Effects of human disturbance on the distribution of arbuscular mycorrhizae fungi in the Maasai-Mau forest, Kenya

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Abstract:

A study of Arbuscular Mycorrhiza Fungal (AMF) spore abundance and species diversity was undertaken along a gradient of disturbance in the Maasai Mau forest which forms part of the Mau forest complex. The aim of the study was to determine AMF diversity and abundance along disturbance gradient and establish dependency of indigenous trees species of forest so as to provide scientific information useful in forest restoration programs. Soil samples were collected from two sites from 30 sampling points within 5 levels of disturbance. About 200g of the field soils were processed for AMF spore abundance, while another 200g was used to set up trap cultures. It was from the trap cultures that the diversity of AMF communities was determined. AMF identification was done by observation of spore morphology and their characteristic reaction with Melzer's staining reagent. A mixed culture of AMF inoculum used to treat the trees species studied for dependency was also obtained from the trap culture. Abundance of spores was significantly variable ($P<0.002$) among the five levels of disturbance in both altitudinal sites. There was significant difference in the rate of shoot growth between treatment and control in Albizia gummifera, Acacia drepanolobium and Acacia nilotica ($P<0.05$). Acacia mellifera, Senna spectabilis and Prunus africana showed slight variability between the two groups that was not significant on the two tail, two sample (paired) t- test. There was no difference in Podocarpus falcatus in the growth rate of tree shoots between treatment and control group. The effect AMF has on Rhizobium effectiveness in nitrogen fixation was tested using seeds of Albizia gummifera and Acacia nilotica. The tripartite symbiotic association of Rhizobium-AMF-and legumes (Acacia nilotica and Albizia gummifera) had a significant effect on the rate of shoot growth and nodulation ($P<0.05$). The trees that were treated with AMF and Rhizobium inoculi nodulated within16 weeks of growth. None of the trees inoculated with Rhizobium alone nodulated within the 16 weeks duration. This study has demonstrated that trees indigenous to Maasai Mau forest formroot associations with arbuscular mycorrhizae fungi and that legume trees benefit from the rpartite symbiosis of arbuscular mycorrhizal fungi and rhizobia. Therefore there is potential in dualinoculation of tree seeds with arbuscular mycorrhizae fungi and Rhizobium in enhancing the biomass and increasing the rate of tree growth. It has also demonstrated that mycorrhizal fungi are one of the main pathways by which most plants obtain nutrients and therefore critical for terrestrial ecosystem functioning. The inoculation with the mixed AMF inoculi consistently gave a greater response for all parameters measured, than in control group. This indicates that the success of rehabilitation and reforestation of tropical forests greatly depend on mycorrhizal root colonization of seedlings which increases their competitiveness due to increase in the initial growth rates. Among the trees tested, the most responsive were the fast growing leguminous tree species Albizia gummifera and Acacia nilotica. The data shows that Albizia gummifera and

Acacia nilotica are the better choice trees of, if faster growth and forest establishment is desired while using AMF in rehabilitation.