MYCORRHIZAE

Mycorrhizae literally translates to "fungus-root." Mycorrhiza defines a (generally) mutually beneficial relationship between the root of a plant and a fungus that colonizes the plant root. In many plants, mycorrhiza are fungi that grow inside the plant's roots, or on the surfaces of the roots. The plant and the fungus have a mutually beneficial relationship, where the fungus facilitates water and nutrient uptake in the plant, and the plant provides food and nutrients created by photosynthesis to the fungus. This exchange is a significant factor in nutrient cycles and the ecology, evolution, and physiology of plants.

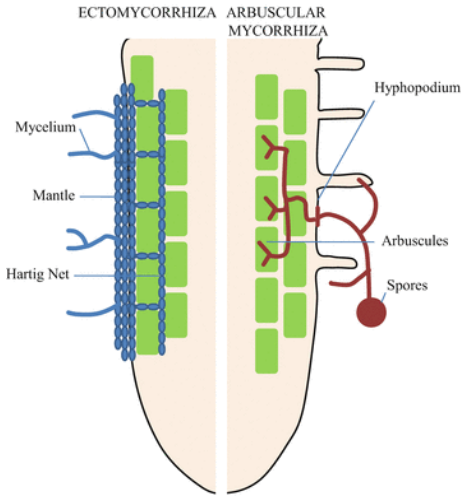
Not all plants will have mycorrhizal associations. In environments in which water and nutrients are abundant in the soil, plants do not require the assistance of mycorrhizal fungi, nor might mycorrhizal fungi germinate and grow in such environments.

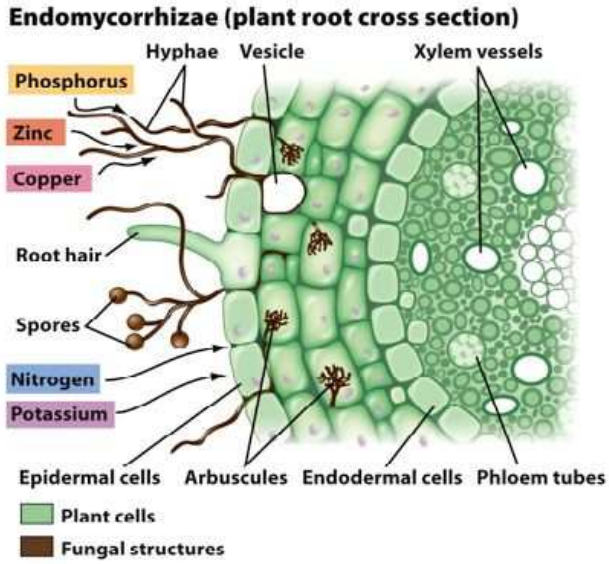
Types of Mycorrhizae :

There are two predominant types of mycorrhizae: ectomycorrhizae, and endomycorrhizae. They are classified by where the fungi colonize on the plants.

Ectomycorrhiza :

Ectomycorrhiza tend to form mutual symbiotic relationships with woody plants, including birch, beech, willow, pine, oak, spruce, and fir. Ectomycorrhizal relationships are characterized by an intercellular surface known as the Hartig Net. The Hartig Net consists of highly branched hyphae connecting the epidermal and cortical root cells. Additionally, ectomycorrhiza can be identified by the formation of a dense hyphal sheath surrounding the root's surface. This is known as the mantle. In other words, ectomycorrhiza live only on the outside of the root. Overall, only 5-10% of terrestrial plant species have ectomycorrhiza.





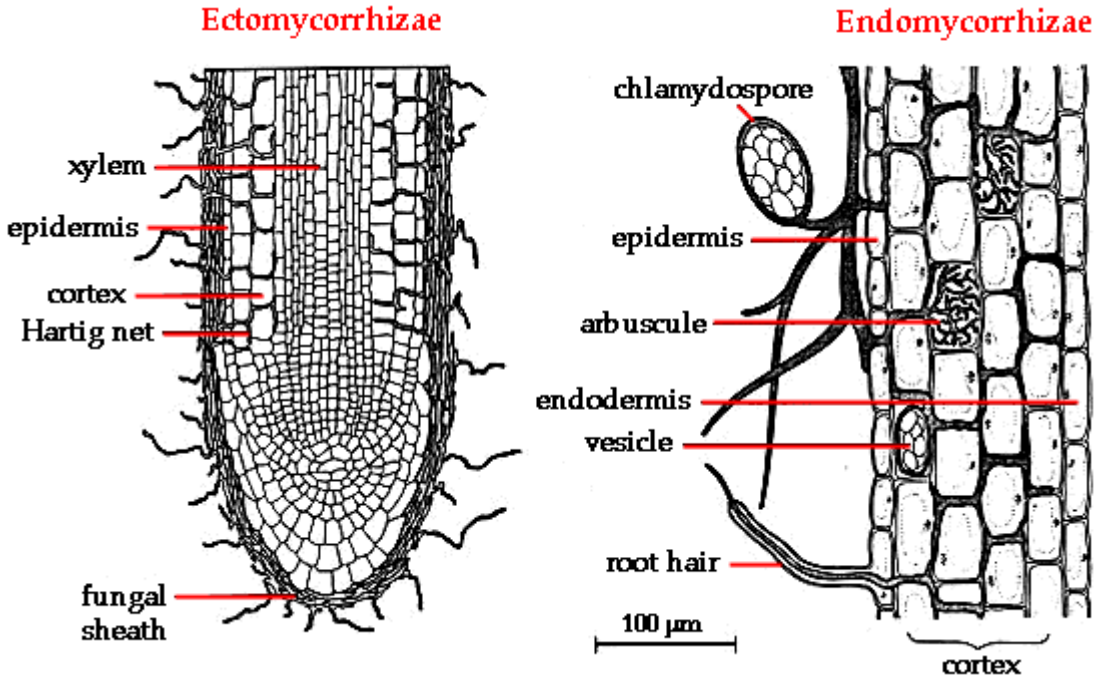
Endomycorrhiza :

