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Cordyceps mrciensis sp. nov. from a spider in Thailand

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Abstract—A fungus associated with a spider collected from the Mushroom Research Centre, Chiang Mai, Thailand was found to represent a new species of the genus *Cordyceps*. It is described as *C. mrciensis* sp. nov. *C. mrciensis* differs from other species occurring on spiders in that the stromata have a fertile part with a distinctive sterile appendage, superficial perithecia and ascospores that do not break into secondary partspores.

Key words—entomogenous fungi

Introduction

Cordyceps is a morphologically and ecologically well-defined group of parasites on arthropods (insects, spiders and mites) and hypogeous fungi (Kobayasi 1941, 1982, Mains 1954, 1957, Kobayasi & Shimizu 1960, 1977, Evans 1982, Zhang et al. 2004, Stensrud et al. 2005). This genus is one of the two most important genera of invertebrate pathogens (Hywel-Jones 2001) and is cosmopolitan in

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distribution (Hawksworth et al. 1995). Kirk et al. (2001) suggested that there are 100 *Cordyceps* species, although 280 species were listed by Kobayasi (1982). According to Index Fungorum (www. Indexfungorum. org), more than 500 epithets are assigned to *Cordyceps*, however, many are known to be taxonomic synonyms.

In Thailand, 26 species of *Cordyceps* have been identified, including four species on spiders (Hywel-Jones 2001). Kobayasi (1962) recorded five *Cordyceps* species parasitizing spiders (Arachnida) worldwide. Mains (1954) listed eight species of *Cordyceps* known to parasitize spiders.

While collecting entomogenous fungi in northern Thailand forests, a new *Cordyceps* species was found parasitizing a spider. This species is distinct from all other *Cordyceps* species and represents a novel taxon.

Materials and methods

Collections were made at the Mushroom Research Centre (MRC) in northern Thailand. Soil, litter, herbs, and trees, including the under sides of leaves were examined and dead and infected insects were collected. Specimens were stored in plastic containers and transported on the same day to the laboratory for identification. The holotype is now deposited in the Thai Mycological Association Herbarium (TMAH).

Taxonomic description

Cordyceps mrciensis Aung, J.C. Kang, Z.Q. Liang, Soytong & K.D. Hyde **sp. nov.**
[MB 510252] FIGURES 1 & 2

Stromata e abdomine hospitis oriunda, ramosa, filiformia, 5-12 mm longa. Pars fertilis nigrescens. Appendix apicalis filiformis 4 mm longa. Perithecia superficialia, elongata vel ellipsoidea, 210-375 × 150-180 µm. Asci 135-306 × 9-15 µm, capitibus 5.4-8.4 µm in diam. Ascosporae 185-435 × 3-5 µm, multiseptatae, cellulis 3.6-21 µm longis, non-separabilis.

Etymology: mrciensis = refers to the Mushroom Research Centre (MRC), the locality where the specimen was found.

Holotype: Thailand, Chiang Mai, Mae Taeng, T. Pa Pae, Bahn Pha Daeng, 128 Moo 3, Mushroom Research Centre, from spider (Arachnida) attached to a rotten bamboo culm, 17 September 2005, Ohnmar Myo Aung TMAH 0001. The holotype is deposited in Thai Mycological Association Herbarium (TMAH).

Stomata arising from abdomen of infected spider, filiform, 5-12 mm long, light brown, branching. **Fertile part** black, with a 4 mm long sterile appendage. **Perithecia** superficial, elongate to ellipsoid, 210-375 × 150-180 µm, some with a short neck, about 120 × 30 µm. **Asci** filiform, 8-spored, 135-305 × 9-15 µm; caps of asci 4.2-6.6 µm high, 5.4-8.4 µm wide. **Ascospores** filiform, 185-435 × 3-5 µm, not breaking into secondary ascospores, septate at 3.6-21 µm intervals.

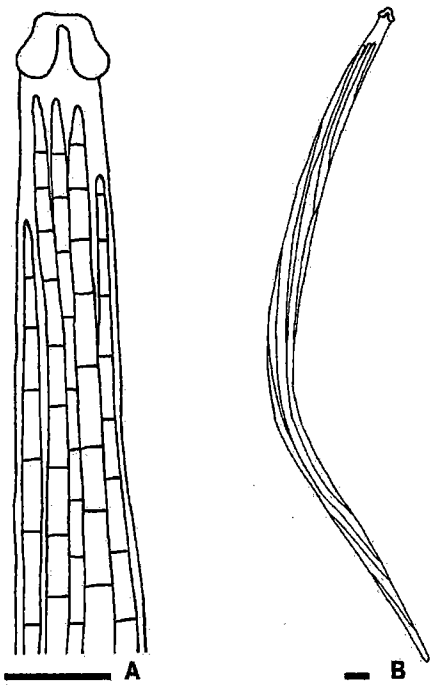


Fig 1. *Cordyceps mrciensis A. Upper part of* an ascus with mature ascospores. B. An ascus with filiform ascospores. Bars = 5 µm.

