

The Lecideaceae.

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GENERAL CONSIDERATIONS

It was stated in the second paper of this series that the disposition of the *Lecideaceae* in an early paper of the series would show what slight changes are needed in treating lichens as we treat other ascomycetes. It is hoped that this paper has accomplished this in phraseology intelligible to those acquainted with the present-day language of systematic mycology.

The *Lecideaceae* form a well-defined family of lichens, the affinities of which seem plainly marked. In apothecial structure, and so far as known, in structure of the sexual reproductive areas, the family seems to be closely related to the mainly non-lichen *Patellariaceae* and to such lichens as the *Gyalectaceae*, the *Lecanactidaceae*, the *Collemaceae*, the *Baeomycetaceae*, and the *Cladoniaceae*.

Following the commonly-accepted theory that the lichens have been evolved from non-algicolous fungi, the origin of the *Lecideaceae* and related lichens from *Patellaria*-like ancestors is a reasonable supposition, though the relative rank of the various related families named in the last paragraph is not easy to decide. Within the *Lecideaceae*, the line of evolution seems to have been in the direction of a well-developed exciple and from simpler to more complex spores. With the advance in these two directions has gone a slightly increased development of the thallus.

In structure, the thallus is crustose, and the thalli vary from inconspicuous, evanescent conditions to those which are conspicuous and sometimes even subsquamulous. Rarely the thallus extends upward as a veil which surrounds the apothecia laterally and suggests how the thalloid exciple of higher families probably arose. As usual in crustose forms, the thalli are composed of hyphae which are densely disposed toward the upper, exposed surface and more loosely disposed toward the lower surface (Fig. 2).

The apothecial evolution passes from forms with weak, light-colored exciples and soft texture (Fig. 10) to those with strong, dark exciples, which are firm in texture (Fig. 11). The superficial apothecial characters are so much alike in many of the species that one cannot always feel certain even of the genus of unfamiliar forms until he has studied them microscopically.

*Contributions from the Botanical Laboratory of Miami University.—XVIII

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The paraphyses are commonly distinct in young apothecia, but in mature apothecia they are usually more or less gelatinized and coherent. In some of the species, they become so gelatinized that they form a homogeneous mass about the asci, in which the individual paraphyses are no longer discernible. When distinct, the paraphyses are sometimes branched, most commonly toward their apices (Fig. 1 and 12).

There is great diversity with respect to spore development, the whole range of spore structure, from minute, simple, hyaline spores to those which are large, brown, and muriform being found within the family (Figs. 3, 4, 5, 6, 7, 8, 9, and 13). This condition makes it appear quite possible that the family may be polygenetic.

The genus, *Biatorella*, contains non-lichen forms and is probably as a whole more closely related to the *Patellariaceae* than to the *Lecidiaceae*. However, our two species, both of which are lichens, are herein admitted to the latter family. Through one or more species with larger spores than are usually found in this genus, *Biatorella* approaches *Lecidea*. Starting with *Lecidea*, we have a natural series in spore development with intermediate conditions difficult to place. The series runs thus: *Lecidea* with simple hyaline spores (Fig. 3); *Biatorina* with two-celled, hyaline spores (Fig. 4); *Bilimbia* with several-celled, hyaline spores, not much narrowed (Fig. 5); and *Bacidia* with several-celled, hyaline, acicular spores (Fig. 6). *Buellia* and *Rhizocarpon* are aberrant genera, brown-spored, and closely related among themselves (Figs. 8, 9, and 13). Through *Buellia*, the two genera are related to *Rinodina* of the *Physciaceae*. The two aberrant genera are like other members of the *Lecideaceae* with respect to thallus development and general apothecial characters, the aberrancy being with respect to the spores, on which account the two genera are placed in another family, the *Buelliaceae*, by some workers, perhaps with sufficient reason.

The algal host is *Pleurococcus*-like (Fig. 2, c) in nearly all species of the *Lecideaceae*; but the host cells are so hypertrophied and distorted that their generic rank is often difficult to ascertain, except by cultivation outside of the lichen thallus. The algal-host cells are few in number in some of the species and are sometimes absent during a portion of the life history of the lichen. The host is usually found throughout the superficial portions of the thallus, except near the upper surface, from which portion the algae are usually absent, except in a dead or dying condition, difficult to detect.

The writer has collected the *Lecideaceae*, with other fungi, in Butler County for fifteen years, and has worked for the Ohio Biological Survey in Preble, Warren, Highland, Fairfield, Adams, Hocking, and Lake counties. Besides these collections made by the writer, a few specimens were examined from Champaign, Hamilton, Wayne, Morgan, Madison, Muskingum, Franklin, Vinton, and Summit counties. Of the 37 species treated in this paper, 24 had not been reported from Ohio previously.

*Systematic Account.***LECIDEACEAE**

Thallus crustose, without plectenchymatous cortex (Fig. 2, a), varying from granulose and often evanescent to conspicuous, areolate, or even subsquamulose conditions, attached to the substratum by hyphal rhizoids (Fig. 2, d), and in a few instances extending up as a veil and surrounding the apothecia laterally, the hyphae densely interwoven toward the upper surface, but more loosely disposed below (Fig. 2, a and b); apothecia usually minute or small, commonly rounded, the exciple weak and obscure (Fig. 10, d), or more strongly developed when conspicuous and much darker in color (Fig. 11, b); hypothecium varying from hyaline to dark brown (Fig. 10, b and Fig. 11, c); hymenium almost always lighter and commonly hyaline (Figs. 10 and 11, a); paraphyses usually simple, but branched forms to be found frequently (Figs. 1 and 12), pale throughout or darkened toward the sometimes enlarged apex, commonly more or less coherent and indistinct at maturity; spores simple and hyaline to muriform and brown (Figs. 2, 3, 4, 5, 6, 7, 8, 9, and 13).

KEY TO THE GENERA

- Spores minute, numerous in each ascus *Biatorella*, p.
 Spores larger, usually 8 in each ascus,
 Spores hyaline.
 Spores one-celled (simple) *Lecidea*, p.
 Spores more than one-celled (compound).
 Spores 2-celled *Biatorina*, p.
 Spores 4- to several-celled.
 Spores ellipsoid, fusiform, or dactyloid *Bilimbia*, p.
 Spores acicular *Bacidia*, p.
 Spores brown, or becoming brown.
 Spores 2-celled *Buellia*, p.
 Spores 4-celled and becoming muriform *Rhizocarpon*, p.

Biatorella De Not. Giorn. Bot. Ital. 21. 192. 1846.

Thallus granulose to verrucose and subareolate, sometimes inconspicuous and evanescent; apothecia minute to middle-sized, adnate or more or less immersed, exciple usually prominent and persistent, but sometimes becoming covered, disk flat to convex; hypothecium and hymenium pale to brown; spores simple, hyaline, minute, numerous in each ascus.

