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Mycorrhizae: Types and their Role in Nutrients Accumulation

(*Kailash Chand Kumawat and Nikita Kumari)

Department of Industrial Microbiology,
Jacob Institute of Biotechnology and Bio-engineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, Uttar Pradesh, India
*kailash.kumawat@shiats.edu.in

Mycorrhizae literally translate 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 is 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.

In some cases, the relationship is not mutually beneficial. Sometimes, the fungus is mildly harmful to the plant, and at other times, the plant feeds from the fungus. 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 mycorrizal 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.

Fungi Benefits from Plants

When the plant is provided with enough water and nutrients, it is able to photosynthesis and produce glucose and sucrose-some of which is made directly accessible to the *mycorrhizal* fungi. The fungi are also provided with photo synthetically fixed carbon from the host, which functions as a trigger for nitrogen uptake and transport by the fungi. All of this is necessary for fungal growth and reproduction.

Role in nutrients accumulation in mycorrhizae

- Mycorrhizae are a symbiotic association between plant roots and fungi.
- Their major role is to enhance nutrient and water uptake by the host plant by exploiting a larger volume of soil than roots alone can do.
- Mycorrhizae come in a number of forms, dependent upon both host plant and fungal taxonomy.
- They play important roles in plant resource capture and nutrient cycling.
- The ability of AM fungi to enhance host plant uptake of relatively immobile nutrients, in particular Phosphorus (P), and several micronutrients, has been the most recognized beneficial effect of mycorrhiza.
- Arbuscular mycorrhizal fungi absorb inorganic P either from the soluble P pools in the soil, or from insoluble forms, such as, Rock Phosphates (RP).
- Recent studies show that mycorrhizal fungus Glomus intraradices solubilized RP through localized alterations of pH and/or by the production of organic acid anions, that may act as chelating agents.
- Although, most research regarding the role of mycorrhizae in P nutrition has dealt with inorganic P, however, few investigations have also considered the utilization of organic P compounds by AM colonized plants. Furthermore, though the mycorrhizal colonization is known to improve plant N nutrition, yet, their role in making N available to plants has not been fully recognized. Uptake of other nutrients, such as, Na, K, Mg, Ca, B, Fe,, Cu, and Zn, by growing plants is influenced by mycorrhizal colonization .