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vol.19  
no. 2  
1949

Hypocreales of Iowa

I. S. Fitzgerald

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v.19, no.2



# State University of Iowa Studies in Natural History

G. W. Martin, Editor

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Volume XIX

Number 2

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## HYPOCREALES OF IOWA

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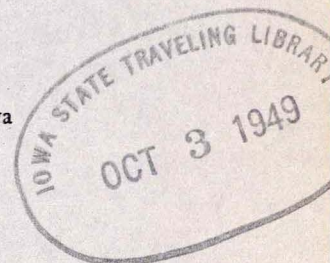
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Published by the University, Iowa City, Iowa

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Study Series No. 422

Published by the University, Iowa City, Iowa

1949

## HYPOCREALES OF IOWA

The Hypocreales is an order of pyrenomycetous fungi separated from the closely related Sphaeriales by the brightly colored, membranous or fleshy perithecia and often stromata as compared with the dull, leathery or carbonaceous perithecia and stromata of the Sphaeriales. The two orders form a parallel series, ranging from forms in which the perithecia are free and superficial, through those which are partially imbedded in a subiculum or stroma to those in which they are entirely immersed in a well-developed and frequently stalked stroma.

The Hypocreales are most abundant in the tropics but a number of genera and species are represented in the northern temperate regions and since many of these are common and conspicuous they may be regarded as among the better known fungi of the area. Extensive treatments are available in the literature; those of Ellis and Everhart (1892) and Seaver (1910), for the North American species, of Petch (1938) for the British species and of Lindau (1897) for the group as a whole have proved most useful. Nevertheless, the distribution of many species is incompletely recorded and it seems desirable to review and record the occurrence of the members of the group in representative areas. The following account of the Hypocreales of Iowa cannot be supposed to be complete. It does attempt to bring together the records of species previously reported from the State and to add to the list certain species not previously recorded.

Fungi of this group show great difference so far as habitat is concerned. Some are parasitic on other fungi, on lichens, or on plants. Others are parasitic on adult insects or insect larvae or pupae, while the great majority are saprobic, living on soil or decaying fungi and plant parts.

Conidial stages are known for a number of the species and are in some cases familiar by their imperfect names. For example, the conidial stage of *Nectria cinnabarina* Fries is *Tubercularia vulgaris* Fries, that of *Hypocrea rufa* Fries is *Trichoderma lignorum* (Fries) Harz, and that of *Gibberella pulicaris* (Fries) Sacc. is *Fusarium roseum* Link.



Seaver (1910) lists 158 species of Hypocreales divided among 39 genera as occurring in North America. In the present report 39 species, representing 16 genera, are listed as occurring in Iowa. The ranges of many other species as given by Seaver suggest that additional species occur in Iowa but, if so, they have not as yet been reported.

There are several different systems of classification in use. Lindau (1897) includes all species in a single family, but divides it into six subfamilies. Petch (1938), working with the British Hypocreales, and Seaver (1910), with the American forms, divide the order into two families, one (Nectriaceae) having the perithecia superficial, the other (Hypocreaceae) having the perithecia immersed in a stroma.

The present work was suggested by Professor G. W. Martin and was done under his direction, based on material in the mycological collection of the State University of Iowa.

#### Order Hypocreales

Perithecia brightly colored (red, white, yellow, purple or light brown) never black except in aged specimens. Walls of perithecia membranous or fleshy, never carbonaceous. Stroma, when present, bright-colored, fleshy or consisting of a byssoid subiculum.

- a. Perithecia entirely superficial, stroma present or absent ..... I. Nectriaceae
- a. Stromatic bases always present; the perithecia partially to entirely immersed ..... II. Hypocreaceae

#### FAMILY I. NECTRIACEAE

Stroma present or absent; perithecia separate, superficial or erumpent, never immersed; the perithecia may be scattered on the host or substratum with no stroma or may be cespitose on or about a well-developed tuberculate stroma. The clusters of perithecia may be so dense as to obscure the stroma but in such case its presence is indicated by the grouping of the perithecia.

#### Key to genera

- a. Ascospores 1-septate ..... b.
- a. Ascospores more than 1-septate ..... e.
- b. Spores brown ..... 1. *Letendraea*
- b. Spores hyaline ..... c.

- c. Perithecia violet or dark blue by transmitted light, appearing black to naked eye ..... 4. *Gibberella*
- c. Perithecia bright-colored ..... d.
- d. Perithecia cespitose on a well-developed stroma ..... 2. *Nectria*
- d. Stroma absent ..... 3. *Dialonectria*
- e. Ascospores ellipsoid or fusoid, transversely septate but never muriform ..... f.
- e. Ascospores muriform ..... h.
- f. Perithecia violet or blue by transmitted light ..... 4. *Gibberella*
- f. Perithecia bright-colored, red or yellow ..... g.
- g. Perithecia cespitose on or surrounding a stroma ..... 5. *Scoleconectria*
- g. Stromatic base absent ..... 6. *Ophionectria*
- h. Ascospores hyaline ..... 7. *Thyronectria*
- h. Ascospores brown ..... 8. *Thyronectroidea*

#### 1. *Letendraea* Sacc. Michelia 1: 43. 1877.

Stroma absent; perithecia superficial, separate, globose or ovate; asci 8-spored; ascospores 1-septate, brown when mature.

- 1. *Letendraea luteola* Ellis and Ev. Proc. Phila. Acad. 1895: 415. 1895.

Perithecia up to 600 $\mu$  in diameter, separate but gregarious on a blackish-brown subiculum, reddish brown, blackening with age; asci cylindrical, 95-125  $\mu$  in length; ascospores uniseriate, 1-septate, straight or slightly curved 10-12  $\times$  5 $\mu$ .

This species was noted from Iowa and illustrated by Martin (1940). Aside from the Iowa collection, this species is known only from the type collection made by Morgan in Ohio.

#### 2. *Nectria* Fries, Summa Veg. Scand. 387. 1849.

Stroma erumpent or superficial, tuberculate or depressed; perithecia separate but cespitose on the stroma; asci cylindrical or clavate, 8-spored; ascospores hyaline, 1-septate.

The genus *Nectria* as established by Fries (1849) and adopted by Saccardo (1883) included a large group of species which have since been segregated to various other genera of the Nectriaceae. Saccardo listed seven subgenera, assigning the stromatic species to the subgenus *Eu-Nectria* and the non-stromatic species to the subgenera *Dialonectria* and *Hyphonectria*. Cooke (1884) was the first to



use the genus in a restricted sense. He used it to refer to the stromatic species and raised Saccardo's subgenus *Dialonectria* to generic rank, placing in the latter genus the non-stromatic species previously referred to *Nectria*.

Seaver (1909) took *Nectria Peziza* as the type of the genus. Since that is a non-stromatic species he stated that *Nectria* must properly refer to those species without a stroma. He then set up a new genus, *Creonectria*, to which he referred the stromatic species. Clements and Shear (1931) list *Nectria cinnabarina* as the type of *Nectria*. Since this is listed by both Cooke and Saccardo as a true *Nectria* it would seem to be a good choice. The treatment by Cooke, referring the stromatic species to *Nectria* and the non-stromatic forms to *Dialonectria*, is followed in this discussion.

1. *Nectria cinnabarina* (Fries) Fries Summa Veg. Scand. 388. 1849. Fig. 1.

*Sphaeria cinnabarina* Fries, Syst. Myc. 2: 412. 1823.

*Cucurbitaria cinnabarina* Greville, Scot. Crypt. Fl. 3: 135. 1825.

*Sphaeria ochracea* Fries, El. Fung. 2: 79. 1828.

*Sphaeria Celastris* Fries, El. Fung. 2: 81. 1828.

*Sphaeria dematiosa* Schw. Trans. Am. Phil. Soc. II. 4: 205. 1832.

*Nectria ochracea* Fries, Summa Veg. Scand. 387. 1849.

*Nectria Russellii* Berk. & Curt.; Berk. Grevillea 4: 45. 1875.

