

**V-D-1. On non-calcareous (HCl-) rocks  
± submerged in freshwater.  
Thallus effuse, K-**

(Also see: Hymenelia lacustris, with pale disks and continuous orangish thallus; Amygdalaria spp. and Lecidea phaeops, with external cephalodia).

**1. Thallus white.** Thallus large (ca. 5 cm or more), somewhat thick (ca. 0.6 mm in center), the center areolate (not lobate); areoles separated by broad cracks; areoles angular, 1-1.5 mm wide, rugose, becoming convex, minutely verrucose, minutely and irregularly cracked; texture soft; surface subnitid towards periphery; marginal lobes + contiguous, distinctly radiating, convex, 0.2-0.35 mm wide, apiculate; hypothallus black, distinct, radiating, surrounding the thallus. Cortex 30 µm, indistinct. Medulla transparent. Apothecia sparse but occasionally congested, 0.7-1 mm, immersed then distinctly elevated, simple or subcomposite; discs concave to plane, black; margin white to ashy white, entire to slightly sinuate. Spores 20-25 x 10-15 µm. Pycnospores unknown. Hymenium ca. 125 µm. Paraphyses coherent, thickened above to 3-4 µm, indistinctly septate. On siliceous rock, semi-aquatic. Arctic (Greenland; NW Territories). .....A. humboldtii

**1. Thallus ± gray.** ..... 2

**2. Thallus areolate-verrucose.** Spores mostly 20-26 x 12-14(-18) µm. Thallus pale to dark yellowish to greenish or bluish gray, continuous to discontinuous, on a blackish hypothallus; areolate-verrucose, areoles 0.6-1 mm, having sloping sides, like volcanos; Apothecia 1 per areole, prominent, discs 0.3-0.6 mm, craterform, irregular; margins white pruinose, thin, prominent, generally radially striate (not Lecanora-type margins). Medulla densely granular. Thallus K+ only after pre-treatment in HCl. Frequent, western. ....A. gibbosa

**2. Thallus continuous to rimose or rimose-areolate.**  
..... 3

**3. Spores over 20 µm long.** ..... 4

**3. Spores 13-17 x 9-10 µm.** Thallus rimose. Usually K+ yellow. ....(see A. laevata)

**4. With internal cephalodia under the apothecia. Spores 20-30 x 16-22 µm.** Thallus gray, often yellowish, continuous to rimose, rather thin. Apothecia immersed, the disks 0.5-0.8 mm, olivaceous to dark red, epruinose. Pycnospores 10-12 µm. Hymenium 200-240 µm. Egan cites me as the source for the report of this species from N. America, but offhand I don't know why I got the idea it occurs on this continent [probably based on a specimen in somebody's herbarium;

need to check my preliminary attempt at a revised checklist before Egan's]. .....A. submersa

**4. Without cephalodia. Spores 22-35 x 14-18 um.** Thallus blue-gray with yellowish tinge, limited with a thin margin, chinky-areolate; areoles flat to slightly convex; thin dark hypothallus sometimes present. Upper cortex 30-50 um; cortical cells in distinctly perpendicular rows. Medulla filled with granules (dissolving in HCl). Apothecia 1-3 per areole, immersed; disk to 0.5 mm, black, epruinose; margin thick, gray or sometimes with thick dark proper margin. Hymenium 110-200 um, I+ blue (according to Thomson). Epithecium dark olive. Subhymenium obscure, I+ blue. Paraphyses sometimes much branched toward apices, not moniliform. Spores 8/ascus, broadly ellipsoid. On siliceous (e.g., basalt) rocks and boulders in or near brooks, often submerged for long periods. Boreal-alpine. Alaska; Greenland. ....A. aquatica

**V-D-2. On  $\pm$  dry, On non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus dark gray, dark brown, or black.**

**1. Medulla C+ red (gyrophoric acid).** (Also see Mosigia gibbosa [Rimularia], Schaereria spp. and Amygdalaria spp.). Hypothallus black, thin, evident at margin as specks or a slightly fimbriate radiating zone not more than 1-2 mm wide. Thallus effuse, extensive, to 10 cm or more across, verrucose-areolate, slate-gray to black, matt; areoles rounded-convex, not angular, to 0.5 mm wide and high; fertile areoles twice as wide and high. Thallus imbibing water when wet, becoming soft in texture. Cortex 10-15  $\mu$ m; cells 2-3  $\mu$ m diam. Medulla opaque, granular. Apothecia 1 per areole; disk black, to 0.5 mm diam., immersed, deeply concave when young; thalline margin level with disc at maturity. Epithecium HCl+ green. Hymenium 100-110  $\mu$ m, I+ blue becoming wine red. Subhymenium 20-40  $\mu$ m or more high, inversely conical, I-. Paraphyses septate, not strongly moniliform. Asci 70  $\mu$ m high, narrowly clavate. Spores 8, ellipsoid, 12-14 x 6-8  $\mu$ m. Pycnidia often forming erumpent pustules, often abundant on sterile thalli; pycnosporos bacilliform, 6-7 x 0.5  $\mu$ m. Thallus K-, P-. On hard siliceous rock, usually on vertical surfaces, ca. 2000 m. Colorado; Arizona. ....A. quartzitica

**1. Thallus C-.** .....2

**2. Thallus determinate, orbicular,  $\pm$  distinctly radiating.** .....  
(see Key IV: A. sublapponica, A. subradians)