KEY TO THE SPECIES OF BIATORELLA

- The whole apothecium dark colored 1. *B. simplex*
 The disk of the apothecium white-pruinose 2. *B. pruinosa*

1. **Biatorella simplex** (Dav.) Br. & Rostr. Bot. Tidssk. 3: 241 1869.

Lichen simplex Dav. Trans. Linn. Soc. Lond. 2: 283. pl. 28. f. 2. 1794.

Thallus thin and smooth or thicker and roughened, sometimes subareolate, ash-white to green-gray and darkening, rarely disappearing; apothecia minute to middle-sized, 0.2 to 0.8 mm. in diameter, adnate, scattered or

crowded, rounded or variously irregular, black but usually dark red when damp, flat or slightly convex, the thin exciple raised and persistent; hypothecium light or darker brown; hymenium pale or tinged brown; paraphyses semi-distinct to coherent-indistinct; asci cylindrico-clavate; spores oblong-ellipsoid, 3 to 5 mic. long and 1 to 1.5 mic. wide.

Collected in Butler, Adams, Montgomery, Hocking, and Ross counties. On limestone. Not previously reported from Ohio, but probably frequent where there is limestone, though inconspicuous and easily overlooked.

2. **Biatorella pruinosa** (J. E. Smith) Mudd Man. Brit. Lich. 191. 1861.

Lichen pruinusus J. E. Smith in Sowerby, Eng. Bot. 32: pl. 2244 1811.

Thallus light colored, usually thin and smooth, rarely disappearing; apothecia minute to middle-sized, 0.2 to 1 mm. in diameter, adnate scattered or crowded, flat or slightly convex, the disk pruinose, and the exciple persistent; hypothecium lighter or darker brown; hymenium usually pale; paraphyses coherent and becoming indistinct; asci cylindrico-clavate; spores oblong-ellipsoid, 3 to 5 mic. long and 1 to 1.5 mic. wide.

Collected in Butler and Adams counties. On limestone. Not previously reported from Ohio, but often occurring with the last in limestone areas.

Lecidea Ach. Meth. Lich. XXX. 32. pl. 2. f. 1, 2. 1803.

Thallus smooth, roughened, or verrucose, in some species chinky to areolate, or even subsquamulose, rarely rudimentary and evanescent; apothecia minute to middle-sized, usually adnate, but rarely sessile or immersed, with pale to black, and flat to strongly convex disk; exciple and hypothecium from pale to dark brown in section; hymenium lighter, most commonly pale; spores simple, hyaline, 8 in each ascus.

KEY TO THE SPECIES OF LECIDEA

Exciple soft, usually light colored.

Apothecia usually surrounded by a thalloid veil *coarctata*

Apothecia not surrounded by a thalloid veil.

Exciple becoming covered.

Hypothecium pale or pale yellow.

Apothecia always minute.

Spores 5 to 7 mic. long 2. *L. introspallida*

Spores 7 to 15 mic. long 3. *L. varians*

Apothecia reaching middle size 4. *L. rupestris*

Hypothecium light-brown to dark brown.

Thallus gray-green or lighter 5. *L. viridescens*

Thallus darker from the first or becoming so.

Thallus minute and evanescent 6. *L. humicola*

Thallus well developed and persistent.

Thallus of raised granules 7. *L. uliginosa*

Thallus of flat granules 8. *L. salvicola*

Exciple persistent 9. *L. flexuosa*

Exciple horny, dark colored.

Disk usually convex, commonly on wood 10. *L. enteroleuca*

Disk flat or less commonly convex, on rocks.

Disk usually white-to rusty-green-pruinose 11. *L. albocaerulescens*

Disk black, scarcely pruinose 12. *L. platycarpa*

1. **Lecidea coarctata** (J. E. Smith) Nyl. Act. Soc. Linn. Bord. 21: 358. 1856.
Lichen coarctatus J. E. Smith in Sowerby, Eng. Bot. 8: pl. 534. 1789.

Thallus of minute, scattered or clustered, rounded, angular, or minutely and irregularly crenate, green-gray, pale brown, or more commonly ash-white granules, sometimes passing into a subcontinuous, chinky or areolate crust; apothecia minute to small, 0.2 to 0.4 mm. in diameter, adnate, from flesh-colored to black, commonly concave or flat, sometimes difform, frequently surrounded laterally by a thalloid veil; hypothecium and hymenium pale to pale brown; paraphyses distinct; asci clavate or cylindrico-clavate; spores ovoid to ellipsoid, 13 to 23 mic. long and 7 to 10 mic. wide.

Collected in Lake, Ross, Hocking, and Preble counties. Also examined from Lawrence County. On rocks and old bricks. Not previously reported from Ohio. Widely distributed in the State, but rare, except in Lake County, where this fungus was unusually common.

2. **Lecidea intropallida** sp. nov.

Thallus a continuous, smooth or slightly roughened, ash-gray and darkening crust; apothecia minute, 0.15 to 0.25 mm. in diameter, adnate or partly immersed, flesh-colored to yellow-brown, flat to slightly convex, the concolorous and inconspicuous exciple soon covered; hypothecium and hymenium pale; paraphyses sometimes distinct, but more commonly coherent-indistinct; asci clavate; spores simple, hyaline, ellipsoid, 5 to 7 mic. long and 2.5 to 3 mic. wide.

Collected near Painesville in Lake County. On pebbles in a moist wood. The type specimen is deposited in the writer's herbarium, and a cotype may be seen in the State Herbarium.

3. **Lecidea varians** Ach. Syn. Meth. Lich. 38. 1914.

Thallus of very minute, raised or flattened, green-gray to yellow-green granules, these forming a thin but continuous, smooth or granulate-rugose, often chinky crust, usually bordered and often decussated by black lines; apothecia minute, 0.12. to 0.25 mm. in diameter, often clustered or even conglomerate, adnate, from pale yellow to brown and finally black, flat with a thin exciple to convex with covered exciple; hypothecium pale to pale yellow; hymenium pale below, but often yellow or blue-violet above; paraphyses usually coherent, distinct or indistinct; asci clavate; spores ovoid-ellipsoid, 7 to 15 mic. long and 5 to 7.5 mic. wide.

Collected in Adams County. On maple bark. Also reported from Franklin County. The plant is so minute and inconspicuous as to be very difficult to detect and is probably distributed widely in the State.

4. **Lecidea rupestris** (Scop.) Ach. Meth. Lich. 70. 1803. (See Fig. 10).
Lichen rupestris Scop. Fl. Carn. ed. 2. 2: 363, 364. 1772.

Thallus a continuous, moderately thick, smooth or more or less roughened, often chinky to subareolate, ash-gray, yellow-green, or darken-

ing crust; apothecia small to large, 0.4 to 1.3 mm. in diameter, at first immersed but becoming adnate, yellow to yellow or red-brown, flat to strongly convex and the exciple covered; hypothecium pale or pale yellow; hymenium pale; paraphyses coherent, semi-distinct to indistinct; asci clavate; spores ellipsoid, 10 to 15 mic. long and 5 to 7 mic. wide.

