Title: Plant Growth Promoting Actinobacteria: Their Drought Tolerant Mechanisms and Applications in Plants

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ABSTRACT

Current global climate change has led to drought events in many countries, including Thailand, which has experienced significant impacts on agricultural productivity in various crops, including kale (*Brassica oleracea* var. *sabellica*). Kale has gained popularity due to its high nutritional value, being rich in antioxidants, minerals, carotenoids, and essential vitamins (B, C, and K). This vegetable grows well at low temperature (15-21 °C), whereas excessive heat can result in yield reduction, or complete crop loss and a bitter taste. Actinobacteria are known for their ability to promote plant growth and increase tolerance to adverse environmental conditions. Additionally, actinobacteria can colonize plant roots, making them promising candidates for mitigating abiotic stress in plants. This study investigates the drought tolerance mechanisms of 3 plant growth-promoting actinobacteria: *Streptomyces thermocarboxydus* isolate S3, *Micromonospora chalcea* CMU55-4, and *M. chalcea* CMU66-1. *S. thermocarboxydus* isolate S3 and *M. chalcea* CMU66-1 grow under drought conditions ($A_w \leq 0.919$). Whole genome analysis using RAST server showed that these actinobacteria possess genes related to glutathione metabolism, osmotic stress, and oxidative stress. This study hypothesizes that these actinobacteria can produce key metabolites contributing to drought tolerance. Under drought conditions, *S. thermocarboxydus* isolate S3 increased production of antioxidants, as determined by the DPPH and ABTS assays with the values of 5.20±1.02 mg GAE/g extract and 191.88±4.32 mg TE/g extract, respectively. Furthermore, the potential of *S. thermocarboxydus* isolate S3 in promoting kale growth under drought conditions will be assessed through 4 experimental treatments: (1) kale seeds soaked in sterile distilled water and grown under normal conditions, (2) kale seeds soaked in sterile distilled water and grown under drought conditions, (3) kale seeds soaked in *S. thermocarboxydus* isolate S3 spore suspension and grown under normal conditions, and (4) kale seeds soaked in *S. thermocarboxydus* isolate S3 spore suspension and grown under drought conditions. It is expected that *S. thermocarboxydus* isolate S3 will enhance kale growth under drought conditions and produce key compounds that alleviate drought-induced stress in plants.