Dissertation Title Morpho-Molecular Taxonomy and Species Diversity of Nematode-Trapping Fungi in Yunnan Province, China

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ABSTRACT

Among the approximately 160,000 described fungal species, about 0.1% possess the capability to form specialized trapping structures through vegetative hypha or conidia to capture nematodes for nutrient, these are known as Nematode-Trapping Fungi (NTF). Presently, over 180 NTF species produce eight types of trapping structures have been identified within *Zoopagomycota* (*Zoopagales*), *Basidiomycota* (*Polyporales* and *Agaricales*), and *Ascomycota* (*Orbiliomycetes*). Among them, NTF in *Orbiliomycetes* (ONTF) have emerged as a core group in NTF research due to they exhibit significant potential for application in the biological control of harmful nematodes, while also holding high research value in the theoretical studies on fungal evolution, regulation and balance of ecosystems.

The primary research objectives in the field of nematophagous fungi revolve around optimizing the utilization of NTF and unraveling their evolutionary processes. Understanding the diversity and phylogenetic relationships of ONTF serves as the foundational basis for achieving these core objectives. Therefore, this study selected Yunnan Province, China, known for its rich biodiversity, as the research area. Soil samples were collected from terrestrial forests, freshwater, and burned forests habitats. ONTF were isolated and identified. The aim is to explore ONTF diversity and discover new ONTF species

A total of 3929 isolates representing 91 ONTF species were isolated from 3788 samples. From 1710 terrestrial soil samples and 1710 freshwater sediment samples, 1832 strains representing 49 species and 1623 strains representing 42 species of ONTF were respectively isolated. In both habitats, *Arthrobotrys* is consistently dominant, with 1734 strains representing 40 species and 1536 strains representing 35 species, whereas the genera *Dactylellina* and *Drechslerella* were detected in lower numbers, with only 98 strains representing nine species and 60 strains representing seven species, respectively. A total of 474 strains representing 38 species of ONTF were isolated from 368 burnt forest soil samples, with the genus *Dactylellina* being the dominant group (264 strains, 22 species), follow by *Drechslerella* (115 strains, nine species) and *Arthrobotrys* (95 strains, seven species)

This study identified 42 new NTF species, accounting for 29% of all known NTF, indicating a substantial number of undiscovered ONTF resources in nature. Seven new *Arthrobotrys* species, one new *Dactylellina* species, and two new *Drechslerella* species were discovered from 1,710 terrestrial soil samples. Twelve new *Arthrobotrys* species were obtained from 1,710 freshwater sediment samples, suggesting that aquatic habitats contain a significant number of undiscovered NTF. Geographically, 77.3% (17 species) of the new species were found in the northwest of Yunnan Province (three parallel rivers region), indicating this area may be a hot-spot for NTF distribution. Furthermore, 20 new species of rare NTF (17 new *Dactylellina* species and three new *Drechslerella* species) were isolated from 368 burned forest soil samples. Finding so many new species in such a limeted samples suggesting that forest fires have a significant impact on ONTF and more rare microbial resources may be unearthed in burned forests.

The discovery of *Arthrobotrys blastospora* among the 42 new species holds significant importance for the evolutionary research of ONTF. *A. blastospora* produces yeast-like blastospores, which is distinct from all modern ONTFs and remarkably similar to the earliest fossil of carnivorous fungi (*Palaeoanellus dimorphus*). The identification of

this species not only confirms the authenticity of this fossil and its relationship with modern NTF but also provides crucial information for the evolutionary of NTF.

This study provides the new insights into the diversity and distribution of ONTF, laying the foundation for ecology and evolutionary on ONTF. Furthermore, the discovery of new ONTF species enriches the genetic resources available for the taxonomy and application, offering abundant materials for further investigation.

Keywords: 42 New Taxa, Burned Forest, Diversity, Nematophagous Fungi, *Orbiliomycetes*, Trapping Structure