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Multigene Phylogeny Reveals Endophytic Xylariales Novelties from *Dendrobium* Species from Southwestern China and Northern Thailand

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Abstract: Xylariales are common endophytes of *Dendrobium*. However, xylarialean species resolution remains difficult without sequence data and poor sporulation on artificial media and asexual descriptions for only several species and old type material. The surface-sterilized and morph-molecular methods were used for fungal isolation and identification. A total of forty-seven strains were identified as twenty-three species belonging to Apiosporaceae, Hypoxylaceae, Induratiaceae, and Xylariaceae. Five new species—*Annulohypoxylon moniliformis*, *Apiospora dendrobii*, *Hypoxylon endophyticum*, *H. officinalis* and *Nemania dendrobii* were discovered. Three tentative new species were speculated in *Xylaria*. Thirteen known fungal species from *Hypoxylon*, *Nemania*, *Nigrospora*, and *Xylaria* were also identified. Another two strains were only identified at the genus and family level (*Induratia* sp., *Hypoxylaceae* sp.). This study recorded 12 new hosts for xylarialean endophytes. This is the first report of Xylariales species as endophytes from *Dendrobium aurantiacum* var. *denneanum*, *D. cariniferum*, *D. harveyanum*, *D. hercoglossum*, *D. moniliforme*, and *D. moschatum*. *Dendrobium* is associated with abundant xylarialean taxa, especially species of *Hypoxylon* and *Xylaria*. We recommend the use of oat agar with low concentrations to induce sporulation of *Xylaria* strains.

Keywords: endophytes; multi-locus phylogeny; orchids; oat media; Xylariomycetidae

1. Introduction

Dendrobium Sw. is one of the three largest genera in Orchidaceae [1]. Many *Dendrobium* orchids have important medicinal and ornamental values [2,3]. However, the majority of *Dendrobium* species are endangered due to low germination rates, habitat destruction, and over-exploitation as reported in the IUCN (International Union for Conservation of Nature) Red List of Threatened Species. Fungal endophytes play an important role in orchid development and defense against stress [4–7]. The symbiotic germination of eleven orchid species can be enhanced by some fungal endophytes [8,9]. Extracts of both *Dendrobium* and fungal endophytes have been found to possess various bioactivities such as angiogenesis inhibitory, anti-cancer, anti-inflammatory, anti-mutagenic, and anti-oxidative bioactive properties [10–16].