**2. Thallus indeterminate, not orbicular or radiating.** ..... 3

**3. Areoles with white margins and rugae,** otherwise dark, brown-black. Thallus K-, C-. Thallus rimose-areolate, forming an even crust; areoles 0.5-1.5 mm wide, 0.6-0.8 mm thick, quadrangular to irregular, most often angular, separated by narrow cracks, plane to somewhat rugose. Cortex 10-60  $\mu$ m thick, granular; cells globose, 4-6(-8)  $\mu$ m thick, in vertical rows of fastigiate hyphae. Algae 8-10  $\mu$ m diam.; algal layer 60-100  $\mu$ m thick, rather loose. Medulla granular. Apothecia 1 per areole, immersed, round to oblong; disc to 0.3-0.4 mm diam., black, bluish pruinose, plane. Exciple hyaline, black in upper part, I-, 30-40  $\mu$ m thick, to 60  $\mu$ m on lower side. Epithecium olive to intense green. Hymenium 160-200  $\mu$ m; paraphyses not very coherent, towards tips moniliform, 4-5  $\mu$ m thick. Spores 22 x 14  $\mu$ m with "exospore" 4  $\mu$ m thick (according to Hue; 12-13 x 9-11  $\mu$ m according to Bouly de Lesdain). On volcanic rock. Mexico; southwestern. .... A. albomarginata B. de Lesd.  
(Syn.: Lecanora albomarginata B. de Lesd. non (Nyl.) Crombie)

**3. Areoles without white margins or rugae.** ..... 4

**4. Spores under 25  $\mu$ m long and 15  $\mu$ m wide, usually 8/ascus. Apothecia rarely over 1 mm diam.** ..... 5

**4. Spores over 25 um long and 15 um wide, to 4/ascus.**

**Apothecia usually to 2-3 mm or more diam.** 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; disc  $\pm$  pruinose. Usually on  $\pm$  calcareous rocks, or when on  $\pm$  non-calcareous rocks, then often in desert areas exposed to calcium dust. .... (A. desertorum group)

**5. Spores (9-)12-17(-20) x 6-9 um. Hymenium 100-120(-150) um.**

**Pycnospores 14-18 um. Thallus dark olive-brown, brown-gray or dark brown,** thin; areoles flat to more commonly convex, dull or shiny, to 0.8 mm broad; black hypothallus often margining thallus; medulla transparent. Apothecia sessile, raised above areolae, 0.7-1.0 mm diam., solitary to few or composite, disk black, matt, epruinose, concave or flat or slightly depressed, often with a papilla; proper exciple narrow but distinct, and with brown line below it limiting it from thalloid exciple; hypothecium dark cloudy, I- or I+ blue; hymenium I+ blue; epihymenium yellowish olive; paraphyses 2 um, lacking septa and not moniliform, slightly branched; spores 8, ellipsoid. Conidia filiform, straight, 14-16 x 1 um. Thallus K-, C-, KC-, I-. On siliceous rock. Alaska, Northwest Canada, Washington. .... A. aliena

**5. Spores mostly over 20 um long and 10 um wide (but often poorly developed). Hymenium 120-200 um. Pycnospores 6-12(-14) x 1 um. Thallus usually with a more bluish cast (due to pruina).** [Several taxa referred to as "cf." this species may not key out well here; more info. is needed on them]. .... (see A. caesiocinerea)

**V-D-2. On  $\pm$  dry, On non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus  $\pm$  white**

**1. Thallus indeterminate, not orbicular. .... 2**

**1. Thallus determinate or orbicular. .... 3**

**2. Hymenium 100-125  $\mu$ m. Discs 0.5-2 mm diam., epruinose.**

**Thallus gray-white, often with bluish tinge.** Cortex 20-40  $\mu$ m thick. .... (see A. rolleana)

**2. Hymenium under 100  $\mu$ m. Discs to 0.5(-0.7) mm diam.**

**Thallus white or gray-white, without bluish tinge. .... 3**

**3. Spores 16-20  $\mu$ m long. Discs slightly pruinose. Thallus irregularly chinky-areolate, towards the margin becoming less chinky, more continuous, merging into a thin, indistinct ashy hypothallus.** Hymenium 80-100  $\mu$ m. Discs to 0.5 mm diam. Thallus white or ashy white. Cortex 50-80  $\mu$ m thick. Thallus thin to moderately thick, continuous, soft, effuse, not orbicular or lobate, the sterile parts low and ashy whitish, the fertile parts elevated, convex but not verrucose, white or ashy white. Apothecia simple, 1-several in raised warts; discs concave, black; margin raised, pale banded, the sides of the apothecium dark ashy. Spores 8 per ascus, ellipsoid. Paraphyses slender, easily separable in K, not moniliform, becoming branched and interwoven. Epithecium brownish, HCl+ green. "Hypothecium" pale. On calcareous and non-calcareous rock. Arctic (Alaska to Greenland). .... (A. anseris)

**3. Spores 12-13(-14) x 7.5-8.5  $\mu$ m. Discs epruinose. Thallus areolate, with deep cracks; prothallus black,  $\pm$  distinct.** Thallus gray-white to bone-white, effuse. Hymenium 75-80(-85)  $\mu$ m. Thallus moderately thick, subnitid; areoles angular to roundish, 0.35-0.6(-0.8) mm across, contiguous or subdiscrete, almost columnar; sterile areoles depressed convex, irregularly rimulose or rugulose; Apothecia numerous, to 0.7 mm diam., 1(-2)/areole, at first immersed and punctiform, later filling up entire areole leaving only a narrow annulus, and then more or less confluent, separated only by the deep cracks between the areoles, and have the appearance of being elevated, i.e. on tops of columns; disc epruinose; margin moderately thick. Exciple in marginal part of apothecia tall, concolorous with epithecium, flabelliform, with radiating hyphae. Hymenium hyaline; epihymenium dark, gray-brown to green-brown, covered by hyaline amorphous layer. Paraphyses strongly coherent, towards the tips distinctly moniliform, towards the base 1.5  $\mu$ m thick; tips 3-3.5  $\mu$ m. Asci pyriform. Spores biserial. Hymenium I+ blue then yellow-brown. Rock type? Eastern Arctic. .... L. (Aspicilia?) canadensis

