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NEW INFORMATION ON *CORDYCEPIOIDEUS BISPORUS* AND *CORDYCEPIOIDEUS OCTOSPORUS*¹

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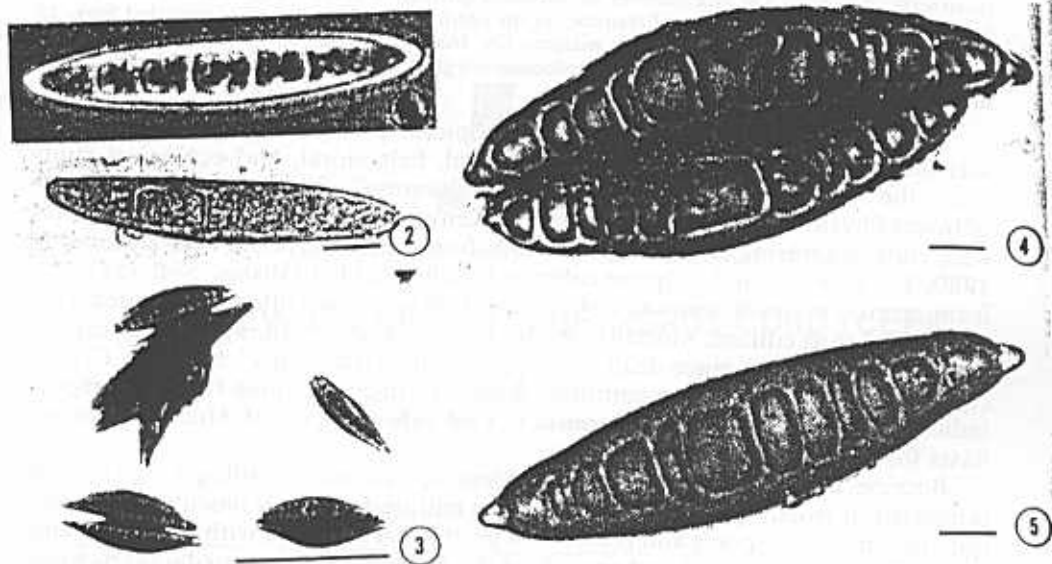
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Cordycepioideus and its type species *C. bisporus* Stiffler were described from alcohol-preserved specimens of the African termite *Macrotermes natalensis* (Haviland) from Lake Manyara, Tanzania (Stiffler, 1941). This fungus has not been reported since. A second species of the genus, *C. octosporus* M. Blackwell & Gilbertson, was described from alcohol-preserved specimens of *Tenuirostritermes tenuirostris* (Desueau) from Jalisco, Mexico (Blackwell and Gilbertson, 1981). These two host termite genera are in different subfamilies of the Termitidae. In both cases, the fungal specimens were collected from termites found dead in the field. No imperfect stage was described with either species of *Cordycepioideus*.

Cordycepioideus bisporus and *C. octosporus* show macroscopic similarity to species of *Cordyceps* (Fr.) Link. Perithecia are immersed in a prominent, stalked stroma. However, centrum structure of *C. bisporus* and *C. octosporus* is distinctly hypocreaceous (Stiffler, 1941; Blackwell and Gilbertson, 1981). Ascospores have been described as ellipsoidal to cylindrical, tending to be flattened on one side, and one-celled. There are two spores per ascus in *C. bisporus*, these measuring $95-105 \times 34-36 \mu\text{m}$. In *C. octosporus* there are 8 spores per ascus, and these are $40-70 \times 15-30 \mu\text{m}$.

We have obtained recently collected specimens of *C. bisporus*, including some that were air-dried. Air-dried termites infected with *C. bisporus* were received within two weeks of their death. While these specimens were clearly *C. bisporus*, they had characters not developed in the type specimen. Additional information obtained from mature specimens of *C. bisporus* and reexamination of type material of *C. octosporus* necessitates emendation of descriptions of the genus and

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FIGS. 1, 2. *Cordycepioideus octosporus*. 1. Spore; phase contrast. 2. Spore; bright field. FIGS. 3-5. *Cordycepioideus bisporus*. 3. Spores showing association of spore pairs from a single ascus; bright field. Bar = 100 μ m. 4. Spores from a single ascus; bright field. 5. Spore; bright field. Bar = 10 μ m, all FIGS., except 3.

both species. Additional information from the collectors of the new specimens is also provided.

