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Cu(II) pollution affects fecundity of the mangrove degrader community, the Labyrinthulomycetes

Abstract: Thraustochytrids, a group of fungus-like organisms belonging to the protist class Labyrinthulomycetes, are common colonisers and degraders of fallen leaves in mangroves and, thus, are actively involved in nutrient cycling. Mangroves, often located at the river mouth, constantly receive freshwater runoff, which contains organic and inorganic pollutants, including metals. Metals are known to cause cellular damage, which may affect the survival of thraustochytrids in the mangrove environment. A previous study suggested that Cu(II), one of the major metal ions in coastal water and sediment, retards the growth of and causes cellular damage to mangrove thraustochytrids. We hypothesize that increased concentrations of Cu(II) negatively affect the fecundity of mangrove thraustochytrids. In a laboratory study, we assessed the sporulation success (number of zoospores produced per colony) and the growth response (biomass) of 11 isolates of *Schizochytrium limacinum* collected from four mangrove stands in Taiwan exposed to increasing concentrations of Cu(II). Tolerance to Cu(II) varied among the tested isolates of *S. limacinum*. In general, a negative dose-response relationship was exhibited between growth response/sporulation success and increasing concentrations of Cu(II). However, exposure to low concentrations of Cu(II) had a stimulating effect on growth (2 mg l^{-1}) and sporulation (2–64 mg l^{-1}) for some isolates. A sharp decline in growth was observed at 32 mg l^{-1} Cu(II), and sporulation success was more tolerant to increasing concentrations of Cu(II). The IC_{10} and IC_{50} values for growth were 1.0–16.5 mg l^{-1} and 9.1–23.9 mg l^{-1}, respectively, whereas those for sporulation success were 0.6–40.7 mg l^{-1} and 10.5–108.4 mg l^{-1}, respectively. In conclusion, Cu(II) interfered with both the growth and sporulation success of *S. limacinum*, which may affect its abundance and distribution in mangrove environments.

Keywords: marine fungi; metals; *Schizochytrium*; toxicology.

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Introduction

The Class Labyrinthulomycetes is a group of fungus-like organisms, currently classified in the super-group Chromalveolata (Adl et al. 2005). There are two main groups in the class and some *incertae sedis* (Adl et al. 2012): the genus *Labyrinthula* Cienk., which is characterized by the production of an ectoplasmic net within which somatic cells can move and absorb nutrients; and the Thraustochytriaceae, which includes (1) the thraustochytrids – which are characterized by globose to subglobose vegetative cells with an external ectoplasmic net, scaly cell walls, and production of biflagellate zoospores, and (2) the aplanochytrids – which are morphologically similar to the thraustochytrids but their spores move in a gliding manner using ectoplasmic net elements (Leaño and Damare 2012). For thraustochytrids, only asexual reproduction has been observed, during which zoospores are formed in zoosporangia and, upon release, are attracted to organic matter and swim towards it (Fan et al. 2002). When zoospores settle, the flagella are lost and the cells subsequently develop and enlarge into new thalli. The general life cycle of thraustochytrids is depicted in Figure 1.

Thraustochytrids are predominantly marine/estuarine and can be isolated from various organic substrates, such as leaves, algae, etc., in coastal habitats and form part of the decomposer community (Wong et al. 2005). They produce extracellular enzymes, including