Unveiling Microbial Potential: Investigating Zinc-Solubilizing Fungi in Rhizospheric Soil Through Isolation, Characterization and Selection

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Abstract : This study investigates the potential of various fungal isolates to solubilize zinc and counteract rice pathogens, with the aim of mitigating zinc deficiency and disease prevalence in rice farming. Soil samples from the rhizosphere were collected, and zinc-solubilizing fungi were isolated and purified. Molecular analysis identified Talaromyces sp, Talaromyces versatilis, Talaromyces pinophilus, and Aspergillus terreus as effective zinc solubilizers. Through qualitative and quantitative assessments, it was observed that solubilization efficiencies varied among the isolates over time, with Talaromyces versatilis displaying the highest capacity for solubilization. This variability in solubilization rates may be attributed to differences in fungal metabolic activity and their ability to produce organic acids that facilitate zinc release from insoluble sources in the soil. In inhibition assays against rice pathogens, the fungal isolates exhibited antagonistic properties, with Talaromyces versatilis demonstrating the most significant inhibition rates. This antagonistic activity may be linked to the production of secondary metabolites, such as antibiotics or lytic enzymes by fungi, which inhibit the growth of rice pathogens. The ability of Talaromyces versatilis to outperform other isolates in both zinc solubilization and pathogen inhibition highlights its potential as a multifunctional biocontrol agent in rice cultivation systems. These findings emphasize the potential of fungi as natural solutions for enhancing zinc uptake and managing diseases in rice cultivation. Utilizing indigenous zinc-solubilizing fungi offers a sustainable and environmentally friendly approach to addressing zinc deficiency in soils, reducing the need for chemical fertilizers. Moreover, harnessing the antagonistic activity of these fungi can contribute to integrated disease management strategies, minimizing reliance on synthetic pesticides and promoting ecological balance in agroecosystems. Additionally, the study included the evaluation of dipping time under different concentrations, viz.,10 ppm, 20 ppm, and 30 ppm of biosynthesized nano ZnO on rice seedlings. This investigation aimed to optimize the application of nano ZnO for efficient zinc uptake by rice plants while minimizing potential risks associated with excessive nanoparticle exposure. Evaluating the effects of varying concentrations and dipping durations provides valuable insights into the safe and effective utilization of nano ZnO as a micronutrient supplement in rice farming practices.

Keywords : biosynthesized nano ZnO, rice, root dipping, zinc solubilizing fungi.
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