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RESEARCH ARTICLE

ASSOCIATION OF ARBUSCULAR MYCORRHIZAL FUNGAL SPECIES IN THE PLANT SPECIES OF BARGUR HILLS, ERODE DISTRICT, TAMIL NADU, INDIA

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ABSTRACT

The present study was carried out the arbuscular mycorrhizal fungal root colonization and spore population diversity some medicinal plants species at Bargur hills Western Ghats of (Anthyur taluk), Erode district, Tamil Nadu, India. Root and rhizosphere soil samples were collected during the month of August, 2017-March, 2018 from the surface to 20 cm depth as well as pH were also measured. Totally 25 plant species belonging to 19 families recovered Arbuscular mycorrhizal fungal spore and root colonization. The results of the present study arbuscular mycorrhizal spore population in the rhizosphere soil and root colonization of all the plant species. A total of 22 AM fungal species belonging to 7 genera and 2 different orders were recorded from the rhizosphere soil samples of this study region. The *Glomus* was dominant had seen in rhizosphere soil samples in all the medicinal plant species. The maximum spore population was found in the rhizosphere soil samples of *Leucas aspera* (470 /100 g soil) which belongs to the family Lamiaceae and lowest spore population was observed in the *Tephorosia purpurea* (123 /100g soil) belongs to Fabaceae. The highest 83 % AM fungal infection was found in roots of *Achyranthus aspera* belongs to the family Amaranthaceae, while the lowest 23 % AM fungal association was found in the root of *Mimosa pudica* belongs to the family Mimosaceae.

Keywords: Arbuscular mycorrhizal fungi**,** Bargur hills.

1. INTRODUCTION

Forest plays an essential role in maintaining the environmental and bio resources stability and provides multipurpose benefit to the mankind. Mycorrhizal association is essential for forest trees. AMF diversity may equip both tree and forest to functionally adapt to changes in seasons and habitats. Arbuscular Mycorrhizal fungi from symbiotic association with about 90% of the families of all phyla of land plants (1) including ferns and some mosses (2). In Arbuscular Mycorrhizal fungal symbiosis in rhizosphere soils a dynamic process and interaction effects all physiological aspects of the plant host. This fungus have a great potential to enhance plant growth by increase uptake of nutrients especially in phosphorus (3). A major beneficial component of soil microbial community is mycorrhizal fungus, which contributes to plant growth and survival by reducing stresses through symbiosis (4). The mycorrhizal are very common in disturbed areas which indicate their positive role in establishing and building the plant community. The mycorrhizal associations are essential to the colonization of nutrient -deficient soils.

Even the modest things are vital to the world particularly in relation to getting plants established. The mycorrhizal fungi inhabit plant roots and extend the root system into the adjoining soil. Unexpected quantities of mycorrhizal filaments are found available in healthy soil. An extremely small section of soil associated with dynamically growing plants may be full of numerous fungal filaments. The affiliation is favorable for the reason that the plants have the benefit of improved uptake of water and mineral nutrient, resistance against diseases, greater survival, and enhanced growth. Hence in this present study area of Bargur hills, there is no report of AM fungal spore population and root colonization in this study area.

2. MATERIALS AND METHODS

2.1. Study area-description

The present study was undertaken in the Bargur hills, Erode district of Tamil Nadu. Bargur hills are located at 77°20"60' E longitude and 11°37"60' N latitude and 950 m. s. l. above the sea level (Fig-1) Borders of Tamil Nadu and Karnataka regions and the continuation of Sathyamangalam forests, a mixed deciduous vegetation cover of Southern Eastern Ghats. A majority of primitive tribes Lingayath are inhibited in Thamarakarai village in Bargur hills. These hills have three major forest types are present with includes dry deciduous forest, moist deciduous and small patch of grasslands. The climates are mostly in moist

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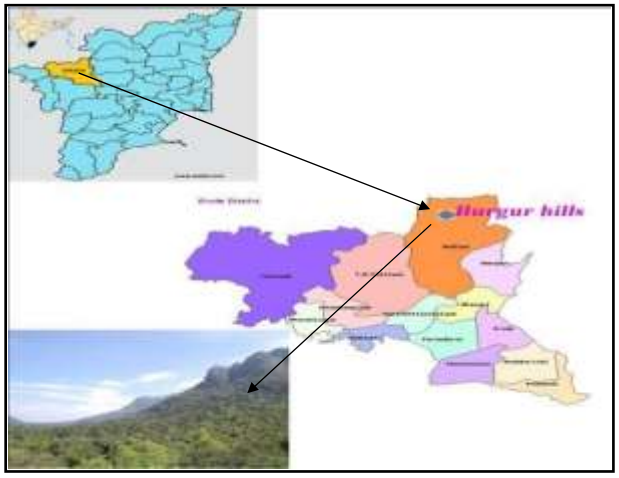
conditions and average rainfall ranging from 50 to 75 cm per year. Hence, the maximum temperature in 40°C to 45°C from April-May and minimum temperature in between 20°C to 25°C from November-December. The major irrigation sources of Palar River to provide water facilities from drinking and agriculture.



