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Diversity of AM Fungi in Rhizosphere of Three Acacia Species in Thar desert Rajasthan

Suman Bala* and Nishi Mathur**

*Department Of Biotechnology, Faculty of Applied Sciences,

JNU ,Jodhpur, Rajshthan, India

** Department of Biotechnology, Mahila P.G. Mahavidyalaya,

Jodhpur, Rajasthan, India

ABSTRACT: Pollution has become a worldwide environmental issue it has created many health problems.A study was conducted to access the diversity of AM Fungi and relationship of three *Acacia Species* in Thar Desert Rajasthan. For this purpose, soil samples along with the plant root were collected from different areas of Thar Desert. The survey of AM fungi associated with *Acacia nilotica , Acacia Senegal and Acacia catechu* in Thar Desert revealed that eleven AM fungi commonly occur in the rhizosphere viz.,*Glomus aggregatum, Glomus constrictum, Glomus deserticola, Glomus fasciculatum, Glomus macrocarpum Acaulospora laevis, Scutellospora calospora* and *Scutellospora nigra*. *Acaulospora morrawae, Gigaspora gigangea, Gigaspora margarita.* Mycorrhizal spore population at various localities varied from 310-450 spores per gram of soil and percentage root colonization by different AM fungi at various localities varied from 52-78 percent. Abiotic Factor of rhizosphere soil of *Acacia species* is different at various localities. The soil pH at various localities varied from 6.8-8.1, while soil moisture varied from 6.5-8.2 percent organic carbon ranged from 0.8-1.4, soil phosphors was 38-60 k/ha and soil nitrogen 19-28 k/ha at different localities

Key Words: Vasicular Arbuscular Mycorrhiza, *Acacia nilotica , Acacia Senegal and Acacia catechu* , Indian Thar Desert.

INTRODUCTION

Acacia , known commonly as acacia, thorntree,whistling thorn, or wattle, is a genus of shrubs and trees belonging to thesubfamily Mimosoideae of the family Fabaceae, described by the Swedishbotanist Carl Linnaeus in 1773 based on the African species *Acacia nilotica*. Many non-Australian species tend to be thorny, whereas the majority of Australian acacias are not. All species are pod-bearing, with sap and leaves often bearing large amounts of tannins and condensed tannins that historically found use as pharmaceuticals and preservatives[1].

In fertile soils,nutrients taken up by the mucorrizal fungi can lead to improved plant growth and production .As a result, mycorrizal plants are often more competitive and better able to tolerate environmental stresses than are nonmycorrizal plants. Mycorrizal association very widely in form and function[2].

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AM fungi are obligate symbiotic fungi the hyphae of which develop mycelium, arbuscules and in most fungal genera vesicles in root and is ubiquitous in distribution. These hyphae can explore an area around the root for exceed that available to root hairs[3]. These extramatrical hyphae are more efficient in nutrient uptake than root hairs . Mycorrhizal propagules can survive in the soil as spores which appear to be longterm structures of different ages, states of dormancy and germination periods and they constitute an inoculums source persisting for many years[4].Arbuscular mycorrhizal Fungi are frequently distributed in different areas of Indian Thar Desert[5]. Manifold beneficial effect of AM fungi includes improved biomass production, nutrient uptake, drought tolerance etc. due to the beneficial effects of AM fungi it is now a day's used frequently in agriculture and forestry[6,7]. AM fungal colonization aids the host plant in maintaining ionic balance by enhancing and/or selective uptake of nutrients[8]. Studies have shown that arbuscules mycorrhizal associations are beneficial for plants growing in various Indian semi-arid landscapes[9]. The present investigation is based on finding out the relationship between AM fungi and *Acacia* and the distribution of AM fungi in mycorrhizosphere of in *Acacia nilotica , Acacia Senegal and Acacia catechu* Indian Thar desert.

MATERIAL AND METHODS

The plant sample along with rhizosphere soils were collected from three Localities, namely, (1) Jodhpur (2) Pali (3)Balotra . In each case soil from 10-15 cm depth was dug out.

