



## Hyphomycetes from aquatic habitats in Southern China: Species of *Curvularia* (*Pleosporaceae*) and *Phragmocephala* (*Melanomataceae*)

HONG -YAN SU<sup>1,2</sup>, DHANUSHKA UDAYANGA<sup>3,4</sup>, ZONG-LONG LUO<sup>2,3,4</sup>, DIMUTHU S. MANAMGODA<sup>3,4</sup>, YONG-CHANG ZHAO<sup>5</sup>, JING YANG<sup>2,3,4</sup>, XIAO-YING LIU<sup>2,6</sup>, ERIC H.C. MCKENZIE<sup>7</sup>, DE-QUN ZHOU<sup>1\*</sup> & KEVIN D. HYDE<sup>3,4</sup>

<sup>1</sup>Faculty of Environmental Sciences & Engineering, Kunming University of Science & Technology, Kunming 650500, Yunnan, China.

<sup>2</sup>College of Agriculture and Biology, Dali University, Dali, 671003, Yunnan, China.

<sup>3</sup>Institute of Excellence in Fungal Research, <sup>4</sup>School of Science, Mae Fah Luang University, Chiang Rai, 57100, Thailand.

<sup>5</sup>Institute of Biotechnology and Gerplamic Resources, Yunnan Academy of Agricultural Sciences, Kunming, 650223, China

<sup>6</sup>College of basic medicine, Dali University, Dali, 671000, Yunnan, China.

<sup>7</sup>Landcare Research, Private Bag 92170, Auckland, New Zealand.

### Abstract

Aquatic hyphomycetes are a diverse, polyphyletic group of asexually reproducing fungi involved in the decomposition of litter in freshwater ecosystems. *Curvularia eragrostidis*, *C. verruculosa* and *Phragmocephala atra* were identified from submerged wood collected from freshwater streams in Yunnan Province, Southwestern China. They were characterised based on morphology and LSU, ITS and SSU sequence data. Phylogenetic analysis of LSU sequences placed the isolates within the order *Pleosporales*. *Curvularia eragrostidis* and *C. verruculosa* are reported from freshwater habitats for the first time. An epitype is designated for *Curvularia verruculosa*. This is the first phylogenetic placement of the genus *Phragmocephala* in the family *Melanomataceae* in *Dothideomycetes*, providing new DNA sequence data. A new species, *Phragmocephala garethjonesii* is introduced based on DNA sequence data and morphology. Descriptions and illustrations are provided for the species with notes on their taxonomy and phylogeny.

**Key words:** Asexual fungi, Dothideomycetes, Epitype, Molecular phylogeny, Secondary invaders

### Introduction

Aquatic hyphomycetes are a dominant and diverse group of asexual fungi involved in litter degradation in freshwater ecosystems (Goh & Hyde 1996a, Ho *et al.* 2001, Cai *et al.* 2003, Tsui & Hyde 2004, Raja *et al.* 2007, Krauss *et al.* 2011). These aquatic fungi are generally saprobes, however they can also be pathogens or symbionts (Wong *et al.* 1998). Goh and Hyde (1996a) recognised four biological groups of freshwater hyphomycetes classified as the ingoldian, aero-aquatic, terrestrial-aquatic and submerged-aquatic species. Most of the species are adapted to living in aquatic habitats, and have specialised propagules for effective dispersal in water (Gulis *et al.* 2005). Molecular phylogenetic data were used to indicate that some freshwater fungi evolved from terrestrial ancestors (Vijaykrishna *et al.* 2006). Some of the species are exclusively adapted to the aquatic habitats (Wong *et al.* 1998), while others are opportunistic saprobes or symbionts partially adapted to survival in water. Therefore, some fungi associated with aquatic ecosystems are also found in association with wide range of terrestrial plants, dead plant material and saprobes or within healthy tissues as endophytes. These species that are not specifically adapted to the freshwater environments can be secondary invaders on partially degraded woody and leaf litter.

The genus *Curvularia* Boedijn belongs in *Pleosporaceae*, *Pleosporales*, *Dothideomycetes* (Boedijn 1933, Sivanesan 1987, Hyde *et al.* 2013). The genus is typified by *Curvularia lunata*, which was originally reported from *Saccharum officinarum* from Java (Boedijn 1933). The key morphological feature of the asexual morph are the ellipsoidal, barrel shaped or curved conidia with pale colour-hyaline apical cells having two or three central darkened cells, one of which is enlarged and contributes to the curvature (Shoemaker 1959, Manamgoda *et al.* 2011). The clarification of the generic boundaries of *Curvularia* and *Bipolaris* (Manamgoda *et al.* 2012a) and subsequent phylogenetic reappraisals