

# MYCOLOGIA

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## THE HYPOCREALES OF NORTH AMERICA—IV

Tribe IV. CORDYCIPIITEAE

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(WITH PLATES 53 AND 54, CONTAINING 26 FIGURES)

Sclerotia formed in the bodies of insects or in the stems of plants, consisting of a more or less well-developed, often compact and hard mycelial tissue; stromata developing from the sclerotia usually after a period of rest, erect and clavate or rarely pulvinate; perithecia immersed or subsuperficial (especially in aged specimens); asci cylindric; spores filiform or subfiliform, simple or many-septate, often breaking into numerous segments, hyaline.

- Sclerotia formed in the bodies of insects or fruiting organs of fungi. 36. CORDYCEPS.  
Sclerotia formed in the tissues of vascular plants.  
Sclerotia originating in the ovaries of plants; stromata long-stipitate. 37. SPERMOEDIA.  
Sclerotia formed in the stems or fruiting axes of plants; stromata short-stipitate or sessile. 38. BALANSIA.

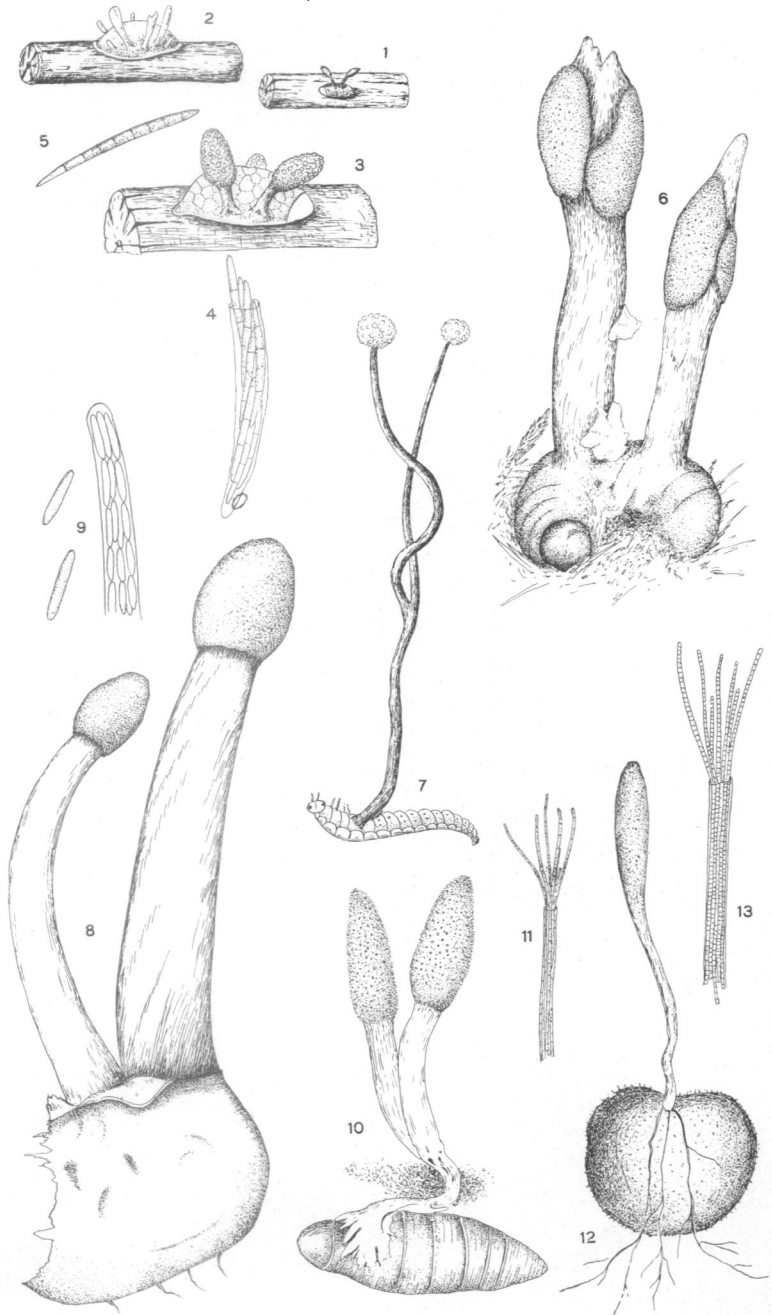
36. CORDYCEPS (Fries) Link, Handb. 3: 347. 1833

*Sphaeria* §*Cordyceps* Fries, Syst. Myc. 2: 323. 1823.

*Torrubia* Lev.; Tul. Fung. Carp. 3: 5. 1865.

Stromata springing from the sclerotium or resting stage of the fungus composed usually of compact mycelial tissue within the bodies of insects or more rarely in other fungi, simple or branched,

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CORDYCEPS

at first (*Isaria* stage) often delicate, producing conidia, later usually clavate, producing perithecia, which are more or less immersed or more rarely subsuperficial, collected into a globose, clavate, or agariciform head supported by a sterile stem, or sometimes surmounted by a sterile apex; asci cylindric, 8-spored; spores filiform or subfiliform, many-septate and often breaking into segments in the ascus, or more rarely simple and entire.

Type species, *Clavaria militaris* L.

Sclerotia formed in the bodies of insects or larvae.

Perithecia collected into a definite, enlarged head, usually immersed.

Stromata large, several cm. high.

Occurring on larvae or pupae.

Head fertile to the tip.

Head clavate.

Stromata bright-orange; on pupae.

1. *C. militaris*.

Stromata brownish; on larvae.

Spore segments short, 1.5 mic. in length.

2. *C. palustris*.

Spore segments long, 3-5 mic. in length.

Plants stout; spore segments 4-5 mic. in length.

3. *C. Ravenelii*.

Plants slender; spore segments 3.5 mic. in length.

4. *C. acicularis*.

Head globose or subglobose.

Plants purplish.

5. *C. insignis*.

Plants yellowish.

Spore segments 4 mic. in length.

6. *C. flavella*.

Spore segments 6-8 mic. in length.

7. *C. entomorrhiza*.

Head with a sterile apex.

Plants stout, yellowish; on white grubs.