**4. Thallus  $\pm$  distinctly radiating. ....** (See Key IV: A. humboldtii, A. candida acid deficient strain, and A. polychroma v.

ochracea

**4. Thallus not radiating.** Paraphyses not moniliform. .... 5

**5. Apothecia 1-2 mm diam.; discs bluish pruinose. Thallus verrucose-areolate,** pruinose, chalky white to gray-white, thicker in center, irregular, orbicular (but apparently not zonate or radiate); areolae appressed to each other, convex, pruinose, to 1 mm across; medulla opaque; hypothallus indistinct. Apothecia numerous and crowded, becoming adnate, irregular in shape; disc concave, black; margin thick, flexuous, of same color as thallus, slightly pruinose; exciple  $\pm$  brownish; hypothecium hyaline, cells  $\pm$  vertical; epihymenium olive green, greener with acids. Spores 4-8 per ascus, broadly ellipsoid, 16-22 x 9-10  $\mu$ m. Hymenium ca. 100  $\mu$ m, I+ blue; paraphyses slightly separable in K, slender with slight widening upward, and though septate, not moniliform. Pycnospores 22-25 x 0.7  $\mu$ m. Exciple K+ yellow. Thalloid margin P+ brown-red; medulla K-, C-, P-, I-. On calcareous rocks, nitrophyllous. Arctic. .... (A. caesiopruinosa)

**5. Apothecia to 0.3 mm diam.; discs epruinose. Thallus rimose-areolate.** Hymenium 100-115(-150)  $\mu$ m. Spores (15-)17-20(-25) x (9-)10-12  $\mu$ m. Thallus determinate, but not distinctly radiating, chalky white with bluish or grayish shade. Apothecia immersed, black, plane, the margin not very prominent. Epihymenium dark olive; paraphyses branched, non-moniliform. .... (L. (Aspicilia?) permutata)

**V-D-3. On  $\pm$  dry, On non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus mottled orange and white.**

**1. Thallus bimorphic, for the greater part thin, to 1.5 mm thick, yellowish ashy, orange, or paler, continuous or rarely minutely and thinly chinky-areolate, the areoles to 0.2 mm broad, flat to convex; other portions thicker, to 0.9 mm, white, dull, the areoles standing higher and scattered over the rest, separated by chinks, flat, to 1 mm broad; fertile areoles also higher and prominent.** Apothecia in the raised or thin portions of the thallus, sessile, constricted at the base, partly confluent; margin white to smoky, entire, smooth; disk concave, black, dull, epruinose; epithecium olive brown, N+ bluish green; "hypothecium" narrow, hyaline; hymenium 90-100  $\mu$ m; paraphyses slender, coherent, simple or slightly branched, non-capitate; spores 8, ellipsoid, containing large oil droplets, 15-21 x 11-12  $\mu$ m. Arctic (Alaska). .....A. heteroplaca

**1. Thallus of discrete, dispersed verrucae to 1.5 mm broad, over a large area, soft, non-lobate, epruinose, white, the surface irregularly reticulately chinky rough; on an orange,  $\pm$  chinky primary thallus.** Apothecia 1-2 in elevated, almost columnar verrucules, with both proper margin and white thalloid margin; disk to 1.5 mm, compounded of a number of smaller units, occasionally with a raised umbo in the center, black, subpruinose. Hymenium 85-100  $\mu$ m. Epithecium olive-brown, interspersed with granules and oil droplets, HCl+ green; "hypothecium" pale. Paraphyses distinct, coherent, conspicuously septate but not moniliform. Spores 17-22 x 10-12.5  $\mu$ m, ellipsoid, 8 per ascus. On acid rocks. Arctic (Alaska to Greenland). .....A. composita

**V-D-4. On  $\pm$  dry, non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus  $\pm$  ochraceous, with yellowish or orangish tinges**

**1. Paraphyses moniliform. Hymenium 70-100  $\mu$ m, Spores 10-15 x 5-8  $\mu$ m.** Thallus  $\pm$  ochraceous gray, or gray with very yellowish or orangish cast, very continuous and thin with slightly raised radiating marginal lobe-like ridges giving a plicate appearance, the lobes not separated by cracks but by thallus portions; central parts appearing more areolate. Apothecia 1(-2) per verruca, 0.2-0.4 mm diam., impressed, often irregular; disc black; margin  $\pm$  darkened toward disc. On shaly or slaty, non-calcareous rock. Alaska. .... (A. plicigera)

**1. Paraphyses not moniliform. Hymenium 125-160  $\mu$ m. Spores (often not well developed), 25-30 x 14-20  $\mu$ m.** Thallus ochraceous, the verrucae olivaceous-ochraceous, effuse, ca. 3 m across, thin. Fertile verrucae well elevated above the thallus, 0.7-1.0 mm diam., olive-ochre. Apothecia numerous to very numerous, occupying almost all verrucae, often several per verruca and confluent or composite; disc black, epruinose, concave, 0.15-0.3 mm diam.; margin raised, thick, entire, subolivaceous. Hymenium inspersed with oil; epithecium olive-brown, HCl+ intense green; paraphyses indistinct, very thin, scarcely thickened above, indistinctly septate. On wet or moist non-calcareous rock, Arctic (Greenland). .....A. pertusa

Also see Hymeneliella lacustris and Eigler flavida



**V-D-5. On  $\pm$  dry, non-calcareous (HCl-) rock.  
Thallus effuse, K-.  
Thallus  $\pm$  gray,  
discontinuous, of  $\pm$  dispersed areoles.**

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

**1. Spores 19-22.3 x 12.4-15.7  $\mu$ m, 8 per ascus; thallus very pale grayish yellowish brown. Apothecia soon lecanorine, epruinose, 0.4-1.3 mm diam., with a thick, smooth, flexuous margin. Rare, Washington. ....A. [caesiocinerea] sp. 1 sensu Brodo**

