecium 15-20 μ m thick; epihymenium gelatinous, olive-green. On calcareous rocks. Israel. A. farinosa sensu Galun

V-C-1-b. A. desertorum group

1. Paraphyses simple and not moniliform. Cortex 30-40 um thick. Disc dark olive-buff, "appearing powdery". Thallus deep olive, determinate, smooth, areolate; areoles thick, convex, 1-2 mm diameter. Cortex fastigate; epinecral layer ca. 15-20 um thick. Algal layer ca. 100-170 um thick. Apothecia immersed, one to several per areole; disk very concave; thalline margin prominent, persistent, thick, concolorous with thallus. Spores 17.4-24.4 um diam., 3-4 per ascus, globose, thin-walled, uniseriate. Hymenium 150-170 um. "Hypothecium" indistinct. Paraphyses ca. 2 um thick, the tips swollen. Asci clavate. Pycnospores unknown. On sandstone, New Mexico. A. elmorei

1. Paraphyses strongly branched, anastomosed; upper 4-8 cells moniliform. Cortex 50-130 um thick. Disc black, often lightly pruinose. Thallus 1-4(5) mm thick, grayish to olivaceous, yellowish or blackish, sometimes rusty colored or ochraceous, smooth, never pruinose, bearing whitish pseudocyphellae; center of \pm blunt verrucae or areolate; areoles variable, semiglobose to prismatic, (0.6)1.5-3(4) mm diam., congested, turgid, very thick (2-7 mm); lobe tips not swollen; without papilliform or spiniform outgrowths; areoles forming rosettes on soil but very independent. Hypothallus rarely visible, finely denticulate. Cortex very cellular; algal layer irregular, sometimes in glomerules interrupted by vertical hyphal bundles. Apothecia numerous, immersed 1 to several per areole, very large, (0.5-)1-3.5(-5.5) mm diam. (to as much as 10 mm according to Esnault), regularly rounded or more often deformed by mutual compression; thalline margin smooth, very thick (cortex ca. 200 um) and very prominent. Hymenium 130-180 um; subhymenium 40-70 um; hypothecium not visible; epithecium green, 30-60 um, N+ intense green; Spores often rare, uniseriate, (2-)4 per ascus, globose, (15-)20-25 um, or broadly ellipsoid, 18-32 x 15-27 um. Pycnospores 8-16 um. Thallus I-, K-, C-, without lichen substances. On rocks (calcareous according to Esnault) on bare soil, sub-erratic on small round stones, or even terricolous in the fissures. Widespread in deserts of western North America. 2

2. Spores 15-28 um diameter, 4 per ascus, \pm spherical. A. desertorum f. desertorum

2. Spores (22-)25-32(-36) x (18-)22-24(-26) um, 2-3 per ascus, \pm ellipsoid. Spermatia 8-16 um. A. desertorum f. sphaerothallina