Collected in Adams Country. On calcareous rocks. Not previously reported from North America.

5. **Lecidea viridescens** (Schrad.) Ach. Meth. Lich. 62. 1903.

Lichen viridescens Schrad. Spic. Fi. Germ. 88. 1794.

Thallus of very minute, smooth or delequescent and powdery, ash-grey to grey-green granules, spread over the substratum as a thin or rarely thicker crust; apothecia minute to small, 0.2 to 0.5 mm. in diameter, adnate, frequently clustered or even conglomerate, becoming black, from flat with the thin livid or darker exciple visible to convex with the exciple covered; hypothecium pale or darker brown; hymenium pale to pale brown; paraphyses coherent, semi-distinct to indistinct; asci clavate; spores oblong-ellipsoid, 9 to 12 mic. long and 4 to 5.5 mic. wide.

Collected on Little Mountain in Lake County, and in Hocking County. On logs in woods. Not previously reported from Ohio, and probably rare in the State.

6. **Lecidea humicola** (Ach.) comb. nov.

Lecidea uliginosa humicola Ach. Meth. Lich. 43. 1903.

Thallus of very minute inconspicuous and evanescent, brown-black granules; apothecia minute, 0.2 to 0.4 mm. in diameter, adnate, dark brown to black, scattered or clustered, plain with a thin concolorous exciple visible, to convex with the exciple finally covered; hypothecium dark brown; hymenium pale brown; asci clavate; paraphyses coherent-indistinct; spores oblong-ellipsoid, 9 to 15 mic. long and 5 to 7 mic. wide.

Collected in Hocking County. On soil in a moist wood. Not previously reported from North America.

7. **Lecidea uliginosa** (Schrad.) Ach. Meth. Lich. 43. 1803.

Lichen uliginosus Schrad. Spic. Fl. Germ. 88. 1794.

Thallus of scattered, clustered, or even heaped, irregular and minute, green-olive to rust-brown, or even brown-black, somewhat raised and rarely coralloid granules, these forming a scattered or continuous crust; apothecia minute to small, 0.2 to 0.4 mm. in diameter, closely adnate or more or less immersed, often clustered, brown to black-brown, flat with the thin lighter-colored or black exciple visible, or becoming strongly convex, with the exciple finally covered; hypothecium light or darker brown; hymenium tinged yellow or brown; paraphyses closely coherent, but usually remaining distinct; asci long-clavate; spores oblong-ellipsoid, 8 to 14 mic. long and 4 to 7 mic. wide.

Collected in Preble, Butler, Warren, Adams, Fairfield, and Lake counties. On dead wood. Widely distributed in Ohio.

8. **Lecidea sylvicola** Koerb. Syst. Lich. 254. 1855.

Thallus of minute, irregular, somewhat flattened or more rarely hemispherical, green-gray, olive-brown, or darker granules, these forming a thin, continuous, or rarely scattered, subleprose, verrucose, or even subareolate, wide-spread crust; apothecia minute to small, 0.2 to 0.5 mm. in diameter, adnate or rarely more or less immersed, dark brown to black, flat to convex, the black exciple soon becoming covered; hypothecium brown to black-brown; hymenium pale or tinged brown; paraphyses coherent, semi-distinct to indistinct; asci clavate; spores ellipsoid, 5 to 9 mic. long and 2.5 to 4 mic. wide.

Collected in Lake, Ross, Preble, Hocking, and Butler counties. On various rocks. Not previously reported from Ohio, and apparently new to America under this name. Widely distributed in Ohio.

For possible relationship to *Lecidea myriocarpoides* Nyl. See "The Lichens of Minnesota" (Cont. Nat. Herb. 14: 74. 1910).

9. **Lecidea flexuosa** (Fr.) Nyl. Act. Soc. Linn. Bord. 21. 356. 1856.

Biatora flexuosa Fr. Vet. Akad. Handl. 1822: 267. 1822.

Thallus of small or minute, flattened or rugose, scattered or clustered, ash-grey to green-gray granules, these bursting into sorediate heaps, or forming a moderately thick, areolate crust; apothecia minute to small, 0.2 to 0.4 mm. in diameter, adnate, black, and flat, the thin, livid or darker, persistent exciple becoming flexuous; hypothecium pale or darker brown; hymenium tinged brown; paraphyses coherent, semi-distinct to indistinct; asci cylindrico-clavate; spores oblong-ellipsoid, 5 to 10 mic. long and 3 to 5 mic. wide.

Collected in Preble, Adams, Ross, and Butler counties. On dead wood. Not previously reported from Ohio, and rare, though probably distributed widely in the State.

The spores are slightly below normal size in our specimens.

10. **Lecidea enteroleuca** Ach. Lich. Univ. 177. 1810.

Thallus thin or becoming moderately thick, smooth or more often granulate, chinky or areolate, the granules or verrucae rarely becoming heaped in the thicker forms, ash-to green-gray, occurring in rounded areas, or irregularly and often widely spread over the substratum; apothecia minute to middle-sized, 0.35 to 1.2 mm. in diameter, adnate, black, flat to more commonly convex, the frequently flexuous exciple often becoming covered; hypothecium pale to dark brown; hymenium pale below, but usually more or less colored above; paraphyses distinct, but often more or less coherent; asci clavate; spores ovoid-ellipsoid, 8 to 17 mic. long and 5 to 9 mic. wide (Fig. 3).

Collected in Lake, Adams, and Hocking counties. On bark and rocks. Not previously reported from Ohio. Rare, but doubtless distributed widely in the State.

11. **Lecidea albocaerulescens** (Wulf.) Schaer. Lich. Helv. Spic. 3: 142. 1828.

Lichen albocaerulescens Wulf. in Jacq. Coll. Bot. 2: 184. pl. 5. f. 1. 1788.

Thallus smooth or somewhat rough, more or less chinky or becoming obscurely small-areolate, ash- to green-gray, or becoming olivaceous, spreading over the substratum as a continuous, moderately thick crust; apothecia small to large, 0.5 to 1.5 mm. in diameter, adnate or more or less immersed, usually flat, almost always white or rusty-green pruinose, the black exciple rarely becoming covered; hypothecium brown to black-brown; hymenium commonly pale; paraphyses distinct, but usually coherent; asci clavate to inflated-clavate; spores ovoid-ellipsoid, 15 to 24 mic. long and 7 to 10 mic. wide.

Collected in Preble, Hocking, and Lake counties. Also examined from Lawrence County. On rocks other than calcareous. Not previously reported from Ohio. Rare, but apparently distributed widely in the State.

12. **Lecidea platycarpa** Ach. Lich. Univ. 173. pl. 2. f. 5. 1810.