8. *C. herculea*.

Plants slender, brownish; on larvae.

9. *C. stylophora*.

Occurring on adult insects (wasps).

10. *C. sphecocephala*.

Stromata small, less than 1 cm. high.

Spores much shorter than the ascus, fusoid; on scale-insects.

11. *C. clavulata*.

Spores nearly as long as the ascus, filiform; not on scale-insects.

Plants 3 mm. high, reddish-purple.

12. *C. Langloisii*.

Plants 5-9 mm. high, yellowish.

13. *C. armeniaca*.

- Perithecia scattered, becoming subsuperficial.  
 Stromata very long and slender, 5 cm. high. 14. *C. Sphingum*.  
 Stromata 1 cm. or less high.  
 Stromata effuse or erect; perithecia becoming spatulate when dry. 15. *C. Cockerellii*.  
 Stromata erect; perithecia flask-shaped. 16. *C. isarioides*.  
 Sclerotia formed in fungi.  
 Stromata agariciform. 17. *C. agariciformia*.  
 Stromata clavate. 18. *C. parasitica*.

I. CORDYCEPS MILITARIS (L.) Link, Handbk. 3: 347. 1833

- Clavaria militaris* L. Sp. Pl. 1182. 1753.  
*Ramaria farinosa* Holmsk. Danske Vid-Selsk. Skr. II. 1: 299. 1781.  
*Clavaria granulosa* Bull. Herb. Fr. pl. 496, f. 1. 1790.  
*Clavaria farinosa* Dicks. Pl. Crypt. Brit. 2: 25. 1790.  
*Isaria farinosa* Fries, Syst. Myc. 3: 271. 1832.  
*Kentrosporium militare* Wallr. Beitr. Bot. 166. 1844.  
*Torrubia militaris* Tul. Fung. Carp. 3: 6. 1865.

Sclerotia formed in the pupae of insects, compact, white; conidial stage (*Isaria*) rising from the sclerotium, consisting of a slender stalk, and a white, floccose, feather-like head; stromata at maturity consisting of a sterile stem and fertile, clavate head, usually simple but more rarely forked or branched, the whole often attaining a height of 4-5 cm., but often much shorter, bright-orange; perithecia thickly scattered or crowded, for the most part immersed with the necks protruding, or superficial (especially in weathered specimens); asci cylindrical; spores filiform, nearly as long as the ascus, many-septate, breaking apart at the septa, giving rise to numerous subellipsoid segments 2-3 mic. long (pl. 53, f. 10, 11).

On pupae buried or partially buried in the ground.

TYPE LOCALITY: Europe.

DISTRIBUTION: Massachusetts to North Dakota and Virginia; also in Europe.

ILLUSTRATIONS: Bull. Herb. Fr. pl. 496, f. 1; Fl. Dan. pl. 657, f. 1; Sow. Engl. Fungi pl. 60; pl. 308.

SPECIMENS EXAMINED: Connecticut, Earle; Iowa, Seaver; Massachusetts, Morris; North Dakota, Seaver (*Isaria* stage only); New York, Murrill, Seaver; New Jersey, Ellis; Pennsylvania, Small; Vermont, Burlingham; Virginia, Murrill.

2. *CORDYCEPS PALUSTRIS* Berk & Br.; Berk. Jour. Linn. Soc. 1: 159. 1857

Stromata 1-3 cm. high; stem 3-4 mm. thick, simple or divided into 2-4 short branchlets, even, smooth, brown; head 1-2 cm. long, thicker than the stem, cylindric-ovoid, dull brownish-purple or flesh-colored, minutely rough with the slightly protruding necks of the perithecia; asci elongate, narrowly cylindric, capitate, tapering below into a long, slender pedicel; spores arranged in a parallel fascicle, slightly curved, filiform, hyaline, becoming many septate,  $100-120 \times 1$  mic., the segments 1.5 mic. long (*pl. 54, f. 5*).

On moist rotten logs, growing from the larvae of some coleopterous insect.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Jour. Linn. Soc. 1: *pl. 1*.

Berkeley in his original description of this species says: "The extremely minute articulations or sporidiola, without any other character, separate this curious species which has moreover a peculiar habit."

3. *CORDYCEPS RAVENELII* Berk. & Curt.; Berk. Jour. Linn. Soc. 1: 159. 1857

Stromata usually solitary, 3-8 cm. high, consisting of a sterile stem and fertile head; stem 2-5 cm. long, grooved or furrowed, brownish, becoming nearly black on drying, about 2-3 mm. in diameter; fertile head terminal or more rarely with a sterile apex or with the perithecia in patches, with bare, sterile spaces between; perithecia partially immersed, becoming almost entirely superficial, giving the fertile portions a very rough appearance, similar in color to the stem; asci very long, cylindric; spores filiform, nearly as long as the ascus, breaking into segments 4-5 mic. long (*pl. 54, f. 10*).

Springing from the larvae of coleopterous insects.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: South Carolina to Pennsylvania (and Iowa?).

EXSICCATI: Rav. Fungi Car. 4: 28. Other specimens examined: Pennsylvania, *Everhart*.

According to Masee, this species has been collected in Texas by Wright, also in California by Harkness and is known in the western states as the "white grub fungus." While the species

seems to have been frequently collected but few specimens are available for examination.

4. *CORDYCEPS ACICULARIS* Rav.; Berk. Jour. Linn. Soc. **1**: 158.  
1857

? *Torrubia Melolonthae* Tul. Fung Carp. **3**: 12. 1865.

? *Torrubia superficialis* Peck, Ann. Rep. N. Y. State Mus. **28**: 70.  
1857.

? *Cordyceps Melolonthae* Sacc. Michelia **1**: 320. 1878.

Stem simple, elongate, slender, cylindrical, often flexuous, brownish, minutely velvety at the base, smooth above, 5–8 cm. high and 1.5 mm. thick; head cylindrical, about 1.5 cm. long and 3 mm. thick; perithecia blackish, large, ovoid, subsuperficial; asci subcylindric, capitate at the apex, with a short pedicel below; spores arranged in a parallel fascicle in the ascus, hyaline, filiform, straight or curved, many-septate,  $130 \times 2.5$  mic.; segments 3.5 mic. long (*pl. 54, f. 9*).

