

Endophytes: An Ecofriendly Approach in Plant Disease Management

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SUMMARY

Endophytes are the hidden world inside plants. It serves as a storehouse of many bioactive molecules like phenols, alkaloids, steroids, saponins, tannins, etc. The presence of endophytes such as *Trichoderma* can induce resistance in plants, triggering a defence response that helps plants to defend from a broad spectrum of pathogens. Endophyte secretes several secondary metabolites that make host plant resistant to environmental stresses, such as drought, soil salinity and extreme temperature.

INTRODUCTION

Endophytes are the organisms, usually fungi or bacteria which live and colonize inside the living host tissues. The concept “plant microbiome” i.e. association of microorganisms genome with plants has emerged and plays an important role in the growth of plants. Metabolites produced by endophyte inhibits the growth of plant pathogens. These can act as a natural insecticides and fungicides providing a more sustainable and eco-friendly approach in managing plant diseases compared to conventional chemical pesticides. They have coevolved with plants and have developed intricate mechanisms to recognize and combat specific pathogens.

Plants seek “Cry for help” when they are under biotic and abiotic stresses.

Under Stress Conditions:

Strigolactone → Recruit *Glomus sp.* → Protection against low temperature
 Low level of Raffinose → Recruit *Bacillus sp.* → Protection against Fusarium

High level of Tryptophan

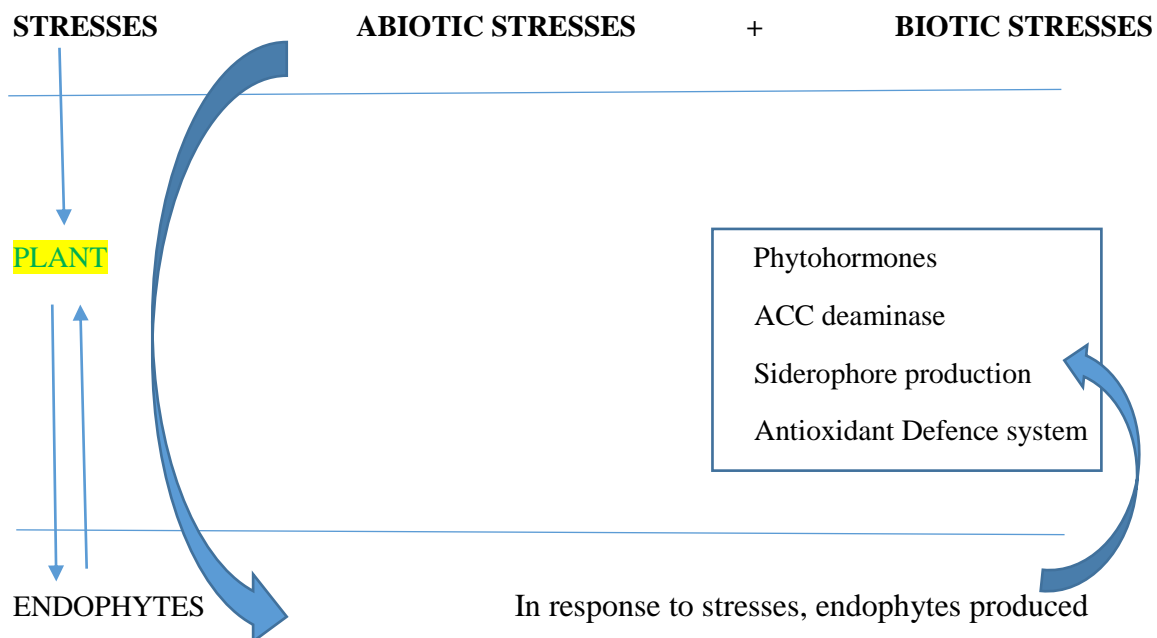


Fig1. Response of endophytes to stresses

3. Antibiotics produced by endophytes

Endophytic bacteria and fungi have been isolated from diverse plant species and has the ability to produce antibiotics that helps them to compete with other microorganisms.

Endophytic bacteria	Compounds	Properties
<i>Bacillus Subtilis</i>	Bacilysocin	Antifungal
<i>Bacillus atrophaeus</i>	1,2 – benzenedicarboxyl acid	Antifungal
Endophytic fungi	Compounds	Properties
<i>Phomopsis sp.</i>	Clavasterols	Antifungal
<i>Aspergillus sp.</i>	Fumigaclavine	Antibacterial

4.Lytic Enzyme Secretion

Some endophytic microorganisms have the ability to produce lytic enzymes as part of their metabolic activities.

Lytic enzymes or hydrolytic enzymes plays an important role in degradation of carbohydrates , proteins, lipids and nucleic acids. For Example , endophytic fungi produces a wide range of hydrolytic enzymes such as cellulases, amylases, proteases, lipases and chitinases. Some lytic enzymes, such as chitinases and proteases have shown antifungal and antibacterial properties.

5.Siderophore production

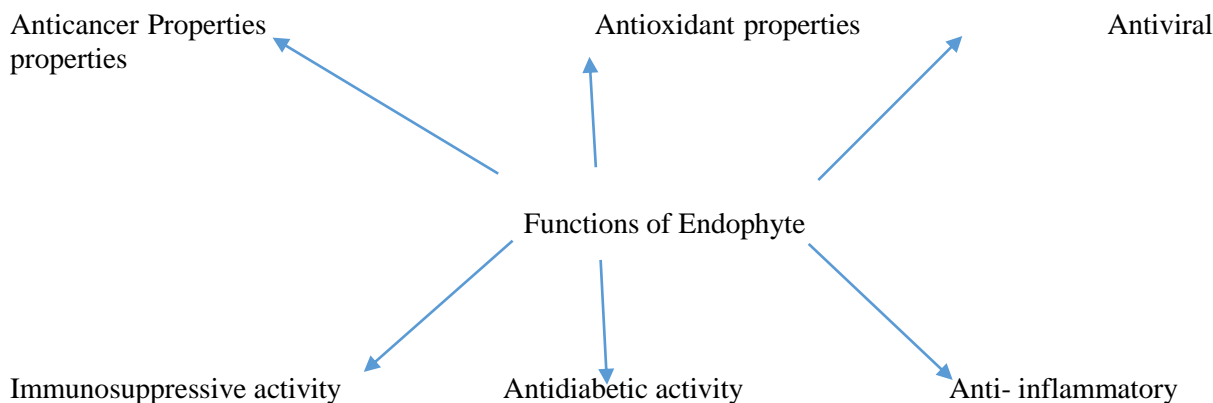
Siderophores are small organic molecules produced by microorganisms, including certain endophytes having affinity to bind iron. By scavenging iron from the environment, endophytes can compete with other pathogens. Siderophore producing endophytes gets benefitted in nutrient acquisition and colonization within the host plant tissues.

Endophytic actinomycetes such as *streptomyces sp.*, *Nocardia sp.* have been reported to produce siderophores.

6.Biomolecules produced by endophytes

Phenolics – Hypericin and capsaicin
 Saponin – Diosgenin
 Xanthones – Pinselin
 Terpenoid – Sordaricin
 Steroids

Flavonoids – Cajanol
 Alkaloids - Camptothecin
 Glycoside- Digoxin
 Quinones - Jesterone



CONCLUSION

Endophytes represent a fascinating area of study with implications on plant biology, agriculture and medicine. This field of research witnessed discoveries of bioactive molecules and contribute to plant disease management. Endophytes can be used as a natural fungicides and insecticides.

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