Thallus a thin, obscurely or more or less plainly roughened, usually chinky to subareolate, ash- to green-gray, continuous or more or less scattered, sometimes disappearing crust; apothecia small to middle-sized or even larger, 0.4 to 1.5 mm. in diameter, commonly scattered, brown-black to black, rarely and obscurely white-pruinose, adnate to sessile, rounded to flexuous, flat or finally convex, the raised exciple sometimes becoming covered; hypothecium dark brown; hymenium pale below and colored above; paraphyses distinct or coherent-semidistinct; asci clavate; spores ovoid-to oblong-ellipsoid, 14 to 20 mic. long and 6 to 10 mic. wide.

Collected in Ross and Hocking Counties. On rocks. Not previously reported from Ohio.

Biatorina Mass. Ric. Lich. 134. f. 262-271. 1852.

Thallus commonly granulose, and often passing into verrucose and chinky conditions, but scarcely ever areolate, sometimes scant and evanescent; apothecia usually minute or small, and commonly adnate, exciple weak and often becoming covered; hypothecium and hymenium passing from pale through shades of brown, the former becoming darker than the latter, this rarely tinged blue or violet above; spores hyaline, 2-celled.

KEY TO THE SPECIES OF BIATORINA

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|---|---------------------------|
| Growing on another lichen..... | 1. <i>B. heerii</i> |
| Growing on wood or on rocks. | |
| On old wood..... | 2. <i>B. prasina</i> |
| On rocks. | |
| Exciple strong and seldom becoming covered..... | 4. <i>B. chalybeia</i> |
| Exciple weak and usually becoming covered..... | 3. <i>B. lentibularis</i> |

1. **Biatorina heerii** (Hepp) Fink Cont. Nat. Herb. 14: 83. 1910.

Biatora heerii Hepp, Spore Flecht. Eur. pl. 16. f. 135. 1853.

Thallus of very minute, rounded and frequently heaped granules, sometimes visible under a hand lens, but often seen only in sections of the substratum, rarely disappearing; apothecia minute, 0.1 to 0.3 mm. in diameter, adnate to sessile, flesh-colored and blackening, flat to slightly convex, the concolorous or darker exciple commonly persistent; hypothecium and hymenium pale to light brown; paraphyses distinct to coherent-indistinct; asci clavate; spores ellipsoid, 7 to 12 mic. long and 3 to 3.5 mic. wide.

Collected in Butler County. On the thallus of *Peltigera canina*. Not previously reported from Ohio. So minute as to be difficult to detect. Consequently nothing further is known of its distribution in the State.

2. **Biatorina prasina** (Fr.) Fink Cont. Nat. Herb. 14: 84. 1910.

Micarea prasina Fr. Syst. Orb. Veg. 257. 1825.

Thallus of minute, closely clustered or even heaped granules, these forming a wide-spread, frequently subleprose, green-gray to dark-olive crust; apothecia minute to small, 0.2 to 0.5 mm. in diameter, adnate, commonly carneous or darkening, more or less convex and usually becoming convex with the exciple finally covered; hypothecium pale or pale brown; hymenium pale below and commonly darker above; paraphyses coherent, semi-distinct to indistinct; asci clavate; spores oblong-ellipsoid, 8 to 12 mic. long and 3.5 to 5 mic. wide.

Collected on Little Mountain in Lake County. On a rotten log. Not previously reported from Ohio, and evidently rare in the State.

Simple spores were seen in the specimens collected, but they were supposed to be immature.

3. **Biatorina lentibularis** (Ach.) Koerb. Syst. Lich. 191. 1855.

Lecidea lentibularis Ach. Syn. Meth. Lich. 28. 1814.

Thallus a thin, smooth or subtartareous, rarely rimose-areolate, ash-white to brown-gray, wide-spread and continuous or finally disappearing crust; apothecia minute to small, 0.2 to 0.5 mm. in diameter, adnate, black, from flat becoming convex and often irregular, the inconspicuous exciple then becoming covered; hypothecium pale to darker brown; hymenium pale or tinged brown; paraphyses distinct to coherent-indistinct; asci clavate; spores oblong-ellipsoid, 8 to 11 mic. long and 2.7 to 4 mic. wide.

A single collection was made in Highland County. On exposed calcareous rocks. Not previously reported from Ohio, and doubtless rare in the State.

An occasional 4-celled spore was seen, a transitional character previously noted by Th. M. Fries. The plant is closely related to the next below, from which it may not be distinct.

4. **Biatorina chalybeia** (Borr.) Mudd, Man. Brit. Lich. 180. 1861.

Lecidea chalybeia Borr. in Sowerby, Eng. Bot. Suppl. 1: pl. 2687. f. 2. 1831.

Thallus a thin, smooth or roughened, ash-gray and darkening crust, forming a continuous layer, becoming inconspicuous and rarely disappearing; apothecia minute to small, 0.3 to 0.5 mm. in diameter, adnate to sessile, concave to slightly convex, black, the exciple concolorous, prominent, and rarely becoming covered; hypothecium dark brown; hymenium pale below and pale brown above; paraphyses wide and strong, distinct to coherent-indistinct; asci clavate; spores oblong-ellipsoid, 8 to 12 mic. long and 3.5 to 4.75 mic. wide (Fig. 4).

Collected in Butler County. On calcareous rocks. Not previously reported from Ohio, and probably rare in the State.

The spores are somewhat larger than in European specimens.

Bilimbia De Not. Giorn. Bot. Ital. 21: 190. 1846.

Thallus usually composed of minute granules, these often run together to form a leprose or verrucose and rarely areolate or even subsquamulose crust, rarely disappearing; apothecia minute or small, usually adnate, with a weak and often covered exciple; hypothecium pale to dark brown; hymenium pale or tinged brown; spores hyaline, usually fusiform or dactyloid, varying from 4- to 9-celled.

KEY TO THE SPECIES OF BILIMBIA

On rocks.

Apothecia and spores smaller 5. *B. microcarpa*

Apothecia and spores larger 6. *B. trachona*

On other substrata.

On mosses 2. *B. hypnophila*

On wood or bark.

Spores becoming more than 4-celled 3. *B. naegeli*

Spores not more than 4-celled.

Apothecia flesh-colored to dark brown 1. *B. sphaeroides*

Apothecia black 4. *B. melaena*

1. **Bilimbia sphaeroides** (Dicks.) Koerb. Syst. Lich. 213. 1855.

Lichen sphaeroides Dicks. Pl. Crypt. Brit. 1: 9. pl. 2. f. 3. 1785.

Thallus of minute, gray-green, often heaped granules, these forming a continuous, thin or thicker crust; apothecia minute to small, 0.2 to 0.4 mm. in diameter, adnate, flesh-colored to red-brown, flat to convex and subglobose, the inconspicuous, concolorous exciple soon covered; hypothecium and hymenium pale; paraphyses usually coherent-indistinct; asci clavate; spores fusiform-ellipsoid, 4-celled, 12 to 20 mic. long and 4 to 6 mic. wide.

