ECO-PHYSIOLOGICAL STUDIES ON ENDOMYCORRHIZAE OF CERTAIN IMPORTANT TIMBER TREE SPECIES OF NORTH-EASTERN INDIA

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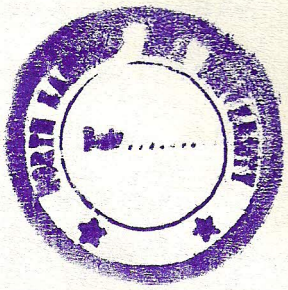

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North-Eastern region of India is endowed with rich natural vegetation and forest resources. The survey of 26 important timber tree species from a natural mountain forest ecosystem of the region indicated their highly mycotrophic nature. Six tree species were ectomycorrhizal and twenty others were endomycorrhizal. In endomycorrhizal group two species had ericoid and remaining eighteen had vesicular-arbuscular type of endomycorrhizal association. The rhizospheric soil of all the tree species was acidic (pH:4.5-6.0), rich in soil moisture (17-40%) and organic matter (5-15%). However, the soil was poor in available phosphorus (1-10ppm).

Cryptomeria japonica, Exbucklandia populnea, Acacia dealbata, Schima khasiana, Machilus kingii, Cinnamomum tamala, Manglietia insignis, Lindera latifolia and Casearia verica exhibited seasonal variation in the level of VA mycorrhizal infection. The percent VA mycorrhizal infection increased during spring and rainy seasons and declined towards winter or late winter depending on the tree species in both the years viz. 1983-84 and 1984-85. In Daphniphyllum himalayanse and Mallotus nepalensis, VA mycorrhizal infection was high in all the seasons. Tree species exhibited higher population of endogonaceous spores in their rhizospheric soil and it varied among various tree species and in different seasons. Cryptomeria japonica, Exbucklandia populnea, Cinnamomum tamala and Lindera latifolia displayed maximum endogonaceous

spore population in rhizospheric soil in rainy season, whereas, in Daphniphyllum himalayanse and Machilus kingi it was maximum in winter. Acacia dealbata, Schima khasiana Mallotus nepalensis, Manglietia insignis and Casearia verica did not show seasonal variation in endogonaceous spore population in the rhizospheric soil.

Seasonal variation in soil pH was low. Moisture content, organic matter, total nitrogen, available phosphorus, exchangeable potassium and exchangeable calcium of the soil exhibited greater seasonal variation.

Spores of Glomus spp, Acaulospora spp, Gigaspora spp and Sclerocystis spp were observed in the rhizospheric soil of the tree species. Spores of different types representing more than one genera of endogonaceous fungi were present in the rhizospheric soil of tree species. Spores of Glomus spp and Acaulospora spp were abundant. Former was found in all the seasons, whereas, latter was common during winter season. Spore populations of Gigaspora spp and Sclerocystis spp was low and were observed during warmer months of April and June.

Ten species of endogonaceous fungi were identified from the soil samples, viz; two species of Acaulospora, namely A. laevis and A. scrobiculata. three species of Sclerocystis, namely S. rubiformis, S. coremioides and S. microcarpus; two species of Glomus, namely G. mosseae

and G. macrocarpus var. geosporus; three species of Gigaspora, namely G. calospora, G. gregaria and G. gigantea.

Seedlings of Exbucklandia populnea developed typical vesicular-arbuscular mycorrhizal infection with Glomus spp in pot culture using nutrient deficient soil. Mycorrhizal seedlings grew better than the non-mycorrhizal ones. Growth response of plants to mycorrhiza and VA mycorrhizal development depended on fertility level of soil. Mycorrhizal inoculation supplemented with low fertilization (14 kg ha^{-1} NPK) of soil resulted in better growth of seedlings than all other mycorrhizal and fertilizer treatments both in combination or alone. At higher soil fertility (56 kg ha^{-1} NPK) both mycorrhizal and non-mycorrhizal plants exhibited similar growth responses. Increase in level of soil fertility suppressed VA mycorrhizal infection. Higher levels of NPK (56 kg ha^{-1}) added to the soil inhibited VA mycorrhizal infection of plants.

Growth characteristics of mycorrhizal plants of Exbucklandia populnea were improved when soluble phosphate (sodium hydrogen phosphate) at low levels (0.34g per pot) and bone meal at relatively higher levels were added to the phosphorus deficient soil. In the presence of soluble phosphate VA mycorrhizal infection was reduced and was inhibited at higher levels (3.47g per pot and above). VA mycorrhizal infection was high in presence of bone meal upto intermediate levels of 17.2g per pot but was reduced

to 20% at higher levels of bone meal (34.4g per pot). The concentration of phosphorus in the root was negatively co-related to percent VA mycorrhizal infection. The results suggested that phosphorus status of the host may regulate mycorrhizal infection of root.

Root/shoot ratio of mycorrhizal plants was lower than that of non-mycorrhizal plants at lower nutrient status (NPK levels) and phosphorus status of soil.

Effect of VA mycorrhiza on the mineral nutrition of the seedlings of Exbucklandia populnea was studied at different fertility regimes and phosphorus amendments of soil. Mycorrhizal infection improved phosphorus nutrition of seedlings. Mycorrhizal plants had higher concentration of phosphorus in comparison to non-mycorrhizal plants at lower fertility levels of soil (0,14kg ha^{-1}NPK). Mycorrhizal plants had higher concentration of phosphorus than non-mycorrhizal plants grown in both sources of phosphorus but, the difference in concentration between mycorrhizal and non-mycorrhizal was observed with relatively higher levels of bone meal and only at lower levels of sodium hydrogen phosphate (0.34, 0.69g/pot). The concentration of nitrogen in the leaves did not differ between mycorrhizal and non-mycorrhizal plants of Exbucklandia populnea but, stem and roots of mycorrhizal plants had higher concentration of nitrogen than non-mycorrhizal plants at lower levels of soil fertility (O, I, II levels of NPK). Concentration of potassium in the

leaves and stem of non-mycorrhizal plants was higher than that of mycorrhizal plants at lower levels (O,I) of NPK added to the soil. No significant differences were observed in the concentration of calcium between mycorrhizal and non-mycorrhizal plants except for leaves which differed at higher levels of NPK. The growth improvement of mycorrhizal plants could be due to phosphorus nutrition.

The activity of acid phosphatase did not differ between the mycorrhizal and non-mycorrhizal roots of seedlings of Exbucklandia populnea.and there was no consistent effect of addition of single super-phosphate to the soil on the activity of this enzyme. Mycorrhizal infection did not affect soluble alkaline phosphatase activity at 'O' level of single superphosphate. Soluble alkaline phosphatase activity was decreased by addition of single superphosphate at 5.0g per pot level in both mycorrhizal and non-mycorrhizal plants. The results suggest that pathway of phosphorus metabolism in mycorrhizal plants may be different from that of non-mycorrhizal plants.