

Plant endophytes: their role in plant growth and protection from biotic/abiotic stress

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Abstract

Endophytes are an interesting group of microbes present inside the plant. They have a symbiotic relationship with their host as they depend on the plant for food and shelter, in turn they produce secondary metabolites and hormones which help in growth and development of plant and also help in protecting plants from pathogens. So many endophytes have been isolated from plant tissues and are tested in lab to assess the production of compounds that are useful for plants. Plant endophytes are known to be involved in production of IAA, siderophores and various enzymes. They are also involved in phosphate solubilization and nitrogen fixation. Fungi and bacteria are the most frequently isolated endophytes.

Keywords:- Endophytes, Siderophores, Secondary metabolites, IAA.

Introduction

Endophytes are microorganisms (fungi and bacteria) that live inside the plant and form a symbiotic association with plants. The term 'Endophyte' was coined by Anton de Bary in 1966. Endophytes don't cause disease in plants under normal conditions and but can do so under stress conditions or on non-host plants. Hordoin *et al* classified endophytes in three groups: -Passenger, Obligatory and Facultative. Endophytes produce important metabolites and hormones for plants which gives them a selective preference over other microbes in plant's ecosystem.

Some common endophytes

Glomerella, Phomopsis, Diaporthe, Alternaria, Acremonium, Chaetomium, Xylaria, Penicillium, Fusarium, Pestalotiopsis, etc.

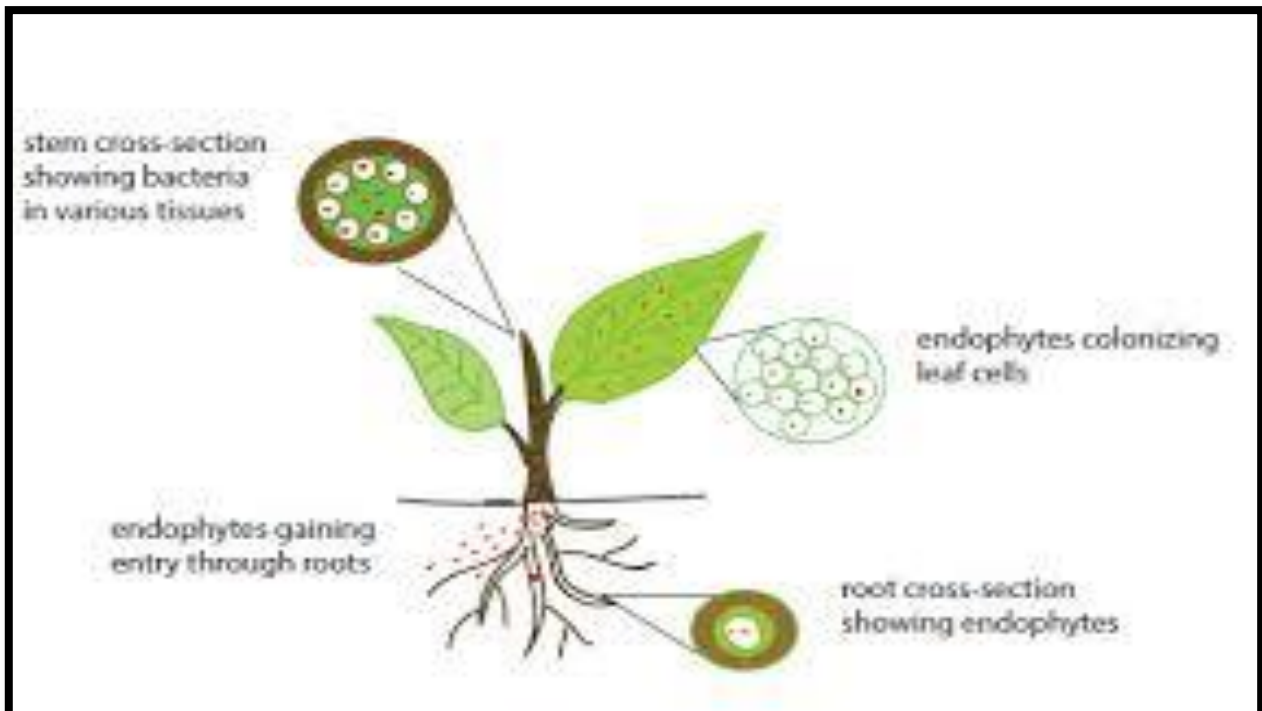


Image Reference:-Chaturvedi.H.; Singh.V.; Gupta.G. (2016), Potential of bacterial endophytes as plant growth promoting factors, Journal of Plant Pathology and Microbiology, 7(9):1000376.

Role of endophytes in plant growth and development

- Various endophyte species attached with root of plants help in growth and development of plants by increasing the fresh and increase in length of lateral roots and root hairs.
- Plant growth promoting endophytes inhabit plant tissues and the close linkage of endophytes inside plant tissues facilitates nutrient exchange and enzymes activity.
- Some of the endophytes isolated from plants differentially produces IAA and NH_3 and in addition to enzymatic and antimicrobial activity, exhibits capacity to solubilize PO_4^{3-} .
- Some isolates were also recovered from plants that are known to produce siderophores. These isolates play a crucial role in plant's growth under iron limiting conditions and controlling plant pathogens.
- Other contributions of Endophytes:-
 - a. Deterring herbivore by the production of endophyte.
 - b. Endurance to thrive in hot weather.
 - c. Protection from pests in dicots.
 - d. Production of different phytohormones and isoflavones with GA being produced in higher concentrations.

