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Endophytic Micro Organisms: A Frontier In Plant Disease Management

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Introduction:

Endophytes, a diverse group of microorganisms including bacteria, fungiand other microbes, inhabit plant tissues without causing harm to their host plants. They form symbiotic relationships with their hosts and are ubiquitous across plant species, residing in roots, stems, and leaves. Endophytes are integral to plant health, assisting in nutrient absorption, enhancing stress resilience, and bolstering defenses against pathogens. Additionally, they synthesize bioactive compounds that promote plant growth and provide protection against diseases.

Role of Endophytes:

Endophytic microorganisms play a vital role in enhancing plant growth and fortifying defenses against pests and pathogens through diverse mechanisms. They produce and release secondary metabolites and biochemicals that hinder the harmful effects of plant pathogens, including volatile compounds that inhibit pathogen growth. Some endophytes bolster their host plant's defense mechanisms by triggering systemic acquired resistance (SAR) or induced systemic resistance (ISR). Additionally, endophytes engage in direct competition with host pathogens for nutrients and space, further safeguarding the plant from harm.

Endophytes as Plant Growth Promoters:

Numerous endophytes exhibit plant growth promoting (PGP) properties alongside their ability to protect against pathogens, resulting in stronger and healthier plants. These PGP endophytes not only supply essential nutrients such as nitrogen, phosphate, and iron but also stimulate plant growth and development through various mechanisms. They can modulate plant hormones such as auxin, cytokinin, ethyleneand gibberellin and produce other bioactive compounds. Particularly associated with roots, PGP microbes synthesize several chemical compounds that influence plant growth and development, including indole-3-acetic acid (IAA), gibberellins, cytokinins.

Environmental factors affecting Endophytes:

Weather plays a significant role in influencing the occurrence of endophytes, with factors such as wind being a primary mechanism for spore dispersal. Higher wind speeds can enhance dispersal, increasing the likelihood of endophyte colonization. Additionally, moisture is essential for the germination and colonization of host plants by endophytes. Furthermore, the location and age of plants can impact endophyte density, with older leaves often displaying stronger resistance to colonization compared to younger leaves.

Host Plant Feedback on Endophytes:

The symbiotic relationship between endophytes and plants provides mutual benefits: endophytes gain protection and competitive advantages, while plants receive protection and nutrients. However, endophytes may become pathogenic under certain conditions. It is important to note that the endophytic status of a microorganism varies across host species. Secondary metabolites produced by either the endophyte or the plant regulate endophytic growth within plant tissues, allowing plants to control colonization.

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Conclusion:

Given the intricate dynamics between hosts and endophytes, which may involve shifts from mutualistic to opportunistic pathogenic interactions, it's crucial to study candidate endophytes in plants under various conditions, including abiotic stress. Before microbiome engineering can offer predictable and consistent benefits for widespread adoption, extensive research is necessary. Moreover, a deeper understanding of microbiomes and their impact on plant health will yield innovative monitoring solutions for predicting future disease outcomes associated with pathobiomes.

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