Title : Drought Tolerance Mechanisms of Plant Growth-Promoting Actinobacterium *Streptomyces gardneri* MC1-2

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ABSTRACT

Drought stress is a major factor limiting agricultural productivity worldwide. The application of plant growth–promoting actinobacteria has gained increasing attention as a strategy to enhance crop drought resilience. *Streptomyces gardneri* MC1-2 has been reported to exhibit plant growth–promoting traits, including indole-3-acetic acid (IAA) and siderophore production, phosphate solubilization, and the ability to alleviate drought stress in tomato plants. This study aimed to investigate drought tolerance mechanisms of *S. gardneri* MC1-2 through physiological characterization and genome analysis. The results revealed that *S. gardneri* MC1-2 exhibited drought tolerance, as evidenced by its ability to grow on medium supplemented with 660 g/L sorbitol (water activity, a_w= 0.884). To investigate drought tolerance mechanisms, *S. gardneri* MC1-2 was cultured in ISP2 broth supplemented with 405 g/L sorbitol to simulate drought stress, while medium without sorbitol served as the unstressed control. Under drought stress, *S. gardneri* MC1-2 enhanced osmolyte accumulation, particularly intracellular total soluble sugars (TSS) and proline. The strain grown under drought stress exhibited higher malondialdehyde (MDA) levels than the control, indicating increased lipid peroxidation and oxidative damage. Nevertheless, it activated oxidative stress defense mechanisms by enhancing non-enzymatic antioxidant activity, as determined by ABTS and DPPH assays, and increasing antioxidant enzyme activities, particularly catalase and superoxide dismutase, accompanied by reduced hydrogen peroxide levels.Genome analysis using the RAST server and antiSMASH 8.0 confirmed the presence of genes associated with plant growth promoting traits and oxidative and osmotic stress responses. These findings elucidate the physiological and genomic basis of drought tolerance in *S. gardneri* MC1-2 and support its potential application in improving plant resilience under arid conditions.

Keywords: Actinobacteria; Drought tolerance; Drought stress; Plant growth–promoting bacteria; Streptomyces

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