Collected on Little Mountain, in Lake County. On a rotten log in a wood. Rare in Ohio, and its distribution unknown.

The plant is typical internally, but is young with small, flat or slightly convex, light-colored apothecia.

2. **Bilimbia hypnophila** (Ach.) Th. Fr. Nov. Act. Reg. Soc. Sci. Ups. III. 3: 283. 1861.

Lecidea hypnophila Ach. Lich. Univ. 199. 1810.

Thallus of minute, usually crowded, sometimes confluent granules, these forming an ash- or green-gray, thin, leprose or subgranulose, sometimes scattered and disappearing crust; apothecia minute to middle-sized, 0.2 to 0.75 mm. in diameter, light brown to black, adnate to sessile, scattered or clustered, becoming strongly convex and the exciple becoming covered; hypothecium pale or darker brown; hymenium pale, or tinged brown below and more plainly brown above; paraphyses coherent, semi-distinct to indistinct; asci clavate or long-clavate; spores ellipsoid to fusiform, 4- to 8-celled, 16 to 35 mic. long and 4 to 8 mic. wide.

Collected in Preble, Hocking, and Adams counties. Over mosses on rocks or bases of trees; or rarely on rocks, soil, bark, or wood. Not previously reported from Ohio, and not a common fungus in the State.

3. **Bilimbia naegelii** (Hepp) Zwackh. Flora. 45: 505. 1862.

Biatora naegelii Hepp, Spor. Flecht. Eur. pl. 4. f. 1. 19. 1853.

Thallus of usually flattened granules, these commonly running together to form a moderately thin, more or less roughened, often chinky, ash- or green-gray, or darkening, limited or rarely wide-spread crust; apothecia minute to middle-sized, 0.2 to 0.9 mm. in diameter, adnate or rarely sessile, flesh-colored to dark brown, scattered or clustered, flat with the thin exciple visible to strongly convex with the exciple covered; hypothecium pale or tinged brown; hymenium pale throughout or tinged brown above; paraphyses coherent, semi-distinct to indistinct; asci clavate; spores fusiform-ellipsoid, 4- to 8-celled, 18 to 25 mic. long and 3 to 4 mic. wide.

Collected in Highland County. On bark. Not previously reported from Ohio, and doubtless rare in the State.

The usual width given for the spores is 4 to 6 mic., and our plant is placed here provisionally.

4. **Bilimbia melaena** (Nyl.) Th. Fr. Lich. Scand. 383-385. 1871.

Lecidea melaena Nyl. Bot. Not. 1853: 182. 1853.

Thallus of minute, olive-green to black-brown granules, these forming a thin, granulose or scurfy, sometimes disappearing crust; apothecia minute to small, 0.25 to 0.55 mm. in diameter, black-brown to black, sessile, occurring singly or in clusters, strongly convex to subglobose, the exciple soon covered; hypothecium pale brown to red-brown; hymenium pale or tinged brown; paraphyses coherent, semi-distinct to indistinct; asci clavate to inflated-clavate; spores oblong-ellipsoid or dactyloid, 2- to 4-celled, 12 to 22 mic. long and 4 to 6 mic. wide.

Collected in Lake County. On an old log in a wood. Not previously reported in Ohio, and rare in the State.

Nylander called the apothecium pale within, but forms with red-brown hypothecia are admitted by later writers.

5. **Bilimbia microcarpa** Th. Fr. Bot. Not. 1863: 8. 1863.

Bilimbia obscurata microcarpa Th. Fr. Nov. Act. Soc. Sci. Ups. III. 3: 183. 1861.

Thallus of minute ash-gray or green-gray granules, these rarely forming a thin or moderately thick, subcontinuous, verrucose crust, but more often scattered or disappearing entirely; apothecia minute to small, 0.25 to 0.7 mm. in diameter, scattered or conglomerate, dirty brown to black, soon becoming convex and subglobose, with the pale exciple then covered; hypothecium pale to pale red-brown; hymenium pale; asci clavate to inflated-clavate; paraphyses coherent-indistinct; spores fusiform, 4-celled, 16 to 25 mic. long and 4 to 6 mic. wide.

Collected in Hocking County. On shaded sandstone. Not previously reported from North America.

6. **Bilimbia trachona** (Ach.) Oliver Lich. France 38,39. 1903.

Verrucaria trachona Ach. Meth. Lich. Suppl. 16. 1803.

Thallus thin and granular, passing into smooth or leprose conditions, thence to thickened and subareolate states, ash-colored to dark brown-green, usually continuous over considerable areas; apothecia minute to middle-sized, 0.4 to 0.1 mm. in diameter, from brown-black with lighter exciple to wholly black, adnate or somewhat immersed, flat or finally convex with the exciple at length covered; hypothecium pale brown to black-brown; hymenium pale or rarely pale brown; paraphyses distinct to coherent semi-distinct; asci clavate; spores fusiform-dactyloid, 4-celled, 12 to 20 mic. long and 2.5 to 4.5 mic. wide (Fig. 5).

Collected in several localities in Preble, Highland, and Adams counties. On rocks, usually limestone. Also reported from Cuyahoga and Ottawa counties. Not common, but doubtless distributed widely in the State.

Bacidia De Not. Giorn. Bot. Ital. 2: 189. 1846.

Thallus granulose, passing into chinky, verrucose, subareolate and subsquamulose conditions, seldom or never disappearing; apothecia minute to large, adnate or rarely immersed more or less, exciple usually weak and becoming covered; hypothecium commonly some shade of yellow or brown; hymenium pale to light brown; spores hyaline, acicular, varying from 4- to 16-celled, often curved or variously twisted, usually 8 in each ascus.

KEY TO THE SPECIES OF BACIDIA

On rocks.

Spores hamate or spirally twisted 7. *B. umbrina*
Spores straight or only slightly curved.

Thallus ash- or green-gray 5. *B. inundata*
Thallus olive or darker 1. *B. egenuloidea*

On bark.

Spores less than 40 mic. in length 6. *B. incompta*

Spores 40 to 70 mic. long.

Apothecia flesh-yellow to red-brown 2. *B. rubella*

Apothecia brown to black.

Apothecia usually brown with a striate, usually

pruinose margin 3. *B. fuscrobella*

Apothecia usually black or dark brown, without striate

and pruinose margin 4. *B. schweinitzii*

1. ***Bacidia egenuloidea*** sp. nov.

Thallus of minute, crowded granules, forming a rather thick, conspicuous, rugose and obscurely chinky, dirt-olive and darkening, wide-spread crust; apothecia minute to small, 0.25 to 0.4 mm. in diameter, yellow-brown and darkening, adnate-sessile, flat with an elevated, darker exciple; hypothecium and hymenium pale or tinged brown; paraphyses coherent, semi-distinct; asci clavate; spores hyaline obscurely several-celled, variously curved, 25 to 40 mic. long and 0.75 to 1.25 mic. wide.