*Nectria offuscata* Berk. & Curt.; Berk. Grevillea 4: 45. 1875.

*Nectria nigrescens* Cooke, Grevillea 7: 50. 1878.

*Nectria Sambuci* Ellis & Ev. Proc. Phila. Acad. 1890: 246. 1890.

*Nectria Meliae* Earle, Bull. Torrey Club 25: 364. 1898.

*Nectria purpurea* Wilson & Seaver, Jour. Myc. 13: 51. 1907.

*Creonectria purpurea* Seaver, Mycologia 1: 184. 1909.

Stroma tubercular, fleshy, erumpent, at first pink or orange-yellow, bearing a conidial layer; perithecia developing under conidial layer, at first cinnabar-red, becoming dull brick-red or brown on drying, globose to subglobose, rough, with a naked papillate ostiole; asci cylindro-clavate, 50-90 x 7-12  $\mu$ ; ascospores biserial, elliptical, 1-septate, straight or slightly curved, 12-20 x 4-6  $\mu$ . The conidial stage is *Tubercularia vulgaris* Fries.

This species is common throughout the United States, occurring on deciduous trees and shrubs of many kinds. In Iowa it is particularly abundant on elm and maple. We have one collection on aspen.

3. *Dialonectria* Cooke, Grevillea 12: 77. 1884.

Perithecia superficial, separate, without any continuous subiculum or stroma although individual perithecia may be surrounded near the base by a scant mycelial growth; asci 8-spored; ascospores hyaline, 1-septate.

- a. Perithecia pale-yellow to orange, usually collapsing . . . .

1. *D. Peziza*

- a. Perithecia blood-red, shining, usually entire . . . .

2. *D. sanguinea*

1. *Dialonectria Peziza* (Fries) Cooke, Grevillea 12: 110. 1884. Fig. 2.

*Sphaeria Peziza* Fries, Syst. Myc. 2: 452. 1823.

*Nectria Peziza* Fries, Summa Veg. Scand. 388. 1849.

*Peziza vulpina* Cooke, Hedwigia 14: 82. 1875.

*Nectria aurea* Cooke, Grevillea 8: 9. 1879; Not N. *aurea* Greville 1823.

*Nectria epigaea* Cooke, Grevillea 8: 10. 1879.

*Nectria riminicola* Cooke, Grevillea 11: 108. 1883.

*Dialonectria vulpina* Cooke, Grevillea 12: 83. 1884.

*Nectria perforata* Ellis & Holway, Bull. Geol. Nat. Hist. Surv. Minn. 3: 33. 1887.

*Nectria vulpina* Ellis & Ev. N. Am. Pyrenom. 103. 1892.

*Nectria betulina* Rehm, Ann. Myc. 3: 519. 1906.

Perithecia superficial, scattered, gregarious, or occasionally in dense clusters, at first globose or subglobose, pale yellow, then orange, becoming brown and collapsing on drying, at first with pale yellow or white hyphae arising from the sides and bases and extending over the substratum, later becoming naked, 250-500  $\mu$  in diameter; asci cylindro-clavate, 50-90 x 6-10  $\mu$ ; ascospores broadly ellipsoid, ends rounded, thick-walled, 1-septate, not constricted at the septum, hyaline, 9-14 x 4-6  $\mu$ , the fully mature spores marked by distinct longitudinally spiral striations.

Generally distributed throughout the United States on decaying stumps and logs or fungi. Collections have been made in Iowa on poplar, aspen and elm.

Longitudinal striations have not previously been reported on spores of this species. A check of several specimens in our herbarium including the specimen distributed by Sydow as *Mycotheca* Germ. 388, showed the striations plainly on fully mature spores.



2. *Dialonectria sanguinea* (Grev.) Cooke, Grevillea 12: 110. 1884.

Fig. 3

*Sphaeria sanguinea* Grev. Scott. Crypt. Flora 1: 22. 1823.

*Sphaeria episphaeria* Grev. Scot. Crypt. Flora 1: 22. 1823.

*Sphaeria Purtoni* Grev. Scot. Crypt. Flora 1: 23. 1823.

*Nectria sanguinea* Fries, Summa Veg. Scand. 388. 1849.

*Nectria episphaeria* Fries, Summa Veg. Scand. 388. 1849.

*Nectria Purtoni* Currey, Trans. Linn. Soc. 22: 282. 1858.

*Nectria viticola* Berk. & Curt.; Berk. Grevillea 4: 45. 1875.

*Nectria microspora* Cooke & Ellis, Grevillea 5: 53. 1876.

*Nectria athroa* Ellis & Ev. Proc. Phila. Acad. 1890: 247. 1890.

Perithecia scattered or gregarious, smooth, with papillate apex, blood-red, becoming dark red, ovoid or subconical, 150-250  $\mu$  in diameter; asci cylindrical, 55-80 x 4-7  $\mu$ ; ascospores subfusoid or oblong-oval, the lower cell of the pair often appearing more acute, 1-septate, hyaline, becoming pale-yellow, 10-12 x 4-6  $\mu$ .

Widely distributed throughout the United States on rotten wood and sphaeriaceous fungi. In Iowa it has been found on oak, elm, hickory and *Hypoxylon*.

4. *Gibberella* Sacc. Michelia 1: 43. 1877.

Perithecia scattered or cespitose on an erumpent stroma, dark-blue, appearing black to the unaided eye; asci clavate, 8-spored; spores fusoid, 1-5 septate.

a. Ascospores predominantly 1-septate ..... 1. *G. moniliformis*

a. Ascospores 3-septate ..... b.

b. Ascospores 24-30  $\mu$  in length, on *Morus* .. 2. *G. Moricola*

b. Ascospores 16-22  $\mu$  in length on woody and herbaceous stems other than *Morus* ..... 3. *G. pulicaris*

1. *Gibberella moniliformis* Wineland, Jour. Agr. Res. 28: 920. 1924.

"Perithecia scattered or gregarious, ovoid to sub-conical, free on the surface of the medium or embedded in mycelium, or in a tubercular plectenchymatic stroma, ostiolate, rarely 2-ostiolate, 225 to 300 by 300 to 375  $\mu$ ; peridium of cells fairly uniform in size, and fairly smooth, blue-black when viewed macroscopically, dark-blue by transmitted light; no paraphyses observed; ascospores 8, arranged irregularly in two rows, practically straight, fusiform to ellipsoid, rounded at the ends, often constricted at the septa, pale ochraceous

salmon in masses, 1-3 septate, the one-septate predominating, 3.9 to 4.8 by 15 to 19.  $\mu$ ."

The description given is that of Wineland cited above, based on culture. This species was reported for Iowa by Gilman and Archer (1929) as a parasite of corn. No specimens have been seen. The imperfect stage is *Fusarium moniliforme* Sheldon.

2. *Gibberella moricola* (Ces. & De Not.) Sacc. Michelia 1: 317. 1877.

*Botryosphaeria moricola* Ces. and De Not. Soc. Crypt. Ital. Comm. 1: 212. 1863.

*Gibbera Mori* Fuckel, Jahrb. Nass. Ver. Nat. 23-24: 168. 1870.

Stroma erumpent, pulvinate, yellowish, 1-1.5 mm. long; perithecia cespitose, subglobose, 165 x 210  $\mu$ , black in direct light, dark-blue by transmitted light; asci cylindrical, short-stalked, 8-spored; ascospores obliquely 1-seriate, oblong to fusiform, 24-30 x 6-7  $\mu$ , 3-septate, constricted at the septa, hyaline.

The above description is adapted from Saccardo (1883). The fungus was reported for Iowa by Gilman and Archer (1929) as a parasite of mulberry. Examination of a specimen of Sydow, *Mycotheca Germ. 1241* showed only immature asci and *Fusarium* conidia.

3. *Gibberella pulicaris* (Fries) Sacc. Michelia 1: 43. 1877. Fig. 4.

*Sphaeria pulicaris* Fries, Kunze & Schm. Mycol. Hfte. 2: 37. 1823.