Endophytes as a potential source of biocontrol agent

- Endophytic fungi acts as biocontrol agent and also protects the host plant from infection for the entire life cycle of endophytes by producing 2^o metabolites. The occupation of endophytes ecology and endophytic fungi induce the production of phytoalexins which might be the main factors in plant protection.
- When the endophytes inhibit the pathogens, they are involved in the nutrients and colonizing sites competition, host plant defence stimulation, antimicrobial compounds production with biocontrol activity.
- Nutrient and space competition, plant growth promotion and systemic resistance are the indirect whereas hyperparasitism, lytic enzymes and antibiotic production are direct methods of biological control.
- Endophytes showcase a vital function in the biodegradation of host plant litter. In plant litter biodegradation, endophytic microorganisms, colonize the plant and then trigger the saprophytic organism to act on it through an antagonistic reaction, thereby giving an increase in the decomposition of litter.
- Endophytes can detect physiological changes in plants regulate gene expression for adaption to that environment.

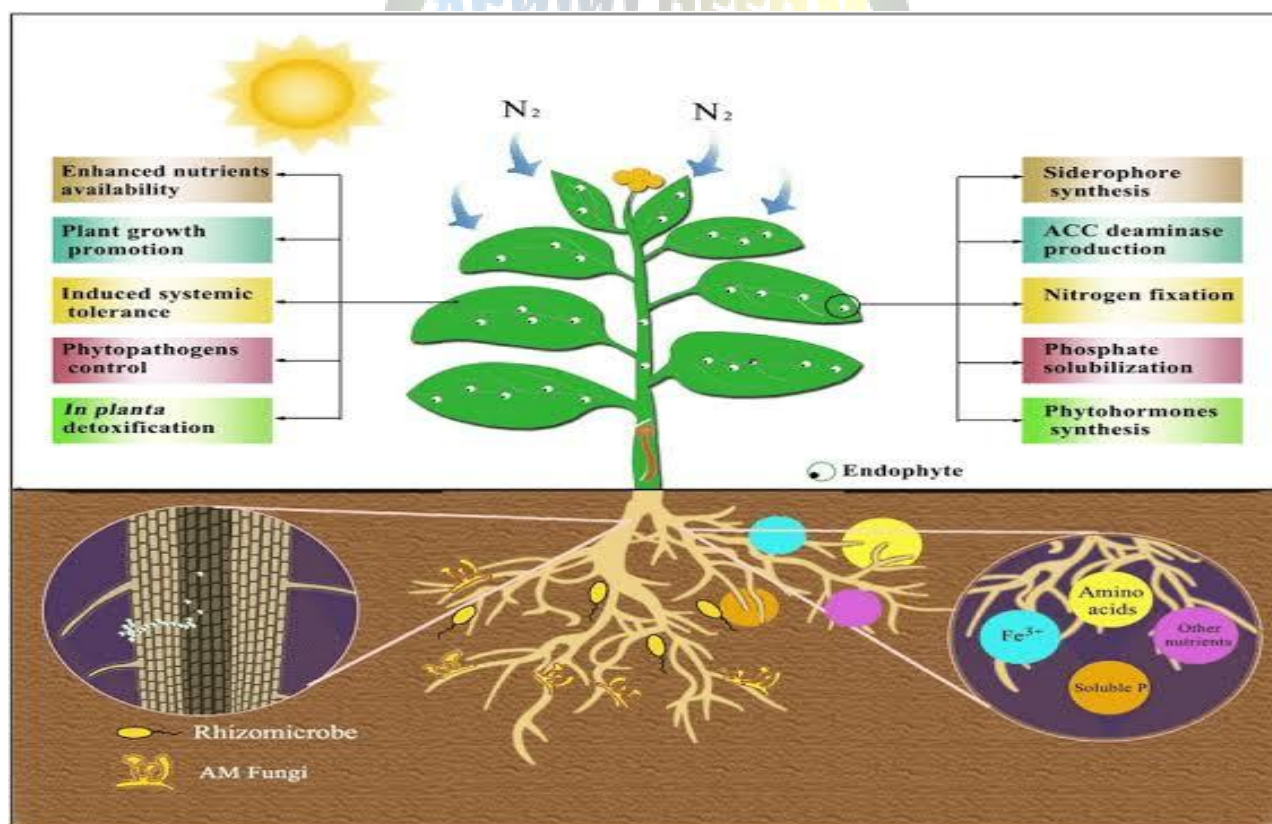


Image Reference:-Nai-Xian Feng;Jiao Yu;Hai-Ming Zhao;Yu-Ting Cheng;Ce-Hui Mo;Qua-Ying Cai;Yan-Wen Li;Hui Li;Ming-Hung Wong(2017),Efficient phytoremediation of organic contaminants in soils using plant-endophyte partnerships,Science of The Total Environment,583:352-368.

Conclusion

Endophytes are microorganisms that live within the plant tissues and establish a symbiotic relationship with them. They produce a diverse range of antibiotics and secondary metabolites which can help in plant growth and protection from plant pathogens. Plant growth promoting activity of endophyte is because of production of phytohormones and enzymes that increase the fresh weight of plants and are also helpful in nutrient absorption. Endophytes also protect the plants from different plant pathogens either directly (by competing for nutrients and space, releasing toxic chemicals, parasitizing the pathogen) or indirectly (by inducing systemic resistance in plants). Various compounds that have been isolated and the functions they perform for their host plant has proved to be a better alternative for managing plant diseases.

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