Collected in Preble County. On granite in a damp field near West Alexandria. The type specimen is deposited in the writer's herbarium, and a cotype may be found in the State Herbarium.

2. ***Bacidia rubella*** (Hoffm.) Mass. Ric. Lich. 118. f. 231. 1852

Verrucaria rubella Hoffm. Deutsch. Fl. 2: 174. 1795.

Thallus of minute, scattered or crowded granules, these frequently becoming compacted into a subleprose or more or less verrucose or chinky, ash- to green-gray, moderately thick or thinner, continuous or sometimes scattered and disappearing crust (Fig. 2); apothecia small to large, 0.5 to 1.35 mm. in diameter, sessile to adnate, flesh-yellow to red-brown, flat with a rather thick and lighter-colored exciple, or becoming convex with the exciple finally covered; hypothecium pale yellow to brown; hymenium pale yellow; paraphyses coherent, semi-distinct to indistinct; asci long clavate; spores about 8- to 16-celled, 45 to 65 mic. long and 3 to 4 mic. wide.

Collected in Butler, Highland, Adams, and Preble counties. Also examined from Franklin County. On bark. Widely distributed in Ohio, but not common.

3. ***Bacidia fuscrobella*** (Hoffm.) Arn. Flora 54: 55. 1871.

Verrucaria fuscrobella Hoffm. Deutsch. Fl. 2: 175. 1795.

Thallus of minute, crowded or scattered granules, these forming a usually conspicuous and often rugose and chinky, green-gray or darker, frequently wide-spread, rarely disappearing crust; apothecia small to large, 0.6 to 1.5 mm. in diameter, pale to darker brown and finally black, adnate or sessile, flat with an elevated, and sometimes transversely striate, and usually pruinose exciple, less frequently becoming convex with the exciple rarely becoming covered; hypothecium yellow to yellow-brown; hymenium

pale yellow; paraphyses coherent, semi-distinct to indistinct; asci long-clavate; spores about 7- to 14-celled, 40 to 70 mic. long and 3 to 5 mic. wide.

Collected in Butler and Adams counties. Also reported from Champaign and Hamilton counties. On bark. This fungus appears to be rare in Ohio.

In one specimen, some of the disks are partly or wholly pruinose, but the plant seemed nearer to this than to *Bacidia suffusa* (Fr.) Fink.

4. ***Bacidia schweinitzii*** (Tuck.) Fink Cont. Nat. Herb. 14: 89. 1910.

Biatora schweinitzii Tuck. in Darl. Fl. Cestr. ed. 3. 447. 1853.

Thallus thin and inconspicuous, or becoming thick and more prominent, composed of rounded and often crowded or even heaped granules, these frequently compacted into a continuous or scattered, verrucose and often chinky, green-gray to olivaceous crust; apothecia small to large, 0.6 to 1.75 mm. in diameter, dark brown to black, adnate or sessile, flat or slightly convex, the concolorous or lighter exciple frequently becoming flexuous; hypothecium pale yellow to dark brown; hymenium pale yellow; paraphyses coherent, distinct to semi-distinct; asci long-clavate; spores about 7- to 15-celled, 40 to 70 mic. long and 2.5 to 3.5 mic. wide.

Collected in Fairfield, Hocking, and Adams counties. On bark. Evidently a rare fungus in Ohio.

5. ***Bacidia inundata*** (Fr.) Koerb. Syst. Lich. 187. 1855.

Biatora inundata Fr. Vet. Akad. Handl. 1822: 270. 1822.

Thallus of minute granules, these usually compacted into a thin or rarely thicker, granulate, chinky, or subareolate, ash- or green-gray or darkening, commonly wide-spread, continuous or scattered crust; apothecia minute to middle-sized, 0.2 to 0.75 mm. in diameter, pale brown to finally black, adnate or rarely more or less immersed, usually flat and bordered by the commonly lighter colored exciple, rarely becoming convex, the exciple then finally covered; hypothecium pale to brown; hymenium pale to pale brown; paraphyses coherent, semi-distinct to indistinct; asci clavate to long-clavate, spores 4- to 8-celled, 15 to 40 mic. long and 1.5 to 2.6 mic. wide.

Collected in Butler, Preble, Highland, Adams, Warren, and Lake counties. On various rocks in shaded or open moist places, and also about the moist shaded bases of rocks in dry fields. Also reported from Cuyahoga county and doubtless common in all parts of the State.

6. ***Bacidia incompta*** (Borr.) Anzi, Cat. Lich. Sondr. 70. 1860.

Lecidea incompta Borr. in Sowerby, Engl. Bot. Suppl. 2: pl. 2699. 1834.

Thallus of very minute granules, these forming a continuous or more or less broken, wide-spread, sometimes thick and rugose or rarely even subareolate, or again thin, smooth, more or less mealy, light or darker green-gray, rarely disappearing crust; apothecia minute to middle-sized, 0.3 to 0.75 mm. in diameter, dark brown to black, adnate to sub-sessile,

flat or becoming convex, with a thin and frequently flexuous exciple; hypothecium pale brown to brown; hymenium pale below and pale brown above; paraphyses coherent, semi-distinct to indistinct; asci long-clavate; spores 4- to 12-celled, 18 to 35 mic. long and 1.5 to 3 mic. wide.

Collected in Adams County. On bark. Not previously reported from Ohio, and doubtless rare in the State.

7. **Bacidia umbrina** (Ach.) Br. & Rostr. Bot. Tidssk. 3: 235. 1869.

Lecidea umbrina Ach. Lich. Univ. 183. 1810.

Thallus a rather thick and continuous, or rarely thinner and scattered, subleprose, chinky, rugose-granulate or subareolate, green-gray to dark olive-brown, sometimes largely disappearing crust; apothecia minute to small, 0.25 to 0.6 mm. in diameter, light brown to black, adnate to somewhat immersed, at first flat with a commonly paler exciple, becoming convex with the exciple sometimes covered; hypothecium pale or darker brown; hymenium pale throughout, or tinged brown above; paraphyses coherent, semi-distinct to indistinct; asci long-clavate, or inflated-clavate; spores hamate, or more or less spirally twisted, about 4- to 8-celled, 18 to 30 mic. long and 2 to 3 mic. wide (Fig. 7).

Collected in Preble, Lake, Hocking, and Adams counties. Also examined from Wayne County. On various rocks. Not previously reported from Ohio, but evidently distributed widely in the State.

Buellia De Not. Giorn. Bot. Ital. 21: 195. 1846.

Thallus granulose, verrucose, or areolate, rather better developed than those of the preceding genera as shown in the more frequent verrucose and areolate conditions; apothecia minute to large, sessile to immersed, the disk and the exciple usually black; hypothecium usually brown; hymenium pale to light brown; paraphyses usually distinct; spores brown, 2-celled.