**V-D-6. On  $\pm$  dry, non-calcareous (HCl-) rock.**  
**Thallus effuse, K-.**  
**Thallus  $\pm$  gray,**  
**not dispersed; thick, areolate to verrucose;**

**1. Spores over 25  $\mu$ m long and 15  $\mu$ m wide, to 4/ascus. .... 2**

**1. Spores under 25  $\mu$ m long and 15  $\mu$ m wide, usually 8/ascus, or apothecia or spores not developed. ....3**

**2. 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. .... (A. desertorum group)

**2. 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. .... (A. calcarea group)

**3. Thallus determinate, orbicular. .... 4**

**3. Thallus indeterminate, not orbicular. .... 5**

**4. Paraphyses moniliform. ....** see Key IV: A. contigua and A. subplicigera

**4. Paraphyses not moniliform. ....** see Key IV: A. concinna, A. novae-semiliae,

**5. Thallus K+ red after pre-treatment in HCl.** Spores mostly 20-26 x 12-14(-18)  $\mu$ m. Thallus pale to dark yellowish to greenish or bluish gray, continuous to discontinuous, on a blackish hypothallus; areolate-verrucose; verrucae 0.6-1 mm, having sloping sides, like volcanos; Apothecia 1 per areole, prominent, discs 0.3-0.6 mm, craterform, irregular; margins white pruinose, thin, prominent, generally radially striate (not Lecanora-type margins). Medulla densely granular. Frequent, western. Part of Herre's material, from central California coast (tentatively identified as this species, with spores 19.5-24.5 x 11-13.5  $\mu$ m and very dark greenish thallus) seems to fit here; the rest of his material has larger spores. ....A. gibbosa

**5. Thallus K- even after pre-treatment in HCl.** Paraphyses moniliform. .... 6

**6. Hymenium 120-200  $\mu$ m. Thallus usually dark, at least under the pruina. ....** (see A. caesiocinerea)

**6. Hymenium mostly to ca. 100  $\mu$ m. Thallus pale. .... 7**

**7. Hymenium 75 um. Thallus pale rosaceous (grayish on reddish substrate?),** soft,  $\pm$  distinctly orbicular and abruptly delimited but not zonate or radiate, thickish, areolate to verrucose. Apothecia numerous, sometimes confluent, 0.5-0.7 mm, elevated on subcolumnar verrucae; disk black, epruinose, margin entire, tumid, gray. paraphyses distinctly moniliform; spores 14-20(-22) x 8-13 um. Pycnospores unknown. On somewhat calcareous siliceous rock. Arctic (Greenland; NW Territories). .....A. nathorstii

**7. Hymenium usually over 90 um. Thallus grayish, yellowish, brownish, or bluish.** ..... 8

**8. Verrucae in thallus center very coarse and thick, 1-1.6(-2) mm across, 0.5-1 mm thick, smaller and thinner in marginal areas.** Thallus whitish gray (brownish in thinner and younger parts),  $\pm$  contiguous; marginally verruculose, centrally thickened verrucose the verrucae occasionally constricted at the base; hypothallus ashy, scarcely visible. Cortex transparent, not inspersed. Apothecia abundant, in most verrucles, dispersed to grouped, 1(-2-3) per areole; discs 0.7-1(-1.6) mm diam., black, concave; margin thin or sometimes thick, prominent, with thin fissure separating it from the disk. Spores 8 per ascus, 17-20(-25) x (12-)13-16 um, often broadly ellipsoid or even subglobose, 14-16 um. Hymenium 100-120 um; paraphyses distinct, with the upper 4-6 cells moniliform and globose, to 3.6 um. Epithecium yellowish brown, HCl+ green. "Hypothecium" pale. Pycnospores unknown. On siliceous or slightly calcareous rock, arctic (Alaska to Greenland). .....A. pergibbosa

**8. Verrucae  $\pm$  uniform, smaller and thinner, mostly under 1 mm wide and 0.5 mm thick.** Discs and spores mostly smaller. .... 9

**9. Pycnospores 14-17(-22) um long. Paraphyses rarely branched. Thallus areolate-verrucose, the verrucae  $\pm$  bullate, becoming lobed.** Apothecia not craterform, becoming lecanorine. Thallus very rough and thick (0.4-0.65 mm thick); verrucae 0.4-1 mm across,  $\pm$  bullate, gray to bluish gray. Cortical cells 2.5-4.5(-6) um diam. Apothecia with a slightly prominent, smooth, flexuous margin; discs 0.2-0.4(-0.6) mm broad, plane, epruinose or slightly pruinose; hymenium (65-)90-110(-120) um. Paraphyses moniliform. Spores ellipsoid, 14-19 x 7.7-8.7 um, 8 per ascus. Frequent. Eastern temperate-boreal. ....A. verrucigera (inactive strain)

**9. Pycnospores 7-9 um long. Paraphyses  $\pm$  branched and anastomosing. Thallus rimose-areolate to verruculose;** uniformly pale gray, not zonate, 1-4 cm across, areoles unevenly convex, 0.7-1 mm across, 0.4-0.6 mm thick, very irregular in shape, verrucose or with uneven, smooth surface; separated by deep, wide cracks with perpendicular sides. Cortex 20-25(-35) um thick, transparent, the outer 5-7 um pale brownish olive; cells

very distinct, globular to oblong, 3-4.5 um wide; epinecral layer 8-13 um. Algae 8-12 um; algal layer 50 um thick, continuous and even. Medulla usually transparent or  $\pm$  with air. Apothecia very numerous, sometimes giving large areas of thallus a dark color, immersed, solitary, few or composite in each areole; the disk 0.3-0.6(-1) mm, black; margin concolorous with thallus, often very thin, at most weakly prominent when young. Hymenium (85-)100-125 um. Epithecium olive. Paraphyses distinctly moniliform far down; upper 3-4 cells globular, 3-3.5 um wide; lower cells narrow but distinctly constricted at the septum; tips with 10-17 um thick gelatinous cover. Asci rarely fully developed, clavate. Spores 8, ellipsoid, (15-)19-22(-30) x (8-)10-12(-18) um. Medulla transparent, lax, hyphae very thin-walled. On non-calcareous rock, in dusty, probably nitrogen-enriched, places. British Columbia. .... (A. laxula)

**Thallus  $\pm$  dark brown, but usually bluish gray from pruina**  
**A. caesiocinerea sensu lato**

This is an extremely common and variable complex, that is difficult to characterize as a whole. Many authors use it as a convenient trashbag for almost any grayish, effuse,  $\pm$  areolate, K- Aspicilia on siliceous rocks. I don't have enough information at present to distinguish the various "A. cf. caesiocinerea" material reported in the literature from the real thing.

