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Microbe-mediated abiotic stress relief in plants

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Abiotic stress is often caused due to extreme environmental conditions. Abiotic stressors include high winds, extreme temperatures and pH, radiation, heavy metal contamination, etc. These factors cause stress in plants in the form of gene and cellular changes, metabolic disorders and changes in growth rate as well as yield. Additionally, abiotic stress greatly limits agricultural productivity. Therefore, necessary means of abiotic stress management are required. Microbes are one of the simplest solutions for abiotic stress management. They are natural residents of soil with unique properties that can alleviate the stress conditions without disturbing the ecosystem. Most of the microbes can survive in extreme conditions and several studies have reported their ability to reduce stress in plants. The microbes enable stress tolerance through various strategies and it is called induced systemic tolerance. During elevated temperatures and drought conditions, bacteria such as Azospirillum brasilense produce osmolytes like glycine betaine which enhances stress tolerance. Pseudomonas syringae, commercialised as Frostban in 1987, is used to prevent the occurrence of frosts in plants. Further, high saline conditions cause ion toxicity in plants, which can be remedied by introducing bacterial endophytes, Azospirillum, Bacillus and Pseudomonas fluorescens. The different mechanisms involved in the reduction of abiotic stress caused due to increased salinity include osmoregulation, increased proline production, restriction on sodium uptake and aminocyclopropane-1-carboxylic acid (ACC) deaminase production. The presence of heavy metals is mitigated by Rhizobium or Bradyrhizobium, which form an association with the affected plants. They mitigate this condition by bioaccumulation, biosorption or by chelating heavy metals. Therefore, the aforementioned instances provide a glimpse into the role of microbes in efficiently equipping plants to tolerate abiotic stress in an eco-friendly manner.

Keywords: Agricultural Microbiology, Soil Microbiology, Plants, Abiotic Stress, Environmental Microbiology, Microbial Commercialisation

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