Discussion

Cordyceps mrciensis was associated with a single infected spider, attached to a rotten bamboo culm, collected at Mushroom Research Centre, Chiang Mai, Thailand.

Most *Cordyceps* species are believed to be specific to various arthropod groups, such as spiders with the degree of specificity differing from species to species (Nikoh & Fukatsu 2000). Therefore, our discussion will be based only on *Cordyceps* species associated with spiders (Arachnida).

According to Mains (1954) only eight species of *Cordyceps* have been recorded in association with spiders. *Cordyceps mrciensis* can be distinguished from these known species in having stromata with a fertile part and a stipe that continues as a distinctive sterile appendage, superficial perithecia and ascospores that do not break into partspores. There are only two species, *C. thaxteri* Mains and *C. engleriana* Henn., that have superficial perithecia. In *C. thaxteri* the perithecia are scattered, free, narrowly ovoid, and large (960-1200 x 300-360 µm, Mains,

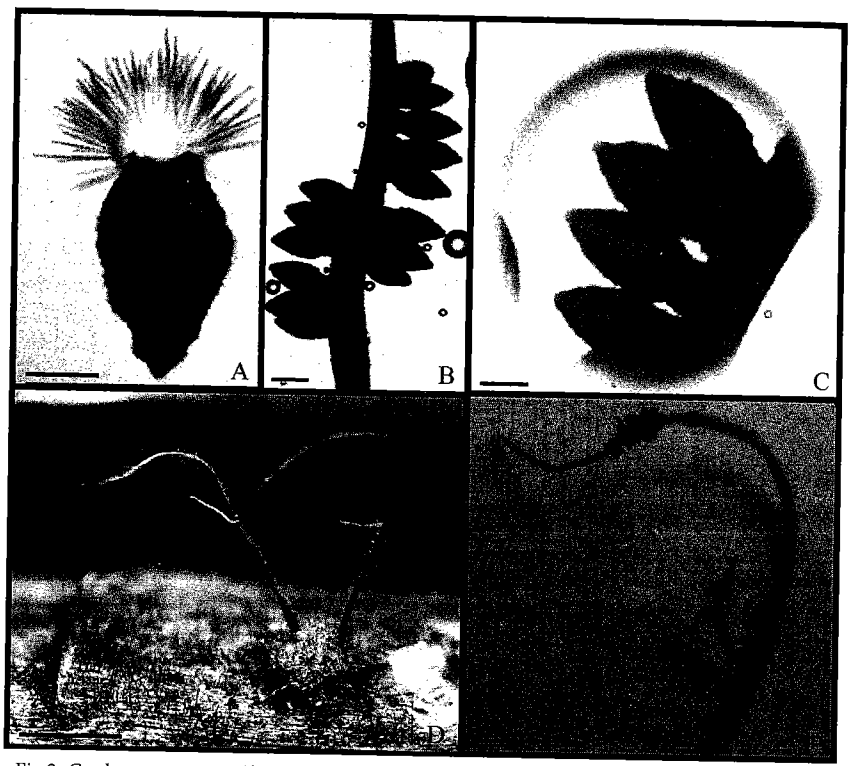


Fig 2. *Cordyceps mrciensis* (from holotype). A. A perithecium and asci. B. Superficial perithecia. C. Perithecia. D. Small spider bearing two stromata with superficial perithecia E. Appendage. Bars: A & C = 100 µm, B = 200 µm, D & E = 2.5 mm.

1954). The perithecia of *C. engleriana* are also superficial, but crowded at the apex of the stromata and ovoid or flask-shaped (Mains 1954). *Cordyceps mrciensis* also has superficial perithecia but they are elongate to ellipsoid, small, 210-375 × 150-180 µm and some have short necks. The ascospores of *C. thaxteri* and *C. engleriana* break into partspores, whereas those of *C. mrciensis* do not. *Cordyceps caloceroides* Berk. & M.A. Curtis and *C. grenadensis* Mains, also associated with spiders, posses ascospores that do not break into secondary partspores. *Cordyceps caloceroides* has immersed perithecia with slightly protruding ostioles, while *C. grenadensis* has partly imbedded, ovoid perithecia. The perithecia of *C. mrciensis* are entirely superficial and somewhat scattered on the stipe.

Besides the above characters, the distinctive fertile part of the stroma with a distinctive sterile appendage is sufficient to distinguish *C. mrciensis* from the known *Cordyceps* species from spiders (Table 1).