KEY TO THE SPECIES OF BUELLIA

- On rocks 3. *B. turgescens*
 On wood, or on bark.
 On dead wood 1. *B. myriocarpa*
 On bark 2. *B. parasema*

1. **Buellia myriocarpa** (Lam. & DC.) Mudd. Man. Brit. Lich. 217. 1861.

Patellaria myriocarpa Lam. & DC. Fl. ed. 3. 2: 346. 1805.

Thallus a thin and scurfy, smooth or chinky, or thicker and roughened-verrucose, ash- to green-gray, or darkening crust, irregularly spread over small areas, and rarely disappearing; apothecia minute to small, 0.2 to 0.6 mm. in diameter, often numerous, black, adnate, flat and bordered by an exciple, or becoming convex with the exciple sometimes covered; hypothecium dark brown; hymenium pale, or pale below and pale brown above; paraphyses distinct, but sometimes loosely coherent; asci clavate; spores oblong-ellipsoid, 7 to 16 mic. long and 4 to 7.5 mic. wide.

Collected in Butler and Lake counties. On dead wood, especially posts and boards. Also reported from Cuyahoga County. An inconspicuous fungus, doubtless distributed widely in the State.

2. **Buellia parasema** (Ach.) Koerb. Syst. Lich. 228. 1855.

Lichen parasemus Ach. Lich. Suec. 64. 1798.

Thallus usually continuous and smooth, but sometimes becoming thicker and roughened, granulate, chinky, or finally areolate, ash- to green-gray, and darkening, or even yellow-green, usually bordered wholly or in part by a black margin; apothecia small to large, 0.4 to 1.3 mm. in diameter, black, adnate to sessile, or rarely more or less immersed, flat with a prominent, concolorous, sometimes flexuous exciple, or sometimes becoming convex, with the exciple often covered (Fig. 11); hypothecium dark brown; hymenium pale below and pale brown above; paraphyses distinct (Fig. 12), but sometimes loosely coherent; asci clavate (Fig. 13), or rarely inflated clavate; spores oblong to ellipsoid, 10 to 18 mic. long and 5 to 9 mic. wide, rarely 3-celled (Fig. 13).

Collected in Fairfield, Lake, Adams, Highland, Hocking, and Butler counties. Also examined from Morgan, Madison, and Muskingum counties. On bark. Generally distributed in Ohio.

3. **Buellia turgescens** sp. nov.

Thallus a thick, continuous or scattered, flat or verrucose, areolate or subareolate, dull olive-brown, and darkening crust, covering small areas or spreading widely over the substratum, the marginal areoles sometimes lobulate; apothecia minute to small, 0.2 to 0.5 mm. in diameter, immersed to adnate, scattered or clustered, black, flat with the thin concolorous exciple visible, or convex with the exciple covered; hypothecium pale or darker brown; hymenium pale; paraphyses stout, distinct, but often loosely coherent; asci clavate or inflated-clavate; spores brown, 2-celled, oblong to oblong-ellipsoid, 8 to 13 mic. long, and 4 to 6 mic. wide, 8 in each ascus.

Collected in Lake County. On exposed igneous rocks. The type specimen is deposited in the writer's herbarium, and a cotype may be found in the State Herbarium.

This species is a coarser plant than *Buellia turgescens* (Nyl.) Tuck., with much stronger, darker thallus and apothecia on the whole larger.

Rhizocarpon Ram. in Lam. & DC. Fl. Fr. ed. 3. 2: 365. 1805.

Thallus usually verrucose, areolate or subareolate, tending toward squamulose conditions, better developed than in other members of the family, scarcely ever showing granulate conditions, and never disappearing entirely; apothecia also larger than in the other genera, adnate to immersed, usually black, but rarely white-pruinose; hypothecium usually dark brown; hymenium pale to light brown; spores 4-celled to muriform, and pale to brown, various conditions of septation and coloration sometimes appearing in the same hymenium.

KEY TO THE SPECIES OF RHIZOCARPON

- On bark 2. *R. alboatrum*
 On rocks.
 Spores smaller and 4-celled 1. *R. vernicomoideum*
 Spores larger and becoming muriform 3. *R. petraeum*

1. ***Rhizocarpum vernicomoideum*** sp. nov.

Thallus of minute, rounded, scattered or sometimes clustered, straw-colored granules, covering small areas, and usually resting on and limited wholly or in part by a black hypothallus; apothecia minute to small, 0.2 to 0.6 mm. in diameter, black, semi-immersed to adnate, at first flat with a thin somewhat raised exciple, becoming convex with the exciple finally covered; hypothecium brown; hymenium pale or tinged brown below and light brown above; paraphyses coherent, distinct or semi-distinct; asci clavate; spores brown, 4-celled, becoming slightly constricted at the septa, 15 to 18 mic. long and 5 to 7 mic. wide, 8 in each ascus.

Collected at Cantwell Cave in Hocking County. On shaded sandstone, intermingled with an ash-gray, crustose thallus, which appeared like a sterile *Pertusaria*. The type specimen is deposited in the writer's herbarium, and a cotype may be seen in the State Herbarium.

The plant resembles *Buellia vernicoma* Tuck.

2. ***Rhizocarpum alboatrum*** (Hoffm.) Th. Fr. Nov. Act. Reg. Soc. Sci. Ups. III. 3: 337. 1861.

Lichen alboater Hoffm. Lich. Icon. 30. 1784.

Thallus ash-gray varying toward white, commonly spread widely over the substratum as a continuous or rarely scattered or disappearing, smooth, chinky, verrucose-areolate, or sometimes mealy crust; apothecia small to middle-sized, 0.35. to 1 mm. in diameter, adnate or immersed, dull black and often more or less white-pruinose, flat with the black exciple visible, or convex when the exciple often becomes covered; hypothecium brown to black-brown; hymenium pale or tinged brown; paraphyses distinct, but sometimes coherent; asci clavate; spores oblong-ellipsoid. brown, 4-celled to muriform, 12 to 22 mic. long and 4 to 9 mic. wide (Fig.8), 8 in each ascus.

Collected in Butler, Preble, Ross, and Highland counties. On bark, especially elm bark. Also reported from Ottawa County. Rare but doubtless distributed widely in the State.

3. ***Rhizocarpum petraeum*** (Wulf.) Koerb. Syst. Lich. 260. 1855,

Lichen petraeus Wulf. in Jacq. Coll. Bot. 3: 4. pl. 6. f. 2a. 1789.