2.2. Sample collection

Present study the root and rhizosphere soils samples were collected from 25 plant species during the year August, 2017 to March, 2018. All the samples were placed in the olyethylene bags, labeled and then transported to the laboratory. The root samples were freshly processed, whereas rhizosphere soil samples were analyzed for mycorrhizal spore population and AM fungal root colonization.

2.3. Estimation of AM fungal root colonization

The fresh root samples were cleared and stained in tryphan blue following method of (5). Root samples of each plant species were washed gently under tap water and cleared in 2.5% KOH, acidified in 5 N HCL and stained in lacto glycerol with 0.05% Trypan blue. The stained roots were examined under a compound microscope (40x–100x). Hundred root segments for each sample were randomly selected for microscopic observation and the degree of colonization was estimated using the slide method.

The percentage of AM fungal infect ion was calculated using the formula:

$$\text{Percentage of infection} = \frac{\text{No. of root segments infected}}{\text{Total no of root segments observed}} \times 100$$

2.4. AMF spore identification

AM fungal spores were extracted from 100 g rhizosphere soil by wet-sieving and decanting method (6) through a series of 710 to 37µm size sieve filter. For the identification and nomenclature of these AM fungal spore synoptic keys developed by (7-9) were used. The classification was based upon the color, shape, hyphae, structure, size, and cell wall thickness and spore diameter.

2.5. Soil pH

The pH of the rhizosphere soil samples was determined (soil-water suspensions 1:5) with the help of pH meter (Elico) and values were recorded.

3. RESULTS AND DISCUSSION

The present study arbuscular mycorrhizal spore population and root colonization of totally 25 plant species belong to 19 families (Fig-2) and pH also measured. The maximum Arbuscular mycorrhizal fungal colonization was found in the roots of *Achyranthus aspera* (83%) belongs to Amaranthaceae and lower root colonization was found in *Mimosa pudica* (22%) belongs to the family Mimosaceae. The plant species like *cardiospermum luridum* (39%) belongs to Sapindaceae, *Hemidesmus indicus* (33%), (Apocynaceae), *Hibiscus micranthus* 30% (Malvaceae), *Commelina benghalensis* 24% (Commelinaceae), *Mimosa pudica* 22% (Mimosaceae) showed to 20 to 40% of infection. The plant species like *Abrus precatoris* (55%) (Fabaceae), *Barleria tomentosa* (44%) Acanthaceae, *Crotolaria pallida* 49% (Fabaceae), *Datura metal* 43% (Solanaceae), *pavonoia odorata* 60%; Malvaceae, *polygala javana* 53% (Polygalaceae), *Stachyrarpeta jamecensis* 57% (Verbinaceae), *Tephrosia purpurea* 46% (Fabaceae) showed to 60% of infection (Table-1; Fig-3, 4).

The other plant species *Barleria prionits* (72%) Acanthaceae, *Clitoria teranceae* (67%) (Fabaceae), *Canscorra decussate* (65%) (Gentinaceae), *Corchorus olitorius* 74%, (Tiliaceae), *Leuca saspra* (70%) Lamiaceae, *Strobilanthus clorota* (77%) Acanthaceae, *Strobilanthus consanguine* 68% (Acanthaceae), *Urena lobata* 63% (Malvaceae) showed 60 to 80% of infection. The one species belongs to Acanthaceae member *Achyranthus aspera* showed 83% of infection. This finding is anagreement with Miller (10) and D' Souza and Rodrigues (11). Variation in Arbuscular Mycorrhizal fungal association and spore number are known to be affected by rapid changes in soil nutrients, environmental factors, soil fertility or soil

disturbances in the sites. Majority of the belonging to the family Aizoaceae, Commelinaceae and Nyctaginaceae believed to be non-mycorrhizal plants were found to be associated with AM fungi. In the present study the commlinaceae member *Commeliana benghalensis* associated with AM fungi. The root of the *Com. benghalensis* showed 24% of infection. In the present study, the plant species belonging to non-mycotrophic families were found to be mycotrophic. This is accordance with Normal *et al*., (1995) who also indicated that some of the representatives of non-mycotrophic families viz. Amaranthaceae, Brassicaceae, Caryophyllaceae, Chenopodiaceae, Cyperaceae and Juncaceae could also form mycorrhizal association. In the present investigation the *Achranthus aspera* belongs to Amaranthaceae showed mycorrhizal infection. The present findings no correlation between mycorrhizal variables such as percentage of root length colonized by Arbuscular Mycorrhizal fungi, intensity of infection and spore density. The relationship between spore number, percentage colonization by AM fungi and intensity of infection is complicated as it is influenced by many environmental and biological factors.

