



Research Paper

**OCCURRENCE AND DISTRIBUTION OF AM FUNGI ASSOCIATED IN
Avicennia marina (Forssk) Vierh. SOILS OF SOUTH EAST COSTAL AREA
OF MUTHUPET, INDIA**

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Abstract

A study was conducted to assess the occurrence and distribution of AM fungi in root zone soils of *Avicennia marina* at south east coastal area of Muthupet, India. The mangrove soil contains lower AM fungal population and nutrients. 14AM species belonging to five genera namely *Acalospora*, *Glomus*, *Gigaspora*, *Sclerosystis* and *Scutellospora* was isolated from the rhizosphere soils of *Avicennia*. Among them *Glomus* sp. was the most predominant species found in the root zone soils of all the study sites.

Key words: *Avicenna*, AM fungi. *Glomus*. Mangrove.

INTRODUCTION

India being one of the mega diversity regions of the world supports an enormous biodiversity of ancient lineage. It is estimated that over 45,000 species of plants are accounted from Indian subcontinent, which represents roughly 11% of the known plants species of the world. Because of its richness, in overall species diversity, India is recognized as one of the 17 Mega Diversity zones of the world. Mangrove creates habitats for diverse floral and faunal communities including numerous mangroves dependent microorganism(12).

Mangroves are facultative halophytes, characterized by regular tidal inundation and fluctuating salinity. Mangroves are a type of coastal woody vegetation that brings muddy saline shores and estuaries to tropical and subtropical regions (6). They are characterized by high levels of productivity and fulfill essential ecological functions, harbouring precious natural resources (18).

Ecological functions attributable to Arbuscular mycorrhizal (AM) fungi include helping to increase plant tolerance of adverse soil conditions, influencing response to severe climate conditions and increasing plants productivity in natural plant communities (3). AM fungi increase the physiological nature of absorbing surface area of the root system and also increase the tolerance of plants to drought, high soil temperature and extremes of soil acidity caused by high levels of metals. They provide protection from certain plant pathogenic fungi and nematodes that attack roots.

Therefore, present study aims to investigate the diversity of AM fungi in *Avicennia marina* at Muthupet.

MATERIALS AND METHODS

STUDY AREA

The coast line of Tamilnadu extends about 950 kilometer within the latitude 8N-13° 30' N and longitude 77° 15' E-80° 20' E with approximately 46 big and smaller rivers. All these rivers carry fresh water and silt particles from the upper reaches and discharge in the coastal zone. Mangroves in Tamilnadu comprise in Cauvery delta complex Pichavaram, Muthupet areas. Based on the above obtained on marine AM fungi and Mangroves ecosystem, the present study has been undertaken in the proposed study area in Muthupet mangroves, a coastal deltaic habitat along the East Coast of Palk strait, in Bay of Bengal in Thiruvavarur District, Tamilnadu. The study area comprises a stretch of 6 kilometers in the Muthupet mangrove up to its tail end. The three sampling areas are as follows.

Site.1-Chef corner

Site. 2-Sethukuda

Site.3-Thuraikkadu

Avicennia marina plant was selected for sampling and identified using the Gambel flora(4), An area of 3m² was chosen for sampling from each study site. Rhizosphere soil and root samples were collected in polyethylene bags from depths of 0-30 cm for study the AM fungal colonization and spore number in *Avicennia* plant. Soil pH and soil Electrical conductivity (EC) was measured in standard soil analysis techniques, viz, (17) rapid titration method (2) were employed for determination of organic carbon and available P respectively available potassium was estimated by the ammonium acetate method (8) Available Zinc, Copper, Manganese and Iron were Quantified by the DTPA-CaCl₂-TEA method (11). Root zone soil samples were analysed for AM fungi spore number (5). The root samples were cleaned with 10% KOH and stained with trypan blue lactophenol (14). Altogether 14 AM fungal members were isolated and brought to pot culture studies with plant of onion (*Allium cepa*.L). After plants were 90 days old, the spore and sporocarps were re-isolated for identification (15).

RESULT AND DISCUSSION

Physico-chemical analyses of three different study sites were presented in table 1. In all the study sites, soils were showed nearly neutral to alkaline. The alkaline nature of mangrove soils has been already reported (16). Electrical conductivity ranged from 3.88 to 4.20 dsm. Mangrove soils were mostly clay loam and brown in colour. Total phosphorus and nitrogen content are generally deficient and other soil element such as K, Ca, and Mg, are in minor variation. All the study sites contain higher amount of Na.

A total of 14 AM fungal species representing five genera, including *Acalospora*, *Glomus*, *Sclerosystis*, *Scutellospora*, and *Gigaspora* was isolated from the soils of three different study site. AM fungal spore number and species richness was higher in site 1, 2 and 3 respectively (Table 3 and Fig.1) While it was comparatively lower spore number in site 3. It was ranged from 140 to 216. Generally AM fungal spore number and species were less in all the sites. There was an impact of salinity and season (9). The study confirmed that the *Glomus* and *Gigaspora* was the most dominant AMF found in mangrove soils (Table 2 and Fig.1). There was a certain degree of specificity among the different species in root zone soils (13). Gildon and Tinker (1981) have isolated one

species of AM fungi from rhizosphere soil of plants. In the present study, it correlate with findings of Beena et al, 2001,(10).