Trap Cultures

Pot Cultures have been shown to be a useful tool in inducing sporulation of AMF from field soils in arid ecosystems to facilitate the detection of AMF species that are present in the rhizosphere and roots but do not sporulate readily in the field at the time of sampling. To establish successive pot cultures, 500 g dry wt. field soil was mixed with autoclaved sand (1:1, v/v) [10,11]and planted with surface-sterilized seeds (by 0.1% w/w mercuric chloride solution for 2 min and then washed with distilled water) of *Cenchrus ciliaris* L. as host.

Root Colonization by AMF

To determine the percent root colonization, root samples collected from different sites were washed in tap water and staining was done by the method of Phillips and Hayman[12] for rapid assay of mycorrhizal association. The root samples were cut into pieces of 1 cm length and placed in 10% KOH solution, which was kept at boiling point for about 10 min (depending upon the hardness of the root sample). The root samples were captured on a fine sieve and rinsed with distilled water until the brown colour disappeared. Post-clearing bleaching was done with alkaline hydrogen peroxide (0.5% NH_4OH and 0.5% H_2O_2 v/v in distilled water). Roots were rinsed with distilled water, treated with 1% HCl and stained with 0.05% w/v trypan blue in lactic acid-glycerol. Assessment of colonization was conducted on each sample by the glass slide method, in which 100 randomly selected root segments of each replication were determined microscopically. A segment was counted as infected when hyphae, vesicles, or arbuscules were observed. The infection percentage was determined by the method given by Giovannetti and Mosse[13].

Spore Extraction

Spores of AMF were extracted from the field and successive pot culture soils by the wet sieving and decanting technique of Gerdemann and Nicolson[14]. Total spore numbers of mycorrhizal fungi in the soil samples were estimated by the method of Gaur and Adholey[15] and spore densities were expressed as the number of spores per 100 g of soil. The isolated spores were picked up with needle under a dissecting microscope and were mounted in polyvinyl lactoglycerol (PVLG). However, PVLG was mixed with Meltzer's reagent (1: 1, v/v) in case of *Scutellospora* species. All the spores (including broken ones) were examined using Medilux-20 TR compound microscope. Taxonomic identification of spores up to species level was based on spore size, spore colour, wall layers and hyphal attachments using the identification manual of Schenck and Perez[16] and the description provided by the International collection of vesicular and AMF.

Root Staining

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Roots staining procedures were adapted from Philips & Hayman[12]. Roots were rinsed to remove adhering soil and debris, and cut into 0.5 to 1 cm long segments, root samples collected were gently washed under tap water, cleared in boiling 10% KOH and stained in lactophenol containing trypan blue[13]. The percentage of root colonization was calculated by the grid line intersect method.

Soil Parameters

Soil samples were analyzed for pH and percentage of soil moisture was calculated on oven dry weight basis. Organic carbon was estimated by the method of Walkley and Black[17]using 1 N potassium dichromate and back titrated with 0.5 N ferrous ammonium sulphate solution.

Site Description

The Indian Thar Desert comprises about 70% part of the Western Rajasthan. Important climatological characteristics of surveyed areas are summarized in Tables.

RESULT AND DISCUSSION

After collection of plant species the studies were further carried out to find out the effect of abiotic factor viz. Soil pH, Soil moisture, organic carbon , phosphorous and nitrogen on spore population and percentage of root colonization by AM fungi. for this purpose soil sample along with roots were collected from rhizosphere soil of the three *Acacia* Species from various localities viz. Jodhpr ,Pali and Balotra. Soil of all the three localities was sandy(Figure-1,2 &3). Mycorrhizal spore population at various localities varied from 310-460 spores per gram of soil and percentage root colonization by different AM fungi at various localities varied from 52-78 percent.

