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**RESEARCH ARTICLE**

# STUDIES ON THE ARBUSCULAR MYCORRHIZAL FUNGAL ASSOCIATION IN THE PLANT SPECIES OF THEERTHAMALAI HILLS, WESTERN GHATS OF DHARMAPURI DISTRICT TAMILNADU, INDIA

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## ABSTRACT

The present study to investigate the arbuscular mycorrhizal fungal root colonization and spore population of some medicinal plants species at Theerthamalai hills Western Ghats of Dharmapuri district, Tamil Nadu. Root and rhizosphere soil samples were collected during the month of August, 2010-March, 2011. From the surface to 20 cm depth as well as pH were also measured. Totally 42 plant species belonging to 24 families recovered Arbuscular mycorrhizal fungal spore and root colonization. The results of the present study arbuscular mycorrhizal fungal spore population in the rhizosphere soil and root colonization of all the plant species. The maximum spore population was found in the rhizosphere soil samples of the plant species *Leucas aspera* (386/100g of soil) which belongs to the family Lamiaceae and lowest spore population was observed in the *Wrightia tinctoria* (117/100g of soil) belongs to Apocyanaceae. The maximum AM fungal infection was found in roots of *Cassia auriculata* (63%) belongs to the family Fabaceae, while the lowest AM fungal association was found in the root of *Achyranthes aspera* (17%) belongs to the family Amaranthaceae. A total of 24 AM fungal species belonging to 4 genera were recorded from the rhizosphere soil samples of this study region. Among these genus *Glomus* was dominant had seen in rhizosphere soil samples in all the medicinal plant species.

**Keywords:** *Glomus* sp, Arbuscular mycorrhizal fungi**,** Medicinal plants, Theerthamalai hills.

## 1. INTRODUCTION

More than a century, observation has revealed that the roots of majority of land plants are associated with fungi. However, it is only in recent years that the significance of this association has emerged. To a great extent, most of the land plants roots associate with soil fungi. Soil is the habitat for plant roots, micro flora (bacteria, actinomycetes, fungi, and algae) microfauna and macrofauna. The zone of soil under the influence of root is called the "rhizosphere". This area of activated microbial populations can extend more than 5 mm from the root surface. However, the abundance and activity of soil microorganisms in general diminish with increasing distance from the root (Pankow *et al.,* 1991). It is now recognized that the "rhizosphere effect" is mainly due to the exudates from the roots, which attract soil microorganisms. These microorganisms play vital roles in physiological processes in the ecosystem of plants growing in soil.

Association of plant roots with fungi is termed as mycorrhizae. It is a marriage between two highly dissimilar organisms based on mutual exchange of nutrients. The plant root system is a major biotic component of soil providing energy for the majority of soil fauna and microflora (Freckman and Caswell, 1985). Soil microorganisms play important roles in plant-soil interactions. Microbes alter nutrient availability, immobilize heavy metals in soils, and bind soil particles in to stable aggregates (Shetty *et al*., 1994).

Arbuscular mycorrhizal fungi are soil microorganisms that establish mutual symbiosis with the majority of higher plants, providing a direct physical link between soil and plant roots. AM fungi geographically ubiquitous occur over a broad ecological range including associated agriculture, horticulture, pasture grasses, tropical plants and cereals (Qadri, 2004). Arbuscular Mycorrhizas improve the growth and nutrient uptake of plants and are formed in 80% of all land plants. Mycorrhizal associations appear to be the result of relatively diffuse co-evolutionary processes. While early events in the evolution of mycorrhizal symbiosis may have involved reciprocal to genetic changes in ancestral plants



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and free living fungi available evidence points largely to ongoing parallel evolution of the partners in response to environmental changes and non-mycotrophy evolved more recently (Cairney, 2000).

AM fungi play a vital role in primary and secondary succession of plant species, especially in low nutrient ecosystems (eg. coastal and sand dunes). The below-ground diversity of AM fungi is one of the major factors contributing to the maintenance of plant biodiversity and to the ecosystem functioning (Van der Heijden *et al*., 1998). Arbuscular mycorrhizal associations are beneficial for plants growing in various Indian semi-arid landscapes (Kaushick *et al*., 1992).

Majority of plants used for medicinal purposes grow in forests and very few of them are cultivated. The forest wealth with regard to plants of medicinal importance has not yet fully been tapped. There is an increasing world-wide interest in AM fungi (AM), which are universally present in all soils and in association with great variety of plants of different taxonomic groups (Sambandan *et al*., 1994). AM fungi are very common in tropical forests while ectomycorrhizae dominates in temperate and coniferous forests. AM fungi infect fine feeder roots and colonize the cortical region from where they extend their mycelia in rhizosphere soil. Besides, these fungi also protect the host plants from root pathogens and enhance drought resistance (Michelsen and Rosendahal, 1990; Verma and Jamaluddin, 1994).

Mycorrhiza allows the fungal symbionts to extract a greater amount of nutrients from the soil such as phosphorus, nitrogen, zinc, boron and colonized by AM fungi benefits a plant in a number of ways: increased nutrient uptake, increased disease resistance, enhanced water relations and increased soil aggregation (Newsham *et al.* 1994). The aim is to use mycorrhiza technology in improving phosphate availability, soil fertility and produce staple food crops in small farming. Maintenance of sustainable soil fertility depends greatly on the ability to harness the benefits of soil AMF, due to depleting phosphate mineral resources arising from the low availability of AMF (Irene and Thomas, 2006).