**1. Hymenium 120-150(-200)  $\mu$ m. Algal layer regular, continuous.**

Thallus to 20 cm diam., rather thick, generally wide-spreading, cracked to warted-areolate; areoles continuous, slightly concave to flat or  $\pm$  convex, occasionally  $\pm$  subsquamulose in the center of thallus, irregular to rounded, 0.3-1(-2) mm wide, often uneven with distinct edges and a rough, matt surface, pale bluish, brownish or dark gray (usually  $\pm$  dark according to Esnault); prothallus when present gray or black, delimiting. Cortex ca. 10-30  $\mu$ m thick; according to Magnusson the cortex is transparent, the cells are large, often elongated, thin-walled, and at least the uppermost colored layer is K+ rose-brown. Algal layer 30-70  $\mu$ m. Apothecia variable, very irregular, 1-5 per areole, 0.2-0.8(-1) mm diam., at first crater-like, sometimes becoming emergent; thalline exciple evident from an early stage, thin, entire, but rarely prominent (according to Magnusson, forming a prominent wall around young apothecia); disc black, epruinose or almost, becoming expanded. subhymenium 30-60  $\mu$ m; hypothecium not visible. Paraphyses branched and anastomosed, moniliform; epihymenium N+ green. Asci (4-)6-8-spored; spores (14-)17-30 x (7-)13-16(-21)  $\mu$ m, broadly ellipsoid to  $\pm$  globose, often poorly developed. Pycnospores 6-12(-14) x 1  $\mu$ m. Cortex and medulla P-, K-, containing aspicilin (no substances according to Esnault). On nutrient-rich siliceous rocks, especially by lakes and seashores and on bird-perching stones, also on walls, etc. .... A. caesiocinerea s. str.

**1. Hymenium 100-125  $\mu$ m. Algal layer often divided by narrow to broad hyphal bundles.** Thallus gray-white or often bluish, rimose-areolate,  $\pm$  thick; areoles 0.5-2 mm diam., 0.4-1 mm thick, polymorphic, sometimes angular, sometimes lobulate, separated by narrow cracks, plane or slightly concave, sometimes passing into a rugulose uneven crust, continuous or forming patches among other lichens; sometimes limited by black line. Cortex 20-40  $\mu$ m thick. Algae 10-24  $\mu$ m diam.; algal layer 40-50  $\mu$ m thick, Apothecia 1-several per areole, immersed, round or becoming angular to irregular when subconfluent, 0.5-2 mm diam.; disc black, plane, epruinose. Epihymenium blackish; paraphyses 5-6  $\mu$ m thick at apices, strongly coherent, once or twice branched; upper 1/4-1/3 moniliform with globose cells. Spores 8, oblong, 20 x 10  $\mu$ m, to ellipsoid, 18-24 x 10-14  $\mu$ m wide, or subglobose, 14 x 12  $\mu$ m. Pycnospores 10-12  $\mu$ m long, straight. On porphyritic rock. Possibly a synonym of A. caesiocinerea ..... A. rolleana

ADD:

Apothecia craterform. Thallus continuous, areolate-verrucose, brownish or yellowish gray to medium olive brown, becoming grayish pruinose. Apothecia one per areole, with a whitish rim which can become slightly prominent, smooth; spores broadly ellipsoid, 16-20(-22) x 9.5-13.7  $\mu$ m, 4-8 per ascus. Common. Distribution uncertain. ....A. cf. caesiocinerea #1

Thallus dark yellow-brown, becoming blue-gray (pruinose), continuous, rough, rimose-areolate; apothecial margins slightly raised, dark gray; hymenium 125-140  $\mu$ m. Frequent in aerohaline (supralittoral) zone or close to seashore on west coast. ....A. cf. caesiocinerea #2

Thallus rimose-areolate, continuous; areoles irregularly angular,  $\pm$  abruptly steep-sided, contiguous, 0.4-0.9 mm wide, moderate to thick, plane to often slightly uneven, light to medium gray or bluish gray, often scabrid. Apothecia common, scattered, 1(-4) per areole, initially immersed, becoming level with areoles or sometimes slightly adnate, 0.5-0.9 mm diam.; thalline margin initially obscure when apothecia subsessile but becoming more obvious with age, often distinguished by a paler (scabrid or slightly pruinose) or darker (with age when slightly raised) coloration than the thallus. Disc concave becoming plane, black. Hymenium (100-)135-150  $\mu$ m; epithecium (green-) black and sordid greenish below, fading down the hymenium; paraphyses becoming branched and moniliform towards the apices. Spores 8, ellipsoid, 20-23 x 10-12  $\mu$ m. Primarily on sandstone but also on conglomerate and igneous rocks, inland and maritime, British Columbia. The spores are smaller than normal, but otherwise this seems to fit under true A. caesiocinerea. .... A. caesiocinerea sensu Noble

**V-D-7. On  $\pm$  dry, non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus  $\pm$  olive to greenish or brownish,  
thin, continuous to rimose-areolate**

