

Buellia de Not.
(LECANORALES: PYXINACEAE)

After various authors

Rev. 4/96
(A MAJOR expansion since the previous edition)

Thallus crustose, smooth, rimose, areolate, granular, or sometimes weakly (to distinctly according to Rogers) lobed at the margins, or subsquamulose, thin or thick, sometimes indistinct or endosubstratal; surface whitish to gray, brown or yellowish, often delimited by a dark prothallus and mosaic-forming, usually ecorticate but sometimes with a well developed cortex; attached by medullary or prothallial hyphae. Soredia very rare; isidia absent.

Apothecia immersed, emergent, adnate, or sessile; black; disk round, flat to convex, sometimes white-pruinose; thalline exciple absent, or in immersed apothecia not distinguishable from the thallus (cryptolecanorine); proper exciple thin, pale and inconspicuous, to well developed and dark-pigmented, continuous with or distinct from hypothecium; hypothecium hyaline to pale or more often dark brown (yellowish, reddish), sometimes olivaceous in part, to black and carbonaceous; without algae below; hymenium colorless, or greenish in upper part, I+ blue, with or without numerous oil droplets that do not dissolve in K; epihymenium brown to olive-green, K-, N- or N+ reddish; paraphyses thin, septate, simple or branched in upper third; tips weakly to strongly thickened and pigmented, often with a dark brown cap; asci clavate or cylindrical, Lecanora-type, unitunicate, I+ blue; tholus I+ blue; spores 8 (rarely only 4, or as many as 32), greenish-brown to brown or gray, ellipsoid, oblong or fusiform, straight or curved, usually 1 septate, sometimes falsely 4-celled by ingrowth of outer wall, or 4-celled to submuriform; wall and septa sometimes usually equally thickened (except in "Hafellia" and at least one other species), sometimes thickened at the septum (rarely also subapically), thinner and paler at the apices; surface smooth or finely ornamented (use oil immersion), without a distinct perispore.

Pycnidia immersed or in warts; wall dark brown at least in upper part; fulcrum endobasidial; pycnospores, simple, colorless, ellipsoid to oblong, bacilliform, fusiform-cylindrical, or ["Amandinea"] threadlike and curved. Various substances, including atranorin, norstictic acid, and numerous xanthones, and paradesides, tridesides, depsidones, and unknowns, or no substances. Photobiont Trebouxia or other chlorococcoid green algae. On rock (especially siliceous), bark, wood, soil or bryophytes, or lichenicolous. Cosmopolitan, in very diverse habitats.

The description above may need to be somewhat modified if one accepts the newer segregate genera Hafellia (lumped by Orange, et al.; differs mainly in having unevenly thickened spore walls) and Amandinea (differs only in pycnospore type, and in my opinion, should probably be lumped).

An older, somewhat better established segregate genus is Diplotomma, which differs in that the ascospores are always 3-septate to muriform and distoseptate as in Rhizocarpon; the apothecia are also often densely pruinose.

Diploicia is distinguished by the distinctly lobed thallus.

Rinodina differ in having a distinct thalline exciple, although in some species this is concolorous with the disc and so evident only in section; species of Rinodina have a pale (usually colorless) hypothecium and usually much more pronounced wall thickenings in the ascospores.

Other crustose genera which are similar to Buellia but unrelated to it include Arthonia, Catolechia, Epilichen, Melaspilea, Orphniospora, and Rhizocarpon, as well as the lichenicolous or non-lichenized Abrothallus, Dactylospora and Rhizodiscina; all of these genera have different ascus structures.

This is another huge, sometimes difficult genus, although not as bad as some of the others.

KEY TO SEGREGATE GENERA OF BUELLIA

After Poelt, and others

1. Paraphyses strongly anastomosing, not or little thickened above.

.....2

1. Paraphyses branched only above, and not anastomosing. Spores without halo, usually small, always rapidly turning brown. Apical apparatus of asci strongly developed (except in Dactylospora). Pycnospores endobasidial. If thallus yellow, then without pulvinic acid derivatives. On various substrates.4

2. Spores with halo at least when young, without a torus, one- to several-septate or muriform, hyaline or becoming brown at maturity, often very large. Pycnospores exobasidial. Apothecia usually initiated on the hypothallus. Thallus yellow (pulvinic acid derivatives) or gray to brown. Apical apparatus of asci variable. Usually on siliceous rocks. (see Rhizocarpon)

2. Spores without halo, but with a torus (dark spot where septum joins lateral wall), 1-septate, brown, small. Thallus yellow (pulvinic acid derivatives); without a hypothallus. Apical apparatus of asci small. On soil or rock or parasitic. 3

3. Thallus bullate-squamulose, folded-swollen, lobed at margin, lemon yellow to greenish yellow, C+ orange; Apothecia initiated between the areoles, flat and marginate when young, to 2 mm. Ascus tip I-. Spores 12-18 x 7-8.5 μ m. Underside of thallus black, with rhizomorphs. On soil or partly on rock, alpine. Catolechia (wahlenbergii)

3. Thallus \pm granular to verrucose-areolate, thin, not lobed, greenish to greenish yellow, C+ orange or C-. Apothecia initiated within the areoles, soon convex and immarginate, to 0.6(-0.8) mm, often confluent. Ascus tip I+ blue. Epihymenium olive-brown to brown, K-. Spores 11-18 x 6-8.5 μ m. Parasitic on Baeomyces. Epilichen (scabrosus)

4. Apothecia \pm lecanorine (algae present in apothecial margin or at least below hypothecia), sessile to immersed; spores usually (at least in KOH) with unevenly thickened walls, often with torus, often with lumina \pm connected by an isthmus. Rinodina sensu lato

4. Apothecia \pm lecideine (algae absent from the apothecia, though apothecia often surrounded by thallus or by a pale margin); spores with evenly thin or rarely somewhat thickened walls (see Hafellia), never with an isthmus nor a torus.5

5. Spores 3-septate to submuriform; thallus not squamulose or lobed.6

5. Spores 1-septate (rarely simple when young).7

6. Apothecia generally projecting, not between areoles, often with pseudothalline exciple (pale margin without algae). Cortex crystalline-granular. Spores distoseptate. Spores mostly under 25 μ m long, rapidly brown, often slightly curved. Hypothecium dark brown. This genus is not accepted by Nordin, who is revising this

group. Diploimmia

6. Apothecia immersed to sessile on the thallus or occurring between the areoles; initiated within the areoles; usually without pseudothalline exciple. Cortex and spores not as above. Buellia (if parasitic, also see Dactylospora)

7. Thallus squamulose or lobed at margin; upper cortex well developed; medulla I-; hypothecium dark.8

(if thallus with lower cortex, see Pyxine)

7. Thallus not squamulose or lobed.9

8. Thallus sorediate, greenish white, \pm pruinose, little changed when wet, K+ yellow then brown, radiating-lobed. Apothecia rare, to 1 mm, epruinose, soon immarginate. Spores 11-14 x 6-7 μ m. On bark, wood, or rock (rarely moss), at low elevations, California. Diploicia (canescens)

8. Thallus not sorediate, whitish, gray or brown, K- or K+ yellow or red, not radiating-lobed. On soil, rock, or other lichens. Buellia

9. Spores simple when young, later indistinctly septate, 10-15 x 6-9 μ m. Thallus brown or black, on black hypothallus, shiny, of irregular, continuous to dispersed areoles, K-, P-, I+ pale blue. Apothecia adnate or between the areoles, to 0.8 mm, flat to convex, greenish when wet, dull, the margin black, thin, disappearing. Hypothecium dark. On rock, arctic-alpine. Orphniospora (moriopsis)

9. Spores distinctly septate even when young.10

10. Parasitic on lichens, without a distinct thallus other than that of the host.11

10. Not parasitic, or if so then (usually?) with distinct thallus. Ascus with I+ blue apical apparatus. 12

11. Ascus tip without apical apparatus, but with gelatinous, I+ strong blue cap. Spores 1-septate to muriform. ... Dactylospora

11. Acus tip with "Jack-in-the-box" type apical apparatus, I-. Spores 1-septate. Buelliella

12. Ascospores with irregularly thickened walls, often over 30 μ m long; hymenium inspersed. Thallus containing placodiolic acid or diploicin. Hafellia

12. Ascospores with uniformly thin walls or somewhat thickened only at septum; spores often smaller. [The following two genera are indistinguishable when pycnidia are absent, and no information is available on most corticolous species, and therefore these genera are keyed together under Buellia]. 13

13. Pycnosporos filiform, usually 15-30 μ m long (ca. 14-17 μ m in A. punctata), curved. Amandinea

13. Pycnosporos bacilliform, under 15 μ m long, straight. Buellia

Spore types:

Buellia-type: without internal wall thickenings; lumina round; torus diffuse or intensely pigmented.

Physconia-type: with faint wall thickening near septum; lumina somewhat elongated and angular

Callispora-type: with wall \pm distinctly thickened laterally, even more near septum; lumina somewhat elongated and angular

Spore ornamentation:

rugulate: sulptures circular to elongate, irregularly arranged, ca. 1 μ m (< 1 μ m = microrugulate)

psilate: not sculptured

Exciple types

aethalea-type: margin mostly prominent and persistent, 40-100 μ m, black or occasionally brown, cryptolecanorine, zeorine (cells arranged anticlinal to thallus surface, elongated and parallel with narrow lumina and strongly thickened walls, cohering) or lecideine (radially formed, with cells \pm rectangular and not isodiametric or polyhedral and isodiametric, without intercellular spaces); with pigments A (green to blue-green, K-, N+ red) and B (dull brown, K-, N-), which are often restricted to the outer part.

vilis-type: margin black, prominent and persistent, radially structured, to 60 μ m broad; inner and outer part with cells elongated and parallel with narrow lumina and strongly thickened walls, cohering; outer part markedly colored with pigment C (dull brown-red to black, K-, N+ intensifying purple and diffusing brown-red); inner part unpigmented and I+ strong violet.

dispersa-type: margin dark brown to black, radially structured, 60-100 μ m wide; inner part with cells elongated and parallel with narrow lumina and strongly thickened walls, cohering; outer part with cells polyhedral and isodiametric, without intercellular spaces; with pigments D (dull brown, K+ brownish diffusion, N-) and B (dull brown, K-, N-), at first only in outer part, then throughout.

leptocline-type: margin black, mostly prominent, ca. 100 μ m broad; inner part with cells elongated, running in all directions, not cohering, usually with distinct interhyphal spaces; outer part with cells elongated and parallel with narrow lumina and strongly thickened walls, cohering.

Buellia s. lato

Rev. 5/94

I. SPORES MORE THAN ONE-SEPTATE

I-A. Spores 3-septate.

1. Obligately parasitic on terricolous and saxicolous Physcia and Physconia species. B. pulverulenta
1. Not obligately parasitic. 2
 2. Saxicolous. 3
 2. Terricolous, corticolous or lignicolous.
3. On calciferous rocks. 4
3. On non-calciferous rocks. 5
 4. Thallus continuous, growing in rounded patches > 1 cm diam., apothecia usually > 0.5 mm diam., spores usually longer than 15 μ m, medulla always I-. B. venusta
 4. Thallus dispersed in small patches < 0.5 cm diam., apothecia usually < 0.5 mm diam., spores shorter than 15 μ m, medulla sometimes I+ blue. Montana, North and South Dakota. B. subdispersa
5. Thallus C+ orange, spores never with longisepta, c. 13 x 5 μ m, on siliceous rocks at low altitudes. B. vernicoma
5. Thallus C-, spores often with longisepta on each side of middle transseptum, c. 19 x 10 μ m, on volcanic rocks at high altitudes. Arizona; Mexico. B. tolucae
 6. Terricolous, overgrowing other lichens and mosses (seldom on wood of fallen logs). Arctic Canada; alpine in Alberta and Colorado. B. terricola
 6. Corticolous or lignicolous. 7
7. Thallus yellowish, C+ orange. 8
7. Thallus whitish or gray, C-. 9
 8. Spores c. 13 x 5 μ m. B. vernicoma
 8. Spores c. 23 x 9 μ m. Alberta to Colorado. B. triphragmioides
9. Thallus K+ yellow turning red. B. lauricassiae
9. Thallus K- or faintly yellow. Washington to Baja California; Arizona; South Dakota. B. triseptata

I-B. Spores submuriform or muriform.

1. Medulla in lower part yellow-orange, K+ red (without crystals), C+ red, P-. Spores submuriform, the locules (5-15 visible) rounded or angular, 18-25 x 11-14 μ m, the walls very thick. On siliceous rocks, away from the spray zone, coastal California. B. capitis-regnum W. Weber
1. Medulla white, K+ or K-, mostly C-. 2
 2. Spores predominantly eumuriform. 3
 2. Spores predominantly submuriform. 4
3. Thallus C+ orange (best seen under the microscope), young spores with conspicuous

septal and apical thickenings, early pigmented. Oregon to Baja California Sur. B. oidalea

3. Thallus C-, spores long remaining unpigmented, thickenings absent. California to British Columbia. B. muriformis

4. Saxicolous. 5

4. Corticolous or lignicolous. 6

5. Apothecia angular, epihymenium and excipulum with blue-green (N+ purple) pigment, spores with 4-6 cells in optical section. B. tolucae

5. Apothecia rounded, blue-green pigment absent, spores usually with 8 cells in optical section. B. alboatra

6. Soralia present, rounded, discrete. B. griseovirens

6. Soralia absent. 7

7. Thallus C+ orange, spores c. 26 x 12 um, when young with conspicuous septal thickenings. Baja California (Norte and Sur). B. oidaliella

7. Thallus C-, spores smaller, without conspicuous thickenings. 8

8. Lignicolous, thallus slightly yellowish, K+ yellow turning red, spores c. 19 x 9 um. Arizona, Texas. B. cedricola

8. Corticolous and lignicolous, thallus not yellowish, K- or K+ faintly yellow. 9

9. Thallus K+ faintly yellow, apothecia epruinose, hymenium with oil droplets, spores c. 22 x 11 um, usually on conifers. California and SW Canada; Utah. B. penichra

9. Thallus K-, apothecia usually pruinose, hymenium without oil droplets, spores c. 16 x 8 um, usually on broad-leaved keys. California. B. alboatra

ADD? (not mentioned in Nordin's articles):

On sandstone. Hypothecium and exciple pale. Thallus thin, white to ochraceous, rimose, I-, K-, C-, P-. Apothecia sessile, the disc black, subplane, the margin white, thin, scarcely prominent. Spores 18-21 x 9-10 um. Utah. B. lecanoroides

Apothecia to 0.9 mm diam. Alpine, New Mexico. Discs \pm plane, the margin thin, \pm persistent. Thallus rimose-areolate, on distinct hypothallus, cortex K+ yellow; medulla K-, I+ blue. Spores 18-23 x 8-11 um. [B. saximontana Egan ined.]

