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MITIGATION OF THE SALT-INDUCED DAMAGES IN MAIZE SEEDLINGS BY PLANT GROWTH-PROMOTING RHIZOBACTERIA

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Abstract

In agricultural lands, plants are constantly exposed to numerous abiotic stresses factors all over the world. Salinity stress is one of the most major threatening abiotic stress problem for sustainable agricultural production. Recent studies have shown that plant growth promoting rhizobacteria (PGPR) offers an innovative and environmentally friendly solution to reduce salinity stress. The current study aimed to evaluate the effects of *Bacillus safensis*, *Bacillus pumilus*, *Bacillus* sp., and *Pseudoarthrobacter oxydans* on growth, physiological responses maize seedlings under salt stress (100 mM) into hydroponic conditions.Hoagland's mediums were added to hydroponic systems containing 100mM NaCl and 5mL of Luria Bertani broth containing each bacterial strain (the concentration of each strain was $1x10^9$ colony forming units mL^{-1}) and uninoculated bacterial system were used as control. When we compared bacteria inoculated plants and uninoculated plant, the findings clearly showed that salt stress markedly reduced the fresh-dry weight, and photosynthetic pigment content of the seedlings. Notably, the application of PGPR strains mitigated these detrimental effects, resulting in significant improvements in both fresh and dry weight compared to the control group. While salt stress led to a decline in the protein content of maize seedlings, the inoculation with PGPR strains restored protein levels, demonstrating a notable enhancement in protein content. Furthermore, PGPR inoculants induced considerable alterations in the protein profile, as evidenced by SDS-PAGE analysis. Salt stress resulted in increased activities of antioxidant enzymes, including superoxide dismutase (SOD), peroxidase (POX), and ascorbate peroxidase (APX), while catalase (CAT) activity remained unchanged. In contrast, PGPR inoculations enhanced the activities of SOD, POX, and CAT enzymes, with APX activity showing a significant increase solely in plants treated with *Bacillus sp.* under salt stress. Additionally, the application of PGPR effectively alleviated these salt-induced increases in lipid peroxidation and hydrogen peroxide content. These results suggest that PGPR play a crucial role in enhancing the salt tolerance of maize seedlings by stimulating biosynthetic processes, regulating antioxidant enzyme activities, and modulating endogenous regulatory mechanisms, such as hormone levels.

Key words: abiotic stress, maize, plant physiology, PGPR, salinity

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