**1. Apothecia well elevated above thallus.** Thallus pale gray to ochraceous or brownish gray, thin, poorly limited, not radiate, granulose, becoming  $\pm$  confluent into an areolated crust, often eroded; areoles to 0.35 mm broad, convex, angular to rounded. Apothecia numerous, dispersed, 0.3-0.5 mm; discs urceolate, appearing divided but without excipular columns, black, epruinose; margin thick, raised, with flabelliform radiating hyphae constricted at the septa, blackish. Spores (14-)16-23 x 10-12.5  $\mu$ m, broadly ovate. Hymenium 90-100  $\mu$ m. Epithecium brownish. Paraphyses distinctly moniliform, the tips thickened. Pycnosporos unknown. On siliceous rock. Arctic (Alaska to Greenland). .....A. elevata

**1. Apothecia level with thallus. .... 2**

**2. Thallus determinate, orbicular,  $\pm$  zonate. Medulla granular.**

Thallus brownish gray, pale yellow-brown to light olive-gray (never ashy- or blue-gray?; sometimes with violet tint), continuous, smooth or indistinctly rimose-areolate, zonate to radiate at times, determinate, limited by a distinct blackish hypothallus; cortex opaque, granular interspersed; medulla filled with granules. Epithecium olive brownish, HCl+ green. "Hypothecium" cloudy and interspersed with oil. Hymenium 90-135  $\mu$ m. Paraphyses coherent,  $\pm$  branched and anastomosing, the tips globular, the cells below the tip submoniliform. Spores 8, ellipsoid, (15-)17-22(-25) x 10-12(-14)  $\mu$ m. Apothecia toward the center, innate; disc 0.3-0.5(-1.0) mm diam., concave, black; margins absent or indistinct, slightly prominent, smooth and even, concolorous with thallus. Pycnosporos 22-40  $\mu$ m. On acid rocks. Arctic-alpine. Alaska to Greenland; infrequent in British Columbia. ....A. supertegens

**2. Thallus indeterminate, not orbicular or  
zonate. .... 3**

**3. Thallus thickish,  $\pm$  distinctly rimose-areolate to areolate-  
verrucose, often with a bluish pruina. .... (see A. caesiocinerea)**

**3. Thallus thin, continuous to  $\pm$  indistinctly rimulose or sometimes  
partly rimose-areolate, without a bluish cast. .... 4**

**4. Growing in Tennessee. Spores, if developed, to 17  $\mu$ m long.**

Thallus continuous, effuse, to at least 4 x 2 cm across, thin, uniformly ca. 0.2(-0.4) mm thick, pale olive to pale sordid grayish green, indistinctly and irregularly rimulose, towards margin subareolate to subsquamulose, not delimited, dissolved into 0.5 mm broad,  $\pm$  scattered, thin but uneven areoles, partly with free and crenulate-

edges. Surface on the whole uneven with low protuberances between the irregularly arranged fissures. No hypothallus. Upper cortex 20-25 um, colorless with yellowish olive surface, partly filled with air, cellular; cells 3.5-5(-7) um, often angular, very thin-walled. Algae 10-20 um diam.; algal layer 50-80 um thick. Medulla colorless, with much air, cellular; cells 4-7.5 um, thin-walled, partly filled with oil, especially below apothecia. Thallus K-. Apothecia dispersed, immersed; disc 0.3-0.5 mm diam., usually regular, olive gray to somewhat pale, concave, minute; thalline margin thick, prominent, wall-like; hymenium 110-135 um high, I+ olive-yellow; paraphyses 1.7 um thick, moniliform above, the apices 4-5 um thick; epihymenium olive to greenish, HCl+ green. Spores rarely developed, broadly ellipsoid, 15-17 x 10-12 um. Pycnidia 85-100 um diam., wall pale, pycnospores 12-14 x 0.8 um, straight. On granitic rock, Tennessee. Similar to A. laevata but K-, with shorter conidia, paler apothecial margin, absent exciple, etc. .... A. olivaceopallida (Magn.) ined.

**4. Growing in the arctic or along the west coast. Spores mostly over 17 um long.**

Apothecial margin blackish. Thallus gray-olive to olive-brown; smooth, thin, almost membranous, finally rimose-areolate; apothecial disc round, 0.16-0.4 mm diam., rim becoming lecanorine, thick, smooth, even, almost black; spores 16.5-24 x 8.8-13 um, ellipsoid. Uncommon, west coast. (A. laevata also seems to key out here except for the K+ yellow reaction).....A. cf. karelica



**V-D-8. On  $\pm$  dry, non-calcareous (HCl-) rock.**

**Thallus effuse, K-.**

**Thallus  $\pm$  gray,  
thin, continuous to rimose-areolate**

**1. Thallus smooth to scurfy, of easily detached,  $\pm$  papillate or flattened glebulose granules, at times later becoming  $\pm$  granular-sorediate,** othewise rimose-areolate, pale to dark bluish gray; prothallus sometimes evident, conspicuous, dark green-gray, delimiting. Apothecia usually infrequent, 0.5-0.7(-1) mm, at first urceolate, later emergent, black; thalline margin often granular, mostly paler than thallus. Spores (17.0-28.5)22.5 x 17(16-20)  $\mu$ m, (4-)8/ascus, subglobose to ellipsoid. Hymenium 130-165  $\mu$ m. Asci small. On nutrient-rich siliceous rocks on or near the seashore. .... (A. leproscens)

**1. Thallus smooth, thin, continuous to rimose-areolate, not papillate, nor granular-sorediate. .... 2**

**2. Thallus determinate, orbicular, ..... 3**

**2. Thallus indeterminate, not orbicular. .... 6**

**3. Thallus distinctly radiate or lobate, grayish to white. ....**  
(Key IV: A. concinna)

**3. Thallus at most zonate or indistinctly radiate at times, with yellowish, brownish, or olivaceous tinges.** [If thallus distinctly bluish gray, see A. americana]. .... 4