Hymenium inspersed, 70 um. Thallus grayish, K+ yellow, C-. Spores 19-27 x 5-8 um, only partly 3-septate, thin-walled. Apothecia \pm convex, naked. Usually on wood (?)

..... B. disciformis v. triphragmia

II. SPORES ONE-SEPTATE. ON ROCK.

1. Hypothallus black and prominent, visible between areoles or as a black edge around areoles. 2

1. Hypothallus lacking, or of scattered, black specks or visible only as a black fringe at margin. KEY II-A

2. Thallus gray, K+ yellow, areolate, the areoles 0.5-1 mm, plane to convex. Apothecia black, epruinose, one per areole, immersed then adnate, plane, the margin thin. Epithymenium and hypothecium brown. Spores 11-12 x 7-9 um. On siliceous rock, New Mexico. B. silicicola

(Type specimen lost)

2. "Not as above" [medulla reaction with IKI unknown for B. silicicola]. 3

3. Medulla I+ blue. 4

3. Medulla I-. 10

4. Hypothecium dark; epithymenium brown. 5

4. Hypothecium hyaline or pale. On siliceous rock. ... 9

5. Thallus K+ red (crystals), containing norstictic acid. 6

5. Thallus K+ yellow or K-. 7

6. Spores (10-)13-15(-18) x (6-)8-10.5 um. Apothecia persistently immersed. B. aethalea

6. Spores to 13 um long and 7 um wide. Apothecia becoming adnate or sessile. 7

7. Hypothecium brown-black or dark brown, extending through the thallus to the hypothallus. Exciple continuous with hypothecium, concolorous. Paraphyses ± agglutinate, branched. Apothecial margin narrow. Mostly on slightly inclined faces of low granitic boulders; also on sandstone, quartzite and serpentine. Eastern U.S.; California. B. spuria (Schaerer) Anzi

7. Hypothecium yellow-brown to light red-brown, not extending as a tail into thallus. Exciple distinct from hypothecium, brown at margin, pale inside. Paraphyses discrete, simple. Apothecial margin thick. Eastern U.S. (New England to Alabama) B. stigmaea

8. Growing on the seashore, boreal-arctic (often associated with Lecanora straminea). Thallus ± brown. Pycnidia common and conspicuous; pycnospores 15-30 um long, curved. Spores broadly oblong, constricted at septum, (10-)13-18 x 7-9.5(-11) um, Phyconia-type; ornamentation rugulate. Thallus areolate to bullate; medulla I-. Apothecia biatorine to lecideine, 0.5-0.8 mm diam., broadly sessile; disc plane to convex; margin thick, persistent. Exciple aethalea-type. Hymenium without oil droplets, 58-80 um; epithymenium brown; hypothecium dark brown. Alaska.

Amandinea coniops (Wahlenb. in Ach.) Choisy ex Scheidegger & Mayrhofer

8. Usually growing inland. Thallus ± gray. Pycnidia less conspicuous; pycnospores short, straight. Spores 11-15 x 6.5-8 µm. Thallus ashy, rimose-areolate. Apothecial margin thick. B. aethalea v. aethaleoides (including B. malmei)

9. Thallus K+ red, C-. Epihymenium brown. Spores 12-16 x 6-9 µm.

..... B. uberius

9. Thallus K+ sordid yellow. Epihymenium green. Spores 15-16(-18) x 9 µm.

..... B. lacteoidea

10. Thallus dark brown to black. Spores simple when young.

(Orphniospora moriopsis)

10. Thallus pale, yellow, gray or white. Spores soon distinctly septate. 11

11. Thallus C+ or KC+ pink or red. Thallus white, turning yellowish in herbarium, K- or K+ yellow, areolate, surrounded by a very distinct black hypothalline line. Apothecia 0.2-0.5 mm diam., disk ± pruinose or not, even or convex; margin thin. Hypothecium brown. Spores 7-11 x 5-8 µm. Thallus I-. On non- or weakly-calcareous rocks. Santa Barbara Island, California (reported by Bratt, 1993). [See Scheidegger's European treatment for more info.] B. cerussata Llim. ex Werner

11. Thallus C-, KC-, or if C+ orange-red, then distinctly yellowish when fresh. [This may be a bad choice--need to contrast with B. ocellata]. 12

12. Thallus ochre yellow or greenish straw yellow, C+ orange-red, On siliceous rocks, sea level to subalpine. B. ocellata (Flotow) Körber

12. Thallus gray or white, or greenish or brownish, mostly C-. 12a

12a. Thallus K+ red, Spores ellipsoid, 13-17 x 8-10 µm, the walls unevenly thickened. Arctic. B. immersa

12a. Thallus K+ yellow or K-. 13

13. Hypothecium hyaline. Spores 14-18 x 7-8 µm. Thallus verrucose-areolate, K-, P-, On calcareous rock, Arctic. B. notabilis

13. Hypothecium brown-black. 13a

13a. Thallus rimose, whitish to pale gray, K+ yellow. Spores 9-13 x (4-)5-6 µm. On sunny, calcareous or siliceous rock. B. stellulata (Tayl. in Mack.) Mudd (syn.: B. maritima)

13a. Thallus scurfy, ashy, greenish, or brownish, K-. Spores 9-16 x 4-8 µm. "B. stigmataea Koerber (= ? Amandinea punctata)

**II-A. On rock;
Spores 8, 1-septate;
Hypothallus indistinct or absent**

1. **Thallus indefinite, tartareous, scant or obsolete.** 2
1. **Thallus definite (but may be indeterminate).** 6
 2. **Hypothecium hyaline or pale.** 3
 2. **Hypothecium pale brown to dark brown.** 4
3. **Exciple brown at edge, hyaline inside.** On small pebbles in very wind-exposed habitat and on recently eroded surfaces of granitic boulders. Boreal-arctic. B. vilis Th. Fr.
3. **Excipulum intense emerald green.** On siliceous rock, New Mexico. B. smaragdula (Type specimen lost)
4. **Thallus ashy to greenish or brownish.** very thin, rimose (or scurfy to verruculose or lacking?), P-, K+ yellowish (?) or K- (no substances). Apothecia broadly sessile or slightly constricted at base, to 0.6 mm, plane to convex, black, the margin thin, black, persistent (or disappearing?); exciple aethalea-type; epihymenium brown; hypothecium brown (to brown-black?). Hymenium 70 μ m, not inspersed. Spores oblong, constricted or not at the septum, Buellia-type, (7-?)12-15 x (4-?)6-8 μ m; ornamentation psilate. Pycnidia very rare and inconspicuous; pycnospores filiform, curve, to 15 μ m long. Medulla I-. Widely distributed, temperate to arctic. [Description based on saxicolous material described by Scheidegger, 1993; question marks indicate information from other sources]. Amandinea punctata (Hoffm.) Coppins & Scheidegger (including? "Buellia" stigmaea)
4. **Thallus white,** very thin, almost absent. Apothecia black. Epihymenium and hypothecium brown. Spores 12-16 x 5-6 μ m. (poorly known taxa on siliceous rocks in New Mexico, perhaps only variations on A. punctata). 5
5. **Thallus visible only under the apothecia. Apothecia becoming convex and immarginate,** to 0.6 mm. Spores rather thick-walled. B. nantiana
5. **Thallus very thin, effuse. Apothecia plane to subconvex, the margin persistent.** subnitid, sessile, Thallus K-. Spores not constricted. B. saxicola
6. **Thallus continuous, becoming rimose.** 7
6. **Thallus areolate or subsquamulose.** 10
7. **Medulla I+ blue.** 8
7. **Medulla I-.** Spores \pm constricted, 13-16 x 6-8 μ m. Alpine, New Mexico. B. lakensis Egan ined.
8. **Medulla K+ red (crystals), Pd+ yellow.** Thallus cream colored, thin, becoming rimose-areolate. Spores 8-13(-15) x 4-7 μ m. Apothecia soon adnate. B. stigmaea
8. **Medulla K+ yellow or K-.** 9

9. Medulla K+ yellow, Pd+ red, C-, I+ blue (in spots). Thallus pale creamy yellow, continuous, becoming rimose-areolate. Apothecia to 0.7 mm, immersed to emergent, black, epruinose, plane, the margin moderately thick and raised. Hypothecium and epihymenium brown. Spores 10-16 x 5-8 um. Widely distributed.B. mamillana

9. Medulla K± yellow, KC+ yellow or brownish, I+ strongly blue-violet. Thallus chasmolithic to continuous or rimose, white to ashy. Apothecia to 1.2(-1.5) mm, sessile with constricted base, On perpendicular to overhanging, rain-exposed parts of siliceous boulders in subalpine to alpine areas. B. leptocline (Flotow) Körber

10. Thallus areolate to squamulose to subfoliose, of contiguous, poorly delimited, ± deeply lobulate, imbricate scales, little adherent to substrate, Often parasitic. Montane/subalpine. B. badia (resembles Melanelia spp. and also Lecidea lurida)

10. Thallus areolate, not distinctly squamulose, closely adherent. 11

11. Areoles dispersed, convex, becoming subsquamulose or lobate.

..... 12

11. Areoles contiguous, plane. 14

12. Thallus brown-gray to ashy gray, Spores 9-15 x 5-8 um. Conidia filiform. Confluent acid (major), superconfluent acid and unknown pigment (both minor). On non-calcareous rock. New England to Washington and California.B. (Amandinea?) turgescens

12. Thallus white (or gray). Apothecia immersed then soon sessile to adnate, to 0.8 mm, black, plane to convex. 13

13. Hymenium inspersed with oil drops. Thallus P+ yellow, epruinose, California.B. lepidastroidea Imsh. ined.

13. Hymenium without oil drops. Thallus P-, often pruinose, Widespread in Southwest.B. retrovertens

14. Thallus ± yellow (or buff). Medulla I-. 15

14. Thallus not yellow. 19

Thallus \pm yellow.

15. Exciple green at edge; epihymenium green or brown. Medulla I-. 16

15. Epihymenium and exciple brown. 17

16. Epihymenium green. Thallus pale yellow or greenish yellow, K+ sordid yellow, P-, Discs often bluish pruinose. Coast of California. B. halonia

16. Epihymenium brown. Thallus pale yellowish or buff, K+ sordid yellow, P+ red. Discs epruinose. Eastern. B. lepidastr

17. Thallus C-, On siliceous sandstone. Utah. B. saurina W. Weber

17. Thallus C+ orange or red. Hypothecium and epihymenium brown. 18

18. Apothecia strongly marginate from the start, never pseudolecanorine, Spores (15-)17-23 x 7-11 μ m, Montane to subalpine, California. B. semitensis

18. Apothecia cryptolecanorine to lecideine, innate to broadly sessile with a black narrow margin (or immarginate from the start and often pseudolecanorine), Spores 11-15 x 6-8.5 μ m; Alpine, Colorado. B. jugorum (Arnold) Arnold

19. **Thallus brown.** Epihymenium brown. 20
19. **Thallus ± gray or white.** 21
20. **Growing in the Southwest.** Spores 6-12 x 6-7(8) um, rather thick-walled, not constricted. Hypothecium hyaline or dark. On siliceous rocks B. novomexicana
20. **Growing in the Midwest.** Spores 9-15 x 5-8 um. Hypothecium hyaline. B. nigra
21. **Epihymenium or exciple green.** 22
21. **Epihymenium and exciple brown (or violet).** 23
22. **Thallus chalky white, K+ bright yellow, C-, I-, continuous or very finely rimose. Epihymenium green,** Maritime, on "± decalcified calcareous rocks or silicates contained in calcareous rocks". B. maritima
22. **Thallus pale yellowish or buff, rimose-areolate, K+ sordid yellow, P+ red. Epihymenium brown.** Eastern. (B. lepidastrum)
23. **Epihymenium and exciple violet.** Thallus chalky white, areolate, the areoles plane to subconvex. Apothecia to 0.9 mm, black, immersed then adnate, becoming convex and immarginate, the margin thin, black. Hypothecium brown. Spores 15-20 x 9 um, evenly thin-walled, not constricted. On calcareous rocks, New Mexico. R. calcariaecola
23. **Epihymenium or exciple brown.** 24
24. **Thallus K+ red.** Thallus ash-gray or brownish, areolate or rimose-areolate. Spores 10-15 x 6-8 um. Hypothecium hyaline to brown-black. Apothecia remaining immersed. B. aethalea
24. **Thallus K+ yellow or K-.** 25
24. **Apothecia often slightly white pruinose,** California. B. fimbriata (Tuck.) Sheard
25. **Apothecia not white pruinose.** 24
26. **Medulla K+ yellow.** 27
26. **Medulla K-;** thallus rimose-areolate, ashy. Spores 11-15 x 6.5-8 um. Apothecial margin thick. B. aethalea v. aethaleoidea (including B. malmei)
27. **Thallus continuous to rimose-areolate,** white to ashy. Medulla KC+ yellow or brownish, I+ blue. Apothecia to 1(-1.5) mm, black, naked, the margin thick, ± persistent. Hypothecium and epihymenium ± red-brown. Spores 11-18 x 6-9 um. B. leptocline
27. **Thallus areolate,** ashy-glaucous, subnitid, smooth, the areoles contiguous, convex to subplane, 0.5 mm. Apothecia black, naked, to 0.6 mm, plane to subconvex, the margin thin, black. Epihymenium and hypothecium brown. Spores 12-15 x 4-8(-9) um. On siliceous rock, New Mexico. B. cinereoglauca

III. SPORES ONE-SEPTATE. ON SOIL, MOSS OR HUMUS

1. Thallus determinate, plicate-radiate or squamulose-lobed.2

1. Thallus crustose, indeterminate. 6
(also see B. disciformis)

2. Thallus distinctly yellow, plicate-radiate.(Catolechia wahlenbergii)

2. Thallus not yellow.3

3. Thallus chestnut brown, squamulose to subfoliose, of contiguous, poorly delimited, \pm deeply lobulate, imbricate scales, little adherent to substrate. Apothecia rare, to 0.8 mm, bare, soon convex and immarginate. Spores 11-21 x 6-9 μ m. Often parasitic. Montane/subalpine. (see B. badia)

3. Thallus whitish.4

4. Thallus greenish glaucescent to white, composed of scattered, turgid, wavy and plicate squamules, On soil, S. California and Baja California.B. bolacina

4. Thallus white, determinate, composed of scattered lobules or forming a rosette of much divided lobes. 5

5. Hypothecium brown-black. Thallus K+ pale yellow, P+ orange. Thallus white or whitish, almost tcompletely chalky. Apothecia 0.5-0.8 mm diam.; disc \pm pruinose when young becoming convex; margin whitish, disappearing. Spores 13-22 x 6-10 μ m. On soil, \pm calcareous. B. elegans

5. Hypothecium brown, often pale. Thallus K-. Thallus thick, well visible, white or whitish, chalky, of areoles or squamules very close together and completely separated from each other. Apothecia 0.3-1 mm diam.; disk generally blue-white pruinose. Spores 15-25 x 7-12 μ m. On soil, calcareous or not. B. epigaea

6. Spores (7-?)12-15 x (4-?)6-8 μ m.(Amandinea punctata)

6. Spores over 18 μ m long and over 8 μ m wide. 7

7. Thallus K-. Apothecial disk generally blue-white pruinose. Thallus thick, well visible, white or whitish, chalky, of areoles or squamules very close together and not completely separated from each other. Apothecia 0.3-1 mm diam.; disk generally blue-white pruinose. Hypothecium brown, often pale. Spores 15-25 x 7-12 μ m. On soil, calcareous or not. B. epigaea

7. Thallus K+ yellow. Apothecial disk epruinose. 8

8. Spores 18-24 x 8-10 μ m. Thallus papillose-granular. Only on mosses.
.....B. papillata

8. Spores 25-32 x 9-13 μ m. Thallus verrucose-granular. On plant detritus and rotten wood as well as on mosses.B. insignis

IV. SPORES ONE-SEPTATE. ON BARK OR WOOD.

1. Asci with consistently more than 8 spores. Apothecia plane to convex, the margin thin, often excluded. Epithymenium brown; hypothecium brown to brown-black. Widely distributed.2

(Noble's unknown from British Columbia may be one of these)

1. Asci with 8(to occasionally 12) spores. 4

2. Spore wall unevenly thickened. Hymenium densely inspersed; epithymenium greenish, K+ purplish; ascospores 12-16 per ascus, 13.5-16.5 x 6.5-7.5 μ m.