In this study the rhizosphere soils sample of Bargur hills, totally 22 Arbuscular Mycorrhizal fungal species isolated and identified (Table-2; Fig-5, 6). Of these 1 species of *Ambispora*, *A. appendiculatum*, 2 species of *Funneliformis*, *F. fragilistratum*, *F. geosporum,* 14 species of *Glomus*, *G. heterosporum, G. hoi, G. invermeyanum, G. macroporum, G. maculosum, G. microsporum, G. magnicule, G. monosporum, G. multicaulis, G. multisubstensum, G. panishalos, G. radiatum, G. segmantatum, G. versifome*, 1 species of *Sclerocytes, S. pachycaulis,* 1 species of *Paraglomus*, *P.occultum,* 2 species of *Rhizophagus*, *R. intraradix, R.manihotis,* and, 1 species of *Pasiphora, P. dominika* recovered from the rhizosphere soil samples.

Fig. 2. Identification of some plant species in Bargur hills

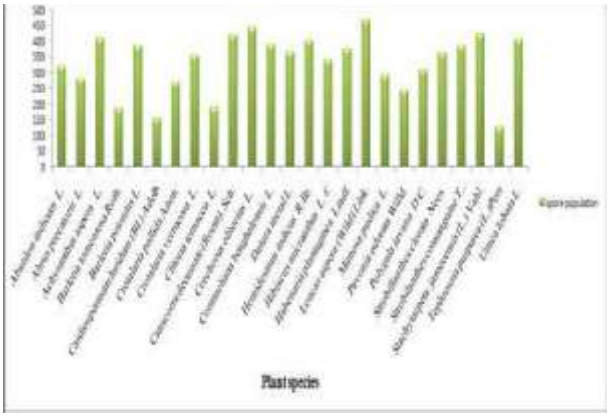


Fig. 3. AM fungal Spore population in rhizosphere soil samples of Bargur hills.

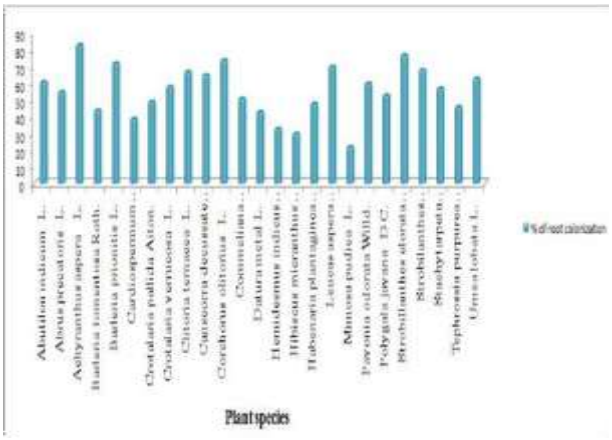


Fig. 4. AM fungal colonization in the root samples of Study area.

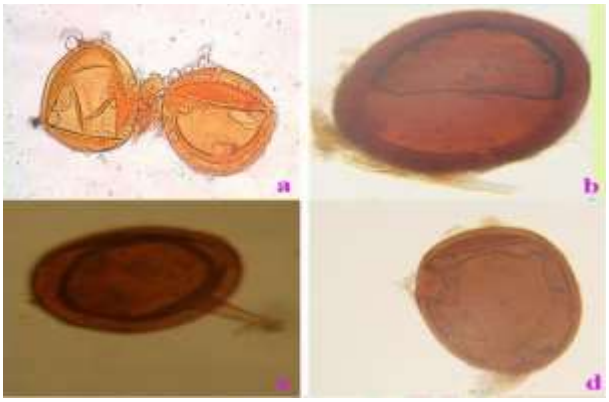


Fig. 5. AM fungal spores isolated from the rhizosphere soil of Bargur hills..

Similarly, Santhoshkumar and Nagarajan (12) studied in AM fungal spore population and root colonization in 20 plant species belonging to 20 families and they isolated from the rhizosphere soil totally 39 AM fungal species belongs to 6 genera identified.

Table 1. Arbuscular Mycorrhizal fungal spore population and root colonization in the plant species of Bargur hills, Anthiyur (Taulk), Erode district, Tamil Nadu, during 2017-2018.