**4. Medulla transparent. Hypothallus indistinct, pale (concolorous with thallus). Spores 13-17 x 8-10  $\mu$ m.**

Pycnospores 13-17  $\mu$ m. Thallus somewhat yellowish gray, thin. Spores 8, broadly ellipsoid to subglobose, Thallus indistinctly zonate; areoles also  $\pm$  radiate but contiguous, thinning down toward the periphery; center chinky-areolate; areoles angular. Cortex opaque. Apothecia abundant centrally; discs to 0.5 mm diam., concave to flat, black; margin not prominent, darkened. Epithecium olive brown. "Hypothecium" pale. Paraphyses coherent, in much gelatin, at most indistinctly moniliform. Hymenium 85-110  $\mu$ m. Paraphyses indistinctly moniliform. On non-calcareous rocks. Alaska. .... A. cingulata

**4. Medulla gray, opaque. Hypothallus distinct, dark, limiting. Spores (if developed) mostly over 17  $\mu$ m long and 10  $\mu$ m wide. .... 5**

**5. Thallus gray to gray-white. Spores 20-25 x 13-15(-17)  $\mu$ m, broadly ellipsoid. Pycnospores 7-9  $\mu$ m long.** Thallus rimose-areolate. Apothecia often absent, 0.3-0.5(-0.7) mm, irregularly rounded; disc black, slightly depressed; thalline margin not prominent; proper margin scarcely

developed. Pycnospores straight. Hymenium 115  $\mu\text{m}$ , I+ dark blue throughout. Epithecium 25  $\mu\text{m}$ , sordid blue-green, K $\pm$  brown with a violet shade. Paraphyses towards tips  $\pm$  moniliform,  $\pm$  branched, with globose or broadly ellipsoid cells 3  $\mu\text{m}$  thick. Thallus forming  $\pm$  orbicular areas 1-2.5 cm diam.; distinctly limited by dark subfimbriate hypothallus, . Areoles 0.5-1.0 mm wide, mostly angular, smooth and plane, or in older (central), perhaps overnourished, parts sometimes concave with thick, raised edges or by pressure higher to irregularly verrucose; marginal areoles thinner. Cortex 25  $\mu\text{m}$  thick,  $\pm$  gray. Medulla gray, with much air, translucent in N. Apothecia few or occasionally in thallus center numerous, immersed. Exciple not developed. On chert, Wisconsin. .... A.? limitata

**5. Thallus brownish gray, pale yellow-brown to light olive-gray (never ashy- or blue-gray?; sometimes with violet tint). Spores (15-)17-22(-25) x 10-12(-14)  $\mu\text{m}$ . Pycnospores 22-40  $\mu\text{m}$ .** Thallus zonate to radiate at times, continuous, smooth or indistinctly rimose-areolate, determinate, limited by a distinct blackish hypothallus; cortex opaque, granular interspersed. Medulla granular. Epithecium olive brownish, HCl+ green. "Hypothecium" cloudy and interspersed with oil. Hymenium 90-135  $\mu\text{m}$ . Paraphyses coherent,  $\pm$  branched and anastomosing, the tips globular, the cells below the tip submoniliform. Spores 8, ellipsoid. Apothecia toward the center, innate; disc 0.3-0.5(-1.0) mm diam., concave, black; margins absent or indistinct, slightly prominent, smooth and even, concolorous with thallus. On acid rocks. Arctic-alpine. Alaska to Greenland; infrequent in British Columbia. .... A. supertegens

**6. Apothecia prominently adnate above the thallus, the margins thick; thallus very thin. Spores 12-17 x 8-10  $\mu\text{m}$ .**

Fertile verrucae, with prominent wall (concolorous with thallus), giving ring-like appearance. Thallus  $\pm$  gray, clay ashy, rimose but not areolate, not radiate but partly fimbriate, epruinose; cortex transparent, thin, c. 25  $\mu\text{m}$ ; hypothallus pale. Apothecia in prominent verrucae with vertical sides or slightly narrowed at base, to 0.5 mm diam.; disc concave, black, or brownish black when wet. Hypothecium hyaline; epihymenium brown, HCl+ green; hymenium 70-100  $\mu\text{m}$ , I+ blue, upper part brownish yellow; paraphyses fairly free in K, slender, rarely branched, upper part submoniliform, cells constricted at septum but elongate; spores 8, ellipsoid, 12-17 x 8-10  $\mu\text{m}$ . Conidia not known. On acid or calcareous rocks. Arctic. [If thallus somewhat thicker, more brownish and spores 14-23 x 10-12.5  $\mu\text{m}$ , see A. elevata). .... (A. annulata)

**6. Apothecia at same level as thallus. Thallus thick or thin. Spores mostly over 17  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide. .... 7**

**7. Paraphyses  $\pm$  distinctly moniliform. .... 8**

**7. Paraphyses at most submoniliform, with narrow cells.**

..... 9

**8. Pycnospores 7-9 um long. Thallus uniformly pale gray, 1-4 cm across, rimose-areolate to verruculose; areoles unevenly convex, 0.7-1 mm across, 0.4-0.6 mm thick, very irregular in shape, verrucose or with uneven, smooth surface; separated by deep, wide cracks with perpendicular sides.** Thallus not zonate. Cortex 20-25(-35) um thick, transparent, the outer 5-7 um pale brownish olive; cells very distinct, globular to oblong, 3-4.5 um wide; epinecral layer 8-13 um. Algae 8-12 um; algal layer 50 um thick, continuous and even. Medulla usually transparent or  $\pm$  with air. Pycnospores straight. Apothecia very numerous, sometimes giving large areas of thallus a dark color, immersed, solitary, few or composite in each areole; the disk 0.3-0.6(-1) mm, black; margin concolorous with thallus, often very thin, at most weakly prominent when young. Hymenium (85-)100-125 um. Epithecium olive. Paraphyses  $\pm$  branched and anastomosing, distinctly moniliform far down; upper 3-4 cells globular, 3-3.5 um wide; lower cells narrow but distinctly constricted at the septum; tips with 10-17 um thick gelatinous cover. Asci rarely fully developed, clavate. Spores 8, ellipsoid, (15-)19-22(-30) x (8-)10-12(-18) um. Medulla transparent, lax, hyphae very thin-walled. On non-calcareous rock, in dusty, probably nitrogen-enriched, places. British Columbia. ....A. laxula

