Role of endophytic microbes for Climate Resilence and sustainable agriculture

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Abstract:

Climate change is a significant threat to global food security and agricultural productivity. The ever-burgeoning global population demands more food grains than the current production; on the other hand, the plunge in the availability of arable land, lack of water resources, environmental protuberances severely affected the crop yield. The combined environmental stresses, which leads to the degradation of cultivated land area and agricultural productivity. Thus, an innovative and sustainable solution is required to face up to the crop yields in an eco-friendly manner. Due to mild success rate with various classical and traditional techniques, one of the promising approaches is the exertion of plant-associated microbes for sustainable crop yield and plant development. Endophytic microbes improve plant tolerance to abiotic stress through several functional traits such as the production of phytohormones, improvement of mineral and water absorption, production of ACC deaminase, Antioxidant enzymes producrion, EPS (Exopolysaccharides), and epigenetic regulation of gene expression. Understanding how these beneficial microbes improve stress tolerance and plant development would help to utilize more of these organisms. This review mainly focuses on the microbiome approach for sustainable agriculture, especially endophytic interaction with host plants, to mediate various environmental stresses and to enhance crop productivity to meet the demands of ever burgeoning population.

Key Words: Abiotic stress, Drought Stress, Salinity stress, Plant–microbe interactions, PGPB

1.Introduction

Ever-changing adverse climatic variations created various abiotic stresses, such as acidic conditions, light intensity, submergence, anaerobiosis, nutrient starvation, high temperature, drought, salinity, and heavy metals shown unfortunate influence on agriculture and the ecosystem, limiting the crop yield. More specifically, salinity drought and heat stresses stress can exhibit significant impact on agricultural productivity. According to Mooney et al. (2009), changing climatic variables pose a significant threat to natural ecosystems. However, adverse environmental factors are main constraints for global food security, food quality, and crop productivity.

The global population is gradually increasing at an unprecedented rate and is expected to reach 9.7 billion in 2050 (UN Report, 2019). To meet the food requirement from the existing agricultural land under extreme adverse climate conditions without further damaging environmental quality is challenging aspect (Singh et al., 2020). Conventional reclamation methods through chemical amendments often fail in the fields, necessitating more sustainable and eco-friendly strategies to mitigate abiotic stresses in crops. Thus, an innovative and sustainable solution is required to face up to the crop yields in an eco-friendly manner. In this direction, one of the promising approaches is the exertion of plant-associated microbes for enhancing of crop yield and mitigating of abiotic stresses.

Plant associated bacteria can act as potential agents to improve level of adaptability towards adverse environment (Hallman et al., 1997). Phytomicrobes develop adaptive strategy for combating detrimental effects of environmental stresses like drought, salt, nutrient deficit or extreme

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