ARBUSCULAR MYCORRHIZAL (AM) FUNGI FROM COASTAL SAND DUNE VEGETATION OF GOA

B.F. Rodrigues and V. Jaiswal
Department of Botany, Goa University, Teleigao Plateau, Goa 403 206.

Abstract

Arbuscular mycorrhizae (AM) may be used for rebuilding the vegetation of coastal region under threat. Prior to exploiting the reclaiming potential of these organisms, it is necessary to examine their occurrence and distribution in sand dunes. The occurrence and the number of AM propagules in the rhizospheric soils of six selected saline host plant species was worked out. Arbuscular mycorrhizal propagules were observed in rhizospheric soils of all the selected host plant species. Average spore count was 327.5 spores/100 g rhizospheric soil. Fifteen species of AM fungi were identified from the soil samples. Species of *Glomus* dominated the rhizospheric soils of the sand dune ecosystem.

Introduction

Sand dunes throughout the world have been recognized for their ecological significance. The dune vegetation helps in keeping the coastal land free from erosion and also prevents internal desertification. There has been a continuous pressure on sand dunes. The dimension of hotel industries and tourism development is surely affecting the dune system. The presence of fungus plant mutualistic symbiosis termed 'Mycorrhizae' is critical for the regeneration of the coastal ecosystem. Arbuscular mycorrhizae that participate in the uptake of phosphorus are involved in pioneer colonization of nutrient deficient sites. There is a need to identify the AM species from existing vegetation so that the same may be used for rebuilding the vegetation of coastal area under threat. No efforts seem to have been directed to isolate and identify the native AM fungi in saline soils in the state.

Materials and Methods

The coast of Goa which is approximately 120 km in length has beautiful stretches of sandy shores and beaches. Two adjacent coastal beaches were selected for the survey of the distribution of AM spores, viz., Bogmalo beach (0.70 km) and Hansa beach (0.60 km). Soil samples were collected from the two locations and were analysed for pH, P and K content. Rhizospheric soil samples were collected from six selected host plants from 0-25 cm depth. The collection was done in between the months of July to October 96. Soil samples (100 g) were assayed for spore count using the Wet Sieving and Decanting procedure (Gerdemann & Nicolson, 1963). The spore counting was done for the estimation of spore density (Gaur & Adholeya, 1994). The spores and the sporocarps were examined for their various characteristics for identification (Schenck & Perez, 1988). Single spore pot cultures of the isolated spores were prepared using *Eleusine coracana* (Linn.) Gaertn. and *Sesbania bispinosa* (Jacq.) Steud. as host plants. Later, the roots were examined for infection (Phillips & Hayman, 1970).

Results and Discussion

Physio-chemical properties of soil samples from the two locations of coastal areas taken for the present study indicated that the soils were alkaline. The pH ranged from 8.3 to 8.6. The sandy soil had low available phosphorus (6.73 kg/ha - 17.95 kg/ha).

Potassium content was also low (22.4 kg/ha - 44.9 kg/ha). The rhizosphere of all the six plant species examined exhibited AM spores. Average

spore count was 327.5 spores/100 g of rhizospheric soil. The soil characteristics and the spore count in rhizosphere of each plant species is presented in Table-1. Number of AM spores was found to be less where soil phosphorus content was higher. The maximum spore count was 427/100 g at P content 6.73 kg/ha and minimum spore count was 311/100 g and 170/100 g at P content 17.95 kg/ha. This shows that the higher concentration of P limits AM fungal spore population. Earlier studies of AM fungi isolated in soil samples collected from different parts of the country have indicated that the P content was found to be negatively correlated with the number of spores in the soil (Mukerji & Rekha Rani, 1989). The spore count did not show any definite correlation with the K content.