The great interest in AM in recent years has prompted numerous survey aimed at enumerating and assessing AM fungi in a particular region or in a natural environment. Hence in this present study was isolate and identification AM fungal spores from rhizosphere soils samples in the medicinal plant species in addition with root colonization in the study region.

## 2. MATERIALS AND METHODS

*2.1. Study area -Description*

Theerthamalai Hills, a range of mountains in the Eastern Ghats in Tamil Nadu South India. The name "Theerthamalai" derives from Tamil word 'Therrtham' meaning "Neer Aruvi" and 'Malai' meaning Hill, thus Theerthamalai Hill. They really consist of a forest-clad and grassy table land, with summits rising about 8000 ft. The highest peak of the Theerthamalai Hills 2,527 meters (8,842 ft), located in the Dharmapuri district (Fig. 1). Harur is located at 12°04′N 78°30′E12.07°N 78.5°E. It has an average elevation of 350 meters (1148 feet). Harur is situated along the Salem and (via Harur) Chennai State Highway 18.

The climate is generally warm. The hottest period of the year is between the months of March to May, reaching a maximum temperature of up to 32°C in April. The temperatures drop in December and the low temperatures continue up to February, touching a minimum of 14°C in January. The district has an average annual rainfall of 895.56 mm. The tropical forests here generally have short shrubs and thorned-plants. Temperature being increasing after March. May is the hottest maximum with a mean daily maximum temperature of 36.5ºC and minimum temperature of 28ºC. The maximum temperature may go up to 36.5ºC on same days. The maximum and minimum temperatures are 36.5ºC and 17.7ºC recorded during the month of May 2010 and January 2011 respectively (Table 1), (Fig 2).

*2.2. Sample collection*

The present study root and rhizosphere soils samples were collected from 25 plant species during the year August, 2010 to March, 2011. All the samples were placed in the polyethylene 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 (Philips and Hayman's (1970). 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). The percentage of AM fungal infect ion was calculated using the formula:

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

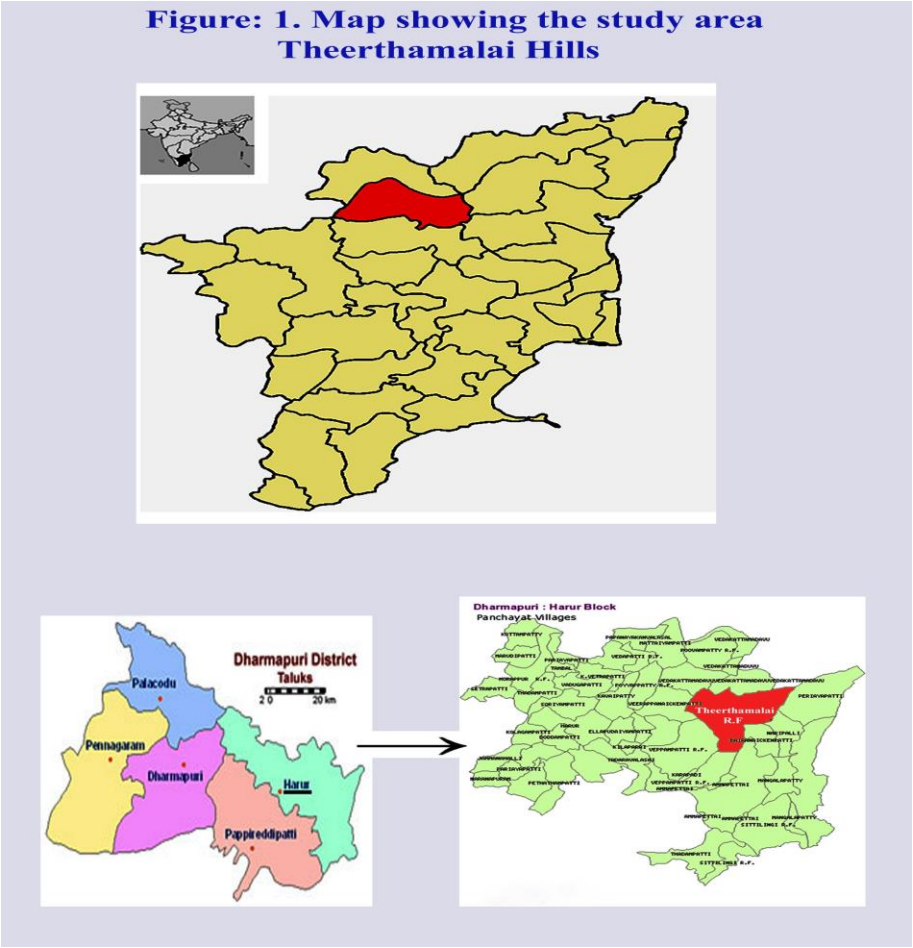


**Fig. 1. Map indicating the study area Theerthamalai hills, Dharmapuri district**

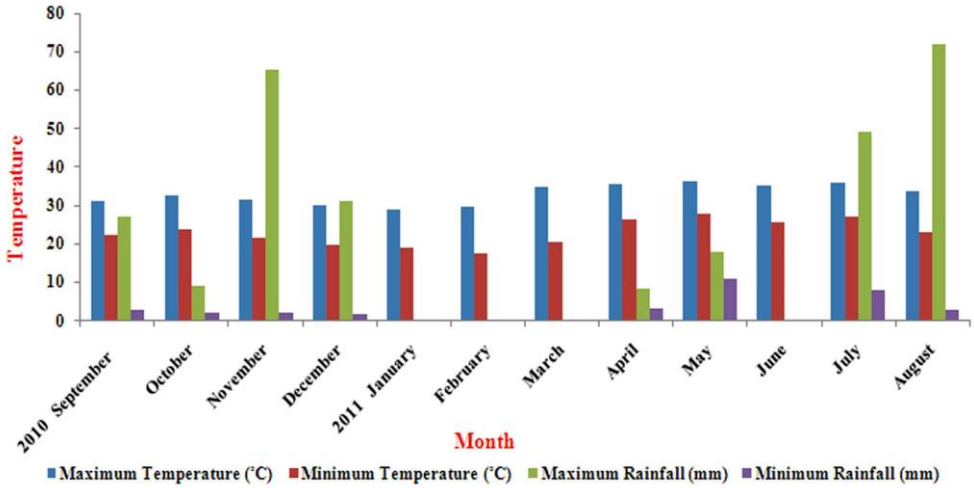


**Fig. 2. Meteorological factors of Theerthamalai hills during 2010-2011.**

*2.4. AMF spore identification*

AM fungal spores were extracted from 100 g rhizosphere soil by wet-sieving and decanting method (Gerdemann and Nicolson, (1963) through a series of 710 to 37µm size sieve filter. For the identification and nomenclature of these AM fungal spore synoptic keys developed by (Schenck, and Perez (1990; Raman, N. and V. Mohan Kumar, 1988; Schüßler Walker, 2010.) 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.

*2.6. Available nitrogen (N)*

Available nitrogen in the soil was estimated following the method of Sankaram (1996). 20 g soil sample was taken in distillation flask and 200 ml of water, 100 ml of 0.32% Potassium permanganate solution and 100 ml of 2.5% NaOH were added. The sample was digested for 1 hour and distilled to 30 ml. The distillate was collected in 20 ml of 2% Boric acid and titrated against N/50 sulphuric acid using bromo-cresol green indicator (0.099 g bromo-cresol green and 0.066 g methyl red dissolved in 100 ml of 95% ethyl alcohol). From the titre value, the available nitrogen in the soil was calculated.

*2.7. Available Phosphorous (P)*

Available phosphorous in the soil was determined following the method of Olsen *et al*. (1954). Phosphorous from the soil was extracted by adding 50 ml of extracting solution (15 ml of ammonium fluoride solution, and 25 ml of 2 N HCl was added to distilled water to make up to 500 ml), to 1 g of the soil. The suspension was shaken for 1 min and the content was filtered using Whatmann No.1 filter paper. To 5 ml of the filtrate, 4 ml of ascorbic acid reagent (ammonium molybdate 12 g dissolved in 250 ml of water was added to 291 mg potassium antimony tartarate in 100 ml distilled water and 140 ml concentrated sulphuric acid and the volume was made up to 10 ml and left for 10 minutes. The colour intensity of the reaction mixture was read at 640 nm in a Beckman Du-40 spectrophotometer. The values were calculated from a standard graph, which was plotted with $KH_2PO_4$. The available phosphorous in the soil was calculated by multiplying the factor derived from the standard curve and dilution factor.

