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MYCORRHIZA AND ITS ROLE

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The term 'Mycorrhiza' denotes the symbiotic relationship between fungi and the roots of higher plants. In nature, nearly 99% plants are mycorrhizal and it is rather difficult to find a plant without mycorrhiza. 'Endomycorrhiza' and 'Ectomycorrhiza' are the two major types of mycorrhizae encountered more frequently.

The major distinguishing feature of ectomycorrhizae is the intercellular development of hyphae in the cortex resulting in the hartig net. Externally it appears as single unforked, bifurcate, corralloid or even nodular roots. Most fungi that form ectomycorrhizae with forest trees are belonging to the group of Basidiomycetes; however, some species of Ascomy-cetes like truffles are also symbiotic.

The endomycorrhizal fungi, commonly referred to as the 'Vesicular-arbuscular mycorrhizae' (VAM) are the most widespread and important root symbionts which occur in practically all families of angiosperms and gymnosperms including pteridophytes and bryophytes. Although endomycorrhizal fungi can form a loose network of hyphae on feeder root surfaces, they donot develop the .dense fungal mantle similar to that of ectomycorrhizae. The vesicles and arbuscles are the two distinct characteristic features of endomycorrhizae. There is no external change in the morphology of the roots infected with VAM fungi. The fungi which forms endomycorrhizae mainly belong to Phycomycetes which do not produce above-ground fruiting bodies. They spread in the soil by root contact and the viability of spores is maintained for many years in the soil in the absence of a suitable host. It is a well established fact that VA mycorrhizae can increase the plant growth in soils having low fertility. Researchers have paid much attention on the role of mycorrhizae in plant development, mainly relating to natrition uptake, particularly uptake of phosphates. VA mycorrhizal infection tends to be the most prevalent in soils of moderate or low fertility. Generally the amount of infection is being reduced by the addition of P, N or complete fertilizers to soil. High levels of soluble phosphates in the soil depresses mycorrhizal development while low levels adversely affect the plant growth.

The exploitation of soil by mycorrhizal roots as a means of increasing phosphate uptake is well established. The normal phosphate depletion zone around non-mycorrhizal roots is thought to be between 1-2 mm. But, Rhodes and Gerdemann (1975) demonstrated that in endomycorrhizal roots this depletion zone is increased upto a maximum of 20 mm. VA mycorrhiza can also increase the uptake of other nutrients.

The increased uptake of other elements like N, K, Ca, Mg, Cu, Mn, Na, Si, Zn, Al and B by mycorrhizal plants have been more variable than that of phosphates. Many investigators have analysed mycorrhizal and non-mycorrhizal plants for concentrations of the above nutrients and found inconsistent result (Mosse, 1973). These elements were found to be present in greater concentrations in mycorrhizal plants while in some cases the concentrations were higher in non-mycorrhizal plants or the differences were not significant at all. This differential uptake may reflect the relative concentrations of these elements present in the soil. VA mycorrhizae can also decrease the resistance to water transport in the plants. The decreased resistance to water transport may be caused by changes brought about in the morphology of the host plant. It was found that mycorrhizal infection increased the amount of vasular tissue in tomato, petunia and maize stems which has an indirect effect resulting from the greater uptake of phosphorus (Daft and Okusanya, 1973).

VA mycorrhizae are referred to as 'universal plant symbiont', because the plant usually studied by plant physiologists are hosts for endomycorrhizal fungi. Inoculation of mycorrhizal fungi to the plants normally causes an increase in growth. However, the magnitude of this growth can be reduced quite readily by increasing the quantity of available phosphorus in the soil. Recent work showed that many forest tree species have an obligate physiological requirement for endomycorrhizae and some of these species are apparently not even affected by phosphate levels of the soil. Methodology must be developed for systematic study of mycorrhizae before quantitative data on nutrient cycling can be obtained. This is, however,an extremely difficult task and such an effort has not yet been made. At present, therefore, we have to assume that nutrient and even water uptake of forest trees is atleast enhanched by mycorrhizae.

Ectomycorrhizae are also more resistent to feeder root diseases than non-mycorrhizal roots. The fungal mantle and hartig net provide a mechanical barrier to the invasion of pathogenic fungi. There is evidence that many ectomycorrhizal fungi produce antibiotics and also some inhibitory compounds that might play a role to increase the resistence of the mycorrhizae. Other possible mechanisms include an alteration of root exudates that would make mycorrhizae less attractive to zoospores of root pathogens and also an alteration of rhizosphere population in such a way that non-pathogenic fungi are favoured over pathogenic ones. On the contrary, very little information is available about the effect of VA mycorrhizae on diseases. VA mycorrhizae do not have fungal mantles that would provide a protective barrier against the invasion of root pathogens; however, it is possible that other mechanisms could play a role proposed for the enhanched resistence of ectomycorrhizae to root diseases. This is a very important field of research in the near future.

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