On larvae buried in the ground.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: South Carolina (and New York?).

ILLUSTRATIONS: Jour. Linn. Soc. **1**: *pl. 1*; Ann. Bot. **9**: *pl. 2, f. 27, 28*.

EXSICCATI: Rav. Fungi Car. **4**: 29 (as *Cordyceps carolinensis* Berk. & Rav.).

Berkeley says: "This species is closely allied to *C. Ravenelii* but the habit is very different. I can find no essential difference in the fruit."

Massee also regards *C. Ravenelii* as scarcely more than a variety of the present species.

Mr. Peck (l. c.) states that *T. superficialis* is "related to and intermediate between *T. Ravenelii* and *T. carolinensis*." It is not unlikely that a more extended study will show the three species to be identical.

5. *CORDYCEPS INSIGNIS* Cooke & Rav.; Cooke, Grevillea **12**: 38.  
1883

Stromata 4–6 cm. long, purple; stem 7–8 mm. thick, equal, pallid, sulcate (when dry), very minutely velvety at the base; head broadly ovoid, 1.5 cm. in length, very slightly roughened by the

necks of the slightly protruding perithecia; asci narrowly cylindrical, slightly constricted below the capitate apex, narrowed below into a slender stem-like base; spores arranged in a parallel fascicle, slightly twisted, hyaline, filiform, many-septate, wavy when free,  $170-180 \times 15$  mic., separating readily into segments in the ascus; segments 6-7 mic. long.

On larvae on the ground.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: KNOWN only from the type locality.

6. *CORDYCEPS FLAVELLA* Berk. & Curt.; Berk. Jour. Linn. Soc.  
10: 375. 1868

Stromata gregarious, 3-5 springing from nearly the same point; stem 2.5-3 cm. long, about 1 mm. thick, straight or more or less curved or flexuous, even and smooth; head globose, roughened by the necks of the protruding perithecia, 2 mm. in diameter, similar in color to the stem; asci elongate, narrowly cylindrical, capitate at the apex, narrowed below into a slender pedicel; spores arranged in a fascicle, filiform, many-septate,  $80 \times 1$  mic.; component cells about 4 mic. long.

Growing from a caterpillar.

TYPE LOCALITY: Cuba.

DISTRIBUTION: Cuba.

ILLUSTRATIONS: Ann. Bot. 9: *pl.* 2, *f.* 7-10.

7. *CORDYCEPS ENTOMORRHIZA* (Dicks.) Link, Handbk. 3: 347.  
1833

*Sphaeria entomorrhiza* Dicks. Pl. Crypt. Brit. 1: 22. 1785.

*Xylaria gracilis* Grev. Scot. Crypt. Fl. *pl.* 86. 1823.

*Torrubia entomorrhiza* Tul. Fung. Carp. 3: 14. 1865.

*Cordyceps Menesteridis* Muell. & Berk.; Berk. Gard. Chron. II.  
10: 791. 1878.

Stromata consisting of a sterile stem and a subglobose fertile head; stem very slender, 2-8 cm. long, yellowish; head  $5-8 \times 4$  mm., golden-yellow, darker with age, roughened by the prominent necks of the perithecia; perithecia ovoid, immersed or partially immersed; asci cylindrical, 6.5-7 mic. thick; spores filiform, many-septate, hyaline, finally separating into segments 6-8 mic. long (*pl.* 53, *f.* 7).

On larvae of insects.

TYPE LOCALITY: Europe.

DISTRIBUTION: South Carolina; also in Europe, Asia, Africa, and Australia.

ILLUSTRATIONS: Dicks. Pl. Crypt. Brit. *pl.* 3, *f.* 3; Gard. Chron. II. 10: 791, *f.* 130; Tul. Fung. Carp. 3: *pl.* 1, *f.* 12-14; Grev. Scot. Crypt. Fl. *pl.* 86.

8. *CORDYCEPS HERCULEA* (Schw.) Sacc. Syll. Fung. 2: 577. 1883.

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

Stromata large, attaining a height of 5-7 cm.; stem yellowish or tan-colored; head enlarged and more than 1 cm. thick, with the fertile portion often interrupted, leaving bare patches and in the specimens examined terminated by a short, obtuse apex; fertile portion roughened by the slightly prominent necks of the perithecia; asci cylindric, as long as 200-225 mic.; spores filiform, nearly as long as the ascus, many-septate, separating into joints 6-8 mic. (*pl.* 53, *f.* 6).

On larvae (white grubs).

TYPE LOCALITY: Salem, North Carolina.

DISTRIBUTION: Connecticut to Ohio and North Carolina.

SPECIMENS EXAMINED: Ohio, *Morgan*; Georgetown, D. C., *Billings*.

9. *CORDYCEPS STYLOPHORA* Berk. & Br.; Berk. Jour. Linn. Soc.

1: 158. 1857

Stromata solitary, dull-brownish, consisting of a sterile stem and fertile head, with a long sterile apiculus, the entire plant 2-3 cm. high; stem straight or flexuous, more or less velvety, longitudinally wrinkled when dry; fertile head slightly roughened by the protruding perithecia; sterile apiculus 1 cm. or more long, asci cylindric or slightly constricted below the capitate apex; spores arranged in a fascicle, filiform, curved when free, many-septate, 125-135  $\times$  1 mic.; segments 3.5 mic. long (*pl.* 54, *f.* 1).

On larvae in rotten logs.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: Michigan and South Carolina.

ILLUSTRATIONS: Jour. Linn. Soc. 1: *pl.* 1; Ann. Bot. 9: *pl.* 2, *f.* 40-42.

EXSICCATI: Rav. Fungi Car. 5: 49.



10. CORDYCEPS SPHECOCEPHALA (Klotzsch) Masee, Ann. Bot.  
9: 13. 1895

*Sphaeria sphecocephala* Klotzsch; Berk. Lond. Jour. Bot. 2: 206.  
1843.

*Torrubia sphecocephala* Tul. Fung. Carp. 3: 18. 1865.

*Cordyceps sphecocephala* Berk. & Curt.; Berk. Jour. Linn. Soc. 10:  
376. 1868.

