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Entitled

*USE OF ROOT ENDOPHYTIC ENTEROBATER SA187 FOR THE IMPROVEMENT OF ABIOTIC STRESS TOLERANCE OF TOMATO*

BY

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Abstract

Agricultural productivity is largely affected by climate change. These climatic alterations translate into adverse abiotic stress conditions, such as heat, drought, and salinity, which restrict the geographical distribution of plants and limit their crop yields. Extreme conditions primarily affect semiarid and arid regions, causing severe environmental and economic repercussions. Plant growth-promoting rhizobacteria (PGPR) have been proposed to overcome these challenges. The desert plant endophytic bacterium Enterobacter sp. SA187 has shown beneficial effects on plant growth and salt stress tolerance in the model plant Arabidopsis thaliana in vitro, as well as under field conditions in different crops. This study aimed to assess the effectiveness of Enterobacter SA187 in terms of plant growth, antioxidant enzyme activity, oxidative damage, and transcriptomic changes under various stress conditions. Tomato plants were subjected to a variety of stress treatments, including salt and heat, with and without bacterial inoculation. We evaluated plant growth, fresh and dry weight, chlorophyll content, $Na^+/K^+$ ratio, and activities of the antioxidant enzymes SOD, POD, and CAT, along with transcriptomic changes. According to our findings, the inoculation of plants with Enterobacter SA187 considerably enhanced plant growth and stress tolerance. The treated plants showed increased antioxidant enzyme activity and decreased oxidative damage, suggesting a more effective defense mechanism against reactive oxygen species induced by stress. Additionally, the $Na^+/K^+$ ratio in both leaves and roots decreased when Enterobacter SA187 was present, indicating enhanced ion homeostasis and decreased sodium uptake under challenging circumstances. Transcriptome sequencing using RNA-seq of tomato roots grown under salt and heat stress revealed the upregulation and downregulation of certain pathway genes related to abiotic stress, such as HKT, SOS, and HFA2. The potential of root endophytic bacteria, such as Enterobacter SA187, as biotechnological tools for improving crop stress tolerance is highlighted by these findings. This study advances our knowledge of how plants and microbes interact to support plant development and stress resistance. Further research is required to determine the effectiveness of Enterobacter SA187 in actual agricultural contexts and to clarify the underlying processes of these interactions. These findings indicate the use of root endophytic bacteria to increase crop stress tolerance, which has implications for sustainable agriculture and food security.

**Keywords:** abiotic stress tolerance, root endophytic bacteria, Enterobacter SA187, tomato plants, transcriptome, antioxidant enzymes.