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| **Dissertation Title** | Fungi Associated with Coffee in Yunnan and Chiang Rai Provinces and Worldwide Checklist |
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## ABSTRACT

Yunnan, China, and Chiang Rai, Thailand, are located in the northern part of the Greater Mekong Subregion (GMS), are characterized by their warm climate and rich ecological diversity, offering a unique habitat for diverse fungal communities. These environmental conditions not only support the growth of *Coffea arabica*, one of the region's most economically important cash crops, but also favor the proliferation of fungi, increasing the crop's vulnerability to fungal infections during both cultivation and post-harvest periods. Thus, a comprehensive study was conducted to investigate the fungi associated with the economic crop coffee in Yunnan, China, and Chiang Rai, Thailand. To address this challenge and contribute to sustainable agricultural development, a comprehensive study was conducted to investigate the fungi associated with coffee in Yunnan, China, and Chiang Rai, Thailand. A total of 360 saprobic fungal collections were obtained from eight locations—Baoshan, Dali, Dehong, Jinghong, Lincang, Nujiang, and Pu'er in Yunnan in China and Chiang Rai in Thailand. Initial ITS analyses revealed that these collections represent seven classes, 37 orders, 83 families, and 137 genera. The life modes of these taxa were interpreted based on previously published studies, and fungal diversity across the eight locations was compared and discussed.

From the total collections, 139 well-preserved samples with abundant fruiting bodies and mature morphological structures were selected for detailed morphological and multi-locus phylogenetic analyses. These collections span four classes, 27 orders, 69 families, and 87 genera, resulting in the identification of six new genera, 77 new species, one novel DNA sequence, 47 new records, and four additional collections. Notably, four

species (*Acrocalymma daliense*, *Pseudohelminthosporium clematidis*, *Tubeufia coffeae,* and *Menisporopsis dinemasporioides*) were documented in both their sexual and asexual morphs on natural substrates. In addition, 235 fungal endophytes were isolated from 270 leaf segments of *Coffea arabica* collected from four coffee plantations in Yunnan. All isolates were identified through ITS sequencing, revealing their classification within Ascomycota, distributed across two classes, 10 orders, and 17 families. To assess their potential for biological control, 61 endophytes were evaluated in dual-culture assays against four known plant pathogens. Notably, *Nigrospora* sp. XCE-7 and *Daldinia* sp. ME-9 inhibited *Alternaria alternata* with over 70% growth suppression. Likewise, *Daldinia* sp. ME-9, *Nigrospora* sp. T5E-7, and *Daldinia* sp. T5E1-3 effectively inhibited *Penicillium digitatum*, also exceeding 70% inhibition rates. A new species of sooty mold, *Trichomerium puerense*, was also described and confirmed through pathogenicity testing as a pathogen of *Coffea arabica* in Yunnan.

Furthermore, this study compiled a global checklist of fungi associated with *Coffea* species, encompassing 1,295 records, including 987 species across 90 orders, 181 families, and 370 genera. Each entry includes geographical distribution, host plant, isolation source, taxonomic classification, and reference literature. This database provides an invaluable resource for advancing mycological and plant pathological research on coffee crops.

Overall, this work reveals the extensive diversity of microfungi associated with coffee plants in southern China and northern Thailand. The discovery of new taxa and geographic records enhances biodiversity inventories, while the identification of bioactive endophytes offers promising avenues for environmentally friendly disease management strategies. These findings support sustainable agricultural practices, promote biodiversity conservation, and contribute to innovation in plant health management.

**Keywords:** 360 Saprobic Collections, 77 New Species, 6 New Genera, 235 Endophytic Collections, Biocontrol Agent, Coffee Fungal Checklist, Fungal Diversity, Phylogeny, Sooty Mold Fungi, Taxonomy