*Sphaeria Saubinetii* Dur. and Mont.; Dur. Expl. Sci. Alger. Bot. 1: 479. 1849.

*Gibbera pulicaris* Fries, Summa Veg. Scand. 402. 1849.

*Gibbera Saubinetii* Mont. Syll. Crypt. 252. 1856.

*Botryosphaeria pulicaris* Ces. & De Not. Soc. Crypt. Ital. Comm. 1: 212. 1863.

*Gibberella Saubinetii* Sacc. Michelia 1: 513. 1879.

Perithecia cespitose on a brown stroma or scattered and solitary, globose or ovoid, with papillate ostioles, walls slightly rough, blue by transmitted light, up to 300  $\mu$  in diameter; asci clavate, 75-105 x 8-12  $\mu$ ; ascospores oval or fusoid, straight or slightly curved, hyaline, smooth, 3-septate, sometimes slightly constricted at the septa, 16-22 x 5-7.5  $\mu$ .

Occurring from New Jersey to North Dakota and Kansas and in West Virginia on cornstalks, herbaceous stems, bark and dead wood of various trees and shrubs; reported in England on *Pteris*.



The specimen in our herbarium was isolated from wood as a *Fusarium* and fruited on potato dextrose agar in the laboratory. Reported by Gilman and Archer (1929) as a parasite of oats, barley, rye, wheat and corn in Iowa.

5. *Scoleconectria* Seaver, Mycologia 1: 197. 1909.

Perithecia superficial on or surrounding a tubercular or depressed stroma; asci 2-8-spored; spores 3-many-septate, fusoid or filiform, hyaline or sub-hyaline.

- a. Spores fusoid or subellipsoid .....1. *S. Atkinsonii*  
a. Spores filiform .....2. *S. scolecospora*

1. *Scoleconectria Atkinsonii* (Rehm) Seaver, Mycologia 1: 201. 1909. Fig. 5.

*Calonectria Atkinsonii* Rehm, Ann. Myc. 2: 178. 1904.

Stroma erumpent, bearing perithecia so densely clustered that often only the ostioles are distinct; perithecia globose or somewhat ovate, tapering into a prominent, papillate ostiole, lemon-yellow, darkening to greenish-black, wooly-tomentose except for the bare black ostiole, asci clavate, 90-150 x 12-15  $\mu$ , 8-spored; ascospores biseriate, fusoid, slightly curved, subhyaline, 3-septate and constricted at the middle septum, 27-38 x 7-8  $\mu$ .

Our single specimen was collected on deciduous wood by Prof. Macbride and the place of collection was not given but since it was his custom to indicate place of collection on all but local specimens, it is assumed that it was collected in Iowa. Other collections have been made in Ontario and New York on maple, linden and hawthorn.

2. *Scoleconectria scolecospora* (Bref.) Seaver, Mycologia 1: 198. 1909.

*Ophionectria scolecospora* Bref. Unters. Gesammt. Myk. 10: 178. 1891.

Clusters of perithecia regular, rounded; individual perithecia dull-red, at first slightly furfuraceous, becoming quite smooth, nearly globose, finally collapsing; asci clavate to cylindric, 60-80 x 8-10  $\mu$ , filled with numerous minute, spore-like bodies which often obscure the true spores; ascospores cylindric, curved, many-septate, with the septa transverse or extending irregularly, 40-50 x 2.5-3  $\mu$ .

Occurring on various species of *Pinus* from New Jersey to Maryland and California. Reported for Iowa by Gilman and Archer (1929) on *Pinus sylvestris*.

6. *Ophionectria* Sacc. Michelia 1: 323. 1878.

Perithecia superficial, separate, scattered or gregarious; asci cylindric to clavate, 8-spored; ascospores elongate-fusoid or approaching filiform, many-septate.

1. *Ophionectria cerea* (Berk. & Curt.) Ellis & Ev. N. Am. Pyrenom. 118. 1892. Fig. 6.

*Sphaeria cerea* Berk. & Curt. Grevillea 4: 108. 1876.

*Calonectria cerea* Sacc. Syll. Fung. 2: 551. 1883.

*Nectria fulvida* Ellis & Ev. Jour. Myc. 1: 140. 1885.

*Dialonectria fulvida* Ellis & Ev. Jour. Myc. 2: 136. 1886.

*Ophionectria Everhartii* Ellis & Galw. Jour. Myc. 6: 32. 1890.

Perithecia scattered or gregarious, 150-175  $\mu$  in diameter, dull-yellow becoming yellow-brown with age, nearly globose, with a papillate ostiole; asci broadly cylindrical, 65-80 x 8-12  $\mu$ ; ascospores fusoid, straight or slightly curved, ends acute, hyaline or subhyaline, 7-10 septate, 35-50 x 3-3.5  $\mu$ .

Occurring on old fungi from Newfoundland and Ontario to South Carolina.

The specimen in our herbarium is referred to this species with some hesitation. The spores are all 7-septate and range in size from 24-37 x 4-5  $\mu$ , somewhat shorter and broader than the size as given by Ellis and Everhart. The ostiole in our specimen is drawn out into a prominent, slender neck. The specimen seems to fit the description of *Calonectria obtecta* Rehm (1900) equally well, although that species is reported only from Brazil.

7. *Thyronectria* Sacc. Grevillea 4: 21. 1875.

Stromata erumpent or partially erumpent with the perithecia borne superficially in dense clusters; perithecia subglobose; asci 8-spored; ascospores hyaline, many-septate, muriform, often accompanied by smaller spore-like bodies.

a. Perithecia red or brown .....b.

a. Perithecia greenish .....c.

b. Perithecia dark-brown, spores 10-15 x 6-9  $\mu$

..... 1. *T. denigrata*



- b. Perithecia reddish, spores  $16-20 \times 7-8 \mu$   
 ..... 2. *T. berolinensis*  
 c. Perithecia subsuperficial, minute ..... 3. *T. Xanthoxylia*  
 c. Perithecia entirely superficial, up to  $500 \mu$  in diameter  
 ..... 4. *T. virens*
1. *Thyronectria denigrata* (Wint.) Seaver, Mycologia 1: 204.  
 1909. Fig. 7.

*Pleonectria denigrata* Wint. Bull. Torrey Club 10: 49. 1883.

Stromata brownish, erumpent; perithecia forming dense rounded clusters 2-5 mm. in diameter, individual perithecia globose, brown to black with shining black ostioles,  $350-450 \mu$  in diameter; asci broadly cylindrical to clavate,  $70-80 \times 10 \mu$ ; ascospores oval, muriform, with 3-5 transverse septa, hyaline or pale yellow,  $10-15 \times 6-9 \mu$ .

Occurring on branches of *Gleditsia triacanthus* from Delaware to Kentucky and Kansas. Rarely collected in Iowa.

2. *Thyronectria berolinensis* (Sacc.) Seaver, Mycologia 1: 205.  
 1909. Fig. 8.

*Pleonectria berolinensis* Sacc. Michelia 1: 123. 1878.

*Pleonectria Ribes* Karst. Medd. Soc. Faun. Fl. Fenn. 5: 42. 1879.

Perithecia erumpent, superficial on a subimmersed stroma, brick-red to brown,  $300-500 \mu$  in diameter, depressed-globose, becoming pezizoid with age; asci cylindro-clavate,  $80-90 \times 9-10 \mu$ ; ascospores ellipsoid, muriform, with 5-7 transverse septa,  $16-20 \times 7-8 \mu$ .

Occurring on dead branches of *Ribes* and *Prunus* from Massachusetts to Montana and Colorado. Our four collections are on *Ribes*.

3. *Thyronectria Xanthoxylia* (Peck) Ellis & Ev. N. Am. Pyrenom. 92. 1892. Fig. 9.

*Valsa Xanthoxylia* Peck, Ann. Rep. N.Y. State Mus. 31: 49. 1879.  
*Fenestella Xanthoxylia* Sacc. Syll. Fung. 2: 332. 1883.