During the present study mycorrhizal spore population was not found to be correlated with percentage root colonization in rhizosphere of *Acacia* ,collected various localities of the region. This suggests that it is not the quantity of mycorrhizal spores which affects the root colonization ,but it is the potentiality of AM spore which decides the rate of colonization.[18]

Since, the abiotic factors of rhizosphere soil of *Acacia nilotica*, *Acacia senegal* and *Acacia catechu* at various localities viz. Jodhpur ,Pali and Balotra(figure -4,5 & 6) .It is clear from the observation that soil pH at various localities varied from 6.8-8.1, while soil moisture varied from 6.5-8.2 percent ,organic carbon ranged from 0.8-1.4, soil phosphors was 38-60 k/ha and soil nitrogen 19-28 k/ha at different localities. While correlating mycorrhizal root colonization with abiotic factor ,it was observed that increase in soil pH with decrease in soil phosphorus and soil nitrogen resulted in increased percentage root colonization as the sample of Pali showed .However soil moisture and soil organic carbon level could not be correlated with percentage root colonization by AM fungi during the present study[19]. Possible reason for this might be almost similar level of soil moisture(6.8-8.5) and organic carbon (0.8-1.4).

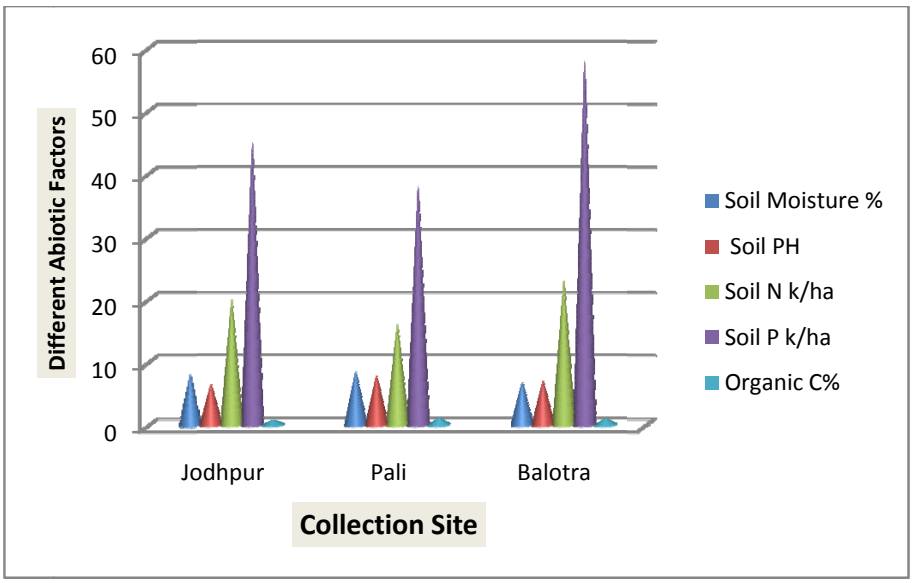

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Fig-1.Abiotic Factor of rhizosphere soil of *Acacia nilotica* at various localities.

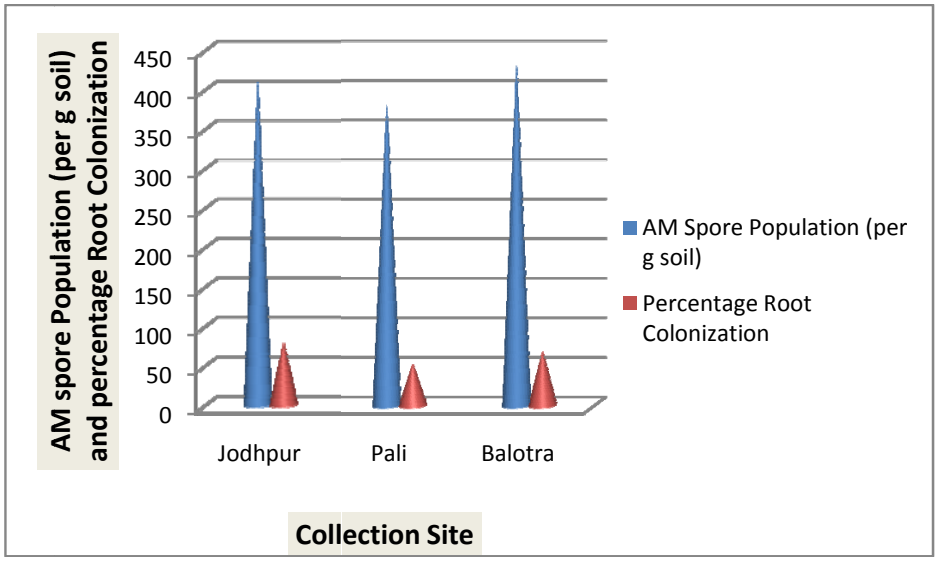

Figure .2:Mycorrhizal spore population and Percentage of Root Colonization in rhizoshere of *Acacia nilotica* at various Localities.

