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HIGH CONCENTRATION OF COPPER AND ZINC INFLUENCES MICROBIAL BIODIVERSITY OF *ZEA MAYS* L. RHIZOSPHERE AND SELECTS MULTIMETAL RESISTANT BACTERIA STRAINS

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Abstract

Heavy metal contamination of soil is a widespread global problem due to persistence in the environment. Moreover, heavy metals are a significant toxic factor to biota, they can accumulate in biological systems and be introduced into food chain via different mechanisms. Bioremediation is a promising alternative to physic-chemical methods of remediation, involving both plants and their associated rhizosphere microorganisms in the degradation and/or removal of pollutants. Soil microorganisms play important roles in the recycling of plant nutrients, maintenance of soil structure, detoxification of noxious chemicals, and in the control of plant pests and growth. Thus, rhizosphere bacteria can promote phytoremediation capability through different mechanisms as: release of chelants, acidification, redox changes and reduction of phytotoxicity of the pollutants. In addition, plants can promote bacteria growth secreting specific secondary metabolites able to reduce toxic effect of contaminants. The goals of this work were to evaluate the bacterial diversity in the rhizosphere of *Z. mays* plants grown on Cu and Zn contaminated soil and to identify microorganisms potentially useful in phytoremediation processes. Bacterial biodiversity was assessed both *in situ,* by direct analysis of rhizosphere microorganisms present in contaminated and pristine soil, and by analyzing the evolution of the isolated community on rich medium in the presence of increasing concentrations of different metals. Sequences analysis of 16S rDNA from selected isolated stains revealed seven different phylogenetic groups: *Flavobacterium, Bacillus, Chrysiobacterium, Pseudomonas, Agrobacterium, Stenotrophomonas, Lysinibacillus.* Metals reduced biodiversity, shifting the community towards the Gram positive *Bacillus* and *Lysinibacillus* genera. In addition, two bacteria strains (C7 and C31) were isolated as highly tolerant to Zn and Cu (MIC value of 11.0 and 3.0 mM, respectively for both strains), and resulted also multimetal resistant (MIC values for Ni, Ag , Cd, Pb, Cr, of 1.0, 1.0, 0.1, 5.3, and >23.0 mM, respectively for both strains). Polyphasic characterization of C7 and C31 identified them as two strains of *Stenotrophomonas maltophilia*, a species isolated in environments highly contaminated with heavy metals, also known for its ability to produce antifungal compounds that inhibit a large number of plant pathogens. In conclusion our study shows that the application of Cu and Zn strongly modify the microbial bio-diversity of the *Z. mays* rhizosphere and select some of the resistant bacteria strains potentially useful for improving the capacity of this crop to remediate heavy metal contaminated soil.