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The role of the soil bacteria on the plant immunity

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Abstract

Root bacteria construct the majority of microorganisms that are in a colonized state in the roots of plants and are in a symbiotic connection with plants and are considered as biocompatible organisms to increase the yield. Microorganisms generally live on the surface on the plants but when they are applied to the seed and the soil, they start colonizing the root surface and internal tissues of the plant and in turn they stimulate the plant growth through different mechanisms. Rhizobacteria (PGPR) that enhance the plant development are known as soil bacteria that occupy the perimeter or surface of the root. PGPR bacteria's type, and availability of different nutrients and elements for these bacteria affect their nitrogen fixing capacity which eventually affects the plant growth rates and yield. Moreover, these bacteria can also stimulate the plant resistance by either strengthening the plant immunity or by producing secondary metabolites that in turn fight against the pathogenic microorganisms. In the studies that we are reviewing we will be discussing PGPR bacteria, their mechanism of action and their potential to be utilized as fertilizers or plant growth stimulants.

Introduction

The recent global climate change has negatively affected the biodiversity, vegetation cover and agricultural activities. The number of researches related to the use of bacteria that contribute to plant development in order to increase productivity in agriculture, resistance to the stress conditions and to ensure the increased plant immunity is also becoming more and more popular [1]. Plant growth promoting bacteria usually colonize the host in a form that creates rhizosphere (PGPR) and can be listed as Acetobacter, Acinetobacter Substituted, Aereobacter, Agrobacterium, Alcaligenes, Bacillus, Burkholderia, Clostridium, Enterobacter, Erwinia, Flavobacterium, Klebsiella, Micrococcus, Pseudomonas, Rhizobium, Serratia and Xanthomonas bacteria that belong to species that are effective in terms of providing stress tolerance [2]. It is known that plants have a symbiotic relationship with microorganisms in the soil. The most well-known of these are the arbuscular microsomal fungi (AMF) [3]. In agricultural production, abiotic and biotic stress conditions are a factor that significantly affect the overall yield. Plants growing under stress conditions face many harmful factors such as susceptibility the pathogens, hormonal and nutritional imbalance in the growth of plants and physiological disorders. It is noted that PGPR and AMF protect the plants against these factors and promote plant development [4].

Results

One of the implementations made to increase the yield in agricultural production and to prevent the threats that chemicals may pose has been the use of bacteria that promote plant development. In a study with PGPR bacteria, it was determined that some bacteria increased the stem weight in wheat, which was achieved by

applying P. polymyxa with the highest root and stem weight, followed by P. putida and B. Megaterium [5]. Studies on bacteria living in the soil are gradually increasing.

In the study, the effects of different PGPR bacteria in different growing environments on the root and stem development of wheat and corn plants were examined. In a recent research, soil material was used as a control and 13 different growing environments including other materials were prepared. Four different PGPR bacteria were used and these were Pantoe Agglomerans, Pseudomanas Putida, Bacillus Suptilis and Arthrobacter Agilis, which have nitrogen- binding and phosphorus- dissolving properties. Compared to the control groups, the usage of these bacteria significantly increased the health, growth and the yield of the studied plants. PGPR's may be more important for young plants in terms of rapid root formation, lateral and capillary root development, for efficient water and nutrient uptake from roots and increasing root viability [6].

Discussion

Rhizobacteria applied to the seeds or soil increase the root growth, nutrient uptake, and nitrogen fixation [7]. The root system is very important because, plants can develop and receive many of the nutrients necessary for their growth thanks to their roots. In the process of obtaining nutrients and sufficient water, the root tips in the plant root system have vital importance [8]. Studies suggest that utilization of microorganisms during the seeding might increase the plant immunity, plant growth and plant resistance to the stress conditions [9]. The future perspective is that these microorganisms can replace the excessive usage of the fertilizers as biocompatible and organic counterparts, to increase the plant health and the yield so that the impact of the global warming can be overcome to provide food for the humanity. Future studies will shed lighter on the microorganism types and their effects on different plants.

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