*2.8. Available potassium (K)*

The method of Sankaram (1996) was followed for the determination of available potassium in the soil. Soil sample, 5 g was taken, 250 ml neutral ammonium were added and stirred for 5 min. The suspension was filtered through Whatmann No.1 filter paper. The filtrate was collected and readings were taken in a flame photometer (Evans Electro Selenium Ltd). The instrument was checked with distilled water and KCl was used as standard.

*2.9. Available microelements*

Lindsay and Norvell's (1978) method was followed to estimate available microelements such as Zn, Mn, Cu and Fe. From the soil sample, 10 g soil was taken, 20 ml of DTPA (diethylene triamine penta-acetic acid) were added and stirred for 2 hour. The suspension was filtered through Whatmann No.1 filter paper. The filtrate was collected and readings were taken in atomic absorption spectrophotometer (AA 1475 Varian, USA). The following wavelengths were used: 213.86 nm for Mn, 324.75 nm for Cu and 248. 33nm for Fe.

## 3. RESULTS

In the present study results revealed that arbuscular mycorrhizal fungal (AMF) infections and spore population of totally 42 plant species belongs to 24 families in the plant from Theerthamalai hills during the year 2010 – 2011, (Table: 2). The pH, macro and micronutrient contents of rhizosphere soil samples were presented in (Table: 3). The pH of the soil samples varied from 4.7 to 7.9. The nitrogen content of soil samples ranged from 56 to 77 kg/ha. The phosphorus level of soil samples was 7.0 to 13.0 kg/ha. The potassium content in the soil samples ranged from110 to 135kg/ha.

*3.1. AM fungal spore population and root colonization*

In the present study totally 42 medicinal plant species belonging to 24 families were examined for AM fungal association. Of these the maximum spore population was displayed in the plant species of *Leucus aspara* (386/100g of soil) belongs to the family Lamiaceae and minimum spore was observed in *Wrightia tinctoria* (117/100g of soil) belongs to the family Apocyanaceae.

