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Actinobacterial Way of Nitrogen Fixation

Brunda B N
M.Sc (Agri.), Division of Microbiology, ICAR-Indian Agricultural Research Institute (IARI),

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Abstract

Actinobacteria quite less popular organism, it confers lot many benefit to plant but it is not explored well to express its full potential. It confer many plant growth promoting traits which benefit to plant in overcoming abiotic and biotic stresses.

Keywords: Actinobacteria, Biological Nitrogen fixation (BNF), Actinorhizal nodules

Introduction

The name Actinobacteria (formerly known as Actinomycetes) comes from the Greek word aktis or aktin, which means "ray fungus". These gram-positive, aerobic, spore-forming actinobacteria have a considerable quantity of guanine and cytosine (more than 55% by mole) in their DNA. They are also in charge of giving freshly rained-on, well-prepared soils their distinctive "earthy" scent. Both bacterial and fungal traits are present in actinobacteria.

Nitrogen (N) is one of the most crucial elements for plant development and productivity. Growing plants cannot utilise the approximately 78% of available atmospheric nitrogen because of its stable state. Biological nitrogen fixation (BNF), which has the potential to boost agricultural output and sustainability without compromising the environment or the health of the soil, is one of the potential biological alternatives for N-fertilizers. Plants may utilise ammonia, which is created when biological N fixation (BNF) converts atmospheric nitrogen into it. The use of N2-fixing actinobacteria as bio-inoculants has shown to be one of the most efficient and ecologically friendly strategies to increase crop plant growth and output because nitrogen is a main limiting factor for plant growth. In order to fix atmospheric nitrogen, actinobacteria use a nitrogenase enzyme complex.

Numerous nitrogen-fixing actinobacteria, such as Agromyces, Arthrobacter, Corynebacterium, Frankia, Micromonospora, Mycobacterium, Propionibacterium and Streptomyces have been isolated from the rhizosphere of numerous crops. These bacteria deliver fixed nitrogen to the surrounding plants. Utilising actinobacterial strains in rotation

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with non-leguminous crops can boost crop development and yield by fixing atmospheric nitrogen and supplying combined nitrogen to the plant. These symbiotic interactions would reduce competition from rhizosphere bacteria on the roots' surface. They would provide appropriate reducing conditions, a more consistent supply of substrates for metabolism, and protection from high oxygen concentrations.

The actinobacteria Frankia spp. support the fixation of nitrogen in nonlegumes in both symbiotic and free-living conditions. Non-Frankial actinobacteria have increased dramatically, according to Gtari et al. (2012), which has sparked investigation into the origins and emergence of actinobacterial diazotrophy. Actinorhizal nodules typically grow indefinitely; as a result, new cells are constantly formed at the apex and progressively contract an infection. Bacterial filaments that are actively fixing nitrogen are found inside the mature cells of the nodule. Regarding the processes that lead to nodulation, there is little information available.

No counterpart to the rhizobial Nod factors has been identified, however actinorhizal plants harbour numerous genes that are known to contribute to the development and operation of Legume nodules (coding for haemoglobin and other nodulins), where they are thought to play similar roles. Nitrogen-fixing root nodulation, confined to four plant orders, encompasses more than 14,000 Leguminosae species, and approximately 200 actinorhizal species forming symbioses with rhizobia (Rhizobium, Bradyrhizobium, etc.,) and Frankia bacterial species, respectively.

Conclusion

By all these we can realize as actinobacteria has potential to fix atmoxpheric Nitrogen in addition to this it will solubilize Phosphorous and screte phyto harmones such as IAA, Cytokinin, Gibberlin and mainly ethylene, this act as stress burstor by cleaving ethylene precursor ACC into ammonia and α-keto butyrate. So plant won't experience stress and in turn plant will be nurtured because of other phytoharmones and farmers will save money instead of spending on urea and in turn less contaminants in environment.