Florida. (*Hafellia bahiana* var. *pleiotropa*)

2. Spore wall evenly thickened. 3

3. Hymenium inspersed. Thallus white to somewhat ochraceous, K+ sordid yellow, P-, rimose-areolate, limited by blackening hypothallus. Apothecia to 1.0 mm. *B. disciformis* v. *polyspora*

3. Hymenium not inspersed. Thallus greenish, grayish brown or brownish, or lacking, *Amandinea polyspora* (Willey in Tuck.) E. Lay & P. May

4. Thallus with yellow soredia. Unknown pigment (major); secalonic acid A and unknown eumittrin derivatives (both minor). On bark or wood. Florida. *B. wheeleri* R. C. Harris

4. Thallus not sorediate. 5

5. Spore wall strongly reticulate-ridged, Spores 14-20 x 8-11 μ m. On bark, Florida. *Amandinea leucomela* (Imsh.) P. May & Sheard

5. Spore wall smooth or almost. 6

6. Spore wall unevenly thickened. 7

6. Spore wall evenly thickened. 8

7. Hymenium inspersed with numerous oil drops. Spore wall thickened just below apex; thallus K+ sordid yellow. *Hafellia* (including *H. bahiana* var. *bahiana*. Note: *H. dissa*, an Australian species, is not correctly reported from N. America)

7. Hymenium without oil drops, or rarely with some oil in upper part. Spore wall thickened only at septum, On bark or wood, Florida to South Carolina. *B. imshaugiana* R. C. Harris

8. Spores averaging 16 μ m or more long and 5 μ m or more wide. 9

8. Spores averaging mostly 15(-17) μ m or less long and mostly 5 μ m or less wide. KEY IV-A

9. Apothecial disk yellow-green pruinose; thallus yellowish (xanthonic); ascospores 19-28 x 8-10 μ m. Florida. *B. melanochlora* (Krempelh.) Müll. Arg.

9. Apothecial disk epruinose. 10

10. Thallus K+ red (crystals), P+ pale yellow, containing norstictic acid.
..... 11
10. Thallus K+ yellow or sordid, without norstictic acid. 12
11. Hymenium without oil drops; Exciple pale, except at margin; internal stipe reddish brown. Hypothecium yellow-brown to brown. Apothecia to 0.8-1.5 mm, K-. Norstictic acid (major), atranorin, dissectic acid, stictic acid, and unknown pigments (all minor). Eastern (Florida to Louisiana in the south, Indiana to New York in the north). B. curtisii (Tuck.) Imsh. in Brodo
11. Hymenium with numerous oil droplets throughout. Exciple and internal stipe dark brown. Hypothecium brown-black. Apothecia to 0.8 mm, On bark or wood. Southeastern. B. curatellae Malme
12. Hymenium inspersed with oil drops. 13
12. Hymenium not inspersed.
13. Spores (16-)18-26(-30) x 6-11 um. Hymenium less than 100 um tall. On bark and wood, widely distributed. B. disciformis
13. Spores often over 26 um long and 11 um wide. Hymenium 100 um or more tall.
..... 14
14. On smooth conifer bark. Thallus C-. B. arnoldii
14. On wood (usually on moss). Thallus C+ yellow. (B. insignis)
13. Thallus scant, becoming granular, on an obscure white hypothallus; apothecia hemispherical, On bark. Northeastern (S to N. Carolina, W to Minnesota), and California. B. dialyta
13. Thallus areolate, white; apothecia plane to convex. 14
14. Spores (14-)17-22(-24) x (6-)7-9(-10) um. Hymenium 60-70(-90) um, not inspersed. 6-*O*-methyldarthonin (major), atranorin, methyl β -orsellinate, 5-hydroxy- β -orsellinic acid (all minor) [this report of the chemistry, by Kalb & Elix, is under B. zahlbruckneri, supposedly a synonym unless something's changed since Esslinger & Egan 1995]. B. erubescens
14. Spores 25-32 x 9-14 um. Hymenium 100-120 um. On wood and over mosses. Thallus K+ yellow. (B. insignis)

**IV-A. On bark or wood;
Spores 1-septate, averaging mostly
15(-17) um or less long and mostly 5 um or less wide.**

1. Spores averaging more than 5 um in width. 2

1. Spores averaging 5 um or less in width. Thallus , K+ sordid yellow, P-.
Eastern. 6

2. Thallus K-, P+ orange-red (fumarprotocetraric acid). Ascospores 13.5-16.5 x 6.5-7.5 um. Thiophanic acid (major); 3-Q-methylthiophanic acid, arthothelin, eumitrin F, myeloconone A2, and fumarprotocetraric acid (all minor). Florida. B. rubifaciens R. C. Harris

2. Thallus (or exciple and internal stipe) K+ yellow or red, P+ yellow or orange (norstictic acid or baeomycesic acid), K+ yellow, P- (atranorin) or K-, P- (no substances). 3

3. Disc of apothecia (orange-)red-pruinose when young. Thallus scant, greenish-glaucous, minutely granulate, granules scattered or crowded, on a white hypothallus. Apothecia 0.3-0.7(-0.8) mm, immersed to adnate; disk flat to convex, becoming strongly convex; margin prominent, black, thin, finally disappearing. Hypothecium brown. Hymenium not interspersed. Spores ellipsoid, 10-14 x 5-6 um. Barbatic acid (major), obtusatic acid (minor). On bark, Vermont, Massachusetts, Virginia. B. elizae

3. Discs black (epruinose) when young. Hymenium without oil. 4

4. Thallus of large, rounded, tumid warts (not verruculose), becoming subsquamulose, brown-gray to ashy gray, thick, On old wood and rocks. New England to Illinois, Ohio, and Minnesota; Washington and California. B. turgescens

4. Thallus scant to continuous, becoming areolate (areoles flat) and verruculose or granular, whitish, grayish, greenish or brownish, or lacking. 5

5. Exciple pale, except at margin (uniformly brown to dark brown according to Awasthi); stipe present. Thallus \pm granular, thin or thick, becoming subverruculose, whitish, brownish gray or gray, Thallus (exciple and internal stipe according to Awasthi) K+ yellow or red (atranorin, + or - norstictic acid). Apothecia to 1 mm, black, the margin persistent. Usually on bark. Eastern and Northwest (Washington to Alaska). B. stillingiana
Steiner

5. Exciple brown to black; no stipe. Thallus scant to continuous, becoming areolate (areoles flat) and verruculose, greenish or brownish, or lacking, P-, K+ yellowish or K- (no substances). Apothecia to 0.5 mm, the margin disappearing; Widely distributed, temperate to arctic. Amandinea punctata (Hoffm.) Coppins & Scheidegger

6. Thallus containing bright pink or red pigment. 7

6. Thallus not pigmented. 8

7. Thallus thick, bullate, shiny, P-, UV+ yellow/orange; pigment red (chem.: xanthones and chiodectonic acid); spores 8.5-12 x 4-5.5 um, On bark. Florida. B. coccinea (Fée)

Aptroot

7. Thallus thin, weakly areolate, P+ yellow, UV+ white; pigment pink (chem.: baeomycesic and squamatic acids according to ?; barbatic (major), lichexanthone and obtusatic (minor) according to Kalb & Elix 1998); spores 9-13 x 4-5.5 um. On bark, Florida to Texas. B. caloosensis Tuck.

8. Exciple pale, except at the margin. 9

8. Exciple brown throughout. 10

9. Hymenium not inspersed. Thallus of small granules. Exciple with a strongly differentiated hyaline layer. On bark, Southeastern. B. amphidexia Imsh. ex R. C. Harris

9. Hymenium densely inspersed. Thallus of \pm dispersed, minute, flat, oblong areoles, Exciple dark brown outside, at most paler brown within. On bark, Southeastern. B. rappii Imsh. ex R. C. Harris

10. Spores 6-10(-12) x 2-4(-4.5) um, Thallus immersed or scant, thin, continuous to slightly cracked or wrinkled, sometimes becoming granular, pale or smoky grey, effuse; On acidic bark or wood (especially conifers and oaks).

Northeastern. B. schaereri

10. Spores mostly 4 um or more wide. Thallus mostly better developed.

Southeastern. 11

11. Thallus P+ yellow, UV+ white, On bark, Southeastern. (see B. caloosensis)

11. Thallus P-, UV+ yellow/orange or UV-. 12

12. Thallus UV+ (lichexanthone and barbatic acid; obtusatic acid); disk not pruinose. Spores 10-12.5 x 4-5.5 um. Florida. B. catasema (Tuck.) Tuck.

12. Thallus UV-, KC+ orange (xanthones); disk white pruinose. Spores 12-15 x 4.5-6 um. Thiophanic acid (major), arthothelin and 3-O-methylthiophanic acid (minor).

Florida. B. pachnidisca R. C. Harris

ADDITIONAL SPECIES (not in keys):

Ascospore lumina elongated, constricted in the middle, bowling pin- or dumbbell-shaped; ascospores 17-20 x 7.5-9 μm . Apothecia sessile, without thalline margin. Thallus usually somewhat areolate, often poorly developed, not shiny, lacking granules, gray or brownish. Conidia filiform. Florida. B. placodiomorpha Vainio

Thallus verrucose, light yellowish brown, the verrucae scattered, swollen-convex, gomphate or umbilicate, deeply cracked, otherwise smooth and subnitid, to 2 mm diam.; hypothallus lacking. Cortex 100-150 μm thick, dense, prosenchymatous, the hyphae thick, P+ yellow, K+ yellow, KC+ yellow, C-; medulla white, K-, C-, P-, I-. Apothecia sessile on the verrucae, widely attached, black, at first plane but soon convex, excluding the margin. Hymenium 70-80 μm high, not interspersed; paraphyses septate, branched above, fusco-capitate. Exciple and hypothecium dark brown. Hypothecium not stipitate. Spores 8, thin-walled, 1-septate, 12-14 x 6-8 μm . Dimroth's negative (no xantheses). On basalt. Guadalupe Island, Baja California. (B. panniformis W. Weber)

Parasitic on other lichens
(Many other lichen parasites are Buellia-like)

1. Parasite on thallus of Physconia. Thallus developed within medulla of host, with an independent cortex and its own photobiont cells. Hymenium 55-77 μm ; Spores (14.5-)16-21(-23) x 6.5-8.5 μm , 1- to 3-septate, finely warted. B. pulverulenta

1. Parasite on thallus of Dimelaena oreina. Thallus areolate, grayish brown; hymenium 90 μm , spores 12-16 x 6.5-7.5 μm ; ornamentation microrugulate. hymenium without oil droplets; epihymenium brown; hypothecium dark brown; spores Buellia-type, medulla I-; Apothecia lecideine, 0.2-0.7 mm diam., sessile with constricted base; disc convex. Exciple dispersa-type; No substances. Saskatchewan. B. imshaugii Hafellner

ADD:

B. adjuncta Th. Fr.

Descriptions of Species

The reports of the chemistry below need to be checked against what's in the keys, where I have inserted information from Kalb & Elix (1998) that is not given below or even contradicts it.

B. adjuncta

B. aethalea

Spores (10-)13-15(-18) x (6-)8-10.5 μ m. Apothecia persistently immersed. Thallus ash-gray or brownish, areolate or rimose-areolate, often exceeding 1 cm diam.; medulla amyloid or not. Spores broadly oblong, slightly constricted at the septum, Buellia-type, ornamentation microgulate. Hypothecium hyaline to brown-black. Apothecia remaining immersed, cryptolecanorine or zeorine, 0.2-0.5 mm diam., innate, often immarginate; exciple aethalea-type; hymenium not inspersed, 60-90 μ m; epihymenium brown to green; hypothecium hyaline to dark brown. Pycnospores 5-5.5 μ m long. Norstictic and connorstictic acids; rarely with stictic acid agg. On horizontal to vertical siliceous rocks, coast to alpine. Tennessee. This species was considered doubtful for North America by Imshaug.

B. alboatra (Hoffm.) Th. Fr. (syn. B. microbola, Diplotomma alboatrum, D. ambiguum, D. epipolium, D. nivalis; D. chlorophaea)

Thallus very variable [due to amount of calcium oxalate on the cortex and structure of host lichen thalli], usually thin, but sometimes rather thick (0.1-1.5) mm, often wide-spreading, white or pale to dark gray or ochraceous, smooth or rimose-cracked, warty, or granular, sometimes subsquamulose, \pm determinate; dark prothallus rarely present.