The highest AM fungal infection found in the roots of *Cassia auriculata* (63%) belongs to the family Fabaceae and lowest AM fungal infection was recorded in *Achyranthes aspera* (17%) belongs to the family Amaranthaceae.

**Table 3. pH, macro and micro elements contents of Rhizosphere soil samples of medicinal plant species at Theerthamalai hills.**

| S. No | Name of the plant | Soil Texture | pH | EC | Macronutrients Kg/Ha | | | Micronutrients (ppm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | N | P | K | Iron | Zinc | Mn | Cu |
| 1. | *Annona squamosa* L. | Sandy loam | 6.4 | 0.4 | 77 | 8.0 | 105 | 4.90 | 0.92 | - | 0.80 |
| 2. | *Capparis sepiaria* L. | Clay loam | 6.5 | 0.5 | 70 | 10.0 | 125 | 4.96 | 0.90 | - | 0.90 |
| 3. | *Sida acuta* Burm.f. | Sandy loam | 6.8 | 0.6 | 70 | 11.0 | 125 | 4.98 | 0.94 | - | 0.96 |
| 4. | *Chloroxylon swietenia* DC. | Sandy loam | 6.7 | 0.5 | 70 | 13.0 | 120 | 4.90 | 0.86 | - | 0.94 |
| 5. | *Murraya paniculata* (L.) Jack. | Sandy loam | 6.7 | 0.5 | 72 | 9.0 | 118 | 4.76 | 0.80 | - | 0.92 |
| 6. | *Cissus quadrangularis* L. | Clay loam | 6.7 | 0.5 | 63 | 8.0 | 110 | 4.74 | 0.86 | - | 0.90 |
| 7. | *Cardiospermum halicacabum* L. | Clay loam | 6.8 | 0.5 | 64 | 7.0 | 120 | 4.72 | 0.84 | - | 0.90 |
| 8. | *Dodonaea viscosa* Jack. | Sandy loam | 7.3 | 0.5 | 66 | 11.0 | 125 | 4.64 | 0.80 | - | 0.96 |
| 9. | *Abrus precators* L. | Sandy loam | 7.3 | 0.6 | 70 | 10.0 | 130 | 4.68 | 0.86 | - | 0.94 |
| 10. | *Cassia auriculata* L. | Sandy loam | 7.2 | 0.6 | 72 | 13.0 | 105 | 4.80 | 0.84 | - | 0.92 |
| 11. | *Cassia occidentalis* L. | Sandy loam | 6.8 | 0.7 | 64 | 11.0 | 110 | 4.90 | 0.80 | - | 0.90 |
| 12. | *Pongamia pinnata* (L.) Pierre | Clay loam | 7.0 | 0.5 | 63 | 15.0 | 125 | 4.92 | 0.90 | - | 0.94 |
| 13. | *Pterolobium hexapetalum* (Roth) Sant. & Wagh | Clay loam | 6.9 | 0.5 | 64 | 10.0 | 125 | 4.70 | 0.96 | - | 0.70 |
| 14. | *Tephrosia purpurea* (L.) Pers. | Clay loam | 6.5 | 0.7 | 67 | 9.0 | 120 | 4.64 | 0.90 | - | 0.64 |
| 15. | *Tamarindus indica* L. | Clay loam | 7.2 | 0.6 | 70 | 10.0 | 123 | 4.60 | 0.94 | - | 0.64 |
| 16. | *Acacia nilotica* (L.) Willd.ex Delile. | Clay loam | 7.8 | 0.7 | 70 | 11.0 | 125 | 4.70 | 0.94 | - | 0.60 |
| 17. | *Passiflora foetida* L. | Sandy loam | 6.7 | 0.5 | 72 | 9.0 | 118 | 4.76 | 0.80 | - | 0.92 |
| 18. | *Tecoma stans* (L.) Juss.ex Kunth. | Sandy loam | 6.7 | 0.5 | 63 | 8.0 | 114 | 4.74 | 0.83 | - | 0.91 |
| 19. | *Alangium salvifolium* (L.f.) Wangerin Lamarck. | Sandy loam | 6.8 | 0.6 | 65 | 7.0 | 120 | 4.72 | 0.85 | - | 0.93 |
| 20. | *Canthium parviflorum* Lam. | Sandy loam | 7.0 | 0.5 | 66 | 10.0 | 121 | 4.64 | 0.80 | - | 0.96 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21. | *Chomelia asiatica* Schumann ex Engl. | Clay loam | 7.1 | 0.7 | 70 | 10.0 | 130 | 4.68 | 0.86 | - | 0.94 |
| 22. | *Plumbago zeylanica* L. | Clay loam | 6.1 | 0.8 | 70 | 11.0 | 110 | 4.62 | 0.86 | - | 0.74 |
| 23. | *Carissa carandas* L. | Sandy loam | 5.3 | 0.7 | 66 | 10.0 | 117 | 4.66 | 0.84 | - | 0.60 |
| 24. | *Wrightia tinctoria* (Roxb) R. Br. | Clay loam | 7.4 | 0.6 | 65 | 11.0 | 132 | 4.62 | 0.86 | - | 0.78 |
| 25. | *Caralluma adscendens* Wall. | Clay loam | 7.9 | 0.8 | 59 | 9.0 | 129 | 4.79 | 0.86 | - | 0.68 |
| 26. | *Gymnema sylvestre* R.Br. | Clay loam | 5.7 | 0.7 | 68 | 8.0 | 111 | 4.75 | 0.92 | - | 0.60 |
| 27. | *Pergularia daemia* (Forssk.) Chiov. | Clay loam | 6.4 | 0.9 | 56 | 9.0 | 130 | 4.64 | 0.82 | - | 0.77 |
| 28. | *Evolvulus alsinoides* L. | Sandy loam | 4.8 | 0.5 | 69 | 11.0 | 140 | 4.71 | 0.81 | - | 0.76 |
| 29. | *Datura stramonium* L. | Sandy loam | 7.2 | 0.5 | 67 | 10.0 | 126 | 4.92 | 0.86 | - | 0.87 |
| 30. | *Solanum surattense* Burm.f. | Sandy loam | 6.3 | 0.6 | 72 | 9.0 | 110 | 4.75 | 0.89 | - | 0.92 |
| 31. | *Justicia tranquebariensis* L. | Sandy loam | 7.3 | 0.9 | 71 | 7.0 | 109 | 4.93 | 0.92 | - | 0.69 |
| 32. | *Leucas aspera* (Willd) Link | Sandy loam | 6.9 | 0.7 | 69 | 7.0 | 134 | 4.83 | 0.88 | - | 0.79 |
| 33. | *Ocimum sanctum* L. | Clay loam | 7.4 | 0.8 | 63 | 11.0 | 135 | 4.70 | 0.91 | - | 0.67 |
| 34. | *Lantana camara* L. | Sandy loam | 4.7 | 0.5 | 73 | 8.0 | 115 | 4.79 | 0.89 | - | 0.84 |
| 35. | *Achyranthes aspera* L. | Sandy loam | 5.5 | 0.6 | 65 | 10.0 | 121 | 4.84 | 0.81 | - | 0.92 |
| 36 | *Aerva lanata* (L.) Juss.ex Schult. | Clay loam | 4.8 | 0.7 | 72 | 11.0 | 121 | 4.62 | 0.83 | - | 0.91 |
| 37 | *Acalypa fruticosa* Forssk. | Clay loam | 7.2 | 0.6 | 63 | 9.0 | 118 | 4.71 | 0.82 | - | 0.86 |
| 38 | *Acalypha indica* L. | Clay loam | 6.3 | 0.8 | 65 | 8.0 | 120 | 4.75 | 0.93 | - | 0.94 |
| 39 | *Jatropha glandulifera* Roxb. | Clay loam | 7.2 | 0.7 | 72 | 9.0 | 132 | 4.70 | 0.91 | - | 0.71 |
| 40 | *Euphorbia hirta* L. | Sandy loam | 6.8 | 0.5 | 70 | 11.0 | 130 | 4.76 | 0.80 | - | 0.87 |
| 41 | *Aloe vera* (L.) Burm.f. | Clay loam | 7.0 | 0.5 | 66 | 10.0 | 128 | 4.98 | 0.84 | - | 0.89 |
| 42 | *Gloriosa superba* L. | Clay loam | 7.2 | 0.6 | 65 | 9.0 | 122 | 4.84 | 0.90 | - | 0.91 |