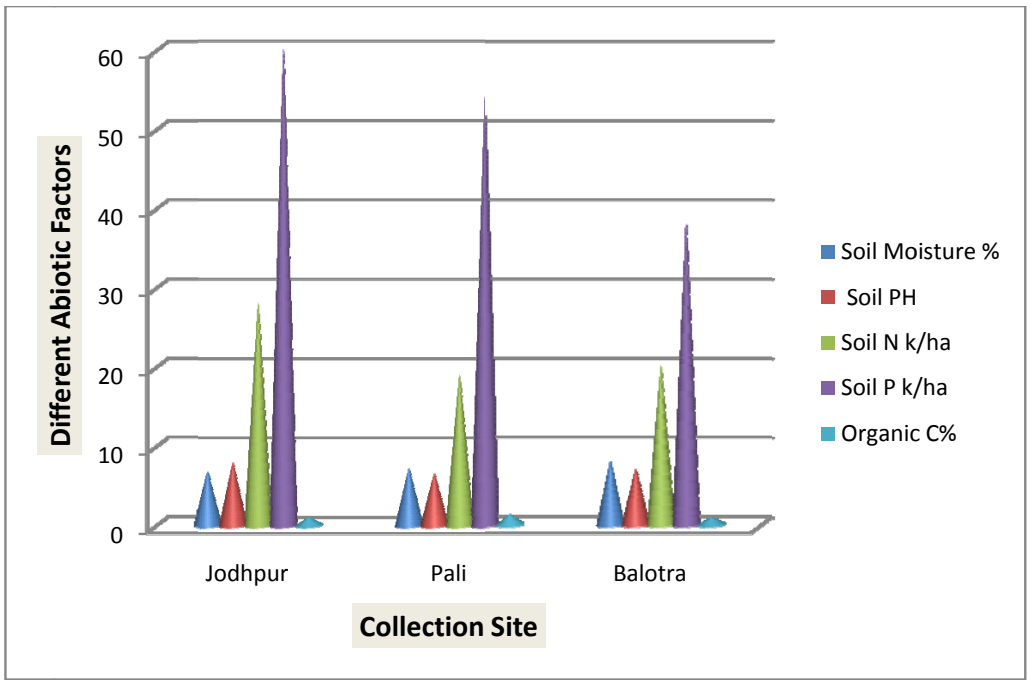

Figure.3 : Abiotic Factors of rhizosphere soil of *Acacia senegal* at various localities.

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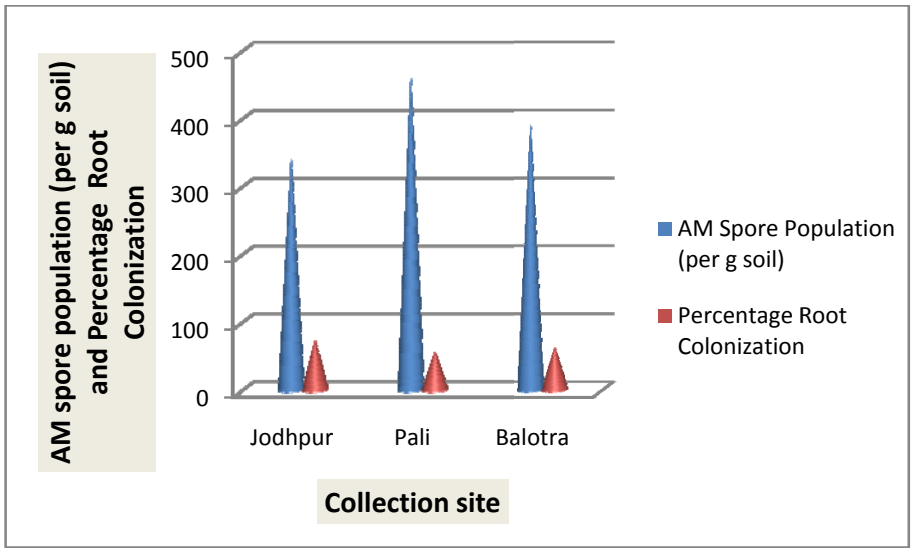

Figure 4 :Mycorrhizal spore population and Percentage of Root Colonization in rhizoshere of *Acacia senegal* at various Localities.

