

A Comprehensive Guide to Mycorrhizal Fungi

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DESCRIPTION

A wide variety of fungus known as mycorrhizal fungi coexist symbiotically with plant roots. The relationship between the fungi and the plants is called mycorrhiza and it is one that benefits both parties. The mycorrhizal fungus colonise plant roots and create a network of hyphae (thread-like structures) in this symbiotic association. The hyphae penetrate the surrounding soil, dramatically expanding the area that can absorb nutrients and water. This makes it possible for the plant to more effectively acquire nutrients including phosphorus, nitrogen and micronutrients. By collecting sugars and other organic molecules from the plant, the mycorrhizal fungus gain from the relationship. The plant provides the fungi with sugars and other nutrients because they are unable to perform photosynthesis on their own. Through the root system, the plant's photosynthesis-produced carbohydrates are delivered to the fungi.

Types of mycorrhizal relationships

The two types of mycorrhizal relationships are ectomycorrhizae and arbuscular mycorrhizae.

Ectomycorrhizae: Pine, oak and beech trees are typical hosts for this kind of mycorrhiza. In ectomycorrhizae, the fungal hyphae expand into the gaps between the root cells and create a sheath around the plant roots. In the outer layer of the root cells, they also organise into a dense network called a Hartig net. Because they encourage nutrient cycling and promote tree growth, ectomycorrhizal fungi are crucial to the health of forest ecosystems.

Arbuscular mycorrhizae: The majority of plant species, including agricultural crops, form arbuscular mycorrhizae, the most prevalent type of mycorrhizal connection. In AM, the fungus' hyphae enter the plant roots' cells and create complex

structures known as arbuscules. These structures give the fungus and the plant a sizable surface area for the exchange of nutrients. Arbuscular mycorrhizal fungi are especially good at helping plants absorb more phosphorus.

Benefits of mycorrhizal associations

The main benefits of mycorrhizal associations for plants include:

Nutrient uptake: Mycorrhizal fungi have a remarkable ability to acquire nutrients, especially phosphorus and nitrogen, from the soil. They can explore a larger volume of soil than plant roots alone, effectively scavenging nutrients that would otherwise be inaccessible to the plant. The fungi absorb these nutrients and transfer them to the plant in exchange for carbohydrates produced through photosynthesis.

Water absorption: The extensive hyphal network of mycorrhizal fungi enhances the plant's water absorption capacity. The fine hyphae can penetrate small soil pores and access water that would otherwise be beyond the reach of plant roots. This is particularly beneficial in drought-prone environments, as the fungi help plants cope with water stress.

Disease resistance: Mycorrhizal associations can confer increased resistance to certain soil-borne pathogens. The hyphae of mycorrhizal fungi can form a physical barrier around the roots, preventing the entry of pathogenic organisms. Additionally, some mycorrhizal fungi produce compounds that inhibit the growth of pathogens, further protecting the plant from diseases.

Enhanced growth and establishment: The presence of mycorrhizal fungi often promotes the overall growth and establishment of plants. The improved nutrient and water uptake provided by the fungi can lead to better plant growth, increased biomass production and improved survival rates, especially in nutrient-poor or degraded soils.

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