**8. Pycnospores 19-24(-28) um long. Thallus bluish gray, rimose-areolate, rather thick, 5-6 cm across; areoles plane, smooth, matt, 0.6 mm wide, separated by narrow cracks;** limited by thin olivaceous hypothallus. Apothecia 0.5 mm diam., one to several per areole, persistently immersed; disc black, epruinose; thalline margin thin, entire, prominent. Spores 8, appearing distichous, often rounded at tips, 18-24(-30) x 12-18 um. Epithecium olivaceous. Paraphyses moniliform. Pycnospores straight to slightly curved. On siliceous rock, mountains of New Mexico; possibly also in Washington state. ....A. americana

**9. Thallus  $\pm$  thick, brownish gray, pale yellow-brown to light olive-gray (never ashy- or blue-gray?; sometimes with violet tint),  $\pm$  limited. Epihymenium olive brownish. Spores mostly under 12 um wide.** .... (A. supertegens)

**9. Thallus very thin (under 0.25 mm), gray, very effuse. Epihymenium pale bluish green. Spores 17-25 x 13-16 um,** broadly ellipsoid. Thallus continuous, indistinctly areolate. Apothecia 0.2-0.3 mm, immersed, disc black. Spores 8 per ascus. Hymenium 100-120 um; paraphyses contiguous,  $\pm$  branched, 1.5 um thick; apices 3-3.5 um wide; upper 10-12 um narrowly submoniliform. Asci swollen. Thallus to 1.5 cm across; only the fertile areoles somewhat distinctly limited, ca. 0.5 mm broad and 0.25 mm thick, convex, the somewhat tumid margin surrounding the

disc. Cortex of fertile areoles 20-30  $\mu$ m thick,  $\pm$  translucent, very pale bluish gray at surface. Algae 7-10  $\mu$ m diam.; algal layer ca. 50  $\mu$ m. Medulla poorly developed. Exciple indistinct. Subhymenium 25-35  $\mu$ m, the base plane with sharp limit, I $\pm$  indistinctly blue. Epithecium 16-22  $\mu$ m, HCl+ intense green. On siliceous rock at high elevation, Oregon. (A. submersa, which is aquatic and has internal cephalodia, also keys out here) .....A. tenuis (Magn.) ined.

ADD:

Thallus thin, smoothish, delicately rimose-areolate; areoles angular, sordid grayish, flat or slightly concave; hypothalline border dull black or bluish black. Thallus K-, C-. Apothecia punctiform, immersed; disc to 0.5 mm diam., concave, black; thalline margin not or slightly elevated. Epithecium pale dingy yellowish brown, subcontinuous. Hymenium hyaline, 132-136  $\mu$ m high; paraphyses slender, loose, coherent at the apices. Hypothecium colorless. Spores ovoid, 24-28 x 16  $\mu$ m. Hymenial gel I+ dull blue. On siliceous rock. Southern California. .... A. laevata sensu Hasse

Thallus thick, gray, rimose-areolate, the areoles rugulose, warty; hypothallus pallid. Apothecia primarily "immersed-sessile"; disk flat, black, epruinose, round or becoming irregular from crowding, now and then becoming convex; thalline margin slightly elevated. Epithecium subcontinuous, yellowish gray to smoky brown. Hymenium 199-128  $\mu$ m high. Paraphyses coherent. Hypothecium colorless or faint yellowish tinted; asci ventricose. Spores ovoid, 15-32 x 12-20  $\mu$ m; epispore thick; hymenial gel I+ blue soon brown. On various rocks, Santa Cruz Peninsula (Herre specimen, cited by Hasse); southern California. .... A. gibbosa sensu Hasse

ADD:

Thallus dark ashy, sometimes pruinose, composed of scattered areolae to 0.5 mm across, the areolae broadening at base; cortex paraplectenchymatous; usually the substratum around the areolae dark-colored, but without well-developed hypothallus. Apothecia 1 per areola; disk black, epruinose, concave; margin I-; hypothecium cloudy, I+ orange (slowly); epihymenium dark olive, HCl+ green; hymenium 85-90  $\mu$ m, I+ blue; paraphyses moniliform; spores 8, ellipsoid to subglobose, 11-17 x 7-10  $\mu$ m. Conidia straight, 13-14 x 0.7  $\mu$ m. Thallus K-, C-, P-, I-. On calcareous rocks in full sun. Arctic. .... A. ryrkaipiae (H. Magn.) Oxner

Thallus pale ashy, thin at circumference, there smooth and continuous, with black hypothallus line delimiting it; toward the center, radiate-areolate; areolae convex, elongate radially, and with transverse cracks; cortex paraplectenchymatous, not vertically arranged. Apothecia quite sessile, in raised areolae with a thick, thalloid margin; thalloid margin I+ blue; proper

exciple indistinct; hypothecium cellular, I+ greenish yellow, of vertical hyphae; epihymenium dark olive-green, K+ reddish brown; hymenium 110-130 um; paraphyses 2 um, tips to 3-4 um and moniliform; spores 8 per ascus, 12-17 x 10-12 um. Conidia 16-17.5 um long. Thallus K-, C-, P-, I-; cortex of margin I+ blue. On acid rocks. Greenland. .... A. circularis (H. Magn.) Oxner