Perithecia bursting through slight longitudinal slits in the bark but not rising above the bark, minute, dark-red, covered by a greenish-yellow furfuraceous coat which also fills the spaces between the perithecia; ostioles black, obtuse; asci broadly clavate,  $60-75 \times 10-15 \mu$ , 8-spored; ascospores slightly yellowish, oval or peanut-shaped, muriform with 5-6 transverse septa,  $18-27 \times 7-9 \mu$ .

Collected in Iowa on wild crab; rare.

Our single collection is labelled *Thyronectria Patavina*, but corresponds in every way with the specimen of *Thyronectria Xanthoxylia* in Ellis & Everhart, North American Fungi 3310. Seaver (1909) unites *T. Xanthoxylia* and *T. virens* with *T. pyrrochloa*, but the differences between the two species seem sufficiently great to warrant separation. The only other report of *T. Xanthoxylia* (as such) is from New York State.

4. *Thyronectria virens* Hark. Ellis & Ev. N. Am. Pyrenom. 92. 1892.  
 Fig. 10.

Perithecia cespitose on a reddish-brown erumpent stroma, entirely superficial, globose, up to  $500 \mu$  in diameter, dark-red, covered by large yellow-green scales, ostioles black, papillate; asci clavate,  $85-115 \times 14-17 \mu$ ; ascospores hyaline, oval, muriform, with 3-6 transverse septa,  $18-23 \times 8-11 \mu$ .

Reported from Connecticut, California and Canada on *Rhus* and dead ash. Our one collection is on deciduous wood. Rare in Iowa.

8. *Thyronectroidea* Seaver, Mycologia 1: 206. 1909.

Perithecia erumpent as in *Thyronectria*; asci cylindro-clavate, 8-spored; ascospores muriform, becoming dark-brown.

1. *Thyronectroidea chrysogramma* (Ellis & Ev.) Seaver, Mycologia 1: 206. 1909. Fig. 11.

*Thyronectria chrysogramma* Ellis & Ev. Proc. Acad. Phila. 1890: 245. 1890.

*Mattiolia chrysogramma* Sacc. Syll. Fung. 9: 993. 1891.

Perithecia erumpent, forming lines 1-2 rows wide on the inner bark of the host, ovoid,  $250-500 \mu$  in diameter, clothed with a greenish-yellow furfuraceous coat, ostioles bare and black; asci cylindro-clavate,  $125-150 \times 16-18 \mu$ , 8-spored; ascospores ellipsoid, muriform, with 7-10 transverse septa, at first hyaline, becoming dark-brown,  $25-39 \times 10-14 \mu$ .

Reported from Ontario to New York and Kansas on American elm. Rare in Iowa, our single collection being on maple.

## FAMILY II. HYPOCREACEAE

Perithecia partially or entirely immersed in a conspicuous, bright-colored stroma which may be seated directly upon the substratum or formed from a sclerotium in the body of an insect, fung-



us, or plant, and which may be effuse or patellate and fleshy or cottony.

#### Key to genera

- a. Stroma seated directly upon the substratum .....b.
- a. Stroma arising from a sclerotium .....f.
  - b. Asci 16-spored .....c.
  - b. Asci 8-spored .....d.
- c. Spores hyaline .....1. *Hypocrea*
- c. Spores dark-colored .....2. *Chromocrea*
  - d. Spores filiform; parasitic on grass stems .....5. *Typhodium*
  - d. Spores ellipsoid or fusiform .....e.
- e. Spores simple or doubtfully 1-septate, colored .....3. *Chromocreopsis*
- e. Spores 1-septate, hyaline .....4. *Hypomyces*
  - f. Sclerotia formed in insects or fungi .....6. *Cordyceps*
  - f. Sclerotia formed in tissues of vascular plants .....g.
- g. Sclerotia formed in ovaries, stroma long-stipitate .....7. *Claviceps*
- g. Sclerotia formed in the stems or fruiting axes, stroma short-stipitate or sessile .....8. *Balansia*

#### 1. *Hypocrea* Fries, Syst. Orb. Veg. 104. 1825.

Stroma patellate or effuse; perithecia immersed; asci cylindrical, at first 8-spored, finally 16-spored; spores globose or subglobose, hyaline.

- a. Stroma effuse, spreading irregularly over the substratum .....b.
- a. Stroma patellate, definitely outlined .....c.
  - b. Forming rings on cups of *Cyathus* .... 1. *H. latizonata*
  - b. Occurring on old wood or on *Exidia* .. 2. *H. sulphurea*
- c. Stroma blackish .....3. *H. Schweinitzii*
- c. Stroma red or brown .....d.
  - d. Stroma wine-red .....4. *H. scutellaeformis*
  - d. Stroma rufous-brown to dark-brown.....5. *H. rufa*

#### 1. *Hypocrea latizonata* Peck, Ellis & Ev. N. Am. Pyrenom. 79. 1892.

Stroma consisting of a white to cream or pinkish subiculum which forms a band 2-6 mm. wide around the outside of the cups

of *Cyathus*; perithecia immersed with the brownish necks protruding; asci cylindric, 60-75 x 4  $\mu$ ; ascospores hyaline, 3-3.5  $\mu$  in diameter.

Reported from Ohio and Indiana and collected on several occasions in Iowa.

#### 2. *Hypocrea sulphurea* (Schw.) Sacc. Syll. Fung. 2: 535. 1883. Fig. 12.

*Sphaeria sulphurea* Schw. Trans. Am. Phil. Soc. II. 4: 193. 1832.

Stroma broadly effuse, irregular, spreading over several centimeters of substratum, white in early stages, becoming bright lemon-yellow, tending toward ochraceous in dried specimens, the margin pallid; perithecia immersed, ovoid, slightly darker than the stroma, the ostioles giving a pitted effect to the stroma; asci cylindrical, 75-100 x 5-6  $\mu$ , 16-spored; ascospores globose, 4-4.5  $\mu$  in diameter, or frequently the lower of each pair oval, 3-4 x 4.5-6  $\mu$ .

Widely distributed from North Dakota east and south; found on bark and on *Exidia glandulosa* Fries. Common in Iowa, being represented in our herbarium by numerous collections on *Exidia* as well as on old bark where there is no evidence of *Exida*.

There seems to be little difference between *Hypocrea sulphurea* and *Hypocrea citrina* Fries as the two species are described in the literature. The original description of *H. sulphurea* gives no information about asci or spores, this having been added by later workers. Saccardo (1883) lists it as a dubious species, rare and resembling *H. citrina*. The latter species is listed by Ellis and Everhart (1892) as common throughout the United States and Canada. Seaver lists them as distinct species, but it seems highly probable that the two names are synonyms and the species should be designated as *Hypocrea citrina*, the name *Sphaeria citrina* having been used by Fries (1823).

#### 3. *Hypocrea Schweinitzii* (Fries) Sacc. Syll. Fung. 2: 522. 1883.

*Sphaeria Schweinitzii* Fries, Elenchus 2: 60. 1828.

*Sphaeria rigens* Fries, Elenchus 2: 61. 1828.

*Sphaeria sublobata* Schw. Trans. Amer. Phil. Soc. II. 4: 194. 1832.

*Sphaeria contorta* Schw. Trans. Amer. Phil. Soc. II. 4: 194. 1832.

*Hypocrea contorta* Berk. & Curt. Grevillea 4: 14. 1875.

*Hypocrea rigens* Sacc. Michelia 1: 301. 1878.

Stromata gregarious, lenticular, centrally attached, margin free



and sometimes lobed, 2-10 mm. in diameter, black with a touch of green, surface slightly roughened by the protruding ostioles, internally white; perithecia globose, 150-175  $\mu$  in diameter; asci cylindrical, 60-75 x 4-5  $\mu$ , spores globose, hyaline, smooth, 3.5  $\mu$  in diameter.

Widely distributed throughout North America on wood and bark of various kinds; very commonly collected in Iowa.