Thallus an ash or green-gray crust, or varying toward brown or brown-black, smooth to more commonly roughened, chinky to areolate, continuous or scattered, of moderate thickness, often widely and irregularly disposed on the substratum; apothecia small to large, 0.5 to 1.3 mm. in diameter, immersed to adnate, black-brown to black, flat with the concolorous

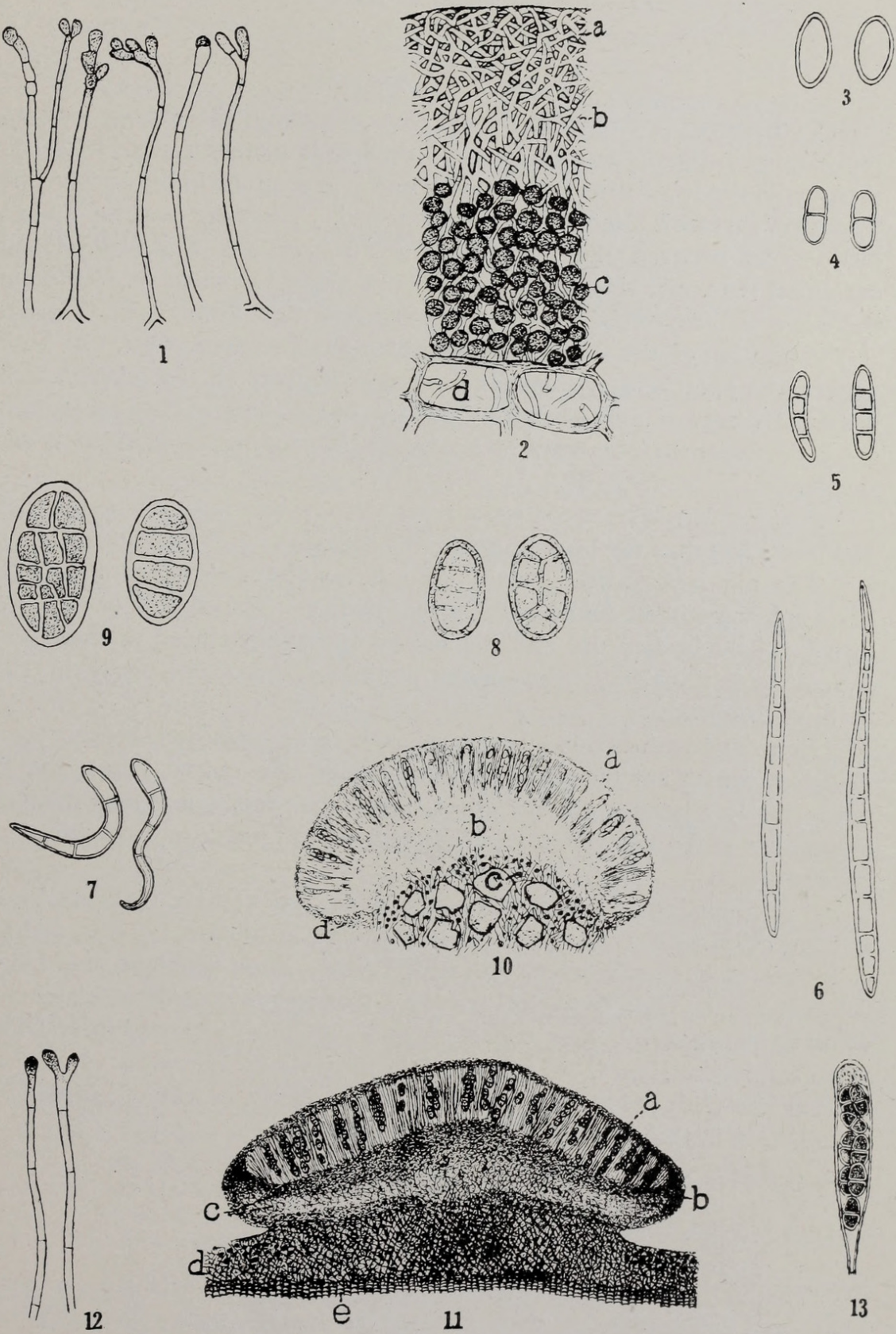
exciple visible, or becoming somewhat convex, with the exciple often covered; hypothecium dark brown; hymenium pale, or tinged brown, especially above; paraphyses coherent, semi-distinct; asci clavate or inflated-clavate; spores oblong-ellipsoid, 4 celled to muriform, hyaline to finally brown, 15 to 40 mic. long and 7 to 18 mic. wide. 8 in each ascus (Fig. 9).

Collected in Lake, Hocking, and Ross counties. Also examined from Summit, Vinton, and Ashtabula counties. On rocks. Rare but widely distributed in the State

EXPLANATION OF PLATE XIII

- Fig. 1. Five paraphyses of *Rhizocarpon alboatrum* to illustrate types of simple and branched forms found in the same hymenium. X 450.
- Fig. 2. A section of the thallus of *Bacidia rubella* and two cells of the woody substratum: a, the upper densely interwoven portion of the thallus; b, part of the less densely interwoven portion below; c, the algal-host cells; d, one of the cells of the woody substratum and three hyphal rhizoids within it. X 450.
- Fig. 3. Spores of *Lecidea enteroleuca* to illustrate the simple, hyaline type. X 760.
- Fig. 4. Spores of *Biatorina chalybeia* to illustrate the 2-celled, hyaline type. X 760.
- Fig. 5. Spores of *Bilimbia trachona* to illustrate the several-celled, hyaline, fusiform or dactyloid type. X 760.
- Fig. 6. Spores of *Bacidia fuscorubella* to illustrate the several-celled, hyaline, acicular type. X 760.
- Fig. 7. Spores of *Bacidia umbrina* to illustrate the several-celled, hyaline, hamate or spirally twisted type. X 760.
- Fig. 8. Spores of *Rhizocarpon alboatrum* to illustrate the several-celled to many-celled and muriform, hyaline to brown type. X 760.
- Fig. 9. Spores of *Rhizocarpon petraeum* of the same type as those shown in the last figure, but larger, and usually composed of more cells. X 760.
- Fig. 10. A vertical section through an apothecium of *Lecidea rupestris*: a, the hymenium, composed of asci and paraphyses; b, the hypothecium; c, the mycelium, the cells of the algal host, and particles of the limestone on which the plant was growing; d, the weak, light-colored, covered exciple. X 79.
- Fig. 11. A vertical section through an apothecium of *Buellia parasema*, the thallus below, and a portion of the woody substratum: a, the hymenium, composed of asci and paraphyses; b, the strongly developed, dark colored exciple; c, the dark colored hypothecium; d, the thallus, composed of interwoven hyphae, and enclosing cells of the algal host, a portion of the woody substratum. X 79.
- Fig. 12. One branched and one unbranched paraphysis of *Buellia parasema*. X 450.
- Fig. 13. An ascus of *Buellia parasema*, containing 8 spores. X 450.

The figures were outlined with camera lucida and drawn on the table, close to the base of the microscope, 100 mm. below the stage. They were reduced one-half in making the plate. Figures 2, 10, and 11 are partly diagrammatical.





Fink, Bruce. 1921. "The Ascomycetes of Ohio IV: The Lecideaceae." *Bulletin* (10), 334–353.

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