Apothecia abundant, rounded, 0.3-0.5(-1)(rarely -1.5) mm diam.; immersed then \pm sessile, disc black or dark brown, at first flat, pruinose, later \pm convex and not pruinose; spurious thalline exciple or veil usually present when young, or thalline granules present on the excipular rim, margin white, sometimes \pm crenulate; true exciple inconspicuous, < 50 μ m thick, hyphae of type 1, variably developed, sometimes totally absent (in saxicolous specimens with immersed apothecia), but excipular hyphae usually present; often with calcium oxalate crystals; epithecium brown; hymenium (45-?)60-75(-100) μ m, colorless, not inspersed; hypothecium dark brown to brownish black, < 190 μ m; asci (36-)55-63(-70) x (10.5-?)15-17(-25?) μ m; spores (11-?) (13-)14.7-17.4(-20)(-30?) x (5.5-?)(6.6-)7.5-9.1(-10)(-17?) μ m, at first (1-)3-septate, mostly submuriform at maturity, with obtuse ends; ornamentation weakly microrugulate

Pycnidia scattered, rare. Conidia 6-10 x < 1 μ m.

Thallus K-, KC-, C-, P-, without substances, or K+ yellow then red, P+ yellow-orange (norstictic acid in medulla).

On nutrient-rich bark, calcareous rocks, walls, and mortar, on seashore siliceous rocks, or rarely on wood. Arctic-boreal to temperate.

Apothecia 0.15-0.4 mm diam. California. Thallus thin, (coarsely-) areolate, scattered or continuous. Disk plane to convex. Exciple thin, concolorous with thallus. Spores ovoid-ellipsoid, 13-22 x 7-11 μ m, 3-septate transversly and becoming 1-septate longitudinally. Hymenium not inspersed. Epihymenium pale to brownish.B. microbola

B. amphidexia Imsh. ex R. C. Harris

Thallus of small (0.5-0.11 mm) grayish granules on a scant white hypothallus, the granules attached by broad base and becoming confluent.

Apothecia round, 0.3-0.5 mm diam., adnate; disc black, plane; margin concolorous, not raised, persistent. Hypothecium brown, not extending as a tail into thallus. Exciple distinct from hypothecium, brown-black at margin, with a strongly differentiated internal hyaline layer. Hymenium not inspersed, 45-60 μ m; [ar]ajuses \pm agglutinate, simple, fusco-capitate, scarcely enlarged at apices; asci narrowly clavate, 8-spored. Spores brown, ellipsoid, not constricted, 9-12(-14) x (3-)4-5 μ m, wall thin and uniform.

Thallus P-, K+ sordid yellow. On bark, Southeastern (Florida and Alabama).

B. arnoldii

On smooth conifer bark. Thallus C-. Hymenium inspersed, 100-130 μ m. Thallus thin to moderately thick, smooth, wrinkled, or rimose; medulla I-. Apothecia 0.4-1 mm diam.; disc flat; true exciple persistent, shiny. Paraphyses 1.5-2 μ m; tips 4-4.5 μ m. Excipulum ca. 60 μ m thick. Spores 8/ascus, 1-septate, 25-32 x (9-)12-15 μ m, often strongly curved, apices pointed, thin-walled and pale; wall internally thickened at the septum. Pycnosporos 3-3.5 x 1-1.5 μ m, narrowly ellipsoid to oblong. Thallus P \pm yellowish, K+ yellow, C- (atranorin).

B. badia

Thallus areolate to squamulose to subfoliose, of contiguous, poorly delimited, \pm deeply lobulate, frequently imbricate scales, little adherent to substrate, chestnut brown. Medulla not amyloid.

Apothecia rare, 0.3-0.6(-0.8) mm, adnate or sessile with constricted base; disc black, epruinose, plane to somewhat convex (soon convex according to ?); margin concolorous with disk, raised, persistent (according to Imshaug) or soon disappearing (according to ?). Hypothecium brown, not extending as a tail into thallus; exciple continuous with hypothecium, concolorous; hymenium not inspersed, 45-60 μ m; epihymenium brown; paraphyses \pm distinct, branched, septate, strongly brown-capitate, apical cell swollen and globular. Asci clavate, 8-spored. Spores 1-septate, brown, ovoid-ellipsoid (broadly oblong according to ?), not or slightly constricted at septum, Buellia-type, (11-)13-16(-21) x (6-)7-8(-9) μ m, ornamentation psilate.

Pycnosporos unknown. Thallus P-, K+ sordid yellow; hymenium I+ deep blue. No substances. Often parasitic. Montane/subalpine. California; Washington. Resembles Melanelia spp. and also Lecidea lurida

B. bolacina

Thallus greenish glaucescent to white, composed of scattered, turgid, wavy and plicate squamules, K+ sordid yellow, P+ yellow; squamules 1-2 mm across, constricted at the base.

Apothecia 0.4-1 mm diam., round, at first immersed, soon superficial and adnate; discs black, plane to convex; margin concolorous, at length excluded. Hypothecium brown-black, not extended as a tail into thallus; exciple continuous with hypothecium, concolorous. Hymenium not inspersed, 75-95 μ m. Epihymenium brown. Paraphyses distinct, free, branched, septate, fusco-capitate, enlarged at apex; asci clavate, 8-spored. Spores brown, 1-septate, ellipsoid, occasionally somewhat constricted, 12-20 x 6-10 μ m, walls thin and uniform, surface reticulate-ridged. On soil, S. California and Baja California.

B. caloosensis Tuck.

Thallus thin, weakly areolate, granulose, greenish straw-colored, the granules 0.05-0.7 mm diam., globular, \pm heaped, finally subconfluent on a whitish hypothallus which blackens at the junction of two thalli.

Apothecia 0.25-0.04(-0.55) mm across, adnate, thin; disk flat to finally convex, becoming black; margin concolorous, at first prominent, then thin and finally disappearing; hypothecium brown to blackish, not extending as a tail into thallus; exciple continuous with the hypothecium, concolorous; hymenium not inspersed, 40-50 μ m; paraphyses agglutinate, branched, septate, fusco-capitate, apical cell swollen, globular; asci narrowly clavate, 8-spored; spores light brown, 1-septate, ellipsoid, not constricted, 9-13 x 4-5.5 μ m, walls thin and uniform.

Thallus P+ yellow (P- according to Imshaug), K+ sordid yellow, UV+ white; pigment pink (chem.: baecomycesic and squamatic acids). On bark, Florida to Texas.

B. (Diplotomma?) capitis-regnum W. Weber

Medulla yellow, K+ red (without crystals), C+ red, P-. Thallus "isabella color" (light yellowish brown) in type collection from Pt. Reyes, or (material I've collected from the Channel Islands) whitish-grayish, verrucose-areolate, shiny, the areoles crowded, convex, irregular, widely attached or constricted to stipitate, 0.5-2.0 mm diam.; under surface black; hypothallus inconspicuous, not radiating over the substrate; cortex 20 μ m thick, opaque, prosenchymatous, \pm amorphous, brownish, K+ clearing, C-, P-.

Apothecia 0.5-1.5(-2.0) mm, sessile, black, at first plane, soon convex, the margin thick then excluded. Excipulum and hypothecium brown-black; hypothecium stipitate, contiguous with the hypothallus; hymenium 100-220 μ m, densely inspersed; paraphyses 1 μ m thick, branched above, the apices somewhat swollen, 2-3 μ m thick, brown. Spores 8, subglobose to short-ellipsoid, brown, submuriform, the locules (5-15 visible) rounded or angular, the walls very thick. 18-25 x 11-14 μ m.

On siliceous rocks, away from the spray zone, coastal California.

B. catasema (Tuck.) Tuck.

Thallus P-, UV+ yellow/orange (lichexanthone and barbatic acid); disk not pruinose. Spores 8/ascus, 1-septate, 10-12.5 x 4-5.5 μ m. On bark, Florida.

B. cedricola Werner

Thallus pale yellowish to grayish, continuous to rimose-areolate, rarely slightly verrucose. Prothallus sometimes present, black. Cortex with a rather thick (12-30 μ m) epinecral layer, not staining in LB, adjacent to the short-celled, thin-walled hyphae surrounding the algae of the algal layer (c. 50 μ m); medulla poorly developed.

Apothecia breaking through the thallus surface, remaining level with the surface or becoming sessile, 0.2-1.2 mm wide, often crowded and coalescing; disc black, flat to convex, epruinose; margin distinct, often with thalline residues at early stages, excluded on strongly convex apothecia. Proper exciple 55-75 μ m thick, inner part with slightly pigmented hyphae with narrow lumina, outer part with thickened, distinctly pigmented cells with rounded to elongated lumina staining in LB; hypothecium hyaline, without oil droplets, 75-100 μ m thick; epithecium brown; subhymenial layers brown, up to 120 μ m thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigmented caps; asci clavate, 60-72 x 20-32 μ m. Ascospores brown, ellipsoid, submuriform to muriform, often curved, mature spores with up to

10 cells, no conspicuous unequal thickenings present, perispore lacking a persistent part, (17.0-)18.3-21.7(-24.9) x (7.9-)8.7-10.2(11.3) μ m.

Pycnidia rare in American material, more common in European and African material, immersed or upper part slightly protruding, rounded to slightly elongate, c. 0.14 x 0.11 mm; wall dark brown in upper part, pale in lower part. Conidia bacilliform, c. 4-5 x 1 μ m.

Chemistry: Thallus K+ yellow turning red, C-, P+ yellow-orange. Norstiictic acid and usnic acid (trace) present.

Ecology: On conifer wood.

Distribution: eastern AZ; Big Bend National Park, TX.

B. cerussata Llim. ex Werner

Thallus C+ or KC+ pink or red. Thallus white, turning yellowish in herbarium, K- or K+ yellow, areolate, surrounded by a very distinct black hypothalline line. Apothecia 0.2-0.5 mm diam., disk \pm pruinose or not, even or convex; margin thin. Hypothecium brown. Spores 7-11 x 5-8 μ m. Thallus I-. On non- or weakly-calcareous rocks. Santa Barbara Island, California (reported by Bratt, 1993). [See Scheidegger's European treatment for more info.]

B. cinereoglauca

Thallus areolate, ashy-glaucous, subnitid, smooth, the areoles contiguous, convex to subplane, 0.5 mm. Apothecia black, naked, to 0.6 mm, plane to subconvex, the margin thin, black. Epihymenium and hypothecium brown. Spores 12-15 x 4-8(-9) μ m. On siliceous rock, New Mexico.

B. coccinea (Fée) Aptroot

Thallus thick, bullate, shiny, P-, UV+ yellow/orange; pigment red (chem.: xanthonenes and chiodectonic acid); spores 8.5-12 x 4-5.5 μ m, 8/ascus, 1-septate. On bark. Florida.

B. curatellae Malme

Thallus composed of small, crowded granules 0.07-0.15 mm diam., cream-colored or gray, K+ red, P+ red (norstiictic); hypothallus scant, white, blackening at junction of two thalli.

Apothecia round, adnate, 0.2-0.8 mm diam.; disc black, plane to convex, epruinose; margin concolorous, thin, at length excluded. Hypothecium brown-black, not extending as a tail into thallus (according to Imshaug); exciple continuous with hypothecium, concolorous. Exciple and internal stipe dark brown, K-. Hymenium 50-75 μ m, with numerous oil droplets throughout. Epithecium olive brown. Paraphyses agglutinate, branched, septate, somewhat enlarged at apices, fusco-capitate. Spores brown, 1-septate, ellipsoid to fusiform-ellipsoid, not constricted, (12-)13-19(-24) x (4-)6-8(-10) μ m, ornamented on surface; wall evenly thin. On bark or wood. Southeastern (Alabama, Florida, Louisiana).

B. curtisii (Tuck.) Imsh. in Brodo

Thallus gray, very variable, from a thin, smoothish, continuous crust to somewhat granulose or warty or occasionally conspicuously granulose; lignicolous forms frequently well developed with large warts (to 0.3 mm across); prothallus visible only as a black line at junction of thalli.

Apothecia round, to 0.8-1.5 mm diam. (occasionally smaller), adnate to sessile; disk black, epruinose, plane to convex; margin concolorous, frequently thick, raised and persistent.

Hypothecium yellow-brown to brown, extending as a tail into thallus. Exciple distinct from hypothecium, brown at margin, pallid inwards, K-; internal stipe reddish brown, K-. Hymenium without oil drops, 70-100 µm; paraphyses \pm agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci narrowly clavate, (4-)8(-12)-spored. Spores brown, 1-septate, fusiform-ellipsoid, not constricted, (12-)16-23(-29) x 6-12 µm, ornamented on surface, walls thin but frequently, especially when immature, thickened at septum, forming an isthmus.

Thallus P+ light yellow, K+ intense red (crystals). On bark and wood. Eastern (Florida to Louisiana in the south, Indiana to New York in the north).

B. dialyta

Thallus often scant, but occasionally running together, becoming granular, whitish to ashy, often compacted into a scurfy, widespread crust; granules 0.07-0.18 mm across), on a very thin, effuse white hypothallus.

Apothecia 0.2-0.4(-0.6) mm diam., adnate to sessile; disk hemispherical, scabrid, black; margin thin, soon disappearing; hypothecium dark red-brown, not extending as a tail into thallus; exciple not well developed, apparently continuous with hypothecium, concolorous. Hymenium not inspersed, 50-65 µm; epihymenium brown; paraphyses agglutinate, branched, fusco-capitate, apical cell globular; asci clavate, 8-spored. Spores brown, 1-septate, 18-26(-30) x (7-)8-12 µm, fusiform-ellipsoid, often curved, not constricted, walls thin and uniform.

Thallus K+ sordid yellow, P+ red. On bark. Northeastern (S to N. Carolina, W to Minnesota), and California (possibly based on a mislabelled specimen).

B. disciformis

Thallus immersed or sometimes somewhat superficial, white to somewhat ochraceous, K+ sordid yellow (atranorin, traces of several unknowns), P-, rimose-areolate or somewhat warted, non-granulose, often limited by blackening hypothallus.

Apothecia round, adnate or sessile, to 1.0 mm diam. (occasionally minute, almost punctiform); disk black, plane to convex; margin concolorous, thin, persistent or often excluded. Hypothecium brown-black, extending as a tail into thallus; exciple continuous with hypothecium, concolorous. Hymenium 70-100 µm tall, inspersed; epihymenium brown, N-. Paraphyses \pm distinct, branched, septate, fusco-capitate, 1.4-2.0 µm thick, enlarged at apices. Asci narrowly clavate, 8-spored (rarely 16-spored--v. polyspora, known from New York). Spores brown, (16-)18-26(-30) x 6-11 µm, fusiform-ellipsoid, often curved, sometimes slightly curved; wall thinner and paler at the pointed apices.

