MATERIALS AND METHODS

The saline-alkali site was located in the campus of the Institute of Technology, Banaras Hindu University, Varanasi. The annual precipitation was 1209 mm and 324 mm. The SA soil had a pH of 9.4, bulk density (1.53 g cm−3), 44% porosity, 0.15 mmho cm−1 electrical conductivity, 0.9% organic carbon and 670 (ppm) available phosphorus. The exchangeable ions (meq 100 g−1) were Na+ 72.70, K+ 0.937, Ca2+ 189.62 and Mg2+ 4.006. A nearby garden soil selected for comparison had a pH of 7.2, bulk density-1.35 g cm−3, 50% porosity, 0.85 mmho cm−1 electrical conductivity, 0.9% organic carbon and 670 (ppm) available phosphorus. The exchangeable ions (meq 100g−1) were Na+ 0.716, K+ 0.3414, Ca2+ 15.22 and Mg2+ 3.817.

RESULTS AND DISCUSSION

All the native plants growing at the SA site were infected by Glomus sp. RR1, showing a strong mycorrhizal dependency. Significant (p ≤ 0.001) seasonal variation was observed in the AM spore count in the rhizosphere soil and root colonization Fig. 1. Fairly high level of mycorrhizal association was recorded in most of the plant species during winter and rainy seasons (> 50% colonization). Among the plants growing in summer season, Cynodon dactylon and Saccharum munja possessed high level of AM colonization (> 55%), which was followed by Accacia nilotica (50%). Moderate level of colonization was recorded in Cyperus
rotendus, Dicanthium annulatum and Dalbergia sissoo (<40%). The AM colonization was infrequent in Cyperus rotundus. Plants growing during rainy season included Desmodium sp., Eclipta alba and Evolvulus sp. Plants showing high level of colonization (>62%) in rainy season were C. dactylon, S. munja, C. rotendus, Evolvulus sp. and Desmodium sp. Moderate colonization during this season was recorded in A. nilotica (52%), E. alba (46%), and D. sissoo (39%). Least colonization (28%) in rainy season was observed in D. annulatum. During winter season the trend observed in the colonization of the plants by AM was similar to that observed in summer season in most of the case. C. dactylon and S. munja possessed highest level of colonization in all the three seasons and the plant showing least AM colonization varied with the seasons. While maximum AM spore count in rhizospheric soil of the plants was recorded in winter season, lowest was found in rainy season. The plants growing throughout the year showed fairly good number of spores in their rhizosphere, of which, S. munja possessed maximum spore count and C. rotundus possessed the least count. Except Evolvulus sp. the plants which grew only in rainy season showed fewer number of AM spores (<10/100 g of soil). Less number of spores was recorded in grasses growing in summer in SA soil, which included C. dactylon, C. rotendus and D. annulatum.

All native plants growing strong mycorrhizal dependency supported the ability of mycorrhizal fungi to adapt to salt stresses and play an important role in alleviating the detrimental effects as also observed by Bandau et al., (2006). Plants growing in the SA soil showed a marked seasonal variation in mycorrhizal colonization. These seasonal changes in the AM activity are regulated by the root phenology as AM association is formed only in young roots and it has a limited period of activity (Harley and Smith, 1983). Root growth generally occurs at times when both temperature and soil moisture conditions are favourable (Gregory, 1987). Onset of favourable conditions enhances root growth and mycorrhizal activity. With rain the moisture, nutrient stress and toxic cations of the SA soil get reduced as a consequence of which a high level of AM colonization may arise as observed in the present study. Low AM colonization recorded during summer season might be due to low activity of AM fungi and root senescence during this season. During summer the SA soil is subjected to high pH, osmotic concentration, and temperature coupled with high salt concentration due to evapotranspiration. Colonization of host plant roots and spore production in the host soil vary seasonally as a function of climate and host plant (Giovanetti, 1985).

Spore count of AM fungi did not appear to be affected by salinity supporting Mergulhag et al., (2001) observation. However, soil salinity has been reported (Juniper and Abbott, 2006) to delay germination and limit growth of hyphae from propagules of AM fungi. Spore production is generally thought to coincide with the periods of fungal resource remobilization from senescing roots (Gemma et al., 1989). In most case spores are less abundant during periods of mycorrhizal formation and they become more numerous during periods of root senescence. This hypothesis is supported by our observation as the spore production increased in winter, which starts after rainy season when root activity starts getting interrupted by a spell of dry season and nutrient stress. In summer the spore count decreased as compared to winter, which might be attributed due to increased rate of root senescence due to harsh soil conditions during summer. Studies done by Escudero and
Mendoza (2005) too show that spore density and AM root colonization when measured at any one time were poorly related to each other. However, spore density was significantly correlated with root colonization 3 months before suggesting that high colonization in one season precedes high sporulation in the next season. AM spores increase as a result of intermittent root growth during seasons of slow root growth and at sites where many rootlets die annually (Mosse, 1973). Spore number is likely to reflect the nutritional status of the host and/or of the soil and the onset of adverse conditions (Mosse, 1973). It can be said that overall trend in mycorrhizal dynamics at the SA soil is regulated by the environmental constraints on root and fungus activity, which vary seasonally. Established mycorrhizal vegetation in such SA stressed conditions can not only extend the infection of seedling and support their growth but may also be of particular ecological interest as this may permit early successional plants to facilitate the establishment of later successional groups (Dickie et al., 2006). Thus AM Fungi can play a remarkable role in the restoration of such stressed lands.

REFERENCES


