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Short Communication

Mycorrhizal Fungi

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The word mycorrhiza is given the mutualistic association between fungus (myco) and roots (rhiza) of the plants. This association is a symbiotic because the relationship is advantageous for both organisms. This was given by A.B Frank in 1885. These are macrosmbiont and microsymbiont. The macrosymbiont gained increased exploration of soil with a net of hyphae that increase the uptake of water and nutrient from the soil interphase. The microsymbiont uses the carbon provides by plants for its physiological functions, growth and development. Some of the mycorrhizae are symbiotic, mutualistic and sometimes weak pathogenic. According to A.B Frank mycorrhiza are Ectotrophic and Endotrophic. In ectotrophic mycorrhizae fungus form sheath on root surface and hyphae grow outward and between outer cortical cells of the roots. While in endotrophic mycorrhizae, fungal hyphae enter the cortical cells of roots and may colonize the root plants intracellular enveloped by plasmalemmma of the host.

Symbiotic relationship with 80% of the vascular plants, bryophytes, angiosperms, pteridophtes many of the associations are mutualistic because typically absorb the mineral nutrient and transfer them to the plants. In return plants provide fungus with sugars. However different type of mychorrhiza has different types of properties and features.

Recent classification of mycorrhiza consists of

- Ectomycorrhiza
- Endomycorrhiza

Ectomycorrhiza Fungi or Sheathing mycorrhiza

Mainly found on woody plants such as conifers and broad leaved plants , mainly found in temperate and boreal regions. Fungi belong to Agaricomycetes such as *Amanita, Boletus, Cortineris, Russula, Hebeloma, Lactarius, Pisolithus, Rhizopogon* and few ascomycetes fungi like Tubers.

Pseudomonas in association with the roots of higher plants reach out to the root surface through root hairs and fungus leads to morphogenetic changes like there will be reduction in root hairs and there will be no branching on the roots of plants. The hyphae extend along with mantel to several kilometers. These are efficient in cycling, produce hydrolytic enzymes and plant growth get slower down [1]. This will make phosphate solubilize and then it is easily available to plants. In temperate region the metabolites are absorbed immediately from the root surface because of presence of these ectomycorrhizal fungi. Mycorrhizal fungi can not degrade the pectin and lignin by itself and require carbohydrates from plants, that's why they are assoiated with each other.

Endomycorrhizal fungi

Unlike ectomycorrhizal which form a system of hyphae that grow around the cells of the roots, the hyphae of endomycorrhiza not only grow inside the roots of the plants but penetrate the root cells wall and become enclosed in the cell membrane as well

This makes for a more invasive symbiotic relationship between the fungi and the plant. The penetrating hyphae create a greater contact surface area between the hyphae of the fungi and plant. This contact facilitates a greater transfer of nutrients between the two.

These are classified in four major groups.

- Arbuscular mycorrhizae
- Ericoid mycorrhiza
- Arbutoid mycorrhiza
- Orchid mycorrhiza

Arbuscular mycorrhizae

Before 1974 the term Vesicular Arbuscular Mycorrhiza (VAM) was used commonly for mycorrhizal associations where vesicles as well as arbuscles were observed in the roots. Later it was recognized that some fungi form mycorrhizae with arbuscules only and lack the ability to form vesicles for instance *Gigaspora, Scutellospora* therefore more general term arbuscular mycorrhiza AM should be used.

Important genera for AM on the basis of molecular studies of ss RNA [2]. They have been assigned to a monophyletic group the Glemeromycota. Almost all members of this group such as *Aculospora, Archaeospora, Enterophospora, Gigaspora, Glomus, Paraglomus*

and *Scutellospora mycorrhiza* with crop plants and have not been grown in axenic culture. They have wide host ranges. Plants in natural communities found colonized by different strains of AM fungi.

The diversity of AM fungi can influence the plant diversity in ecosystem with an increase in AM fungal diversity. There is an increase in plant productivity and plant diversity.

Ericoid mycorrhizae

The ericoid mycorrhizae is mutualistic relationship formed between members of the plants belong to family Ericaceae and several lineages of mycorrhizal fungi. This symbiosis represents an important adaptation to acidic. These are found in boreal forests.

Ericoid mycorrhizae establish loose hyphal networks around the outside of hair roots from which they penetrate the walls of cortical cells to form intracellular coils that can densely pack individual plant cells.

Ericoid fungi form symbioses with several crop and ornamental species such as blueberries, cranberries and *Rhododendron* etc.

Arbutoid mycorrhizae

Arbutoid mycorrhiza are like those of ericoid and monotropoid mycorrhizas, found in the plant order Ericales. Arbutoid associations are found in the *pyrolaceae* family in order Ericales.

The fungi of arbutoid mycorhizas are basidiomycetes, often the same fungal species that form the ectomycorrhizal associations. A major difference between the arbutoid and ectomycorrhizal association is that the hyphae of the former do actually penetrate the outer cortical cells, and fill them with coils, which the hyphae of ectomycorrhizal do not. The intracellular coils, along with the mantle sheath and hartig net are the diagnostic features of arbutoid mycorhizas.

Orchid mycorrhiza

Orchid mycorrhizas are symbiotic relationship between the roots of plants of the family *Orchidaceae* and a variety of fungi. Orchid mychorrhiza are critically important during orchid germination, as an orchid seed has virtually no energy reserve and obtains its carbon from the fungal symbionts. There is a structure named protocorn from where the symbiosis starts. The fungal hyphae that enter the orchid have many mitochondria and few vacuoles, thus increasing their metabolic capacity when paired with an accepting symbiote [3]. The fungi that form orchid mycorrhizae are typically basidiomycetes. These fungi come from a range of taxa including *Cetatobasidium, Sebacina, Tulasnella* and *Russula species* [4]. Most of the orchid associations are with saprophytes or pathogenic fungi, while a few of them associate with ectomycorrhizal fungi.

Features of mycorrhizal fungi

- Mycelium found in root tissue is coarse, coenocytic and grow intercellularly.
- Outside the root produce large spores and can range from 10 um to 1000um.
- They are hyaline to dark in color.
- Texture can be smooth to highly echinulated.
- After penetration, the hyphae branched repeatedly to form dichotomous tree like structure is known as arbuscules, which have short active life which is of 15 days and then they degenerate and new arbuscules are formed in new area
- The plant and the fungal plasma membrane are separated y an apoplastic compartment known as periarbuscular space.

Potential benefits of mycorrhizal fungi

- Enhanced water and nutrient uptake
- Reduction of irrigation requirements
- Increased need for fertilizers
- Increased drought resistance increased pathogen resistance
- Increased pathogen resistance
- Increased plant health and stress tolerance
- Higher transplanting success
- Potentially less pesticide usage.

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