Petch (1935, 1937) discusses this fungus under the name of *Hypocrea lenta*. The latter name is used by Seaver (1910) to refer to *H. Schweinitzii*, but according to the account by Petch the fungus described by Tode as *Sphaeria lenta* and later referred to *Hypocrea lenta* by Berkley and Broome is green-spored.

4. *Hypocrea scutellaeformis* Berk. & Rav.; Rav. Fung. Car. 31. 1855.

Stromata scattered or gregarious, patellate, up to 4 mm. in diameter, wine-colored with a white, free margin, becoming light-brown on drying, surface only slightly roughened by the ostioles, internally loose and cottony in texture; asci 60-75 x 4  $\mu$ ; ascospores globose, 2  $\mu$  in diameter.

This species has previously been known only from the type collection from South Carolina. Our collection was made in Iowa City on box-elder in December 1941.

5. *Hypocrea rufa* Fries Summa Veg. Scand. 383. 1849. Fig. 13. *Sphaeria rufa* Fries, Syst. Myc. 2: 335. 1823.

Stroma patellate, 2-10 mm. in diameter, occasionally confluent and irregular but usually rounded and definite in form, at first rufous-brown with a white margin, later becoming entirely rufous-brown and darkening to almost black, the surface minutely roughened by the slightly protruding necks of the perithecia; perithecia globose, 200  $\mu$  in diameter; asci cylindrical, 75-100 x 4-5  $\mu$ ; ascospores globose, 3.5-4.5  $\mu$  in diameter, or oval, 5-6 x 3.5-4  $\mu$ , hyaline, minutely warted.

Widely distributed throughout North America on wood and old fungi. Commonly collected in Iowa.

2. *Chromocrea* Seaver, Mycologia 2: 58. 1910.

Stroma patellate, fleshy; perithecia completely immersed; asci cylindrical, 16-spored, spores green or brown.

1. *Chromocrea gelatinosa* (Fries) Seaver, Mycologia 2: 58. 1910. Fig. 14.

*Sphaeria gelatinosa* Fries Syst. Myc. 2: 336. 1823.

*Hypocrea gelatinosa* Fries, Summa Veg. Scand. 383. 1849.

*Hypocrea moriformis* Cke. & Masee, Grevillea 17: 3. 1888.

Stroma pulvinate, often tuberculate, 1-4 mm. in diameter, at first yellowish-white, becoming yellow to orange-red, finally greenish-black dotted by the ostioles with their dark spores; perithecia immersed; asci cylindrical, 80-90 x 4-5  $\mu$ , 16-spored; ascospores globose, dark, 4  $\mu$  in diameter, or oval, 5-6 x 3-4  $\mu$ .

Common on decaying wood, Maine to New Jersey, Wisconsin and Iowa. This is one of the commonly collected forms in Iowa and is represented in the herbarium by many collections on deciduous wood.

3. *Chromocreopsis* Seaver, Mycologia 2: 63. 1910.

Stromata gregarious or scattered, tubercular and prominent or depressed, fleshy or subfleshy, the surface slightly roughened and dotted with the slightly protruding necks of the perithecia, these at maturity filled with dark-colored spores; asci cylindric to clavate, 8-spored; ascospores ellipsoid to subcuboid, simple or indistinctly septate, brownish.

1. *Chromocreopsis cubispora* (Ellis & Holway) Seaver, Mycologia 2: 63. 1910.

*Hypocrea cubispora* Ellis & Holway, Jour. Myc. 1: 4. 1885.

"Stromata scattered, tubercular, with a free margin, more or less contracted at the base, often becoming substipitate, 0.5-1 cm. in diameter and the same height, at first very bright lemon-yellow and appearing pruinose, the color often changing in dried specimens, the surface scarcely wrinkled when dry, punctate with the slightly protruding necks of the perithecia filled with dark-colored spores; asci cylindric; spores subellipsoid or cuboid, smoky-brown, with 1 or 2 oil-drops, 5-7 x 4-5  $\mu$ , simple or occasionally obscurely 1-septate. On decaying wood and bark."

Although described from Iowa there is no longer a specimen in our herbarium. The only other recorded collection is from Jamaica. The description given here of the species is that of Seaver cited above.

4. *Hypomyces* Tul. Ann. Sci. Nat. IV. 13: 11. 1860.

Stroma consisting of a byssoid subiculum in which the perithecia are partially to entirely immersed; perithecia numerous,



thickly scattered, bright-colored and soft; asci cylindrical, 8-spored; ascospores hyaline, fusoid, apiculate.

- a. Spores unequally 2-celled ..... 1. *H. hyalinus*
- a. Spores equally 2-celled ..... b.
- b. Stroma white or pallid ..... c.
- b. Stroma brightly colored ..... d.
- c. On *Polyporus versicolor*, spores over 15  $\mu$  in length ..... 2. *H. polyporinus*
- c. On wood or fungi, spores 10-11  $\mu$  ..... 3. *H. papyraceus*
- d. Occurring on the hymenium of species of *Lactarius* ..... 4. *H. lactifluorum*
- d. Occurring on wood and fungi other than *Lactarius* ..... e.
- e. Stroma rose-colored ..... 5. *H. rosellus*
- e. Stroma some shade of orange ..... f.
- f. Occurring on fungi of various kinds ..... 6. *H. aurantius*
- f. Occurring on decaying wood or vegetation ..... 7. *H. ochraceus*

1. *Hypomyces hyalinus* (Schw.) Tul. Ann. Sci. Nat. IV. 13: 11. 1860. Fig. 15.

*Sphaeria hyalina* Schw. Schr. Nat. Ges. Leipzig 1: 30. 1822.

*Hypomyces inequalis* Peck, Bull. Torrey Club 25: 328. 1898.

*Peckiella hyalina* Sacc. Syll. Fung. 9: 945. 1891.

*Apiocrea hyalina* Syd. Ann. Myc. 18: 186. 1920.

Stroma effuse, white or pallid, sometimes slightly pink or brownish; perithecia partially to entirely immersed, darker than the subiculum, brownish or reddish-brown; asci cylindric; ascospores 1-seriate with the ends overlapping, 1-septate, the cells unequal, constricted at the septum, strongly verrucose, 15-20 x 5-7  $\mu$ .

Occurring as a parasite of agarics of various kinds from Maine to North Carolina. Reported from Iowa by Gilman & Archer (1929). Rare.

Sydow (1920) separated the species of *Hypomyces* having 1-septate spores with the cells unequal from those in which the cells are equal and placed them in a new genus, *Apiocrea*.

2. *Hypomyces polyporinus* Peck. Bull. Buffalo Soc. Nat. Sci. 1: 71. 1873.

*Peckiella polyporina* Sacc. Syll. Fung. 9: 945. 1891.

Stroma effuse, forming a whitish to pale-yellow covering over

the pores of the host; perithecia partially immersed in the subiculum, amber; asci cylindric, 100-125 x 5  $\mu$ ; ascospores 1-seriate with the ends overlapping, fusiform, straight or slightly curved, smooth, 1-septate, 15-20 x 4-4.5  $\mu$ .

Occurring from New York and New Jersey to North Dakota as a parasite of *Polyporus versicolor*. Reported from Iowa by Gilman & Archer (1929).

Petch (1938) in a note following his description of *H. aurantius* states "In the United States, this form has been named *Hypomyces polyporinus* Peck." The two forms are certainly very much alike. The spores are alike in size and form, those of *H. polyporinus* being smooth and those of *H. aurantius* verrucose. This difference could be due to age, as could also the difference in color of the subiculum. It is probable that *H. polyporinus* is an immature stage of *H. aurantius*.

3. *Hypomyces papyraceus* (Ellis & Holway) Seaver, Mycologia 2: 80. 1910. Fig. 16.

*Hypocrea papyracea* Ellis & Holway, Ellis & Ev. Jour. Myc. 2: 66. 1886.