On the other hand, endomycorrhizae are found in over 80% of extant plant species -including crops and greenhouse plants such as most vegetables, grasses, flowers, and fruit trees. Endomycorrhizal relationships are characterized by a penetration of the cortical cells by the fungi and the formation of arbuscules and vesicles by the fungi. In other words, endomycorrhiza have an exchange mechanism on the inside of the root, with the fungi's hyphae extending outside of the root. It is a more invasive relationship compared to that of the ectomycorrhiza.

Endomycorrhiza are further subdivided into specific types: Arbuscular Mycorrhizae, Ericaceous Mycorrhizae, Arbutoid Mycorrhizae, and Orchidaceous Mycorrhizae.

Arbuscular Mycorrhiza :

Arbuscular mycorrhizae are the most widespread of the micorrhizae species and are well known for their notably high affinity for phosphorus and ability for nutrient uptake. They form arbuscules, which are the sites of exchange for nutrients such as phosphorus, carbon, and water. The fungi involved in this mycorrhizal association are members of the zygomycota family and appear to be obligate symbionts. In other words, the fungi cannot grow in the absence of their plant host.



Ectotrophic Mycorrhizae :

The fungi involved in this mycorrhizal association are from the Ascomyota and Basidiomyota families. They are found in many trees in cooler environments. Unlike their wood-rotting family members, these fungi are not adapted to degrade cellulose and other plant materials; instead, they derive their nutrients and sugars from the roots of their living plant host.

Plant Benefits from Mycorrhizae:

Mycorrhiza associations are particularly beneficial in areas where the soil does not contain sufficient nitrogen and phosphorus, as well as in areas where water is not easily accessible. Because the mycorrhizal mycelia are much finer and smaller in diameter than roots and root hairs, they vastly increase the surface area for absorption of water, phosphorus, amino acids, and nitrogen—almost like a second set of roots! As these nutrients are essential for plant growth, plants with mycorrhizal associations have a leg-up on their non-mycorrhizal associated counterparts that rely solely on roots for the uptake of materials. Without mycorrhiza, plants can be out-competed, possibly leading to a change in the plant composition of the area.

Additionally, studies have found that plants with mycorrhizal associations are more resistant to certain soil-borne diseases. In fact, mycorrhizal fungi can be an effective method of disease control. In the case of sheathing mycorrhiza, they create a physical barrier between pathogens and plant roots. Mycorrhiza also thicken the root's cell walls through lignifications and the production of other carbohydrates; compete with pathogens for the uptake of essential nutrients; stimulate plant production of metabolites that increases resistance to disease; stimulate flavonolic wall infusions that prevent lesion formation and invasion by pathogens; and increase plant root concentrations of orthodihydorxy phenol and other allochemicals to deter pathogenic activity. In addition to disease resistance, mycorrhizal fungi can also impart to its host plant resistance to toxicity and resistance to insects, ultimately improving plant fitness and vigor.

In more complex relationships, mycorrhizal fungi can connect individual plants within a mycorrhizal network. This network functions to transport materials such as water, carbon, and other nutrients from plant to plant, and even provides some type of defense communication via chemicals signifying an attack on an individual within the network. Not only can plants use these

signals to start producing natural insect repellants, they can also use them to start producing an attractant to bring in natural predators of the plant's pests!

In some cases, mycorrhizal fungi allow plants to bypass the need for soil uptake, such as trees in dystrophic forests. Here, phosphates and other nutrients are taken directly from the leaf litter via mycorrhizal hyphae.

Mycorrhizal fungi are also able to interact with and change the environment in the favor of the host plants—namely, by improving soil structure and quality. The filaments of mycorrhizal fungi create humic compounds, polysaccharides, and glycoproteins that bind soils, increase soil porosity, and promote aeration and water movement into the soil. In environments that have highly compacted or sandy soils, improved soil structure can be more important for plant survival than nutrient uptake.

Some ectomycorrhizal associations create structures that host nitrogen-fixing bacteria, which would largely contribute to the amount of nitrogen taken up by plants in nutrient-poor environments, and would play a large part in the nitrogen cycle. The mycorrhizal fungi, however, do not fix nitrogen themselves.

PROBABLE QUESTIONS :

1. Define Mycorrhizae
2. What do you mean by ecto and endo mycorrhizae? cite example.
3. What is VAM? Mention the role of VAM in agriculture.

REFERENCES:

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