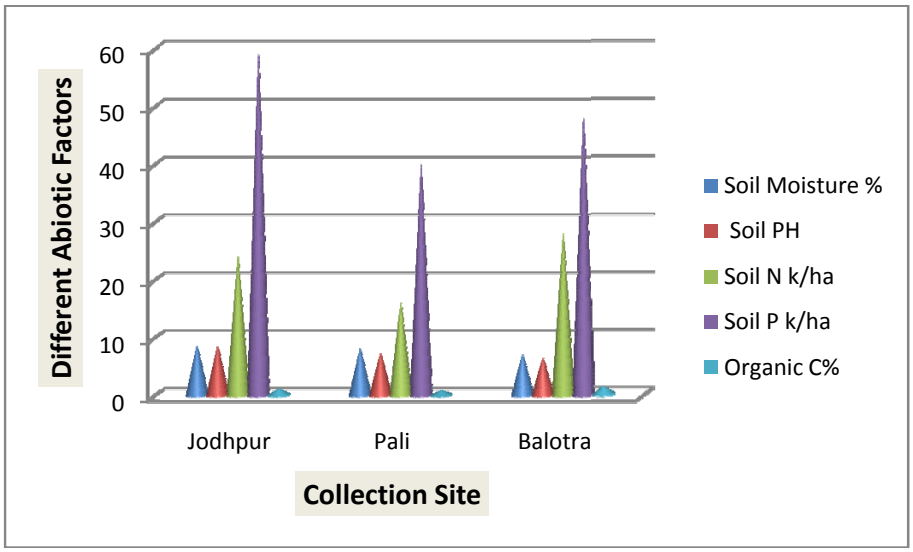

Figure 5 : Abiotic Factors of rhizosphere soil of *Acacia catechu* at various localities.

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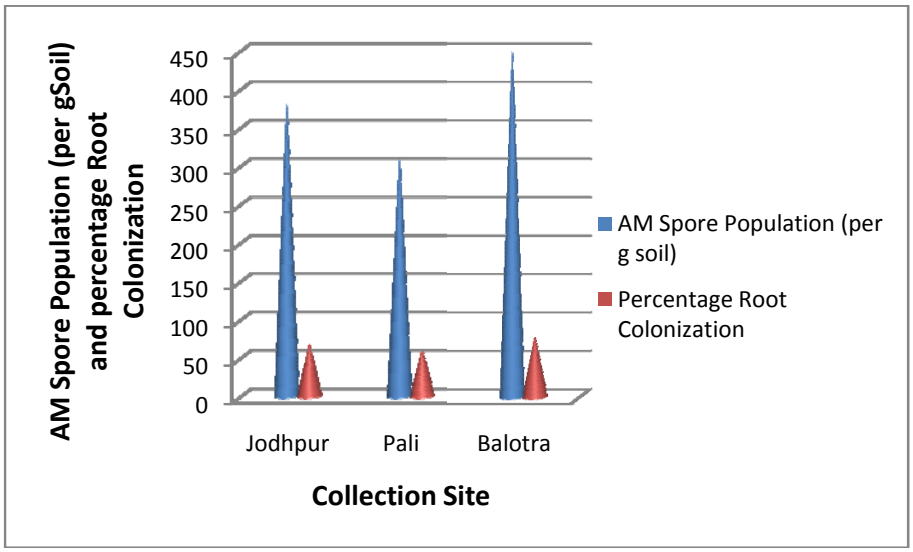

Figure.6: Mycorrhizal spore populaion and Percentage of Root Colonization in rhizoshere of *Acacia catechu* at various Localities.

CONCLUSION

Rhizosphere of Acacia species at Indian Thar Desrt harbour great diversity of AMfungi.However, different Acacia species show variation in mycorrhizal spore population and percentage of root colonization at various localities.

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