Pycnospores 5.5-8.5 x 0.7-1 µm, straight. Medulla I-. On bark and wood, widely distributed, Alaska to Newfoundland, S in the east to Maryland, Pennsylvania, and the Great Lakes area, S in the west to southern CA, AZ

B. elegans/B. epigaea

Thallus white, determinate, composed of scattered lobules or forming a rosette of much divided lobes. Hypothallus none. Apothecia round, at first immersed but soon superficial and adnate, 0.4-1.0 mm diam.; disc black, plane to somewhat convex; margin concolorous, at first with a superficial thalloid coating, thin, \pm persistent. Hypothecium brown, not extending as a tail into thallus; exciple continuous with hypothecium, concolorous. Hymenium not inspersed, 70-85 µm; epihymenium brown; paraphyses agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci clavate, 8-spored; spores brown, 1-septate, oblong-ellipsoid, occasionally

constricted, 13-18 x 6-9 μ m; wall thin and uniform.

Thallus P-, K+ sordid yellow. On soil. Montana, Wyoming, and Nebraska.

[Note: this description is based on Imshaug, who called it B. epigaea; his description seems to \pm fit B. elegans as delimited by Clauzade & Roux, except that he says the thallus is P- (I don't know what the P reaction of B. epigaea is supposed to be, but B. elegans is supposed to be P+ orange); possibly this is "B. epigaea v. effigurata as delimited by Poelt, 1969); need to see what Weber, 1990 says about this]

B. elegans (Description after Thomson 1997)

Thallus of white lobules or radiate lobes, 1-2 cm long, 0.3-1 cm broad; hypothallus lacking; cortex above 20 μ m thick, interspersed with crystalline granules; underside pale, attached with fine hyphae.

Apothecia at first immersed, soon becoming adnate; the broken-through thallus persisting around the margin; margin thin, black, persistent; exciple dark red-brown; disk black, flat to slightly convex, dull, soon epruinose; hypothecium black-brown to black-gray; hymenium 70-85 μ m, hyaline, I+ blue; paraphyses 1-1.5 μ m, tips 4-5 μ m and brown; spores brown, 1-septate, slightly constricted, warty when ripe, wall thin, oblong-ellipsoid, 13-22 x 6-10 μ m. Cortex K+ yellow, C-, P-, UV+ orange; medulla K-, P- or K+ red, P+ orange-red in spots. Atranorin in cortex; medulla sometimes with norstictic acid; possibly xanthonones in cortex. On soil in dry open areas, usually calcareous. Great Plains; Arctic.

B. elizae

Thallus scant, greenish-glaucous, minutely granulate, granules scattered or crowded, on a white hypothallus.

Apothecia 0.3-0.7(-0.8) mm, (immersed to?) adnate, occasionally conglomerate; disk flat to convex, becoming strongly convex, (orange-)red-pruinose when young; margin prominent, black, thin, soon disappearing. Hypothecium brown, not extending as a tail into thallus; exciple continuous with hypothecium, concolorous. Hymenium 40-55 μ m, not interspersed; epihymenium orange-red to red-brown and granulate (colorless in K); paraphyses agglutinate, scarcely enlarged at apices, branched, fusco-capitate; asci narrowly clavate, 8-spored. Spores light brown, 1-septate, ellipsoid to slightly curved, rounded at the ends, occasionally constricted, 10-14 x 5-6 μ m, walls thin and uniform.

Thallus P-, K+ sordid yellow. On bark, Vermont, Massachusetts, Virginia.

B. erubescens

Thallus white to gray-white or somewhat ochraceous, thin to thick, continuous, becoming rimose-areolate, smooth or verruculose-areolate, occasionally (lignicolous) reduced to scattered lumps, rarely limited by a black hypothallus.

Apothecia round, adnate, 0.3-0.8 mm diam.; disc black, plane, becoming strongly convex; margin concolorous, thin (thick according to ?), occasionally excluded. Hypothecium red-brown, extending as a tail into thallus. Excipulum continuous with hypothecium, concolorous, K+ yellow. Hymenium (60-)70-85(-100) μ m, not interspersed. Paraphyses \pm distinct, branched, septate, 1.3-1.5(-2) μ m thick, fusco-capitate, apical cells swollen and globular; asci broadly clavate, commonly 8-spored (occasionally 4- or 6-spored). Spores brown, 1-septate, ovate-oblong, occasionally somewhat constricted, (14-)17-22(-25) x (6-)7-9(-11) μ m, walls thin and uniform.

Thallus K+ sordid or bright yellow, P-, or K+ red (and then also P+ orange?). [Note; the K+ yellow strain (syn. *B. zahlbruckneri*) differs somewhat in morphology and habitat from the typical K+ red strain]. On bark or decaying wood, California to Yukon, E to Colorado, Illinois and Iowa.

B. fimbriata (Tuck.) Sheard

Thallus whitish to bluish, K+ sordid yellow, P-, I-, areolate to rimose-areolate, with fimbriate black prothallus margin covered by large white globules along thin white radiating strands, towards center the globules soon merge into a thick, rimose-areolate crust; hypothallus visible only at margin.

Apothecia round, often slightly white pruinose, immersed (cryptolecanorine), soon sessile, adnate, 0.2-0.6 mm diam.; disc plane, then soon convex or hemispherical, becoming immarginate. Margin concolorous, thin, at first surrounded by a superficial thalloid covering. Hypothecium dark brown, extending through thallus to hypothallus; exciple *aethalea*-type, distinct from hypothecium, brown at margin, pale inside; Hymenium not interspersed, 50-65 μ m; epihymenium brown, granular. Paraphyses \pm discrete, branched, septate, fusco-capitate, apical cell swollen, globular; asci clavate, 8-spored. Spores brown, 1-septate, ellipsoid or broadly oblong, not constricted, *Buellia*-type, 9-15 x (4-)5.5-7 μ m; walls thin and uniform, ornamentation rugulate. Pycnospores bacilliform, 6.5-11 μ m long. Containing 3-chlorodivaricatic acid. California, possibly also Washington.

B. geophila (Floerke ex Sommerf.) Lyngb (sensu Nordin and most other authors, not Sheard's British treatment)

Thallus usually in small patches, thin to rather thick, irregularly warted, sometimes almost granular, white to grayish white; prothallus absent.

Apothecia abundant, sessile, 0.2-1.2 mm diam., sometimes aggregated and confluent; disc black to dark brown, flat then \pm convex. seldom whitish pruinose, usually only on the margin; margin long persistent. True exciple < 70 μ m but usually < 50 μ m, excipular hyphae of type 1; often interspersed with irregularly formed clusters of calcium oxalate crystals; pigment D present. Hypothecium < 100 μ m, dark brown. Asci 60-85 x 15-31 μ m. Spores (23.8-)27.5-32.8(-38.0) x (6.6-)9.0-10.6(-13.3) μ m, thick-walled, dark green, mostly 4-6 per ascus, usually 3-septate when mature, with rather pointed ends; ornamentation weakly microorugulate.

Pycnidia rare. Conidia 4-6 x 1 μ m.

Thallus K- or indistinctly yellow, C-, KC+ yellow to orange-yellow. O-methyltrichlornorlichexanthone present in the phenocortex

On moss, humus, or terricolous lichens, arctic-alpine.

B. griseovirens

Thallus epi- or endosubstratal, often in small patches between other species, thin to rather thick, smooth, wrinkled, rimose or areolate, white to pale gray or somewhat cream-colored, often with a greenish or brownish tinge; prothallus often present, brownish. Soralia usually numerous, \pm delimited, circular, < 0.4 mm across, plane or convex, sometimes confluent, often forming a mosaic to 2 mm diam., occasionally sparse or even absent; soredia farinose, less than 0.01 mm diam., grayish white to pale yellow, sometimes with a greenish or bluish tinge when fresh, pale yellowish gray on storage.

Apothecia rare, round, sessile, 0.3-1.5 mm across; disk black, epruinose, slightly concave

at first with thick, raised, prominent proper margin, sometimes becoming slightly convex and finally immarginate; margin not appearing thalloid when young; true exciple < 120 um, excipular hyphae of type 2; pigment D present; epithecium dark brown; hymenium hyaline, (70-)80-90(-120) um, not inspersed; hypothecium < 240 um, dark brown, extending as a tail into thallus; exciple continuous with hypothecium, concolorous. Paraphyses \pm agglutinate, branched, septate, fusco-capitate, apical cell somewhat enlarged; asci 65-72 x 19-22 um, clavate, 8-spored (occasionally 4- or 6-spored). Spores brown, submuriform, 3-5-septate transversely, 1-2-septate longitudinally, ellipsoid or ovoid-ellipsoid, with obtuse ends, (13-)18.3-222.7(-28) x (6-)8.9-11.5(-13.3) um; ornament minutely and weakly microrugulate.

Soredia K+ sordid yellow or yellowish red (crystals--check in squash preparations), P+ yellow or yellow-orange or cinnabar, C- or C+ yellow or orange. Medulla I-. Containing atranorin, norstictic acid, connorstictic acid, seldom with only one of the substances; sometimes also with "griseovirens unknowns".

On bark of deciduous trees, sometimes also on conifers, rarely on lignum, usually in rather shaded and humid situations. Southern California.

B. halonia

Thallus pale yellow or greenish yellow, K+ sordid yellow, P-, rimose-areolate, often extensive; areoles to over 1 mm across, to ca. 0.6 mm thick, becoming wavy or rugose; upper surface slightly shiny. Epinecral layer 10-20 um; phenocortex 18-22; algal layer ca. 90 um; medulla ca. 500 um, I-. Apothecia sessile with constricted base, (immersed, soon adnate according to ?), 0.8-1.2 mm, black, soon convex and tumid, often bluish pruinose, the margin at first prominent. Excipulum leptocline-type, lecideine, swollen, to 100 um wide, distinctly radially constructed, brown to olive-brown towards outside, orange-brown inside, K+ orange. Epihymenium ca. 10 um high, olive-green. Hymenium ca. 80 um, hyaline. Paraphyses in upper third richly branched, end cells distinctly thickened, to 4-4.5 um wide, with weak brown pigment caps and distinctly green pigment hood. Hypothecium dark brown-orange (red-brown to brown-black), ca. 140 um thick, often strongly also peglike elongated. Spores oblong, not constricted at septum, (10-)12-17(-19) x 6-10 um, in early stages with distinct, median thickening; torus diffuse; spore surface very weakly microrugulate. Pycnidia completely immersed, not chambered; conidia thin-walled, intercalary on bayonet-shaped fulcra, bacilliform, proximal part distinctly narrowed, 5 x 1 um. Atranorin; arthothelin and related substances. On non-calcareous rock. Coast of California.

B. immersa

Thallus K+ red, C-, minutely areolate, ashy white, smooth. Apothecia to 0.5 mm, immersed, black, flat or slightly concave, the margin thick, black. Epihymenium greenish brown; hypothecium and exciple brown. Spores ellipsoid, 13-17 x 8-10 um, the walls unevenly thickened. On rock. Arctic.

B. imshaugiana R. C. Harris

Hymenium without oil drops, or rarely with some oil in upper part. Spore wall thickened only at septum, to half the length of the lumen (not so much that the canal is very narrow and polarilocular in a strict sense); ascospores 8/ascus, 1-septate, 18-19.9-22 x 7-7.7-10 um, fusiform or slightly fabiform, wall smooth. Thallus white or pale gray, mostly epiphloedal, very variable (thin and more or less continuous on twigs in dry areas, to thick, rugose and more areolate on

Taxodium in humid areas), K+ yellow to red (atranorin and usually norstictic agg.). Apothecia 0.2-1.5 mm diam., plane to convex; margin thick, usually raised. Exciple dark outside, pale yellow within; hypothecium brown. On bark or wood, Florida to South Carolina.

B. imshaugii Hafellner

Parasite on thallus of Dimelaena oreina. Thallus areolate, grayish brown; hymenium 90 um, spores 12-16 x 6.5-7.5 um; ornamentation microrugulate. Hymenium without oil droplets; epihymenium brown; hypothecium dark brown; spores Buellia-type, medulla I-; Apothecia lecideine, 0.2-0.7 mm diam., sessile with constricted base; disc convex. Exciple dispersa-type; No substances. Saskatchewan.

B. insignis

Spores 25-32 x 9-13 um. Thallus verrucose-granular. On plant detritus and rotten wood as well as on mosses. Spores sometimes curved; wall paler and thinner at apices, smooth to finely warted.. Hymenium interspersed (according to Sheard, and Awasthi) or not (according to Schauer) (\pm interspersed according to Orange, et al.). Thallus thin to moderately thick and somewhat warted, whitish gray; prothallus indistinct; medulla I-. Apothecia 0.5-1 mm diam., sessile; disc flat then convex, \pm pruinose when young; hymenium ca. 100 um. Thallus P- or P+ yellowish, K+ yellow, C+ yellow (atranorin and unknown), KC-.

B. jugorum (Arnold) Arnold

Apothecia cryptolecanorine to lecideine, innate to broadly sessile with a black narrow margin (or immarginate from the start and often pseudolecanorine), Spores 11-15 x 6-8.5 um; ornamentation microrugulate. Thallus yellow (to yellowish-whitish), K-, I-, C+ orange, UV+ orange, areolate, slightly placodioid, the lobes to 1.8 mm long. Pycnospores bacilliform, 6-9 um long. Containing arthothelin. Alpine, Colorado.

B. lacteoides

Thallus areolate, white to gray, areolate; areoles flat, \pm thin, on a black hypothallus.

Apothecia at first immersed, at length immixt (free between the areoles), round or angular, 0.1-0.4 mm across; disk black, plane; margin concolorous, \pm persistent. Hypothecium hyaline to pale brown, extending through thallus to the hypothallus; exciple continuous with hypothecium, green at margin, colorless inside. Hymenium not interspersed, 60-85 um. Epihymenium green. Paraphyses \pm distinct, branched, septate, fusco-capitate, enlarged at apices; asci clavate, 8-spored. Spores brown, 1-septate, ovoid-ellipsoid, not constricted, (13-)15-16(-18) x 6-8(-9) um, walls thin and uniform.

Thallus P+ yellow, K+ sordid yellow. Medulla I+ blue. On rock, Arizona and New Mexico.

B. lakensis Egan ined.

Medulla I-, K-, C- or C+ rose. Thallus rimose-areolate, light brown, tan or buff, occasionally becoming medium brown in places. Apothecia to 0.8 mm, black, concave to slightly convex, often confluent, the margin black, thin, disappearing. Epihymenium brownish. Hypothecium hyaline to pale brownish. Spores \pm constricted, 13-16 x 6-8 um. Alpine, New Mexico.

B. lauricassiae

Thallus white to glaucescent, P+ orange, K+ red (norstictic acid), C-, composed of scattered granules at margin but towards center a \pm continuous, granular crust. Hypothallus white but at margin and junction of thalli appearing as a black line.