Stromata 2–5 cm. high, consisting of a slender, sterile stem and a fertile head; stem pale-yellow, fibrous, often slightly twisted, 0.5–1 mm. thick; head enlarged, clavate, 5–8 mm. in length and 1.5–2 mm. in thickness, roughened by the slightly protruding necks of the perithecia; perithecia immersed, scattered, prominent; asci very long, cylindrical; spores nearly as long as the ascus, breaking into fusoid segments 9–10 mic. long (*pl. 54, f. 3–4*).

Springing from the bodies of wasps.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: West Indies.

ILLUSTRATIONS: Tul. Fung. Carp. 3: *pl. 1, f. 5–9*.

SPECIMENS EXAMINED: Cuba (specimen given by *Mel. T. Cook*); also collected by *N. L. Britton* and *Percy Wilson*.

11. CORDYCEPS 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, Handbk. Brit. Fungi 771.  
1871.

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

Sclerotia formed in the bodies of dead scale-insects; stromata slender, clavate, at first sterile, at maturity with an enlarged, clavate, fertile head and a slender, sterile stem, the whole 3–4 mm. high, 3–8 springing from a single sclerotium; stem slender, 1–2 mm. long, grayish or cinereous; head thicker, darker in color and strongly roughened by the protruding necks of the perithecia; asci clavate, broader near the middle, 80–100 × 8–10 mic.; spores much elongate, subfiliform, broader near the base and tapering toward either end, 7–8-septate about 50–80 mic. long, 3 mic. thick at the broadest point, hyaline (*pl. 53, f. 1–5*).

On dead scale-insects on the branches of various kinds of trees and shrubs.

TYPE LOCALITY: Bethlehem, Pennsylvania.

DISTRIBUTION: New York and New Jersey to North Dakota.

ILLUSTRATIONS: Ann. Mag. Nat. Hist. III. 7: *pl. 16, f. a-c*;  
Ellis & Everh. N. Am. Pyrenom. *pl. 15, f. 11-13*.

EXSICCATI: Ellis & Everh. N. Am. Fungi 2814. Other specimens examined: Delaware, *Commons*; New York, *Peck*; North Dakota, *Seaver*; Ontario, *Dearness*.

12. CORDYCEPS LANGLOISII Ellis & Everh. N. Am. Pyrenom. 62.  
1892

Stromata solitary, simple, consisting of a sterile stem and a subglobose head, the entire plant about 3 mm. high; stem 1 mm. thick, cylindrical or subcompressed; head capitate, at first white, becoming reddish-purple, the upper convex surface fertile; perithecia tough-membranaceous, ovoid-conic,  $100-150 \times 200-300$  mic., partially immersed in the stroma; asci very long, subcylindric; spores filiform, interwoven, nearly as long as the ascus, less than 0.5 mic. thick.

On dead larvae of the mason wasp.

TYPE LOCALITY: St. Martinsville, Louisiana.

DISTRIBUTION: Known only from the type locality.

SPECIMENS EXAMINED: Louisiana, *Langlois* (type).

13. CORDYCEPS ARMENIACA Berk. & Curt.; Berk. Jour. Linn. Soc.  
1: 158. 1857

Stromata solitary or 2 or 3 springing from nearly the same point, 5-9 mm. high, consisting of a sterile stem and a fertile head; stem about 1 mm. thick, often flexuous and twisted, pale orange with a tinge of pink; head subglobose, 2-3 mm. in diameter, apricot-colored, roughened by the slightly protruding necks of the perithecia; asci long, cylindrical-clavate, capitate, with a slender pedicel below; spores in a fascicle, slightly curved when free, filiform, becoming many-septate,  $80-85 \times 1$  mic., breaking into segments 3 mic. long (*pl. 54, f. 2*).

On the excrement of birds (probably containing insect remains).

TYPE LOCALITY: South Carolina.

DISTRIBUTION: South Carolina.

ILLUSTRATIONS: Jour. Linn. Soc. 1: *pl. 1, f. 1*; Ann. Bot. 9:  
*pl. 2, f. 18*.

14. *CORDYCEPS SPHINGUM* (Schw.) Berk. & Curt.; Berk. Jour. Linn. Soc. 10: 375. 1868

*Isaria Sphingum* Schw. Schr. Nat. Ges. Leipzig 1: 126. 1822.

*Torrubia Sphingum* Tul. Fung. Carp. 3: 12. 1865.

Stromata numerous, as many as thirty often springing from a single sclerotium, very slender and thread-like, about 5 cm. high and 1 mm. in thickness, cinereous, smooth or slightly pruinose, enlarged at the base, more or less bent above; perithecia subsuperficial, subconic, 125–150 × 200–225 mic., brownish; asci elongate, cylindrical; spores filiform, as long as the ascus, about 2 mic. thick (*pl. 54, f. 11*).

On dead larvae in cocoon.

TYPE LOCALITY: North Carolina.

DISTRIBUTION: New Jersey to North Carolina.

ILLUSTRATIONS: Ellis & Everh. N. Am. Pyrenom. *pl. 15, f. 4–7*;  
Tul. Fung. Carp 3: *pl. 1, f. 1, 2*.

SPECIMENS EXAMINED: New Jersey, *Ellis*.

15. *CORDYCEPS COCKERELLII* (Ellis & Everh.) Ellis; Cockerell, Jour. Inst. Jamaica 1: 180. 1893

*Ophionectria Cockerellii* Ellis & Everh.; Ellis, Jour. Inst. Jamaica 1: 141. 1892.

Stromata effuse, spreading over and almost covering the substratum, or erect and 1–2 mm. high, yellow; perithecia occurring in cespitose rounded or irregular clusters, or scattered, subsuperficial or nestling in the substratum; individual perithecia elongate, flask-shaped or cylindrical, about 1 mm. high and 0.5 mm. in diameter, reddish-brown or slightly translucent, smooth, at maturity collapsing laterally, becoming spatulate in form; asci very slender, about 1 mic. thick, breaking up into short segments (*pl. 54, f. 6–8*).

On the body of a sphingid moth.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Jamaica.

