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Bioprospecting of fungi from a coal mining site for their heavy metal tolerance potentials

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Heavy metal contamination of soil, particularly from mining activities, presents significant environmental challenges due to the persistence and toxicity of metals such as lead (Pb) and cadmium (Cd). This study aimed to isolate and characterize fungi from coal mine soils in Enugu, Nigeria, and evaluate their potential for heavy metal tolerance and bioremediation. Soil samples were collected and analyzed for heavy metal concentration using atomic absorption spectroscopy. Six fungi strains were isolated using Sabouraud Dextrose Agar and identified based on morphological and microscopic characteristics. Tolerance assays were conducted in three stages: exposure of fungal isolates to 200 ppm concentrations of Pb and Cd respectively, testing of tolerant fungal isolates at higher concentrations (220 – 400 ppm), and non-tolerant fungal isolates at lower concentrations (20 -180 ppm). Minimum inhibitory concentration (MIC) tests were performed in broth media across a dilution range (200-3.125 ppm) to assess the lower concentration preventing fungal growth. MIC analysis revealed species-specific thresholds, with *Aspergillus alternata* and *Aspergillus fumigatus* also demonstrating resistance at lower concentration. Molecular identification of the most tolerant fungal isolates was carried out by sequencing the ITS gene region of the isolates, followed by BLAST analysis and phylogenetic tree construction. Result showed that *Aspergillus aculeatus* (M8), *Aspergillus niger* (M9), *Rhizopus oryzae* (M10) exhibited significant tolerance to both lead and cadmium, with growth observed even at 400 ppm. Molecular identification confirmed the identity of the tolerant fungi and their phylogenetic relationship to reference strains. These findings highlight the ability of indigenous fungal isolates to survive in heavy metal-polluted environment and support their potential application in mycoremediation. This study concludes that *A. niger, A. aculratus, R. oryzae* are promising candidates for bioremediation strategies targeting lead and cadmium contamination.

Keywords: Heavy metal contamination, fungal tolerance, mycoremediation, *Aspergillus species*, cadmium and lead pollution.