Apothecia round, adnate, occasionally regenerating and conglomerate, 0.3-0.7 mm diam.; disk black, epruinose, \pm plane; margin thick, raised, persistent, concolorous with disc. Hypothecium brown, thin, not extending as a tail into thallus. Exciple distinct from hypothecium, thick, pale but with a thin, brown-black margin. Hymenium not interspersed, 45-65 μ m; paraphyses \pm agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci narrowly clavate, 8-spored. Spores brown, 3-septate, 15-17(-21) x 6-8 μ m, ellipsoid to fusiform-ellipsoid, walls thin and uniform.

On bark. Subtropical (Florida).

B. (Diplotomma?) lecanoroides

Thallus thin, white to ochraceous, rimose, I-, K-, C-, P-. Apothecia sessile, the disc black, subplane, the margin white, thin, scarcely prominent. Spores 18-21 x 9-10 μ m. Hypothecium and exciple pale. On sandstone. Utah.

B. lepidastr

Thallus pale yellowish or buff, rimose-areolate, composed of scattered granules or minute areoles at margin, towards center the areoles larger and contiguous, forming a \pm rimulose crust; individual areoles becoming undulate or crenate, occasionally verrucose or rugose. Hypothallus scant or obsolete. Thallus K+ sordid yellow, P+ red; medulla I-.

Apothecia round, occasionally conglomerate, 0.4-1 mm diam.; discs black, epruinose, plane to slightly convex; margin concolorous, thick, \pm persistent. Hypothecium brown-black, extending to base of thallus. Excipulum continuous with hypothecium, green at margin, brown inside. Hymenium not interspersed, 80-100 μ m. Epihymenium brown. Paraphyses simple, straight, distinctly septate, apices slightly branched; fusco-capitate, enlarged at apices; asci clavate, 8-spored. Spores brown, 1-septate, ovoid-ellipsoid, not constricted, 10-16(-18) x 5-8 μ m, walls thin and uniform.

On rock, Eastern (New England to Alabama).

B. lepidastroidea Imsh. ined.

Thallus white, K+ yellow, P+ yellow, epruinose, areolate, the areoles very irregular in shape, often swollen and \pm furrowed, commonly sublobate. Hypothallus lacking.

Apothecia round, at first immersed but soon sessile and adnate, 0.3-0.8 mm across; disk black, plane to convex; margin concolorous, thin, at length excluded. Hypothecium brown-black, extending as a tail into thallus. Excipulum continuous with hypothecium, concolorous. Hymenium interspersed with oil drops, 60-80 μ m. Epihymenium brown. Paraphyses \pm distinct, branched, septate, fusco-capitate, enlarged at apices; asci clavate, 8-spored. Spores brown, 1-septate, oblong-ellipsoid, not constricted, 12-15 x 5-7 μ m, walls thin and uniform.

On rocks, California.

B. leptocline (Flotow) Körber

Medulla K \pm yellow, KC+ yellow or brownish, I+ strongly blue-violet. Thallus chasmolithic to continuous or rimose, white to ashy. Apothecia to 1.2(-1.5) mm, sessile with

constricted base, lecideine; disc black, naked, plane to convex; margin thick and prominent, \pm persistent. Hypothecium dark brown, epihymenium \pm red-brown. Hymenium without oil drops, ca. 75 μ m high. Spores oblong, not constricted, *Physconia*-type, 11-16(-18) x (6-)7.5-9 μ m; ornamentation rugulate, rarely psilate. Pycnospores bacilliform, 4-5 μ m long. Containing atranorin. On perpendicular to overhanging, rain-exposed parts of siliceous boulders in subalpine to alpine areas.

B. mamillana

Thallus pale yellow or pale creamy yellow, continuous, becoming irregularly rimose-areolate, rarely limited or intersected by a black hypothallus.

Apothecia round, to 0.6-0.7 mm, at first immersed but emergent, at length adnate and superficial; disc black, epruinose, plane; margin at first concolorous with thallus, soon blackening, moderately thick, raised, persistent. Hypothecium brown, not extending as a tail into thallus; exciple distinct from hypothecium, thick, brown at margin, pale inside. Hymenium not inspersed, 55-70 μ m. Epihymenium brown. Paraphyses \pm agglutinate, branched, septate, fusco-capitate, somewhat enlarged at the apices; asci clavate, 8-spored. Spores brown, 1-septate, ovoid-ellipsoid, occasionally bean-shaped, rarely \pm constricted, (10-)12-17 x (5-)6-8 μ m, walls thin and uniform.

Medulla K+ yellow, Pd+ red, C-, I+ blue (in spots). On rock. Widely distributed. Southern Appalachians.

B. maritima

Thallus chalky white, K+ bright yellow, C-, I-, continuous or very finely rimose. Epihymenium green, N+ purple. Apothecia plane, to 0.5 mm diam., \pm pruinose, the margin whitish, pruinose, persistent. Hypothecium red-brown. Spores 8-15 x 4-6 μ m. Maritime, on " \pm decalcified calcareous rocks or silicates contained in calcareous rocks.

B. melanochlora (Krempelh.) Müll. Arg.

Apothecial disk yellow-green pruinose; thallus yellowish (xanthones); ascospores 19-28 x 8-10 μ m. On bark or wood, Florida.

B. muriformis A. Nordin & Tonsberg

Thallus whitish gray, sometimes with a slightly yellowish, greenish or brownish tinge, thin (30-60 μ m), continuous to rimose-areolate or slightly verrucose. Prothallus blackish. Cortex with a thin (2-6 μ m) epinecral layer, not staining in LB, and an up to 25 μ m thick layer of thick-walled, anastomosing hyphae with lumina staining in LB, interspersed with small crystals soluble in K; medulla usually thin, often with similar crystals as in the cortex.

Apothecia sessile, 0.2-1.7 mm wide; disc black, first enclosed in excipular hyphae, when emerging first urceolate, then flat, and eventually convex, epruinose; margin distinct but excluded on strongly convex apothecia. Proper exciple 55-100 μ m thick, inner part with slightly pigmented thick-walled anastomosing hyphae with narrow lumina, outer part with thickened, distinctly pigmented cells with rounded to elongated lumina, staining in LB; hymenium hyaline, with numerous oil droplets, 100-120 μ m thick; epithecium brown; subhymenial layers brown, up to 220 μ m thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigment caps; asci clavate, 75-85 x 18-30 μ m. Ascospores long remaining unpigmented, eventually brown, ellipsoid, muriform, often slightly curved, mature spores with 16-32 cells in

optical section, no unequal thickenings present, perispore lacking a persistent part, (20.9-)25.5-31.5(-39.6) x (11.3-)12.9-16.0(-18.1) μ m.

Pycnidia immersed to slightly protruding, ellipsoid, c. 0.1 x 0.07 mm; wall brown. Conidiophores branched; conidiogenous cells asymmetrical with conidia formed on bayonet-like processes. Conidia bacilliform, c. 4-5 x 1 μ m.

Chemistry: Thallus K+ yellow, C-, P+ yellow. Atranorin and an unknown substance present (RF classes A 6; B 6, C 6).

Ecology: on bark or wood of conifers and deciduous trees, usually in conifer-dominated forests. Mainly in lowland areas close to the sea, but occasionally inland, and sometimes up to 1000 m.

Distribution: British Columbia to northern California.

B. nigra

Growing in the Midwest. Thallus K-, brown or dark gray, thin to moderately thick, minutely areolate, the areoles somewhat concave to flat, scattered or contiguous. Apothecia to 0.4 mm, partly immersed, 1-3 per areole, black, the margin moderately thick, concolorous with thallus. Hypothecium hyaline. Paraphyses tips large, capitate. Spores 9-15 x 5-8 μ m, sometimes slightly constricted.

B. nivalis (Bagl. & Car.) Hertel ex Hafellner

Thallus at first white, parasitic on Xanthoria and Caloplaca, later perhaps free (Buellia margaritacea?), first showing as a paling of the host, then becoming areolate-chinky or farinaceous..

Apothecia at first immersed in the host, becoming adnate, to 0.5 mm broad; disc black, flat then becoming convex and immarginate, epruinose or blue pruinose and rough, finally blackening; margin black and extending under the apothecium, thin, disappearing; exciple brown-black, \pm radiate; epithecium dark, brown; hypothecium dark brown to blackish brown; hymenium hyaline, 70-80 μ m, not interspersed; paraphyses 2 μ m, not branched or with some branching in upper part, tips clavate to capitate, brown, 4-7 μ m; spores olive-brown, becoming brown, 6-8 per ascus, elliptic or kidney-shaped, 3-septate to weakly muriform with 1 longitudinal wall, (13-)15-20(-26) x 6(-9)-12 μ m. Alaska.

B. notabilis

Hypothecium hyaline. Spores 14-18 x 7-8 μ m. Thallus verrucose-areolate with deep chinks, K-, P-, irregular, not well delimited, to 1 mm thick, white or ashy white; areolae to 1 mm broad, angular, bullate, with secondary chinks and then somewhat roughened; with narrow, black hypothallus.

Apothecia commonly contiguous and becoming angular, to 1 mm, deep in thallus but not aspicilioid, disc flat or depressed, black, scabrid, margin black, thin, becoming crenulate to disappearing; exciple exterior brownish to brownish violet, interior hyaline; epihymenium dark; hymenium 90 μ m, upper part dark, lower hyaline; asci clavate; paraphyses slightly thickened above to 3 μ m. Spores 8 per ascus, brown, 1-septate, center slightly constricted, walls thickened and the lumina subangular. Thallus K-, C-, P-, I-. On calcareous rock, Arctic.

B. novomexicana

Thallus K-, C-, tobacco brown to olive-brown, thin, areolate, smooth, nitid; areoles to 0.3

mm, plane, contiguous, angular, forming small patches among other lichens, not radiating at periphery.

Apothecia 1 per areole, immersed then adnate, 0.2 mm diam.; disk black, pruinose or not, plane, the margin thin, entire. Epihymenium brown. Paraphyses free, septate, fusco-capitate. Asci clavate, 45 µm long, 8-spored. Spores brown, rounded at the tips, 6-12 x 6-7(-8) µm, rather thick-walled, not constricted. Hypothecium hyaline or dark. On siliceous rocks. Southwestern.

B. ocellata (Flotow) Körber

Thallus ochre yellow or greenish straw yellow, C+ orange-red, K-, I-, thin, areolate (to rimose-areolate); marginal areoles elongated, several mm long. Apothecia to 0.6 mm, cryptolecanorine, appearing almost lecanorine; disc black, epruinose, ± plane. Exciple aethalea-type. Hymenium without oil drops, 60-95 µm, lower part with pigment A. Epihymenium brown; hypothecium dark brown. Spores Buellia-type, oblong, slightly constricted at septum, 13-16 x 6.5-9 µm; ornamentation microrugulate. Pycnosporos bacilliform, 4.5-5.5 µm long. Containing arthothelin, with stictic acid in a few populations. Closely related to B. jugorum. On siliceous rocks, sea level to subalpine.

B. oidalea

Thallus yellowish-glaucous or ochraceous, contiguous, from thin, cartilaginous and smoothish, soon rimulose, thickened and rugose-verrucose to pronouncedly warty, limited by a black hypothallus.

Apothecia round, adnate, 0.8-2.0 mm. diam.; disk black, plane, soon strongly convex or tumid; margin concolorous with disk, not appearing thalloid when young, thin, soon excluded. Hypothecium brown-black, not extending as a tail into thallus; exciple continuous with hypothecium, concolorous; hymenium inspersed, 140-230 µm; paraphyses semi-distinct, lax, branched, septate, fusco-capitate, apical cell enlarged; asci swollen clavate, 2-, 3-, or 8-spored. Spores oblong-ellipsoid, brown, muriform, 6-10-septate transversely, 2-5-septate longitudinally, (28-)30-55(-78) x (12-)16-21(-24) µm, walls thin and uniform.

Thallus P-, K+ sordid yellow. On bark and wood, coast of Baja California and California.

B. oidaliella A. Nordin

Thallus yellowish white to glaucous gray, thin and rimose-areolate to thick and rugose-verrucose or even subsquamulose. Prothallus often present, blackish. Cortex with a 2-10 µm thick epinecral layer, not staining in LB, and a 12-30 µm thick layer of thick-walled, anastomosing hyphae with ± vertically oriented tips, lumina staining in LB; medulla usually with calcium oxalate crystals and crystals soluble in K.

Apothecia sessile, 0.2-1.6 mm wide; disc black, first flat, soon convex, often with a whitish pruina of calcium oxalate; margin distinct on young apothecia, later exclude. Proper exciple 50-85 µm thick, inner part with slightly pigmented thick-walled anastomosing hyphae with narrow lumina, outer part with thickened, distinctly pigmented, rounded cells; hymenium hyaline, 95-120 µm thick, with numerous oil droplets; epithecium brown; subhymenial layers brown, 180-230 µm thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigmented caps; asci clavate, 6-90 x 17-29 µm. Ascospores brown, ellipsoid, submuriform, mature spores with 6-12 cells in optical section, septa distinctly thickened in young spores, apical thickenings usually absent, perispore with a smooth persistent sublayer

inside the gelatinous outer part, (17.1-)22.7-28.6(-35.1) x (9.5-)11.0-13.9(-16.1) μ m.

Pycnidia immersed, flask-shaped, c. 0.2 x 0.15 mm; wall pigmented in upper part, sometimes slightly folded. Conidiophores branched; conidiogenous cells asymmetrical with conidia formed on bayonet-like processes. Conidia bacilliform, c. 5-6 x 1 μ m.

Chemistry: Thallus K-, C+ orange (best seen under the microscope), P-. One or two unidentified xanthonenes present in the cortex above the algal layer (RF classes A 5,6; B 5,6; C 5,6).

Ecology: on bark or wood, mainly on desert shrubs and trees, often close to the sea in the coastal fog zone, but also further inland; usually at low elevations.

Distribution: Baja California.

B. pachnidisca R. C. Harris

Thallus UV-, KC+ orange (xanthonenes); disk white pruinose. Spores 8/ascus, 1-septate, 12-15 x 4.5-6 μ m. On bark, Florida.

B. papillata

Thallus white or somewhat sordid, forming a thin membranous crust, frequently becoming granulose or rugose-verrucose; hypothallus absent.

Apothecia round, 0.3-1.0 mm diam., adnate; disc plane to convex, black, epruinose; margin concolorous, thin, raised, \pm persistent; hypothecium brown-black, not extending as a tail into thallus (according to Imshaug; internal stipe dark brown, not much distinct from exciple, according to ?); exciple continuous with hypothecium, concolorous; hymenium not interspersed, 70-95 μ m; epihymenium brown; paraphyses \pm agglutinate, branched, septate, fusco-capitate, apical cell somewhat enlarged; asci clavate, 8-spored. Spores colorless or pale green at first, soon dark brown, 1-septate, fusiform-ellipsoid, frequently curved, not constricted, 18-24(-38 according to Imshaug) x 8-10(-15) μ m, smooth, walls thin and uniform.