Table -1 : Soil characteristics and spore density in the rhizospheric soil of some plant species (Mean of three samples)

Family & Plant species (source of sampling)	Depth of sampling (cm)	No. of spores/ 100 g rhizo-spheric soil	Soil pH	Characteristics P kg/ha	K kg/ha
Cyperaceae					
Cyperus sp.	0-25	427	8.6	6.73	33.7
Liliaceae					
Urgenia indica	0-25	370	8.5	9.00	22.4
Asclepiadaceae					
Calotropis gigantea	0-25	355	8.5	11.2	44.9
Poaceae					
Spinifex squarrosa	0-25	332	8.5	11.2	44.9
Arecaceae					
Cocos nucifera	0-25	311 (+11 sporocarps)	8.3	18.0	22.4
Verbenaceae					
Lantana camara	0-25	170 (+4 sporocarps)	8.3	18.0	22.4

Fifteen species of AM fungi were recorded from the rhizospheric soils of the six selected plant species. Most of the AM fungi were isolated as chlamydospores and in few cases sporocarps were recorded. The isolated sporocarps were identified as *Sclerocystis sinuosa* Gerd. & Bakshi. Species of *Glomus* dominated the soils. Very few spores of *Gigaspora* and *Acaulospora* species were recorded. It has been reported that *Gigaspora* and *Acaulospora* species are more tolerant to acidity and *Glomus* species favour neutral and alkaline soils (Mosse, 1973). Present study showed absence of *Entrophospora* and *Scutellospora* species in the rhizosphere of the plant species taken up for the study. Different AM apecies isolated from the rhizosphere of each of the host plant species are listed in Table-2.

The most frequent endophyte recorded was *Glomus fasciculatum* which was present in three of the hosts, viz., *Calotropis gigantea, Cocos nucifera* and *Lantana camara. Glomus citricolum* and *Sclerocystis sinuosa* occupied the next position being present in two hosts, viz., *Urginea indica* and *Spinifex squarrosa,* and *Cocos nucifera* and *Lantana camara* respectively. *Cyperus* spp.

Table -2 : Arbuscular mycorrhizal fungi identified from the rhizospheric soils of some plant species

Family & Plant species	VAM fungi species
Cyperaceae *Cyperus* sp.	*Glomus occultum.*
Liliaceae *Urgenia indica*	*Glomus citricolum* & *Acaulospora bireticulata.*
Asclepiadaceae *Calotropis gigantea*	*Glomus deserticola,* *G. fasciculatum* & *G. intraradices.*
Poaceae *Spinifex squarrosa*	*Glomus citricolum,* *Gigaspora margarita,* *Acaulospora spinosa* & *A. scrobiculata.*
Arecaceae *Cocos nucifera*	*Sclerocystis sinuosa,* *Glomus etunicatus,* *G. fasciculatum,* *G. reticulatum,* *G. versiforme,* *G. hoi* & *Gigaspora coralloidea.*
Verbenaceae *Lantana camara*	*Sclerocystis sinuosa* & *Glomus fasciculatum.*

was exclusively associated with *Glomus occultum*. All the AM spores associated with *Calotropis gigantea* belonged to various species of *Glomus*, viz., *G. deserticola*, *G. fasciculatum* and *G. intraradices*. In remaining hosts different combinations of AM species were observed (Table-2). *Cocos nucifera* and *Spinifex squarrosa* showed maximum species diversity of AM fungi. *Cocos nucifera* was associated with *Sclerocystis sinuosa*, *Gigaspora coralloidea* and five species of *Glomus*, viz., *G. etunicatum*, *G. fasciculatum*, *G. reticulatum*, *G. versiforme* and *G. hoi*. *Spinifex squarrosa* showed presence of *Glomus citricolum*, *Gigaspora margarita* and two species of *Acaulospora*, viz., *A. spinosa* and *A. scrobiculata*. The difference in the species may be attributed to the edaphic factors, host plant interactions at a particular site and host species compatibility with AM fungi.

The roots analysed from single spore pot cultures showed the presence of vesicles and arbuscules confirming that these spores belonged to AM fungi and were potentially viable to bring about infection.

Our study confirms the contention that most plants grown under natural conditions possess AM and phosphorus content in the soil may be the major edaphic factor which determines the abundance of AM fungal spores. AM may be of considerable significance to the success of any coastal environment stabilization programme. Isolation and multiplication of efficient strains of AM fungi is important for mass inoculum production and for adaptation of tree seedlings suitable for rehabilitation and reclamation of these saline and nutrient deficient soils.

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