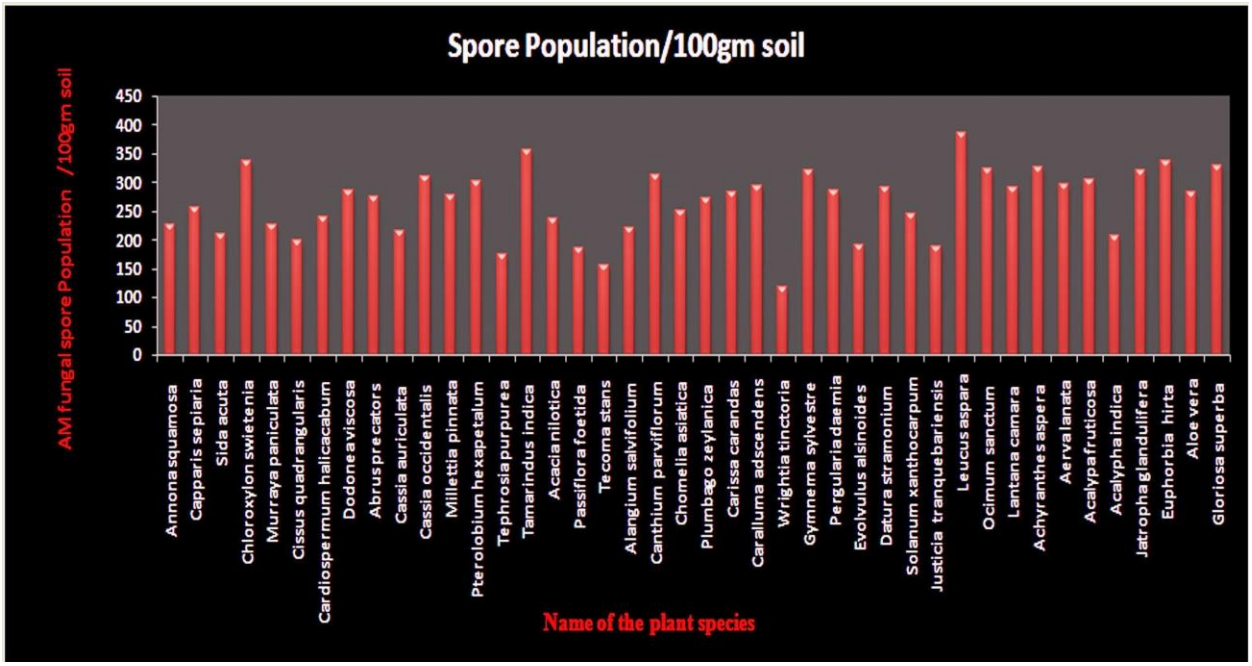


**Fig. 3. AM fungal spore population in the rhizosphere soil samples of Theerthamalai hills.**

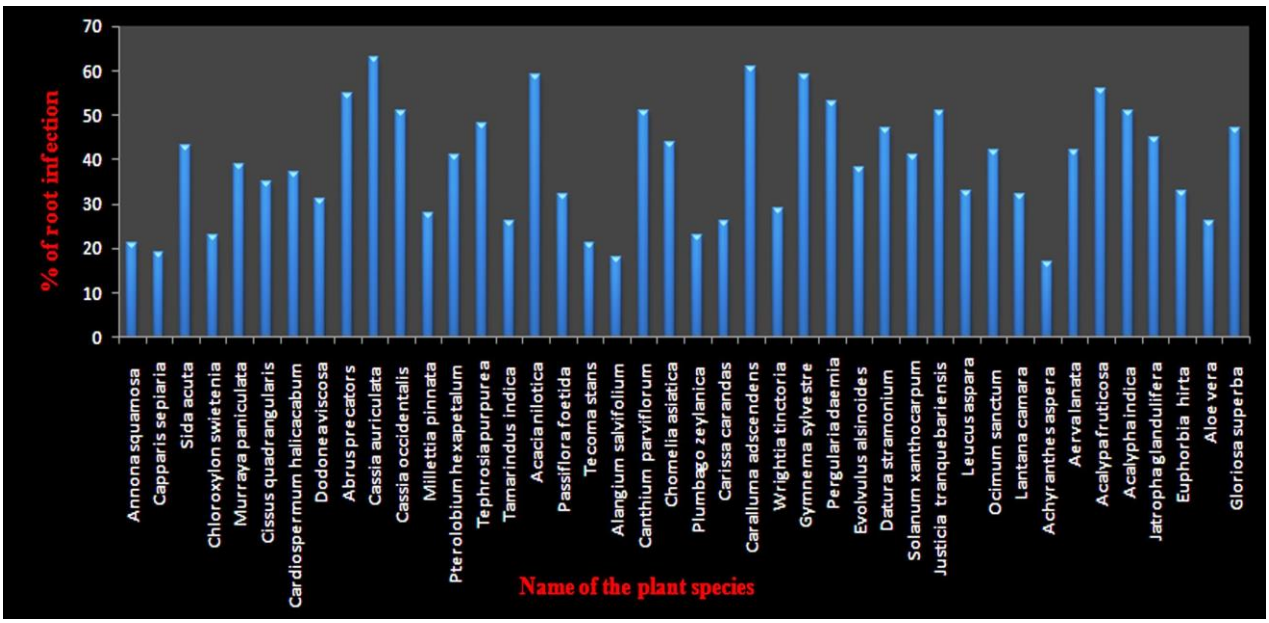


**Fig. 4. AM fungal infection in the root samples of Theerthamalai hills.**

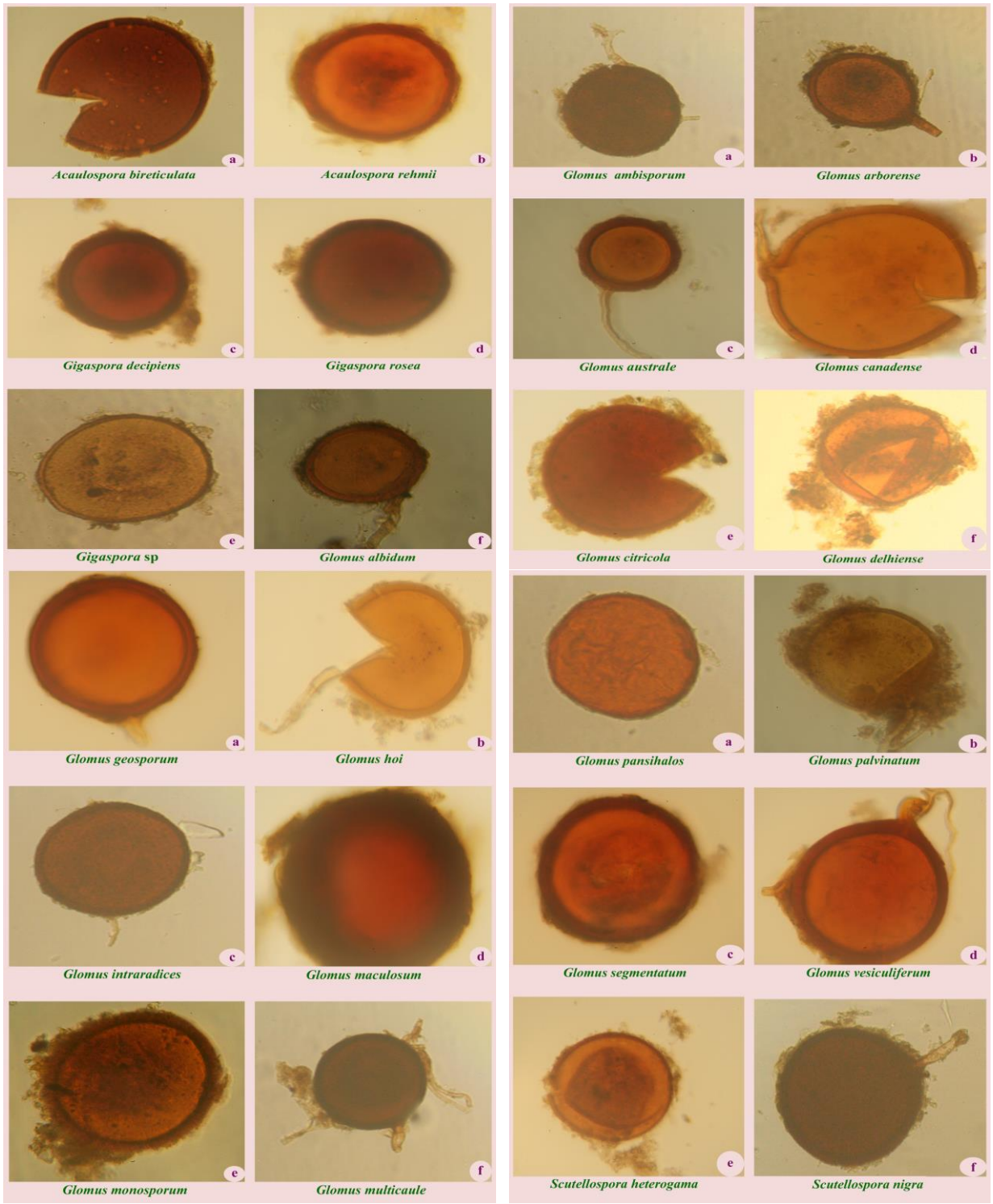


**Fig. 5. Various AM fungal spores identified by rhizosphere soil samples from this study region.**

All the 42 plant species colonized by AM fungal infection. Of these the following species such as *Annona squamosa* (21 %), *Capparis sepiaria* (29%), *Chloroxylon swietenia* (23%), *Pongamia pinnata* (28%), *Tamarindus indica* (26%), *Tecoma stans* (21%), *Alangium salvifolium* (18%), *Plumbago zeylanica* (23%), *Carissa carandas* (26%), *Wrightia tinctoria* (29%), *Achyranthes aspera* (17%), and *Aloe vera* (26%), were infected only less than 30% The other species like *Murraya paniculata* (39%), *Cissus quadrangularis* (35%), *Cardiospermum halicacabum* (37%), *Dodonaea viscosa* (31%), *Passiflora foetida* (32%), *Evolvulus alsinoides* (38%), *Leucas aspera* (33%), *Lantana camara* (32%), *Euphorbia hirta* (33%), infected less than 40% and above 30%.

The species such as *Pterolobium hexapetalum* (41%), *Tephrosia purpurea* (48%), *Chomelia asiatica* (44%), *Datura stramonium* (47%), *Solanum surattense* (44%), *Ocimum sanctum and Aerva lanata* (42%), *Jatropha glandulifera* (45%), *Gloriosa superba* (47%), showed less than 50%. The species like *Abrus precators* (55%), *Cassia occidentalis* (51%), *Acacia nilotica* (59%), *Canthium parviflorum* (51%), *Gymnema