Thallus C-, KC-, P-, K- or K+ yellowish. On soil, mosses and plant detritus, arctic-alpine. Colorado; Washington to Yukon.

B. penichra

Thallus P+ yellow. Apothecia not pruinose. Spores (17-)21-34(-41) x (10-)11-17(-21) μ m. Hymenium interspersed with oil drops. Thallus thin, smooth to rough, becoming minutely areolate, ashy to whitish, bordered and sometimes intersected by black hypothallus. Apothecia 0.35-1 mm diam., sessile; disk flat to slightly convex, dull black; exciple thick, black, somewhat raised, finally disappearing; hypothecium dark brown; paraphyses semi-distinct, appearing to be branched; asci clavate to inflated-clavate; spores 6-8, oblong to oblong-ellipsoid, 3-5-septate transversely and 1-2-septate longitudinally. On trees, Montana, Washington, California. A taxon of uncertain identity from Washington, with a P- thallus, may also key out here.

B. pulverulenta (Anzi) Jatta

Parasite on thallus of Physconia or Physcia spp. (sometimes causing \pm bleached areas), arctic-subalpine. Thallus developed within medulla of host, with an independent cortex 10-120 μ m tall and its own photobiont cells.

Apothecia 0.3-0.5(-0.7) diam., emerging from the thickened epinecral layer of host thallus, soon sessile; disc black, flat then \pm convex, sometimes whitish pruinose; margins distinct then somewhat depressed, often with residues from the epinecral layer of the host and calcium

oxalate crystals. True exciple 25-50 μ m, excipular hyphae of type 1; hymenium (55-)70-85 μ m, hyaline; hypothecium < 240 μ m; asci 60-84 x 15-31 μ m; paraphyses 1.6-2.3 μ m wide; tips to 5 μ m. Spores (14.5-)16.7-19.4(-23) x (5.7-)6.6-7.7(-8.5) μ m, usually 3-septate when mature, with rather pointed ends; ornamentation ruggedly microrugulate.

Pycnidia rarely found in the periphery of the "infected" parts; conidia 5-6 x 1 μ m
K-, C-, P-; no substances.

Alaska, Colorado, Wyoming, Northwest Territories

B. rappii Imsh. ex R. C. Harris

Thallus to 2 cm. diam. but often much smaller, pale gray to greenish glaucescent, of \pm dispersed, minute, flat, oblong areoles 0.06-0.15 mm diam. (appearing granular at times), P-, K+ yellowish (low amounts of atranorin and traces of unknowns); hypothallus scant, white, blackening at junction of two thalli.

Apothecia round, adnate, (0.1-)0.3-0.4(-0.5) mm diam.; disc black, plane to slightly convex; margin concolorous, thin but usually distinguishable and slightly raised, sometimes soon disappearing. Hypothecium brown or light brown, not extending as a tail into thallus. Exciple distinct from hypothecium, dark brown outside, at most paler brown within. Hymenium somewhat inspersed, 70-95 μ m; paraphyses \pm agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci narrowly clavate, 8-spored. Spores brown, 1-septate, fusiform-ellipsoid, not constricted, 9-13 x 4-5 μ m, walls thin and uniform.

On bark, Southeastern (Florida and Alabama).

B. retrovertens

Thallus whitish to grayish or occasionally ochraceous, K+ sordid yellow, P-, subnitidous, but often white pruinose, areolate; areoles scattered or contiguous, subplane to convex, often sublobate. Hypothallus lacking.

Apothecia at first immersed but soon superficial, adnate, round, 0.3-0.9 mm across; disk black, plane to convex; margin concolorous (occasionally pallid when young), thin, occasionally excluded. Hypothecium brown, extending as a tail into thallus; exciple \pm distinct from hypothecium, brown (but sometimes pale inside); hymenium without oil drops, 70-90 μ m; epihymenium brown. Paraphyses semidistinct, only slightly branched, septate, fusco-capitate, enlarged at apex; asci clavate, 8-spored. Spores brown, 1-septate, broadly ellipsoid, occasionally somewhat constricted, 11-17(-19) x 6-9 μ m, walls thin and uniform. Medulla i-.

On rock. Widespread in Southwest, southern California to Texas, and Colorado.

B. saurina W. Weber

Thallus C-, K-, P-, verrucose-areolate, citrine yellow, to 1 cm diam.; hypothallus inconspicuous, consisting of minute black specks on the thallus perimeter; areoles 0.1-0.4 mm wide and high, the outer ones scattered and minute, the inner ones contiguous and larger; cortex very thin; medulla white, I-, P-, K-, UV-. Apothecia 0.2-0.3 mm diam., black, matt, epruinose, plane to subconvex, between or on edges of areoles; margin indistinct. Exciple dark brown. Hypothecium dark brown, not stipitate. Epihymenium violet-brown. Hymenium not inspersed. Spores 8, broadly ellipsoid or subglobose, not constricted at septum, thin-walled. 9-15 x 9-12 μ m. On siliceous sandstone. Utah.

B. saximontana Egan ined.

Apothecia without pseudothalline margin; discs epruinose, to 0.9 mm, immersed then

adnate, black, \pm plane, the margin thin, \pm persistent. Thallus white to gray-white, rimose-areolate, on distinct hypothallus, cortex K+ yellow; medulla K-, I+ blue. Spores 18-23 x 8-11 μ m. Hypothecium pale to golden brown or brownish. Alpine, New Mexico.

B. schaereri

Thallus immersed or scant, thin, scurfy, continuous to slightly cracked or wrinkled, sometimes of widely scattered granules 0.05-0.09 mm across on a white hypothallus, pale or smoky grey, effuse; medulla I-.

Apothecia numerous, bowl-shaped, adnate, to 0.1-0.3(-0.5) mm diam.; disk black, plane to sometimes convex, the margin \pm raised, persistent, concolorous, thin. Hypothecium light brown, not extending as a tail into thallus; excipulum continuous with hypothecium, concolorous or somewhat darker. Hymenium not inspersed, 30-45(-60) μ m; paraphyses agglutinate, branched, septate, strongly brown-capitate, apical cell swollen; asci narrowly clavate, 8-spored. Epithecium brown, N-. Spores 1-septate, rather pale, brown or green-gray, not constricted, uniformly thin-walled, smooth, 6-10(-12) x 2-4(-4.5) μ m.

Pycnidia often numerous, 50-70 μ m; pycnospores 2-3 x 1-1.4 μ m, shortly oblong to ellipsoid. Thallus P-, K-, C- (no substances). On acidic bark or wood (especially conifers and oaks). Northeastern, W to Minnesota.

B. semitensis

Thallus sulphur yellow, buff, or pale, irregularly rimose-areolate, becoming verruculose or verrucose, sometimes crumbling; areoles to 1 mm, plane to moderately convex. Hypothallus obsolete. Thallus K+ sordid yellow, P-. Medulla I-.

Apothecia adnate, round, occasionally crowded, then irregular from mutual pressure, strongly marginate from the start, never pseudolecaneorine, 0.2-1.5 mm diam.; disc black, plane to somewhat convex; margin concolorous, raised, at length excluded. Hypothecium brown, extending as a tail into thallus. Hymenium not inspersed, 80-110 μ m. Epihymenium brown. Paraphyses lax, simple, thin, branched, fusco-capitate, apical cell swollen and globular; asci clavate, 8-spored. Spores brown, 1-septate (rarely 3-septate), ellipsoid, (15-)17-23 x 7-11 μ m, often curved or bean-shaped, rarely constricted, walls thin and uniform.

On rock, Montane to subalpine, California.

B. silicicola (Type specimen lost)

Thallus gray, K+ yellow, areolate with deep cracks, the areoles 0.5-1 mm, plane to convex, matt, white inside; black hypothallus visible between the areoles.

Apothecia 1/areole, immersed then adnate; discs black, epruinose, plane; margin thin, often flexuous. Epihymenium and hypothecium brown. Paraphyses free, septate, fusco-capitate. Asci clavate, 8-spored. Spores brown, 1-septate, not constricted, tips rounded, 11-12 x 7-9 μ m. On siliceous rock, New Mexico.

B. smaragdula (Type specimen lost)

Thallus black, thin, almost indistinct. Apothecia to 0.5 mm; disc black, epruinose, plane to convex, the margin thin, concolorous, often flexuous, almost disappearing. Excipulum intense emerald green. Epithecium emerald green. Hypothecium hyaline. Paraphyses slender, rather coherent, septate, above somewhat branched, capitate; asci cylindrical, ca. 45 μ m long, 8-spored. Spores brown, obtuse at apices, 12-15(-20) x 6-6.5 μ m, thin walled. On siliceous rock, New

Mexico.

B. spuria (Schaerer) Anzi

Thallus whitish to \pm dark gray or ochraceous, occasionally glaucescent, rimose to areolate (or sometimes verrucose-squamulose), the areoles contiguous to dispersed, on a conspicuous black hypothallus. Areoles thin (on hard rocks), to more than 1 mm thick, angular, convex, often black-edged from the upward growth of the hypothallus; hypothallus granular at margin, not feathery. Medulla I+ violet.

Apothecia at first innate but soon somewhat raised and adnate or separated from the areoles and \pm level with them, cryptolecanorine or lecideine, round to angular, 0.2-0.7 mm; margin concolorous, narrow, prominent, \pm persistent. Exciple aethalea-type. Hymenium without oil, 60-80 μ m; epihymenium green to olive; hypothecium brown-black or dark brown, extending through the thallus to the hypothecium; exciple continuous with hypothecium, concolorous. Paraphyses \pm agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci clavate, 8-spored. Spores brown, 1-septate, ellipsoid, occasionally somewhat constricted, 8-13 x 4-6 μ m, the walls thin and uniform. Pycnospores bacilliform, 4.5-6 μ m. Thallus P+ yellow to cinnabar, K+ yellow or sordid and occasionally turning somewhat reddish after a while. Containing atranorin, chloratranorin, norstictic and connorstictic acids, and sometimes stictic acid agg. Mostly on slightly inclined faces of low granitic boulders; also on sandstone, quartzite and serpentine. Eastern U.S.; California.

B. stellulata (Tayl. in Mack.) Mudd

Thallus rimose or minutely areolate, often less than 1 cm diam., thin, whitish or greyish, sometimes tartareous, I-, C-, on a black hypothallus.

Apothecia round, 0.1-0.3(-0.5) mm diam., cryptolecanorine to lecideine, at first immersed but soon immixt; disk black, naked, concave to plane; margin concolorous, at first with a superficial thalloid covering, \pm persistent. Hypothecium brown or brown-black, extending through thallus to the hypothallus. Exciple aethalea-type, continuous with hypothecium, concolorous. Hymenium without oil, 35-45(-70) μ m. Epihymenium green-black to olive. Paraphyses \pm agglutinate, branched, septate, fusco-capitate, enlarged at apices; asci clavate, 8-spored. Spores brown, 1-septate, ovoid-ellipsoid (according to Imshaug) or oblong, not constricted, Buellia-type, 9-11(-13) x (4-)5-6(-7) μ m; walls thin and uniform, ornamentation rugulate or psilate. Pycnospores bacilliform, 3.5-4 μ m. Thallus P-, K+ yellow, Containing atranorin and confluent and 2'-O-methylperlatolic acids. On sunny, calcareous or siliceous rock, coastal, British Columbia to California.

B. stigmaea Tuck.

Thallus cream colored or grayish brown, thin, continuous, soon becoming rimose-areolate; hypothallus black, not always evident. Apothecia round, immersed then erumpent, soon adnate and superficial, 0.2-0.6(-0.8) mm; disc plane, black, epruinose; margin thick, conspicuous, raised, at first concolorous with thallus but soon blackening (generally pallid in water). Hypothecium yellow-brown to light red-brown, not extending as a tail into thallus. Exciple distinct from hypothecium, brown at margin, pale inside; hymenium not interspersed, 50-75 μ m; paraphyses discrete, simple, septate, fusco-capitate, apical cell somewhat enlarged; asci clavate, 8-spored. Spores brown, 1-septate, ellipsoid to somewhat curved, not constricted, 8-13(-15) x 4-7 μ m, walls thin and uniform. Medulla I+ blue. Thallus P+ yellow, K+ red (crystals).

Eastern U.S. (New England to Alabama)

“Buellia” stigmatæa Koerber (=? Amandinea punctata) Description after Thomson 1997

Thallus ashy, greenish, brownish, or lacking, thin, scurfy; hypothallus brown-black or lacking.

Apothecia tiny, 0.3-0.4 mm broad, flat to slightly convex; margin black, becoming excluded in some specimens but usually prominent; exciple brown-black; hypothecium brown-black; epihymenium brown; hymenium brown above, hyaline below; paraphyses loosely attached, septate, branched, tips brown-capitate; spores 1-septate, brown, ellipsoid, small, 9-16 x 4-8 µm. Thallus K-, C-, P-, I-. On rocks.

B. stillingiana Steiner

Thallus whitish, brownish gray or gray, thin and ± granular, to thickened and granulose-areolate or becoming subverruculose, rarely smooth areolate; hypothallus scant, occasionally showing as black line at margin or junction of thalli.

Apothecia round, occasionally conglomerate or regenerating, adnate, to 1 mm diam.; disk black, plane to convex; margin concolorous, thin, persistent. Hypothecium red-brown, subtended by a yellowish or pale yellow-brown parenchymatous tissue (stipe) which extends into the thallus. Exciple ± continuous with hypothecium, yellow brown above and at margins, pale inside (uniformly brown to dark brown according to Awasthi). Hymenium not interspersed, 50-85 µm, pale yellowish or greenish brown; epihymenium brown; paraphyses ± agglutinate, branched, septate, fusco-capitate, somewhat enlarged above; asci narrowly clavate, 8-spored. Spores brown, 1-septate, ellipsoid, not constricted, (10-)12-17(-19) x 5-7(-8) µm, wall thin and uniform, ornamented on surface.

Thallus (exciple and internal stipe according to Awasthi) K+ yellow or red (atranorin, + or - norstictic acid). Thallus P- (occasionally somewhat yellowish in spots). Usually on bark, rarely on wood. Eastern Canada S to Florida; Pacific Northwest (Washington to Alaska).

B. subdispersa Mig.

Thallus whitish, consisting of scattered minute flattened granules or areolae, 0.4-2 mm across, sometimes crowded to form wider patches, up to 0.4 mm thick. Prothallus not seen. Cortex mainly consisting of an epinecral layer, not staining in LB, adjacent to short-celled, thin-walled hyphal ends slightly protruding from the algal layer; medulla often but not always I+ violet. Calcium oxalate crystals present throughout the thallus.

