

Research Article

Fungal-Mediated Synthesis of Copper Nanoparticles for Effective Management of *Xanthomonas oryzae* pv. *oryzae*

Lham Dorjee¹, Robin Gogoi¹, Deeba Kamil¹, Rajesh Kumar² and Alexander Balamurugan¹



Lham Dorjee

¹Division of Plant Pathology, ²Division of Agricultural Chemicals, ICAR-Indian Agricultural Research Institute, New Delhi-110 012, India; Email:r.gogoiari@gmail.com

Abstract

Meeting the escalating demand for food presents a challenge, necessitating the inevitable use of chemical pesticides to ensure a sufficient level of food production. However, these pesticides, have drawbacks and can adversely affect non-target organisms and the environment. Nanoparticles for disease management offer a powerful solution, bringing numerous benefits such as enhanced efficacy, minimized pesticide use, reduced impact on the environment, etc. In the present study, the supernatant of two fungi, *Fusarium verticillioides* and *Bipolaris maydis* were used for copper nanoparticles (CuNPs) synthesis. A 5 mM CuSO₄ solution was used as a precursor and the reaction was carried out at an optimized pH of 8.5 in dark conditions. The shift in the reaction mixture's colour from light blue to yellowish-green and reddish-brown with *F. verticillioides* and *B. maydis* supernatant, respectively, preliminarily confirmed particle size reduction. Characterization of fungal-mediated synthesized CuNPs (FM-CuNPs) using transmission electron microscope measured the size of 8.62-52 nm and 27.96 to 65 nm by employing *F. verticillioides* and *B. maydis*, respectively, with a spherical shape. Dynamic light scattering measured the hydrodynamic size of FM-CuNPs 141.8 nm and 170.2 nm with zeta potential of -19.5 mV and -22.5 mV, respectively. Fourier transform infrared spectroscopy revealed the presence of functional groups such as amines, amides, and OH groups speculated to have a pivotal role in the reduction and stabilization of particle. Additionally, the *in vitro* evaluation efficacy of FM-CuNPs against *Xanthomonas oryzae* pv. *oryzae* exhibited a significant inhibition zone starting from 100 µg ml⁻¹ (1.70 cm) as compared to control. The study demonstrates the remarkable efficacy of FM-CuNPs synthesized for the first time using two aforesaid fungal species.

Key words: *Bipolaris maydis*, CuNPs, *Fusarium verticillioides*, Management, *Xanthomonas oryzae* pv. *oryzae*

Citation: Dorjee L, Gogoi R, Kamil D, Kumar R and Balamurugan A. 2024. Fungal-mediated synthesis of copper nanoparticles for effective management of *Xanthomonas oryzae* pv. *oryzae*. *J Mycol Pl Pathol* 54 (3): 247-260 (<https://doi.org/10.59467/JMPP.2024.54.247>)