sylvestre* (59%), *Pergularia daemia* (53%), *Justicia tranqubariensis* (51%), *Acalypha indica* (51%), showed above 50% and less than 60%. The species like *Cassia auriculata* (63%), *Caralluma adscendens* (61%), recorded above 60% and less than 70% respectively.

*3.2. AM fungal spores recovered from rhizosphere soils samples in plant species*

In the present study first time the AM spore diversity isolated from medicinal plants species ttotally 3- AM fungal spore species was identified six genera from 40 plant species belongs to 7 families, Of these AM fungal spores of the genus *Glomus* was recorded as the most population, followed by *Aculospora*, *Gigaspora*, *Scutellispora*, *Sclerocystis* and *Entrophospora* are recorded in (Fig 6).

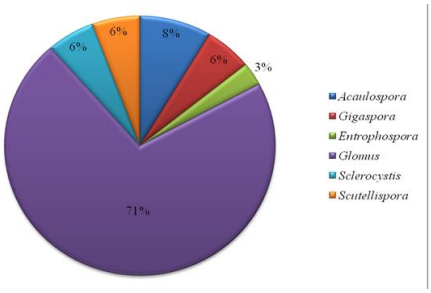


**Fig. 6.** Dominant AM fungal species identified from rhizosphere soils samples in the study region.

**4. DISCUSSION**

Totally 42 plant species belongs to 24 family were analyzed to determine for mycorrhizal infection and spore population in Theerthamalai hills for a period of one year (2010-2011). The factors like climatic and physico-chemical character of the soil were also studied. Generally in Theerthamalai Hills all the plant species have mycorrhizal association. Totally 42 plant species belongs to 24 families were surveyed for AM fungal infection. The range of spore population and rate of AM fungal infection was occurred variously. The root colonization ranged from 17 to 63%. The spore density in the present study from (117 to 386/100gm of soil) moderate to high lands.