SPECIMENS EXAMINED: Bath, Jamaica, *Mrs. Swainson* (Type).

This species, which is said by Professor Cockerell to occur on a sphingid moth, is similar in perithecial and spore characters to *C. Sphingum*. The stromata in this species, however, are effuse or very short while in *C. Sphingum* they are very long and slender. This may be only a variation of the former species.

16. *CORDYCEPS ISARIOIDES* M. A. Curtis.; Masee, Ann. Bot. 9:  
36. 1895

Stromata gregarious, springing from a dense, white mycelium which almost entirely covers the host, 4–8 mm. high, about 1.5 mm. thick, cylindric, almost smooth, even, ochraceous (when dry), sometimes slightly curved; fertile portion 3–6 mm. long, cylindric, obtuse, axial portion not thicker than the stem; perithecia subsuperficial, large, flask-shaped, with elongate necks, ochraceous, crowded, spreading on all sides at right angles to the axis; asci narrowly cylindric slightly capitate, the base narrowed into a slender pedicel; spores filiform, continuous, flexuous when free, hyaline,  $125-135 \times 1.5$  mic., arranged in a parallel fascicle in the ascus (*pl. 54, f. 12*).

Growing from the remains of a moth.

TYPE LOCALITY: United States.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Ann. Bot. 9: *pl. 2, f. 36-39*.

17. *CORDYCEPS AGARICIFORMIA* (Bolt.) Seaver, N. Am. Fl. 3:  
53. 1910

*Sphaeria agariciformia* Bolt. Hist. Fung. 130. 1789.

*Clavaria capitata* Holmsk. Topsv. 38. 1790.

*Cordyceps capitata* Link, Handbk. 3: 347. 1833.

*Torrubia capitata* Tul. Fung. Carp. 3: 22. 1865.

*Cordyceps canadensis* Ellis. & Everh. Bull. Torrey Club 25: 501.  
1898.

*Cordyceps nigriceps* Peck, Bull. Torrey Club 27: 21. 1900.

Stromata occurring singly or in clusters of several each, 3–8 cm. high, consisting of a sterile stem and an ovoid or capitate, fertile head; stem uniform in thickness or a little thicker below, fibrous, yellowish, becoming nearly black (in dried specimens), smooth; head ovoid or agariciform, about 1 cm. in diameter, reddish-brown, becoming nearly black, roughened by the slightly protruding necks of the perithecia; perithecia immersed, but prominent; asci very long, cylindric, about 15 mic. thick; spores filiform, nearly as long as the ascus, finally breaking into segments, subhyaline, fusoid or oblong-ellipsoid, with the ends rounded,  $20-40 \times 4-5$  mic.

Parasitic on *Scleroderma* (?) and *Elaphomyces*.

TYPE LOCALITY: England.

DISTRIBUTION: Maine to Ontario and Florida.

ILLUSTRATIONS: Bolt. Hist. Fung. *pl.* 130; Tul. Fung. Carp. 3: *pl.* 2, *f.* 10-15; Pers. Myc. Eur. 1: *pl.* 10, *f.* 1-3.

EXSICCATI: Rav. Fungi Am. 387; Rav. Fungi Car. 5: 48. Other specimens examined: Delaware, *Commons*; Florida, *Calkins*; Maine, *Miss White*; Massachusetts, *Britton*; New Jersey, *Ellis*.

18. *CORDYCEPS PARASITICA* (Willd.) Seaver, N. Am. Fl. 3:  
53. 1910

*Clavaria parasitica* Willd. Fl. Berol. 405. 1787.

*Clavaria radicata* Bull. Herb. Fr. *pl.* 440, *f.* 2. 1789.

*Sphaeria ophioglossoides* Ehrh.; Pers. in Holmsk. Coryph. 144.  
1797.

*Sphaeria radicata* DC. Fl. Fr. 2: 283. 1805.

*Cordyceps ophioglossoides* Link, Handb. 3: 347. 1833.

*Torrubia ophioglossoides* Tul. Fung. Carp. 3: 20. 1865.

Stromata solitary or very rarely cespitose, consisting of a slender, sterile stem and an enlarged, clavate, fertile head; stem olivaceous, longitudinally striate, becoming very dark colored in dried specimens, sending out numerous branching root-like fibers which surround the substratum and extend for some distance into the surrounding soil; head clavate, much enlarged, tapering often both above and below, dark-brown, becoming nearly black on drying and roughened by the protruding perithecia; perithecia thickly scattered, immersed or slightly protruding; asci very long, often 300 mic., and 8-10 mic. in diameter; spores filiform, nearly as long as the ascus, many-septate and often breaking into segments; segments short, a little longer than broad, about 3-4 × 2-3 mic. (*pl.* 53, *f.* 12-13).

On species of *Elaphomyces*.

TYPE LOCALITY: Europe.

DISTRIBUTION: Ontario to Rhode Island and Virginia; also in Europe.

ILLUSTRATIONS: Willd. Fl. Berol. *pl.* 7, *f.* 17; Bull. Herb. Fr. *pl.* 440, *f.* 2.

SPECIMENS EXAMINED: Maine, *Harvey*; New Jersey, *Ellis*; New York, *Underwood*; Ontario, *Dearnness*; Pennsylvania, *Haines*, *Everhart & Jefferies*; Rhode Island, *Farlow*; Virginia, *Murrill*.

## DOUBTFUL SPECIES

*Cordyceps albella* Masee, Ann. Bot. 9: 39. 1895. The species was based on imperfectly developed material.

*Cordyceps albida* Berk. & Curt.; Cooke, Grevillea 12: 78. 1884. On crickets in Cuba. Mr. Cooke states: "Too imperfectly developed for description."

*Cordyceps caloceroides* Berk. & Curt.; Berk. Jour. Linn. Soc. 10: 375. 1868.

*Cordyceps Cicadae* (Miq.) Masee, Ann. Bot. 9: 38. 1895. *Isaria Cicadae* Miq. Bull. Sci. Phys. Nat. Néerl. 1838: 85. 1838. *Torrubia Miquelii* Tul. Fung. Carp. 3: 11. 1865. *Cordyceps Miquelii* Sacc. Michelia 1: 320. 1878. This species, which occurs on the larvae of *Cicada*, has been reported as occurring in the United States.