CORDYCEPIOIDEUS Stiffler emend. M. Blackwell & Gilbn.

As in original description but with periphyses and apical paraphyses present, centrum development hypocreaceous; ascospores 2 or 8 per ascus, ellipsoidal to ellipsoidal-fusiform, becoming 7-15-septate at maturity.

CORDYCEPIOIDEUS OCTOSPORUS M. Blackwell & Gilbn. emend.

As in original description but with ascospores becoming 7-13-septate at maturity (FIGS. 1, 2).

SPECIMEN EXAMINED: On *Tenuirostritermes tenuirostris* (Desucieu); MEXICO: Jalisco, foot of mountains north of Ajijic, 5200', 19 July 1964; leg. G. C. Nutting and W. L. Nutting (MB53). HOLOTYPE, FH (most perithecia immature).

Reexamination of the type of *C. octosporus* disclosed that most of the perithecia were not mature and contained non-septate ascospores. However, one ascocarp was observed with 7-13-septate spores. These spores were not as dark as spores in the recently collected, mature specimen of *C. bisporus* discussed above, and may not be completely mature.

CORDYCEPIOIDEUS BISPORUS Stiffler emend. M. Blackwell & Gilbn.

As in original description but with ascospores becoming 7-15-septate at maturity (FIGS. 3-5).

SPECIMENS EXAMINED: On *Macrotermes natalensis* (Haviland), TANGANYIKA (TANZANIA): below Great Rift Wall, near Lake Manyara, leg. H. Kirby, T-3039, Jan. 5, 1935. HOLOTYPE, FH

(perithecia immature). On *Macrotermes michaelsoni* (Sjostedt), KENYA: Kajiado, Rift Valley Province, elev. about 1530 m, south of Nairobi, 54 mi north of Namenga, termites collected Nov. 25, 1980, died on Nov. 25, FH (perithecia mature). On *Macrotermes* cf. *subhyalinus* (Rambur), from termites in laboratory cultures, site of field collection not given, ICIPE, Nairobi, KENYA, Dec., 1978, died Jan.-Feb., 1979 (perithecia immature).

Macrotermes michaelsoni (Sjostedt) (Isoptera: Termitidae: Macrotermitinae) was the subject of an intensive physiological, behavioral, and ecological study under the "Grassland Termites Research Programme" of the International Centre of Insect Physiology and Ecology, Nairobi, Kenya. Several thousand pairs of alates were collected during termite flight periods from mid-October to mid-December, 1980. The pairs formed incipient colonies in soil-filled Petri dishes. Soil was taken from termite mounds and was not sterilized. When field collected termites were introduced into culture, mortality in the first week was high, apparently caused in part by the fungus since dead termites were infected with *C. bisporus*. *Cordycepioideus bisporus* is more common than the single previous literature report indicates (W. L. Nutting, pers. comm.). Two other species of *Macrotermes* are hosts for *C. bisporus* in eastern Africa.

Because both species of *Cordycepioideus* appear to be pathogenic, we were interested in isolating *C. bisporus* into pure culture for use in inoculation experiments. Single ascospores and portions of perithecial stromata with perithecia and ascospores were squashed and spread on the following culture media: corn meal agar, half-strength corn meal agar, malt extract agar, proteose-peptone agar, brain heart infusion agar, hemolyzed blood agar (Difco Manual), and oat meal agar. Incubation was at 25 and 30 C.

The thick-walled ascospores of *C. bisporus* failed to germinate under the cultural conditions used. Conidia associated with the perithecial stromata did germinate to produce colonies. Cultures derived from single conidia were like those described for *Cordyceps militaris* (Fr.) Link (Brown and Smith, 1957), except colonies became green after several days of growth. Since ascospores of *C. bisporus* did not germinate and because *Cordyceps* possibly could be associated with the termites, additional study will be needed to establish a connection between *C. bisporus* and its presumptive anamorph.

Cordycepioideus is included in the key to the hypocrealean fungi (Rogerson, 1970). Users of this key will need to take into account the emended description because species of the genus are listed as one-celled.

Key Words: *Cordycepioideus*, Hypocreales, entomogenous fungus, termite pathogen.

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