Arbuscular mycorrhizal are ubiquitous and have a broad ecological range and also AM fungi usually associated with most plants and are important in Agriculture, Horticulture and Forestry. Nishi Mathur and Anil Iyar (1994) reported the *Simmondsia chinensis* in desert associated with AM fungi and noted that the percentage of root colonization could not related to spore population.

In general, mycorrhizal inoculation increased the percentage of mycorrhizal root colonization and spore numbers in soil. Chiramel *et al*., (2006) observed the highest percentage of root colonization in *Glomus intraradices* treated plants followed by those treated with *Gl. monosporum* and *G. leptotichum* wet land woody species. The same results were obtained in the present investigation. Mohan Kumar and Mahadevan (1986) analysis the AM fungal infection in *Acanthus ilicifolius* belongs to the family Acanthaceae from Mangrove forest, Pithchavaram, Tamilnadu. Surprisingly there is no mycorrhizal association was recorded in the roots. It may be due to the soil from mangrove forest was dry. Furthermore, soil moisture substantially reduced the mycorrhizal association due to insufficient availability of oxygen. The same findings no colonization was observed in the plant species of *Adathoda vasica* (Acanthaceae) by Radhika and Rodrigues (2010) from Western Ghats, Goa region. But in the present study reveals that the Acanthaceae members of *Justicia tranquebariensis* (51%), *Leucas aspara* (33%), *Ocimum sanctum* (42%). Colonization was observed and roots showed hyphae and intra cellular arbuscular and vesicles in the soil samples collected from Thirumoorthy hill areas. The similar finding was obtained in the Acanthaceae members of *Astracantha longifolia* (34%), marshy plants (Dharmarajan *et al.,* 1993) from in and around Poondi, Thanjavur District.

Mycorrhizal inoculation resulted in a significant increase in height, biomass and nutrient content of *W. chinensis* seedlings (Nisha and Rajeshkumar, 2010). This report supports earlier investigations in medicinal plants (Earanna *et al.,* 2002; Rajan *et al.,* 2004). *W. chinensis* plants inoculated with AM fungi showed a general increase in growth parameters such as plant height, total dry weight than those of the uninoculated plants. Beena *et al.,* (2001) observed that the AM fungal infection (47%) in Euphorbiaceae members *E. articulate* and the spore population (6/100 gm of soil) form Coastal sand dunes of West Coast of India. In the present study the same results was obtained that the AM fungal infection (33%) and spore population (336/100 g of soil) in other species of *Euphorbia hirta* belongs to Euphorbiaceae member.

The Fabaceae member *Cyperus arenarius* (60%), *Fimbristylis argenta* (22%), observed the AM fungal infection in Cyperaceae member by Beena *et al.,* 2001. But they did not observed any AM fungal infection in plant species of *Cyperus pedunculatus* belongs Cyperaceae member. In the present investigation, all the Fabaceae members, *Abrus precatorius* (51%), *Cassia auriculata* (63%), *C. occidentalis* (51%), *Pongamia pinnata* (28%) *and Pterolobium hexapetalum* (41%), showed fungal infection and spore population. The Solanaceae members *Datura stramonium* (47%) and *Solanum surattense* (41%) infected b AM fungi in the present investigation. Sadiq Gorsi (2002) also obtained the same results and his study revealed that the Solanaceae members of *Solanum nigrum* (30%) infected by Arbuscular mycorrhizae. The inoculation of AM and other beneficial soil microorganisms significantly increased the biomass of different medicinal plants (Sena and Das 1998, Kothari *et al.,* 1999). The same result was present in the present study. Akond and Khan (2001) reported 5% – 73% root colonization by AM fungi in timber yielding plants of Bangladesh which is it consistence with this present study.

Arbuscular mycorrhizal associations are beneficial for plant growing in various Indian semi-arid landscapes (Kaushick *et al*., 1992). Muthukumar *et al*., 1994 reported that the AM fungal infection in the plant species *Acacia eburnean* (70%) and *Mimosa pudica* (70%) belongs to the family Mimosaceae. The same results were obtained in *Acacia nilotica* (59%) the other species of Mimosaceae member. In the present investigation the Verbenaceae member *Lantana camara* (32%) infected by AM fungal infection and also the spore population (289/100gm of soil). But in contrast, Beena *et al*., (2001) reported there is no mycorrhizal infection and spore population present in the different plant species of *Phyla nodiflora* belongs to Verbenaceae member.

Santhoshkumar and Nagarajan (2017) reported that arbucular mycorrhizal fungal association in the rhizosphere soils and root colonization of some medicinal plant Species in Sirumalai hills Eastern Ghats of Dindugul District, and they were identified totally 39 AM fungal species belonging to six genera were recovered the rhizosphere soil samples from the study region. The genus *Glomus* was dominate as followed by *Acaulospora*, *Sclerocystis*, *Entrophospora* and *Gigaspora* was recorded. In the present study observed that, arbuscular mycorrhizal fungi colonized all the medicinal plant species and the three stages of root colonization viz., hyphal, arbuscular and vesicular colonization were recorded. AM spore populations also showed variation in the rhizozphere soil of the shrubs and tree species.

## 5. CONCLUSION

The present study revealed that the all plant species had AM fugal spore density and root colonization. In this symbiotic association of AM fungi is absorb the soil nutrients, zinc, copper especially phosphorous and also increased plant resistance to various stresses like drought, salt and heavy metal. Hence in this present study in baseline data, further more research is needed to AMF inoculum in green house condition increased in biomass and plant growth productivity.

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