*Cordyceps sobolifera* (Hill.) Sacc. Michelia 1: 321. 1878. *Clavaria sobolifera* Hill.; W. Wats. Phil. Trans. 53: 271. 1764. *Torrubia sobolifera* Tul. Fung. Carp. 3: 10. 1865. *Sphaeria sobolifera* Berk. Lond. Jour. Bot. 2: 207. 1843. On larvae of *Cicada*. Masee reports this species as occurring in the West Indies (*pl.* 54, *f.* 13).

## 37. SPERMOEDIA Fries, Syst. Myc. 2: 268. 1822

*Sphacelia* Lév. Mem. Soc. Linn. Paris 5: 578. 1827.

*Kentrosporium* Wallr. Beitr. Bot. 163. 1844.

*Claviceps* L. Tul. Compt. Rend. Acad. Sci. Paris 33: 646. 1851.

Sclerotia formed in the inflorescence of various grasses and sedges, at first consisted of a soft mass of mycelium which produces conidia often accompanied with a saccharine fluid, at maturity hard, subglobose subcylindric or horn-shaped, purplish-black externally, white within; stromata developing from sclerotium after a period of rest, consisting of a sterile stem and fertile head; head subglobose, grayish, reddish-brown, or yellowish margin often partially free; perithecia flask-shaped, immersed in the stroma or with the necks slightly protruding; asci cylindrical, usually capitate, 8-spored; spores filiform, nearly as long as the ascus simple, hyaline.

Type species: *Sclerotium Clavus* DC.

Little is known of the species of this genus. The following is a list of those which have been recognized for North America.

Sclerotia subcylindric, horn-shaped, or clavate.

Sclerotia in the inflorescence of grasses.

Sclerotia purplish-black.

Sclerotia large, 1–2 cm. long.

1. *S. Clavus*.

Sclerotia small, not more than 5 mm. long.

2. *S. microcephala*.

Sclerotia cinereous.

3. *S. cinerea*.

Sclerotia formed in the inflorescence of sedges.

4. *S. nigricans*.

Sclerotia subglobose, or conical.

Occurring on *Paspalum*.

Perithecia  $340 \times 119$  mic.

5. *S. Stevensii*.

Perithecia  $816 \times 225$  mic.

6. *S. Rolfsii*.

Occurring on *Tripsacum dactyloides*.

7. *S. Tripsaci*.

## I. SPERMOEDIA CLAVUS (DC.) Fries, Syst. Myc. 2: 268. 1822

*Sclerotium Clavus* DC. Fl. Fr. 6: 115. 1815.

*Sphaeria purpurea* Fries, Syst. Myc. 2: 325. 1823.

*Sphacelia Segetum* Lev. Mem. Soc. Linn. Paris 5: 578. 1827.

*Claviceps purpurea* L. Tul. Ann. Sci. Nat. III. 20: 45. 1853.

Sclerotia formed in the young ovaries of various species of grasses, at first soft and viscid, at maturity hard, purplish-black externally, whitish within, 1–2 cm. long; stromata often as many as 20–30 from a single sclerotium; stem very slender, flexuous or spirally twisted and of a dark-brownish color; head subglobose with the margin partially free, about 1–2 mm. in diameter, reddish-brown in color and roughened by the slightly protruding necks of the perithecia; perithecia entirely immersed or very slightly protruding, flask-shaped,  $150\text{--}175 \times 200\text{--}250$  mic.; asci very long, cylindrical,  $100\text{--}125 \times 4$  mic.

In the inflorescence of rye, and of other wild and cultivated grasses.

TYPE LOCALITY: France.

DISTRIBUTION: New York to Montana and Utah, and probably throughout North America; also in Europe.

ILLUSTRATIONS: Ann. Sci. Nat. III. 20: pl. 1, 2, 3; Rab. Krypt. Fl. 1<sup>2</sup>: f. 1–5; E. & P. Nat. Pfl. 1<sup>1</sup>: f. 247, B–L.

EXSICCATI: Ellis & Everh. Fungi Columb. 1614, 1816, 2216, 1327; D. Griff. W. Am. Fungi 42; Brenckle, Fungi Dak. 4. Other specimens examined: Colorado, Tracy; Kansas, Bartholomew; Montana, Anderson, Kelsey; Ohio, Craig; Wisconsin, Davis, Pammel, T. A. Williams.

2. SPERMOEDIA MICROCEPHALA (Wallr.) Seaver, N. Am. Fl. 3:  
55. 1910

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

*Sphaeria microcephala* Wallr. Beitr. Bot. 164, as syn. 1844.

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

Sclerotia not exceeding 5 mm. in length; apparently differing from the preceding species only in the smaller size of the sclerotia and stromata.

In the inflorescence of various grasses; American specimens on *Calamagrostis* seem to conform with descriptions of this species.

TYPE LOCALITY: Europe.

DISTRIBUTION: North Dakota; also in Europe.

ILLUSTRATIONS: Wallr. Beitr. Bot. *pl.* 3, *f.* 10-16; Ann. Sci. Nat. III. 20: *pl.* 4, *f.* 1-11.

EXSICCATI: Brenckle, Fungi Dak. 4.

3. SPERMOEDIA CINEREA (D. Griff.) Seaver, N. Am. Fl. 3: 55.  
1910

*Claviceps cinereum* D. Griff. Bull. Torrey Club 28: 240. 1901.

Sclerotia clavate, gradually tapering upwards, straight, curved, twisted, or contorted, 1.5-3 cm. long and 1.75-2.5 mm. thick at the base, very viscid while developing, the base permanently invested by the flowering glumes of the host, dark-gray at the base, gradually fading to very light-gray or almost white at the apex; stromata erect, erumpent; stem cylindric or slightly fusiform, short, stout, almost white; head slightly flattened below and overlapping the upper end of the stalk, 2-3 mm. in diameter, light-gray, almost smooth, viscid, covered with small, darker points indicating the position of the perithecia; perithecia immersed, ovoid or subovoid, 190-225  $\times$  60-90 mic.; asci narrowly cylindric, slightly narrowed below into a rather long, stout pedicel and slightly enlarged at the point of attachment, 135-150  $\times$  4-5 mic.

