Diseases Caused by Fungi and Fungus-Like Organisms

First Report of White Mold Caused by *Trichothecium crotocinigenum* on *Cordyceps militaris* in China

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Cordyceps militaris (L.) Fr. is a highly valued edible and medicinal fungus (Cui 2015). Fruiting bodies of this fungus have been cultivated successfully and used widely as a substitute for *Ophiocordyceps sinensis* in traditional Chinese medicine and health supplements. In September 2018, white cotton-like colonies that caused necrosis of fruiting bodies were observed on *C. militaris* farms of the Tongzhou district, Beijing. More than 30% of approximately 3,000 fruiting bodies were infected. The same symptoms were also observed in four *C. militaris* cultivation areas, especially under the condition of high temperature and humidity. The disease mainly occurred in the later stage of the growth of *C. militaris* (with the fruiting body length of 3 to 5 cm) cultured on wheat media. The aerial mycelia of the pathogen were white, strong, and cotton-like and spread on the surfaces of media and fruiting bodies, fully covering them in 5 to 10 days. The infected *C. militaris* fruiting bodies changed from dark orange to light orange, wilted, and eventually died, resulting in significantly reduced yield and economic loss. Cultures were isolated by aseptically transferring diseased fruiting bodies onto potato dextrose agar (PDA) at 20°C. A voucher specimen has been deposited in the China General Microbiological Culture Collection Center as number 5.2214. Colonies of the parasitic fungus were white with rich sporulation on PDA medium and grew at a rate of 11.4 mm/day at 25°C. The mycelia were floccose or lanose, and conidia were ellipsoidal to cylindrical or allantoid in a size of 2.9 to 8.7 × 1.7 to 3.3 μm (length/width ratio = 1.2 to 2.9). These morphological characteristics were consistent with those of

T. crotocinigenum (Summerbell et al. 2011). The isolates were further confirmed as *T. crotocinigenum* by sequence analysis of ribosomal internal transcribed spacer (ITS) and 28S nuclear ribosomal large subunit (LSU) with primers ITS4/ITS5 (White et al. 1990) and LROR/LR5 (Bhattacharya et al. 2000). The sequencing data were deposited in NCBI database with accession numbers MN944536 and MN944554. Using BLASTN searches (Altschul et al. 1990), the ITS sequence matched the sequence of *T. crotocinigenum* type strain CBS 129.64 (accession MH858389) with identities = 535/536 (99.81%) and gaps = 1/536 (0.19%). The LSU gene sequence matched the sequence of *T. crotocinigenum* type strain CBS 129.64 (accession MH870018) with identities = 823/823 (100%) and gaps = 0/823 (0%). A pathogenicity test was performed by gently dusting conidia onto five healthy fruiting bodies of *C. militaris* and then culturing in a growth chamber with humidity of 80%. Five noninoculated fruiting bodies served as controls. White cotton flocculent colonies developed on all inoculated fruiting bodies after 5 to 7 days, whereas the controls remained symptomless. The fungus on the inoculated fruiting bodies was morphologically identical to *T. crotocinigenum* that was observed on the original diseased fruiting bodies. Reisolations were made from the inoculated fruiting bodies and confirmed to be *T. crotocinigenum* based on morphological characteristics, thus fulfilling Koch's postulates. The artificial pathogenic analysis also found that *T. crotocinigenum* could infect both the mycelia and fruiting bodies, which was consistent with natural infection. To our knowledge, this is the first worldwide report of *C. militaris* infected by *T. crotocinigenum*, which will provide critical information on prevention and control of disease and be helpful for industrial development of *C. militaris*.

References:

- Altschul, S. F., et al. 1990. J. Mol. Biol. 215:403.
- Bhattacharya, D., et al. 2000. Mol. Biol. Evol. 17:1971.
- Cui, J. D. 2015. Crit. Rev. Biotechnol. 35:475.
- Summerbell, R. C., et al. 2011. Stud. Mycol. 68:139.
- White, T. J., et al. 1990. Page 315 in: PCR Protocols: A Guide to Methods and Applications. Academic Press, San Diego, CA.

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