Table 1. Compa

Species

C. arachneicola

C. caloceroides

C. cylindrica

C. engleriana

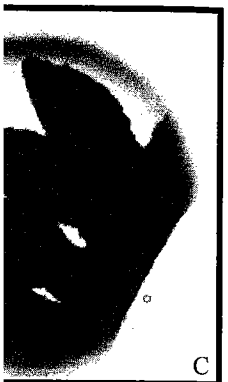
C. grenadensis

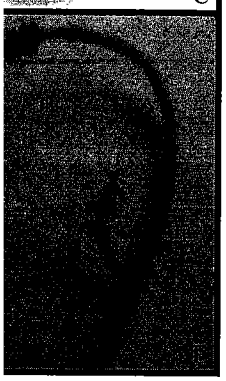
C. ignota

C. mrciensis

C. singeri

C. thaxteri





B. Superficial perithecia.
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Table 1. Comparison of the characteristics of *Cordyceps* species associated with spiders

Species	Stroma	Perithecia (range in μm)	Ascospores (range in μm)	Reference
C. arachneicola	Cylindric, 50 × 2 mm	Completely embedded ellipsoid	-	Kobayasi 1941. Tokyo Bun. Daig. 5 no. 84: 123-125
C. caloceroides	Bright red, furcate, nearly 5 in long, ≤ 1 line thick	Immersed, prominent ostioles, ovoid, 215-250 × 100-150	Not breaking into partspores	Berk. & M.A. Curtis 1868. Jour. Linn. Soc. Bot. 10: 375
C. cylindrica	Cylindric, capitate, twisted-rounded apex 15 × 1.5-2.0 mm	Entirely embedded to the surface or at right angles to the surface 850-1200 × 220-270	-	Petch 1937. Trans British Myc. Soc. 21: 46
C. engleriana	Many, 15 × 0.25 mm	Superficial, crowded, free, ovoid or flask shaped, 600 × 300	Breaking into 22-25 × 1.5-2 μm cylindric fragments	Henn. 1897. Engler Bot. Jahrb. 23: 538
C. grenadensis	2, ovoid, cylindric 10-12 mm	Partly embedded, ovoid, 336-360 × 156-216	Not breaking into partspores	Mains 1954, Bull. Torrey Bot. Club 81: 492–500
C. ignota	Simple, branched, slender, 60 × 0.5-1.5 mm	Slightly embedded, very crowded, ovoid 100-140 × 60-75	-	Marchion. 1945. Physis 20: 17
C. mrciensis	2, branching, filiform, 5-12 mm	Superficial, elongate, ellipsoid, some with short neck, 210-375 × 150-180, 4 mm sterile appendage	Not breaking into partspores	sp. nov.
C. singeri	Clavate, subcapitate, 3-12 mm	Embedded, ovoid, 325-550 × 200-500	Breaking into one-cell segments- 3-4 × 0.7-1	Mains 1954, Bull. Torrey Bot. Club 81: 492–500
C. thaxteri	Subcylindric, 1.5-2.5 × 0.1-0.2 mm	Superficial, few, narrowly ovoid, 960-1200 × 300-360	Breaking into one-cell segments	Mains 1939. Jour. Elisha Mitchell Soc. 55: 120

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Literature Cited

Evans HC. 1982. Entomogenous fungi in tropical forest ecosystems: an appraisal. Ecological Entomology 7: 47-60.

Hywel-Jones NL. 2001. The biological diversity of invertebrate pathogenic fungi. In "Biodiversity of Tropical Microfungi"ed. K.D. Hyde. Hong Kong University Press, Hong Kong. Pp. 107-120.

Kirk PM, Cannon PF, David JC, Stalpers JA. 2001. Ainsworth & Bisby's Dictionary of the Fungi. 9th edn. Commonwealth Mycological Institute: Kew, U.K. 655 pp.

Kobayasi Y. 1941. The genus *Cordyceps* and its allies. Tokyo Bunrika Daigaku, Science Report 5(84): 53-260.

Kobayasi Y. 1982. Keys to the taxa of the genera *Cordyceps* and *Torrubiella*. Transactions of the Mycological Society of Japan. 23: 329-364.

Kobayasi Y, Shimizu D. 1960. Monographic studies of *Cordyceps* 1. Group parasitic on *Elaphomyces*. Bulletin of the National Science Museum, Tokyo 5: 69-85.

Kobayasi Y, Shimizu, D. 1977. Some species of *Cordyceps* and its allies on spiders. Kew Bulletin 31: 557-566.

Mains EB. 1954. Species of *Cordyceps* on spiders. Bulletin of the Torrey Botanical Club 81: 492-500.

Mains EB. 1957. Species of *Cordyceps* parasitic on *Elaphomyces*. Bulletin of the Torrey Botanical Club 84: 243-251.

Mains EB. 1958. North American entomogenous species of *Cordyceps*. Mycologia 50: 169-222.

Nikoh N, Fukatsu T. 2000. Interkingdom host jumping underground: phylogenetic analysis of entomoparasitic fungi of the genus *Cordyceps*. Molecular Biology and Evolution 17:629-638.

Stensrud Ø, Hywel-Jones NL, Schumacher T. 2005. Towards a phylogenetic classification of *Cordyceps*: ITS nrDNA sequence data confirm divergent lineages and paraphyly. Mycological Research 109: 41-56.

Zhang WM, Li TH, Chen YQ, Qu LH. 2004. *Cordyceps campsosterna*, a new pathogen of *Campsosternus auratus*. Fungal Diversity 17: 239-242.