Apothecia immersed or sessile, to 0.5 mm wide; disc black, flat to convex, usually epruinose, rarely with a thin, white pruina; margin thin, often with thalline granules. Proper exciple 12-60 µm thick, excipular hyphae with rounded to elongated cells, in inner part rather thin-walled and only slightly pigmented, in outer part more distinctly pigmented; hymenium hyaline, without oil droplets, 50-70 µm thick; epithecium brown, subhymenial layers brown, to 170 µm thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigmented caps; asci clavate, 50-55 x 12-22 µm. Ascospores brown, ellipsoid, 3-septate, straight or slightly curved, young spores without wall thickenings, perispore with a rugulate, persistent sublayer, thicker than the proper wall, inside the gelatinous outer part, (12.-3)12.9-15.9(-18.1) x (4.7-)5.7-7.0(-7.6) µm.

Pycnidia not seen.

Chemistry: Thallus K-, C-, P-. No substances.

Ecology: on calciferous rocks in open situations, at low to fairly high elevations.
Distribution: Montana to the Dakotas; Arctic Canada.

B. terricola A. Nordin

Thallus forming a rather thin cover over other lichens and mosses, white to grayish white, usually in small patches, smooth to irregularly verrucose, sometimes almost granular. Prothallus not seen. Cortex mainly consisting of an epinecral layer, not staining in LB, adjacent to short-celled, thin-walled hyphal ends slightly protruding from the algal layer. Calcium oxalate crystals present throughout the thallus.

Apothecia abundant, first \pm immersed in the thallus, soon sessile, 0.2-1.1 mm wide, sometimes aggregated and confluent; disc black or dark brown, first flat, later \pm convex, sometimes with a whitish pruina of calcium oxalate; margin prominent at early stages, excluded in strongly convex apothecia. Proper exciple 40-80 μ m thick, excipular hyphae with brown pigmented walls and rounded to slightly elongate lumina, often interspersed with crystals; pigment dissolving into a yellow-brownish solution in K present; hymenium hyaline, without oil droplets, 75-95 μ m thick; epithecium brown; subhymenial layers brown, up to 275 μ m thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigmented caps; asci 70-90 x 10-23 μ m. Ascospores usually 3-septate when mature, with rather pointed ends, the persistent part of the perispore less than half as thick as the proper wall and with narrow gaps, (26.0)27.3-31.6(-33.9) x (7.9-)8.8-10.1(-10.2) μ m.

Pycnidia not seen.

Chemistry: Thallus K+ faintly yellowish, C+ orange-yellow (microscope), P+ faintly yellowish. Atranorin (low concentration) and one or two xanthenes present, one unidentified (RF clss: A 5; B 5; C 5-6; present in eight out of ten tested specimens) and O-methyltrichloronorlichexanthone (in 4 out of 10 specimens). Norstictic acid usually present in apothecia (found in nine out of ten specimens).

Ecology: On soil or rarely wood, arctic-alpine, mainly on calciferous ground.

Distribution: Canadian Arctic; Colorado.

B. tolucae de Lesd.

Thallus grayish white with a faintly yellowish tinge, to 2 mm thick but usually thinner, areolate, areolae irregularly angular, flattened to slightly convex in depressions, 0.2-0.8 mm wide. Prothallus black, well developed. Cortex with a variously thick epinecral layer (to 30 μ m), not staining in LB, adjacent to the short-celled, thin-walled hyphae surrounding the algae of the algal layer.

Apothecia adjacent to the areolae or immersed, level with the thallus surface or slightly protruding, irregularly angular to subcircular, to 0.5 mm wide; disc black, persistently flat, epruinose; margin thin, inconspicuous. Proper exciple only developed in parts not directly adjacent to the thallus, 15-40 μ m thick, inner part with slightly pigmented hyphae with narrow lumina, outer part with distinctly pigmented, short-celled hyphae with \pm rounded lumina; hymenium hyaline, without oil droplets, 60-85 μ m thick; epithecium blue-green; subhymenial layers brown, to 230 μ m thick. Paraphyses simple, apical cells widened and with pigmented caps; asci clavate, 50-64 x 15-26 μ m. Ascospores brown, ellipsoid, with 3 transsepta and with middle cells often divided by longisepta, making the spores 4 to 6-celled in optical section, young spores without wall thickenings, perispore with a rugulate, persistent sublayer inside the gelatinous outer part, (18.1-)18.2-20.6(-21.9) x (8.6-)9.3-10.8(-11.4) μ m.

Pycnidia immersed, flask-shaped to rounded, c. 0.16 x 0.11 mm; wall pigmented in upper part. Conidiophores branched; conidiogenous cells asymmetrical with conidia formed on bayonet-like processes. Conidia bacilliform, c. 9-11 x 1 μ m.

Chemistry: Thallus K+ yellow, C-, P+ yellow. Norstictic acid (major) and atranorin (minor) present.

Ecology: On volcanic rock at high altitudes.

Distribution: San Francisco Peaks, AZ; southern Mexico.

B. triphragmioides Anzi

Thallus usually in small patches, thin to moderately thick, ochraceous or pale yellowish, forming an areolate crust, commonly somewhat rugose or verrucose; areoles scattered to contiguous, occasionally limited by a thin black hypothallus.

Apothecia abundant, seldom aggregated and confluent, round, sessile, 0.2-0.7(-0.9) mm diam.; disk black, plane to \pm convex, naked or with a thin yellowish white pruina; margin concolorous, thin, at first prominent, at length \pm excluded. Hypothecium brown to red-brown, not extending as a tail into thallus. Exciple \pm distinct from hypothecium and somewhat darker, 50-60 μ m; excipular hyphae of type 1. Hymenium not interspersed, 60-70(-95) μ m, hyaline; epihymenium brown; paraphyses \pm distinct to somewhat agglutinate, branched, septate, fusco-capitate, apical cell somewhat enlarged; asci clavate, 50-65 x 17-24 μ m, 8-spored. Spores brown, usually 3-septate when mature (rarely 1- or 2-septate), long-ellipsoid, frequently curved or bean-shaped, with rather pointed ends occasionally slightly constricted at septa, (14-)20.9-24.6(-27.5) x (6-)8-9.4(-10.4) μ m, walls thin and uniform; ornamentation ruggedly microrugulate.

Pycnidia scattered, 0.08-0.11 mm diam., rare; conidia 5-7 x 1 μ m.

Thallus P-, K- or sordid yellow, C+ orange. Arthothelin present in the phenocortex.

Usually on bark of deciduous and coniferous trees, sometimes on wood. California to Alaska.

Buellia triseptata A. Nordin

Thallus whitish to greenish gray, thin and rimose to rather thick and areolate, areolae sometimes verrucose or subsquamulose, usually in small scattered patches to 1 cm diam. Prothallus not seen. Cortex with a 6-15 μ m thick epinecral layer, not staining in LB, adjacent to the short-celled, thin-walled hyphae surrounding the algae of the algal layer.

Apothecia in young stages immersed but soon becoming sessile, 0.2-0.7 mm wide, often tightly crowded; disc black, first flat, later \pm convex, epruinose; margin distinct on young apothecia, later excluded. Proper exciple 15-55 μ m thick, with thickened, distinctly pigmented cells with rounded to elongate lumina; hymenium hyaline, 60-70 μ m thick; epithecium brown; subhymenial layers brown, to 350 μ m thick. Paraphyses simple or branched in uppermost part, apical cells widened and with pigmented caps; asci clavate, 45-60 x 13-20 μ m. Ascospores brown, ellipsoid, sometimes curved, 3-septate, or when irregularly developed with additional longisepta dividing the middle cells, ends rounded to slightly pointed, middle septum often thickened in young spores, perispore with a rugulate, persistent sublayer inside a gelatinous outer part, distinctly thinner than the proper wall, (14.2-)16.1-19.2(-21.8) x (5.6-)6.6-7.9(-9.0) μ m.

Pycnidia immersed, flask-shaped. Conidiophores branched; conidiogenous cells asymmetrical with conidia formed on bayonet-like processes. Conidia bacilliform, c. 4-6 x 1 μ m.

Chemistry: Thallus K-, C-, P-. Atranorin (trace) sometimes present.

Ecology: On bark and wood of conifers and deciduous trees and shrubs, usually in open situations, 500-3000 m.

Distribution: Baja California to Washington; South Dakota; Arizona.

B. turgescens

Thallus brown, occasionally rufescent or pallescent, areolate, the areoles \pm flat or tumid and crowded, appearing as large, rounded verrucae, frequently \pm subsquamulose or plicate.

Apothecia round, innate to immixt, 0.2-0.5 mm across; disc black, plane to somewhat convex; margin concolorous, thin, \pm persistent. Hypothecium brown, not extending as a tail into the thallus. Exciple continuous with the hypothecium, concolorous; hymenium not interspersed, 40-60 μ m; epihymenium brown; paraphyses \pm distinct, branched, septate, pronouncedly fusco-capitate; apical cell swollen and globulose; asci clavate, 8-spored; spores light brown or somewhat greenish, 1-septate, ovoid-ellipsoid, occasionally constricted, 9-15 x 5-8 μ m; walls thin and uniform.

Thallus P-, K+ sordid yellow; hymenium I+ deep blue.

On wood and rock. New England to Illinois, Ohio, and Minnesota; Washington and California.

B. uberius

Thallus K+ red, C-. Epihymenium brown. Spores 12-16 x 6-9 μ m. Thallus tartareous, rimose-areolate, gray-white, the areoles flat or slightly convex. Apothecia punctiform then becoming adnate, flat with prominent, disappearing margin, 1 per areole, largely filling the areole. Hypothecium hyaline. On rock.

B. venusta (Koerber) Lettau (syn. Diplotomma venustum)

Thallus delimited, usually thick, white, gray or ochraceous, smooth or rimose, often subeffigurate; sometimes with dark prothallus.

Apothecia abundant, 0.3-1.2 mm diam., remaining immersed for a long time, later raised above the thallus surface, usually with a thick thalline rim; disc black or dark brown, flat then \pm convex, often whitish pruinose. True exciple < 50 μ m, excipular hyphae of type 1, in young apothecia absent or consisting of only a few excipular hyphae but gradually built up, eventually forming a prominent margin; often with calcium oxalate crystals. Hymenium 75-125 μ m, colorless. Hypothecium hyaline, < 240 μ m. Asci 52-75 x 15-20 μ m. Ascospores (14.3-)16.0-20.1(-24.0) x (6.6-)6.7-8.7(-9.4) μ m, usually 3-septate at maturity, but longitudinal septa sometimes present, often curved, with obtuse ends; ornamentation ruggedly microrugulate.

Pycnidia scattered, rare; conidia 9-12 x < 1 μ m.

Thallus K-, P-, C- or K+ yellow then red, P+ yellow-orange. No substances, or norstictic acid in the medulla.

On calcareous rocks and mortar, sometimes establishing on Lecanora spp.

B. vernicoma (syn. Rhizocarpon vernicoideum Fink, Buelliopsis vernicoma)

Thallus of small granules, often indistinct, yellow, straw colored, greenish to yellowish gray, or dark gray, K-, C-, P-. Thallus thin; granules round, convex, scattered or clustered; thallus covering small areas and usually resting upon and bordered wholly or in part by a black hypothallus.

Apothecia partly immersed to adnate; disc black, epruinose, flat, soon convex and immarginate, 0.2-0.6(-1) mm; margin thin, prominent, becoming flexuously irregular, disappearing. Hypothecium hyaline below, \pm dark red-brown above, not extending as a tail into thallus; exciple brown-black, \pm distinct from hypothecium and extending below it. Hymenium not inspersed, 40-75 μ m; epihymenium \pm granulose. Paraphyses simple (according to Imshaug) or branched, semi-distinct, septate, fusco-capitate, apical cell scarcely enlarged; asci clavate, 8-spored. Spores light brown, ellipsoid or oblong-ellipsoid, slightly constricted at the septa, 3-septate, (9-)12-15(-18) x 4-5(-7) μ m, walls thin and uniform.

On trees or siliceous rock. Ohio, Pennsylvania; New England to Alabama.

B. vilis Th. Fr.

Exciple brown at edge, hyaline inside. Thallus chasmolithic [immersed] (or \pm areolate, ashy?). Medulla I+ strongly blue-violet, K+ yellowish, P-. Apothecia to 0.8 mm, sessile and constricted at base (or adnate?), lecideine; disc plane to slightly convex, black, the margin broad, raised, persistent. Exciple vilis-type. Hymenium without oil, ca. 80 μ m. Epihymenium brown. Hypothecium hyaline, strongly amyloid. Spores broadly oblong, slightly constricted at septum, Buellia-type, 12-15(-17) x (5-)7.5-9 μ m; ornamentation psilate to microrugulate. Pycnospores bacilliform, 2.5-4 μ m. No substances. On small pebbles in very wind-exposed habitat and on recently eroded surfaces of granitic boulders. Boreal-arctic. Colorado and N. Dakota

B. wheeleri R. C. Harris

Thallus with yellow soredia (KC+ orange) in punctiform to diffuse, confluent soralia; ascospores wall strongly ornamented; ascospores 8/ascus, 1-septate, 16-19 x 9-11.5 μ m. On bark or wood. Florida.

Literature

- Fink, B. 1935. Lichen Flora of the United States.
- Galloway, D. 1985. Flora of New Zealand Lichens.
- Harris, R. C. 1988. Buellia... Evansia
- Harris, R. C. 1990. Some Florida Lichens.
- Imshaug, H. 1951. The lichen-forming species of Buellia in North America. Ph.D. Dissertation.
- Kalb, K. and J. A. Elix. 1998. The chemistry of some species of Buellia sensu lato (Lecanorales, lichenized Ascomycotina). Mycotaxon 68: 465-482.
- Nordin, A. 1996. Buellia species (Physciaceae) with pluriseptate spores in Norden. Acta Univ. Ups. Symb. Bot. Ups. 31: 327-354.
- Orange, A., B. J. Coppins and C. Scheidegger. 1992. Buellia. In: Purvis, et al., Lichen Flora of Great Britain and Ireland.
- Poelt, J. 1969. Bestimmungsschlüssel europäischer Flechten.
- Rogers, 19 . Genera of Australian Lichens.
- Scheidegger, C. 1993. A revision of European saxicolous species of the genus Buellia de Not. and formerly included genera. Lichenologist 25(4): 315-364.
- Sheard, J. 19 . The genus Buellia in the British Isles.
- Thomson, J. W. 1979. Lichens of the Alaskan Arctic Slope.
- Thomson, J. W. 1997. American Arctic Lichens II. The Microlichens.
- Weber, W. A. 1971. Four new species of Buellia (Lichenes) from Western North and South America. The Bryologist 74: 185-191.