Stroma effuse, thin, papery, whitish; perithecia subsuperficial, minute, reddish to light-brown; asci cylindrical, 75-80 x 3-4  $\mu$ ; ascospores fusoid, 1-seriate with the ends overlapping, 1-septate with the two cells of the spores easily separating, 10-11 x 2-3  $\mu$ .

Described from Iowa and reported also from Ohio on decaying wood and fungi; not abundant.

4. *Hypomyces Lactifluorum* (Schw.) Tul. Ann. Sci. Nat. IV. 13: 11. 1860.

*Sphaeria Lactifluorum* Schw. Schr. Nat. Ges. Leipzig 1: 30. 1822.

*Hypomyces purpureus* Peck, Bull. Torrey Club 25: 327. 1898.

Stroma forming a thin, continuous, bright-orange covering over the transformed basidiocarp of the host; perithecia thickly scattered, partially immersed, scarlet or deep orange-red, asci 150-175 x 6  $\mu$ , cylindrical; ascospores fusiform, slightly curved, apiculate, 1-septate, 35-40 x 7-8  $\mu$ , strongly verrucose.

Found from Maine to North Dakota and Alabama parasitizing species of *Lactarius*. In Iowa this species is very abundant, always attacking *L. piperatus*.

5. *Hypomyces rosellus* (Fries) Tul. Ann. Sci. Nat. IV. 13: 12. 1860.



*Sphaeria rosella* Fries, Syst. Myc. 2: 441. 1823.

*Nectria rosella* Fries, Summa Veg. Scand. 388. 1849.

*Nectria Albertini* Berk. & Br. Ann. Mag. Nat. Hist. III. 7: 452. 1861.

Stroma effuse, cottony, at first white, becoming rose-colored with lighter margin; perithecia thickly scattered, partially immersed, deep rose-red, conical; asci cylindrical, 140-150 x 6-7  $\mu$ ; ascospores uniseriate with the ends overlapping, fusiform, straight or slightly curved, apiculate, 1-septate, hyaline, 20-30 x 5-6  $\mu$ ; conidial stage *Dactylium dendroides* Fries.

Generally distributed throughout the eastern half of the United States on fungi and old wood.

6. *Hypomyces aurantius* (Fries) Tul. Ann. Sci. Nat. IV. 13: 12. 1860. Fig. 17.

*Sphaeria aurantia* Fries, Syst. Myc. 2: 440. 1823.

*Nectria aurantia* Fries, Summa Veg. Scand. 388. 1849.

Subiculum cottony, at first pallid to light-yellow, becoming bright-orange; perithecia globose with conical apex, 300 x 360  $\mu$ , deep-chrome; asci cylindrical, 110-150 x 6-7  $\mu$ ; ascospores fusiform, acute, usually curved, uniseriate, 1-septate, hyaline, verrucose, 16-17 x 4-6  $\mu$ .

Occurring on decaying fungi of various kinds from Connecticut to Colorado. Our herbarium contains collections on *Polyporus fumosus*, *Polyporus picipes*, *Daedalia unicolor* and *Pleurotus* sp.

7. *Hypomyces ochraceus* Tul. Ann. Sci. Nat. IV. 13: 12. 1860.

*Hypocrea apiculata* Peck, Ann. Rep. N. Y. State Mus. 29: 57. 1878.

*Hypomyces terrestris* Plowr. & Boud. Grevillea 8: 105. 1880.

*Hypomyces apiculatus* Seaver, Mycologia 2: 73. 1910.

Subiculum effuse, subfleshy, at first white, becoming bright-orange, in dried specimens often fading to ochraceous or dull reddish-brown, color variable; young perithecia immersed, becoming sub-superficial at maturity, subglobose with conical apex, deep-orange; asci cylindrical, 150-200 x 6-7  $\mu$ ; ascospores apiculate, 1-septate, slightly constricted, fusiform, verrucose, hyaline, 25-35 x 6-7  $\mu$ .

Occurring on soil or decaying vegetation from New York to Virginia.

According to Petch (1938) the chlamydospore (*Blastotrichum puccinioides* Preuss) and conidial (*Verticillium agaricinum* Corda) stages occur on *Russula* and *Lactarius*, the perithecial stage occur-

ing on the ground or vegetation after the agaric has decayed.

5. *Typhodium* Link, Abh. Phys. Kl. Akad. Wiss. Berlin 1824: 175. 1826.

Stroma effuse, forming sheaths around the stems of grasses, at first pale, byssoid, becoming bright-colored and fleshy; perithecia immersed; asci cylindrical, 8-spored; ascospores filiform, multiseptate.

1. *Typhodium typhinum* (Fries) Seaver, Mycologia 2: 86. 1910.

*Dothidea typhina* Fries, Syst. Myc. 2: 553. 1823.

*Stromatosphaeria typhina* Grev. Scot. Crypt. Flora 4: 204. 1825.

*Cordyceps typhina* Fries, Summa Veg. Scand. 381. 1849.

*Hypocrea typhina* Berk. Outlines of Brit. Fung. 383. 1860.

*Epichloë typhina* Tul. Ann. Sci. Nat. IV. 13: 18. 1860.

Stromata forming sheaths up to 5 cm. in length around the stems of grasses, at first pale, bearing the conidial stage (*Sphacelia typhina* Sacc.), becoming bright-orange and bearing perithecia; perithecia thickly scattered, immersed or sub-superficial, oval, ostioles somewhat darker than the stroma; asci cylindric, 140-150 x 6-8  $\mu$ ; ascospores filiform nearly as long as the ascus, 1.5-2  $\mu$  in diameter, many-septate.

Common throughout the United States on living grasses. Our herbarium contains collections on *Glyceria nervata* and *Bouteloua gracilis*. Reported also (1929) from Iowa on *Elymus virginicus*, *Muhlenbergia* sp., and *Phleum pratense*.

6. *Cordyceps* Link, Handb. Gewächse 3: 347. 1833.

Stroma erect, arising from a sclerotium formed in the body of an insect or fructification of a fungus, consisting of a sterile stalk and a fleshy, clavate, ovoid or subglobose head; perithecia immersed in the head or sub-superficial; asci very long, cylindrical, 8-spored; ascospores filiform, many-septate, in most species breaking into short, rod-like or oval part-spores in the ascus.

a. Sclerotia formed in insects .....b.

a. Sclerotia formed in fungi .....e.

b. On scale insects .....1. *C. clavulata*

b. On insect larvae or pupae .....c.

c. Ascospores linear-clavate, not dividing into part-spores ..... 2. *C. acicularis*

c. Ascospores filiform, dividing into part-spores ..... d.



- d. Fertile portion of head interrupted by sterile patches  
..... 3. *C. herculea*  
d. Head fertile to the tip ..... 4. *C. militaris*  
e. Stroma clavate ..... 5. *C. ophioglossoides*  
e. Stroma subglobose ..... 6. *C. capitata*

1. *Cordyceps clavulata* (Schw.) Ellis & Ev. N. Am. Pyrenom. 61. 1892.

*Sphaeria clavulata* Schw. Trans. Am. Phil. Soc. II. 4: 188. 1832.

*Cordyceps pistillariaeformis* Berk. & Br. Ann. Mag. Nat. Hist. III. 7: 451. 1861.

*Torrubia pistillariaeformis* Cooke, Handb. Brit. Fungi 771. 1871.

*Torrubia clavulata* Peck, Ann. Rep. N. Y. State Mus. 28: 70. 1876.

*Ophiocordyceps clavulata* Petch, Trans. Brit. Mycol. Soc. 18: 53. 1933.

Sclerotia formed in the bodies of scale insects; stromata gregarious, white, grayish or pale brown, 2-4 mm. high, consisting of a straight, slender stalk and broader, clavate head; stalk 0.2-0.4 mm. in diameter; head 0.5-1.2 mm. high by 0.4-0.6 mm. in diameter, roughened by the ostioles; perithecia immersed, narrow-oval; asci narrow-clavate, 80-100 x 8-10  $\mu$ , 8-spored; ascospores narrow-clavate, 7-8 septate, 50-80 x 2-3  $\mu$ , hyaline.