Growing on the inflorescence of species of *Hilaria*.

TYPE LOCALITY: Cochise, Arizona.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Bull. Torrey Club 28: 238, *f.* 1-2.

EXSICCATI: D. Griff. W. Am. Fungi 97.



4. *SPERMOEDIA NIGRICANS* (Tul.) Seaver, N. Am. Fl. 3: 55. 1910

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

Sclerotia formed in the inflorescence of the host, 3-5 in a single spikelet, subcylindric or curved, often slightly flattened, brownish to purplish-black externally, white within, longitudinally striate; stromata not seen in American specimens.

On species of spike-rush (*Eleocharis*).

TYPE LOCALITY: Europe.

DISTRIBUTION: North Dakota and South Dakota; also in Europe.

ILLUSTRATIONS: Ann. Sci. Nat. III. 20: pl. 4, f. 15-22.

EXSICCATI: D. Griff. W. Am. Fungi 10. Other specimens examined: North Dakota, *Brenckle*.

5. *Spermoedia Stevensii* nom. nov.

? *Sclerotium Paspali* Schw. Schr. Nat. Ges. Leipzig 1: 268. 1822.

? *Spermoedia Paspali* Fries, Syst. Myc. 2: 268. 1822.

*Claviceps Paspali* Stevens & Hall, Bot. Gaz. 50: 462. 1910.

Sclerotia yellowish to gray, globose, roughened when mature, about 3 mm. in diameter; head dull yellow; stipe short to medium, usually not more than 1 cm. long; perithecia completely covering the head, numerous, ovoid,  $340 \times 119$  mic.; asci cylindric, 174 mic. long; spores filiform,  $101 \times 0.5-1$  mic.

On species of *Paspalum*.

TYPE LOCALITY: North Carolina.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Bot. Gaz. 50: 460, f. 1, and 461, f. 2, 3, 5.

6. *Spermoedia Rolfsii* (Stevens & Hall)

*Claviceps Rolfsii* Stevens & Hall, Bot. Gaz. 50: 462. 1910.

Sclerotia yellowish to gray, globose, roughened when mature, about 3 mm. in diameter; head dull yellow; stipe filiform, 1-1.5 cm. long; perithecia few in head and mostly upon extreme distal portion, cylindric-ovate,  $816 \times 225$  mic.; asci cylindric,  $375 \times 3$  mic.; spores filiform,  $260-275 \times 0.5-1$  mic.

On species of *Paspalum*.

TYPE LOCALITY: North Carolina.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Bot. Gaz. 50: 461, f. 3, 4.

7. *Spermoedia Tripsaci* (Stevens & Hall)

*Claviceps Tripsaci* Stevens & Hall, Bot. Gaz. 50: 463. 1910.

Sclerotia smooth, white to dark brown or black, nearly conical, 4-5 mm. in diameter at the base; heads gray to grayish-white; stipe thick, white to purplish-white, 1-1.5 cm. long; perithecia numerous, ellipsoid in longitudinal section, with a short beak toward the surface of the head,  $390 \times 153-187$  mic.; asci cylindrical,  $145-175 \times 2-3$  mic.; spores filiform 130 mic. long; conidia hyaline, continuous, fusoid to lunulate,  $17.4-37.7 \times 2.9-8.7$  mic.

On gama grass, *Tripsacum dactyloides* L.

TYPE LOCALITY: North Carolina.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Bot. Gaz. 50: 462, f. 6.

## DOUBTFUL SPECIES

*Claviceps ? caricina* D. Griff. Bull. Torrey Club 29: 300. 1902.  
This is said to be *Sclerotium sulcatum* Desm. (See Mycologia 3: 38. 1911.)

38. *BALANSIA* Speg. Anal. Soc. Ci. Argent. 19: 45. 1885.

? *Ephelis Fries*, Summa Veg. Scand. 370. 1849.

? *Ophiodothis* Sacc. Syll. Fung. 2: 652. 1883.

*Dothichloe* Atk. Bull. Torrey Club 21: 223. 1894.

Sclerotia consisting of a more or less compact fungous tissue formed in the stems or inflorescence of plants; stromata arising from the sclerotium, stipitate and capitate or sessile, separated from the sclerotium by a constriction; perithecia immersed in the stroma; asci 8-spored; spores filiform, nearly as long as the ascus.

Type species: *Balansia claviceps* Speg.

I. *BALANSIA HYPOXYLON* (Peck) Atk. Jour. Myc. 11: 254.  
1905

? *Ephelis mexicana* Fries; Berk. Jour. Linn. Soc. 10: 353. 1868.

*Epichloe Hypoxylon* Peck, Ann. Rep. N. Y. State Mus. 27: 108.  
1875.

*Hypocrella Hypoxylon* Sacc. Syll. Fung. 2: 581. 1883.

? *Ephelis borealis* Ellis & Ev. Jour. Myc. 1: 86. 1885.

*Dothichloe Hypoxylon* Atk. Bull. Torrey Club 21: 223. 1894.

Sclerotia formed in the fruiting axes of the host, curved and

irregular, 1 cm. or more in length, grayish or blackish; stromata black, prominent, pulvinate or subhemispheric, 1-5 mm. in diameter, several springing from the same sclerotium, minutely roughened by the slightly protruding perithecia; perithecia immersed; asci cylindric, with a pedicel at the base, as much as 20 mic. in length; spores 1 mic. thick, at maturity breaking into segments 3-4 mic. long.

On *Danthonia spicata* (L.) Beauv., and other grasses.

TYPE LOCALITY: Sandlake, New York.

DISTRIBUTION: Maine to South Carolina, Texas and Iowa.

ILLUSTRATIONS: Jour. Myc. 11: pl. 81, 82, 38.

EXSICCATI: Ellis & Everh. N. Am. Fungi 2373. Barth. Fungi. Columb. 3027. Other specimens examined: Connecticut, *Sheldon*; Iowa, *Buchanan*; Nova Scotia, *Dearness*.