S. No	Plant Species	pH	Types of infection			Spore Population (100g/soil)	(%) root colonization
			Hyphae	Arbuscule	Vesicles		
1.	*Abutilon indicum* L.	5.2	+	-	+	320	61
2.	*Abrus precatoris* L.	4.9	+	+	-	280	55
3.	*Achyranthus aspera* L.	6.2	+	+	-	410	83
4.	*Barleria tomentosa* Roth.	5.5	+	-	+	185	44
5.	*Barleria prionitis* L.	5.7	+	+	-	387	72
6.	*Cardiospermum luridum* (BI.) Adelb	6.0	+	-	+	156	39
7.	*Crotalaria pallida* Aiton.	4.8	+	+	-	270	49
8.	*Crotalaria verrucosa* L.	5.1	+	-	+	355	58
9.	*Clitoria ternacea* L.	4.9	+	+	-	190	67
10.	*Canscorra decussate* (Roem). Sch.	5.3	+	-	+	420	65
11.	*Corchorus olitorius* L.	6.7	+	+	-	445	74
12.	*Commeliana benghalensis* L.	6.6	+	-	+	390	51
13.	*Datura metal* L.	5.9	+	+	-	365	43
14.	*Hemidesmus indicus* R.Br.	5.4	+	-	+	402	33
15.	*Hibiscus micranthus* L. f.	5.3	+	-	+	339	30
16.	*Habenaria plantaginea* Lindl.	6.1	+	+	-	375	48
17.	*Leucas aspera* (Wild).Link.	6.4	+	-	+	470	70
18.	*Mimosa pudica* L.	5.2	+	+	-	293	22
19.	*Pavonia odorata* Wild.	6.3	+	-	+	245	60
20.	*Polygala javana* D C.	5.5	+	+	-	310	53
21.	*Strobillanthes clorata* Nees.	6.8	+	-	+	360	77
22.	*Strobilanthes consanguine* T. Anderson	5.7	+	-	+	387	68
23.	*Stachytarpeta jamecensis* (L.) Vahl.	6.9	+	-	+	422	57
24.	*Tephrossia purpurea* (L.)Pers	5.6	+	+	-	126	46
25.	*Urnea lobata* L.	6.1	+	-	+	405	63

Table 2. AM fungal genera and species were isolated from the rhizosphere soil samples in Bargur hills, Anthiyur, Erode district.

S.No.	AM fungal genera	AM fungal Species
1	*Ambispora*	*A. appendiculatum*
2	*Paraglomus*	*P.occultum*
3	*Pasipora*	*P. dominika*
4	*Glomus*	*G. heterosporum, G. hoi, G. invermeyanum, G.macroporum, Gl. maculosum, G. microsporum, G. magnicule, Gl. monosporum, G. multicaulis, G. multisubstensum, G.panishalos, G. radiatum, G. Segmantatum, G. versifome*,
5	*Rhizophagus*	*R. intraradix, R.manihotis*
6	*Funneliformis*	*F. fragilistratum*, *F. geosporum*
7	*Sclerocystis*	*S. pachycaulis*

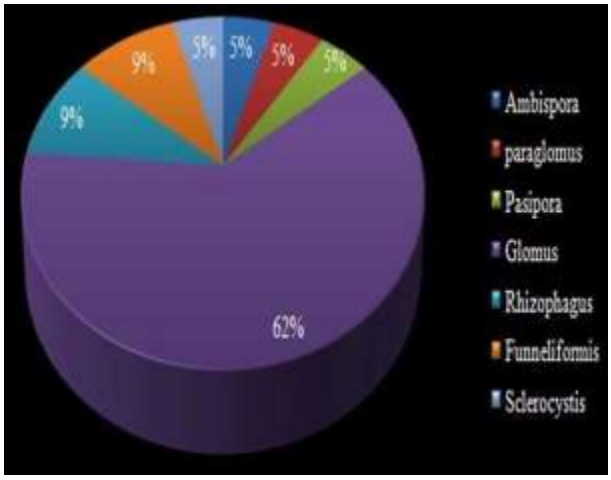


Fig. 6. Dominant Arbuscular Mycorrhizal fungal spores in rhizosphere soils samples of Bargur hills

4. CONCLUSION

In conclusion the present study revealed that the collected plant species from Bargur hills had rich population Arbuscular Mycorrhizal fungal spores and root colonization occurred in plant species. In this symbiotic association of AM fungi to absorb the soil nutrients, zinc, copper especially phosphorous and also increased plant growth biomass, diseases resistance and tolerence.

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