Occurring on dead scale insects from New York to New Jersey and North Dakota. Reported from Iowa by Gilman (1932).

Petch (1931) has established a new genus, *Ophiocordyceps*, for those species of *Cordyceps* having clavate asci and elongate-fusoid spores which do not divide into part-spores at the septa.

2. *Cordyceps acicularis* Rav.; Berk. Jour. Linn. Soc. 1: 158. 1857.

*Cordyceps Ravenelii* Berk. & Curt.; Berk. Jour. Linn. Soc. 1: 159. 1857.

*Torrubia superficialis* Peck, Ann. Rep. N. Y. State. Mus. 28: 70. 1876.

*Cordyceps superficialis* Sacc. Syll. Fung. 2: 574. 1883.

*Ophiocordyceps acicularis* Petch., Trans. Brit. Myc. Soc. 18: 58. 1933.

Stromata usually solitary, 3-8 cm. high, brownish, blackening on drying; head cylindric, fertile to the tip or with the perithecia in patches interrupted by sterile areas; perithecia superficial, broadly conical, 250 x 280  $\mu$ ; asci narrow-clavate, tapering slightly toward base; ascospores multiseptate with septa 4-6  $\mu$  apart, 150-240 x 3-4  $\mu$ ,

not dividing into part-spores, spores not in uniform bundle, in general four spores reaching the apex of the ascus and four terminating some distance below.

Occurring on larvae of coleopterous insects, South Carolina to Pennsylvania and Iowa. Reported for Iowa by Gilman and Archer (1929) on "white grub."

The synonymy of this species is discussed in detail by Petch (1933) who refers it to *Ophiocordyceps*.

3. *Cordyceps herculea* (Schw.) Sacc. Syll. Fung. 2: 577. 1883.

*Sphaeria herculea* Schw. Trans. Am. Phil. Soc. II. 4: 188. 1832.

Stroma up to 7 cm. in height, consisting of a stout, sterile, yellow-brown stem and enlarged fertile head which usually terminates in a short, sterile apex and which has the fertile portion interrupted by sterile patches; perithecia immersed, the projecting ostioles roughening the surface of the fertile portion; asci very long, cylindrical, 225 x 7-8  $\mu$ ; ascospores filiform, multiseptate, breaking into part-spores 5-8 x 1:5-2  $\mu$ ; parasitic on white grubs.

Reported from Connecticut to Iowa and North Carolina; collected infrequently in Iowa.

Petch (1934) discusses the synonymy of this species under *Cordyceps Melolonthae*, which is probably the same species.

4. *Cordyceps militaris* (Fries) Link, Handb. Gewächse 3: 347. 1833. Fig. 18.

*Sphaeria militaris* Fries, Syst. Myc. 2: 323. 1823.

*Kentrosporium militare* Wallr. Beitr. Bot. 164. 1844.

*Torrubia militaris* Tul. Fung. Carp. 3: 6. 1865.

Stromata arising from sclerotia formed in insect larvae or pupae, up to 5 cm. high, bright-orange, becoming pale on drying, head clavate with apex rounded; perithecia thickly scattered, at first immersed, becoming subsuperficial in old specimens, dark-brown, oval, 0.5 mm. high by 0.3 mm. in diameter; asci cylindrical, 210-220 x 4-5  $\mu$ , 8-spored; ascospores filiform, nearly as long as the ascus, dividing into short, subellipsoid segments 2-4 x 1-1.5  $\mu$ .

Rather widely distributed from Massachusetts to North Dakota and Virginia; not uncommon in Iowa.

5. *Cordyceps ophioglossoides* (Fries) Link, Handb. Gewächse 3: 347. 1833.

*Sphaeria ophioglossoides* Fries, Syst. Myc. 2: 324. 1823.

*Cordyceps parasitica* Seaver, N. Am. Flora 3: 53. 1910.



Stroma consisting of an olivaceous, sterile stem which sends numerous root-like branches into the substratum, and a clavate laterally compressed head, red-brown at first, becoming dark-brown to black and roughened by the protruding ostioles; perithecia thickly scattered, immersed or somewhat superficial; asci long, cylindrical, 8-10  $\mu$  in diameter; ascospores filiform, nearly as long as the ascus, many-septate, breaking into part-spores 3.5 x 1.5  $\mu$ ; parasitic on species of *Elaphomyces*.

Occurring from Ontario and Iowa to Rhode Island and Virginia; rarely collected in Iowa, always parasitizing *Elaphomyces variegatus* Vitt.

6. *Cordyceps capitata* (Fries) Link, Handb. Gewächse 3: 347. 1833.  
*Sphaeria capitata* Fries, Syst. Myc. 2: 324. 1823.  
*Cordyceps agariciformia* Seaver, N. Am. Flora 3: 53. 1910.

Stromata solitary or in clusters, 3-8 cm. high, consisting of a stout, sterile stem and an ovoid or subglobose fertile head; stem yellowish, smooth, becoming black and longitudinally furrowed; head yellow-brown, becoming black and roughened by the protruding ostioles; perithecia immersed, prominent; asci long, cylindrical, 15  $\mu$  in diameter; ascospores filiform, breaking into thick-walled fusoid or subcylindrical segments quite variable in size, 7-48 x 3-6  $\mu$ ; parasitic on *Elaphomyces*.

Reported from Maine to Florida and west to Iowa, where it is collected infrequently.

7. *Claviceps* Tul. Compt. Rend. Acad. Sci. Paris 33: 646. 1851.  
 Stromata erect, arising from sclerotia formed in the inflorescences of grasses and sedges, consisting of a slender, sterile stalk and a sub-globose head in which the flask-shaped perithecia are immersed; asci cylindrical, very long, capitate, 8-spored; ascospores hyaline, filiform, continuous.
- a. Sclerotia formed in the inflorescence of grasses .....
    - 1. *C. purpurea*
  - a. Sclerotia formed in the inflorescence of sedges .....
    - 2. *C. nigricans*
1. *Claviceps purpurea* (Fries) Tul. Ann. Sci. Nat. III. 20: 45. 1853.  
*Sphaeria purpurea* Fries, Syst. Myc. 2: 325. 1823.  
*Kentrosporium microcephalum* Wallr. Beitr. Bot. 164. 1844.  
*Cordyceps purpurea* Fries, Summa Veg. Scand. 381. 1849.

*Claviceps microcephala* Tul. Ann. Sci. Nat. III. 20: 49. 1853.

Sclerotium (ergot) formed in ovaries of various grasses, purplish-black, fusoid, straight or curved, up to 4 cm. or more in length depending upon the size of the ovary of the host; stromata rising from the sclerotium, consisting of subglobose, reddish-brown heads 1-2 mm. in diameter borne on slender, flexuous, dark-brown stems; perithecia flask-shaped, entirely immersed, with the ostioles projecting slightly; asci cylindrical, 100-125 x 4-5  $\mu$  ascospores filiform, continuous, 1  $\mu$  in diameter.

Distributed from New York to Montana and Utah, very common in Iowa, collections having been made on species of *Agrostis*, *Avena*, *Bromus*, *Calamagrostis*, *Elymus*, *Glyceria*, *Hordeum*, *Hystrix*, *Koeleria*, *Phleum*, *Phragmites*, *Poa*, *Secale*, *Spartina* and *Triticum*.

2. *Claviceps nigricans* Tul. Ann. Sci. Nat. III. 20: 51. 1853.

Sclerotia formed in inflorescence of sedges, linear, semicylindrical, curved, dark-brown to purplish-black, up to 12 mm in length; stroma up to 8 mm. high, blackish-violet; head depressed-globose, minutely verrucose; perithecia flask-shaped; asci very long, cylindrical, capitate, 8-spored; ascospores linear, continuous, hyaline.

Reported from North and South Dakota and from Iowa by Gilman (1932).

8. *Balansia* Speg. Anal. Soc. Ci. Argent. 19: 45. 1885.