#### DOUBTFUL SPECIES

*Balansia discoidea* P. Henn. Hedwigia Beibl. 39: 77. 1900.  
Doubtfully reported from North America.

#### DOUBTFUL GENUS

USTILAGINOIDEA Bref. Unters. Gesamt. Myk. 12: 194. 1895.

The imperfect stage of this fungus resembles a smut and the perfect stage is said to be similar to *Spermoedia*; the genus has been placed in the Hypocreales by Lindau. *Ustilagoidea Oryzae* (Pat.) Bref. loc cit., commonly known as the green smut of rice, is reported as occurring in Louisiana. No specimens have been seen.

NEW YORK BOTANICAL GARDEN.

#### EXPLANATION OF PLATE 53

Figs. 1-5. *Cordyceps clavulata* Schw. Figs. 1-3 after Berkeley and Curtis.

Fig. 1. Two plants on scale-insect, natural size.

Fig. 2. Scale-insect with a number of sterile plants.

Fig. 3. Scale-insect with mature plants.

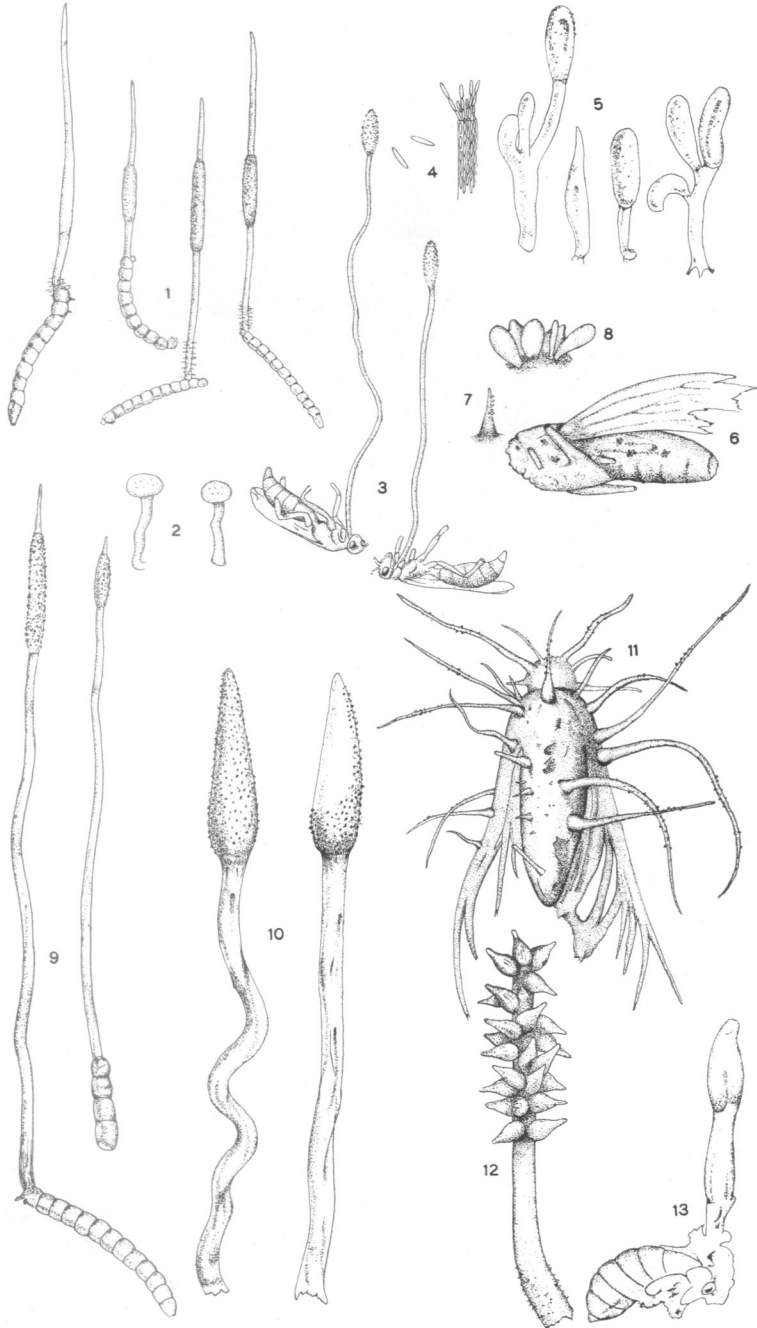
Fig. 4. Ascus with spores.

Fig. 5. One spore removed from ascus.

Fig. 6. *Cordyceps herculea* (Schw.) Sacc. Copied from photograph in herbarium of the New York Botanical Garden, about natural size.

Fig. 7. *Cordyceps entomorrhiza* (Dicks.) Link. Copied from the original drawing.

Figs. 8-9. *Cordyceps agariciformia* (Bolton) Seaver.



CORDYCEPS

- Fig. 8. Two plants copied from the original drawing.  
 Fig. 9. Portion of ascus and spore segments.  
 Figs. 10-11. *Cordyceps militaris* (L.) Link.  
 Fig. 10. Two plants on cocoon, about natural size.  
 Fig. 11. Ascus and spores.  
 Figs. 12-13. *Cordyceps parasitica* (Willd.) Seaver. Copied from original drawing, about natural size.

## EXPLANATION OF PLATE 54

- Fig. 1. *Cordyceps stylophora* Berk. & Br. Copied from original drawing.  
 Fig. 2. *Cordyceps armeniaca* Berk. & Curt. Copied from original drawing.  
 Figs. 3-4. *Cordyceps sphaecocephala* (Klotzsch) Masee.  
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 Figs. 6-8. *Cordyceps Cockerellii* (Ellis & Everh.) Ellis. Drawn from original material.  
 Fig. 6. Remains of insect showing clusters of perithecia.  
 Fig. 7. Portion of erect stroma with perithecial clusters.  
 Fig. 8. Cluster of perithecia.  
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 Fig. 10. *Cordyceps Ravenelii* Berk. & Curt. Copied from original drawing.  
 Fig. 11. *Cordyceps Sphingum* (Schw.) Berk. Copied from Tulasne.  
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 Fig. 13. *Cordyceps sobolifera* (Hill.) Sacc. Copied from Tulasne.

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