Impact of Heavy Metal Contamination on *Taxiphyllum Barbieri*: A Comprehensive Study of Physiological and Biochemical Responses

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Abstract:

Contamination of aquatic environments by heavy metals (HMs) poses a significant concern due to their potential toxicity and persistent accumulation in aquatic ecosystems. Various aquatic bryophytes have proven effective as bio-indicators due to their ability to accumulate substantial amounts of contaminants in water. Despite this, the phytoremediation potential of Hypnales aquatic mosses remains insufficiently explored, especially when compared to their macrophyte counterparts. Investigating the remediation capabilities of these mosses could unveil a valuable and sustainable approach to addressing HM contamination in aquatic environments. This paper presents a comprehensive investigation involving the replication of elevated HM conditions to explore the physiological and biochemical effects of HM contamination on *Taxiphyllum barbieri*. A thorough review of available literature was conducted to identify the maximum concentrations of HM discharged in effluents by various industries. The moss was subjected in the HM (Fe-25 mg/L, Cu-6.5 mg/L, Zn-56 mg/L, Ni-6.5 mg/L, Cd-6.5 mg/L, Cr-4.9 mg/L) for a period of three months. Comparative analyses were conducted between moss samples exposed to HM and those without exposure to assess the impact. The moss's responses were analyzed with respect to total chlorophyll, carotenoid, protein, carbohydrate, proline, superoxide dismutase (SOD), malondialdehyde (MDA) and catalase (CAT). This study reveals that *Taxiphyllum barbieri*, exhibits a high tolerance towards HM. Notably, moss demonstrated a high tolerance to 4.5 mg/L of copper in comparison with other metals as well as the control sample without HM. This enhanced tolerance resulted in enhanced growth, increased pigment levels, and elevated protein content. These findings underscore the phytoremediation potential of Hypnales aquatic mosses, suggesting a promising and sustainable approach for mitigating HM contamination in aquatic environments, with broader implications for environmental conservation.

Keywords: Moss, Heavy Metal Uptake, Phytofiltration, Physiology, *Taxiphyllum barbieri.*