Sclerotia formed in the stems or inflorescences of plants; stromata stipitate and capitate or sessile, separated from the sclerotium by a constriction; perithecia immersed, asci 8-spored; ascospores filiform, nearly as long as the ascus.

1. *Balansia Hypoxylon* (Peck) Atk. Jour. Myc. 11: 254. 1905.  
*Epichloe Hypoxylon* Peck, Ann. Rep. N. Y. State Mus. 27: 108. 1875.  
*Hypocrella Hypoxylon* Sacc. Syll. Fung. 2: 581. 1883.

Sclerotia curved or irregular, formed in the fruiting axes of the host, 4-15 mm. long by 1-5 mm. in diameter, gray or blackish; stroma black, prominently pulvinate, depressed or rounded, plane or constricted at point of junction with the sclerotium, 1-5 mm. broad by 1-2 mm. high, surface minutely roughened by the slightly protruding ostioles; perithecia immersed, flask-shaped, 200-400 x 100-200  $\mu$ ; asci cylindrical, 8-spored, 120-200 x 6-8  $\mu$ ; ascospores fili-



form, nearly as long as the ascus, 1  $\mu$  in diameter, at maturity separating into segments 3-4  $\mu$  in length.

Occurring on grasses from Maine to South Carolina, Texas and Iowa. Reported from Iowa by Gilman & Archer (1929) on *Danthonia spicata* (L.) Beauv.

Species falling within the Iowa range but unreported for Iowa:

#### Nectriaceae

- Dialonectria diplocarpa*
- Dialonectria papilionacearum*
- Sphaerostilbe flammea*
- Neocosmospora vasinfecta*
- Nectria coccinea*
- Nectria Coryli*
- Nectria Cucurbitula*
- Nectria ochroleuca*
- Nectria tuberculariformis*
- Nectria verrucosa*
- Scolecnectria balsamea*
- Thyronectria missouriensis*
- Thyronectria sphaerospora*

#### Hypocreaceae

- Chromocreopsis bicolor*
- Byssonectria violacea*
- Hypomyces chrysospermus*
- Hypocreopsis subcarnea*
- Gordyceps stylophora*

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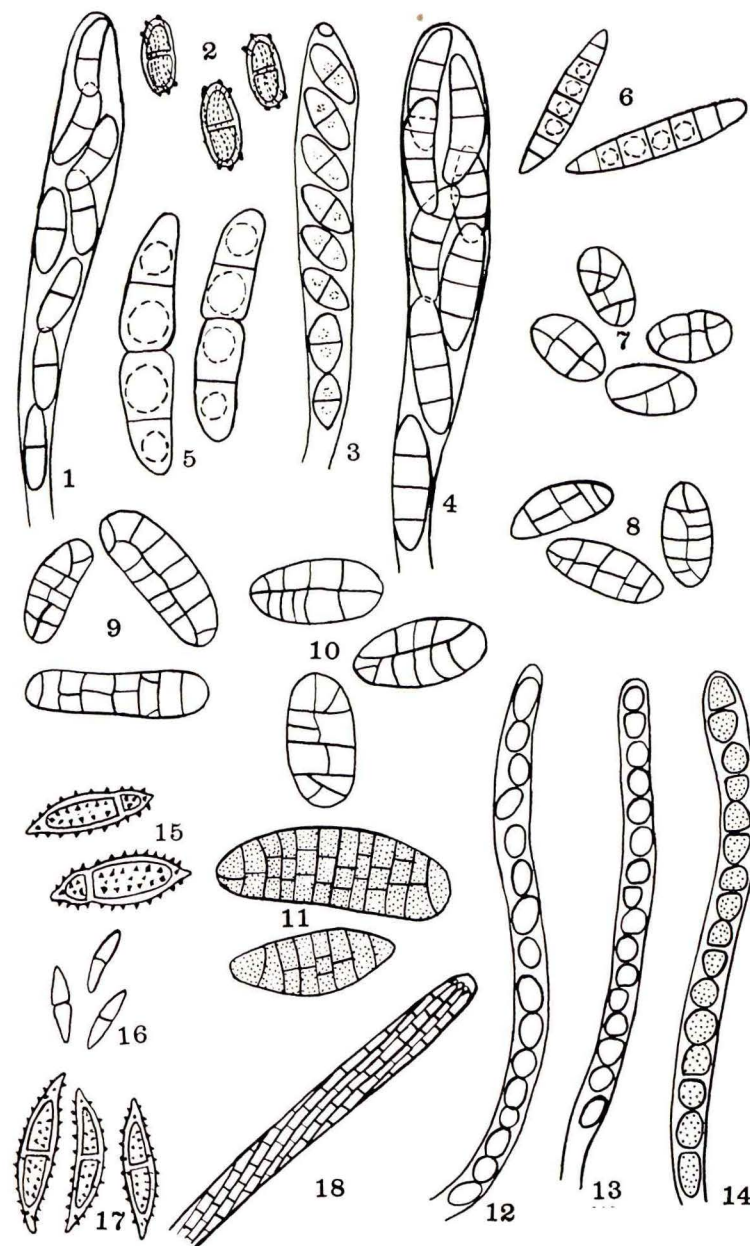
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## Explanation of Figures

- Fig. 1. *Nectria cinnabarina*, ascus and spores.  
 Fig. 2. *Dialonectria Peziza*, spores.  
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 Fig. 18. *Cordyceps militaris*, terminal portion of ascus with spores.

All drawings made with aid of camera lucida and reduced in reproduction to approximately  $\times 1000$ .





List of recent publications in the University of Iowa Studies in Natural History. The Department of Publications of the University, Iowa City, will supply information about earlier numbers available.

## Volume XVII

- Notes on the lower basidiomycetes, by DONALD P. ROGERS. 1935. Pp. 44. \$35.
- The violaceae of Iowa, by GRACE E. NEWBRO. 1936. Pp. 32. \$25.
- A key to the families of fungi, exclusive of the Lichens, by G. W. MARTIN. 1936. Pp. 36 \$35. (Out of print)
- The gasteromycetes of Iowa, by PAUL E. KAMBLY and ROBERT E. LEE. 1936. Pp. 72. \$75.
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An addition to bibliographies of the Genus *Cuscuta*, by HENRY LEE DEAN.  
The morphology of *Podaxis pistillaris*, by TRAVIS W. BRASHFIELD.  
Discomycetes from Panama and Colombia, by EDITH K. CASH.
- The crinoid fauna of the Hampton formation at Le Grand, Iowa, by L. R. LAUDON and B. H. BEANE. 1937. Pp. 48. 12 pl. \$35.
- The summer birds of the Lake Okoboji Region of Iowa, by T. C. STEPHENS. 1938. Pp. 68. \$35.
- Contributions from the botanical laboratories, 1938. Pp. 32. 7pl. \$15.  
The efficiency of monocotyledon roots in soil conservation, by HOWARD J. DITTMER.  
Additional myxomycetes from Panama, by G. W. MARTIN.  
Hymenial organization of *Sebacina calcea*, by E. B. WITTLAKE.  
Studies in evaporation: I. Evaporation from an eastward facing slope, by W. A. ANDERSON.
- Keys to the woody plants of Iowa in vegetative condition, by HAROLD D. HARRINGTON, 1940. Pp. 120. \$50.

## Volume XVIII

- Outline of the fungi, by G. W. MARTIN. 1940. Pp. 40. \$20. (Out of print)  
Suppl. Outline of the fungi, by G. W. MARTIN. 1941. Pp. 64. (Out of print)
- The Hydnaceae of Iowa, by L. W. MILLER and J. S. BOYLE. 1943. Pp. 92. 9pl. \$40.
- The Tremellales of the north central United States and adjacent Canada, by G. W. MARTIN, 1944. Pp. 88. 5pl. \$35.
- The plant geography of Iowa, by Bohumil Shimek, 1948. Pp. 178. \$1.00.

## Volume XIX

- Prospects for settlement in northeastern New Guinea, by ROBERT G. BOWMAN, 1948. Pp. 126, 8pl. \$1.00.

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