The *Avicennia marina* plant soils examined AM Fungal colonization. The present root colonization was more in roots of plants in site 3(Fig.2). The minimum colonization was observed in site 1. The results suggested that the variation in soil Physico-chemical characteristics seems to be the desired factors in influencing distribution of AM fungi in mangrove soils.

ACKNOWLEDGEMENT

The authors are grateful to UGC, New Delhi for financial assistance, PG and Research Department of Botany M.R.Govt.Arts college Mannargudi, Tamil nadu, India for providing the instrumentation facilities.

Table 1 SOIL PHYSICO- CHEMICAL PARAMETERS OF AVICENNIA MERINNA (Forssk) VIERH in MUTHUPET MANGROVES

| S.NO | Parameters | Site-1 | Site-2 | Site-3 |
|------|------------------------|-----------|-----------|-----------|
| 1 | Soil pH | 7.3±2.00 | 8.20±0.1 | 7.89±0.1 |
| 2 | Soil colour | Brown | Brown | Brown |
| 3 | Soil texture | Clay | Clay | Clay |
| 4 | EC (dsm-1) | 4.02±1.00 | 3.88±1.0 | 4.20±1.0 |
| 5 | Sodium | 87.0±2.00 | 90±2.0 | 86.4±0.3 |
| 6 | Total Nitrogen mg/kg | 54±0.02 | 56±01 | 60±0.03 |
| 7 | Total Phosphorus mg/kg | 19±0.12 | 24±0.3 | 20±0.3 |
| 8 | Potassium mg/kg | 140±1.20 | 160±0.3 | 110±1.3 |
| 9 | Calcium mg/kg | 10.2±1.02 | 12.1±0.1 | 16±1.0 |
| 10 | Magnesium mg/kg | 42.0±0.04 | 39.7±0.1 | 47.0±2.0 |
| 11 | Zinc mg/kg | 220.2±2.0 | 231.0±1.2 | 213±1.4 |
| 12 | Copper mg/kg | 6.90±1.4 | 9.10±0.3 | 7.21±0.01 |
| 13 | Manganese mg/kg | 4.2±0.01 | 4.3±0.01 | 4.4±1.0 |
| 14 | Ferrous mg/kg | 121.0±0.2 | 146.6±1.2 | 113.1±1.0 |

Table 2. PERSENTAGE OF AM FUNGI ROOT COLONIZATION AND SPORE DENSITY OF *Avicennia marina* (Forssk) Vierh. IN MUTHUPET MANGROVE

| S.No. | AM fungal species. | Site-1 | Site-2 | Site-3 | Frequency of diribution |
|-------|---|--------|--------|--------|-------------------------|
| 1 | <i>Glomus aggregatum</i> (Schenck&smith) | ñ | ñ | ñ | 100 |
| 2 | <i>Glomus mossae</i> (Nicol&Getd)Getd &Trappe | ñ | ñ | ñ | 100 |
| 3 | <i>Glomus geosporum</i> (Nicol&Getd)Walker | ñ | ñ | - | 67 |
| 4 | <i>Glomus microcarpum</i> (Tul, & C.Tul) | ñ | - | ñ | 67 |
| 5 | <i>Glomus consitricum</i> (Trappe) | - | ñ | ñ | 67 |
| 6 | <i>Glomus rubiforme</i> (Gerdemann &Trappe) | - | - | ñ | 33 |
| 7 | <i>Glomus maculosum</i> (Mitler & Walker) | - | ñ | ñ | 67 |
| 8 | <i>Acaulospora bireticulata</i> (Rothwell & Trappe) | ñ | ñ | - | 67 |
| 9 | <i>Acaulospora delicuta</i> (Walker, Pfeffer, Bloss) | - | ñ | ñ | 67 |
| 10 | <i>Acaulospora spinosa</i> (Walker & Trappe) | - | ñ | - | 33 |
| 11 | <i>Sclerosystis rubiformis</i> (Gerdemann & Trappe) | ñ | - | ñ | 67 |
| 12 | <i>Scutellospora heterogama</i> (T.H.Nicolson &Gerd) C.Walker &F.E.Sander | - | ñ | ñ | 67 |
| 13 | <i>Gigaspora albida</i> (Schenck & Smith) | - | ñ | ñ | 67 |
| 14 | <i>Gigaspora margarita</i> (WN.Becker & IR.Itall) | ñ | ñ | ñ | 100 |
| | Total | 7 | 11 | 11 | |

Table 3. AM FUNGI SPORE DENSITY OF ROOT ZONE SOILS OF *Avicennia marina* (Forssk) Vierh. IN MUTHUPET MANGROVE

| S.No. | AM fungal name | Spore No. in per 100g of soils Site- 1 | Spore No. in per 100g of soils Site-2 | Spore No. in per 100g of soils Site- 3 |
|-------|---|---|---|---|
| 1 | <i>Glomus aggregatum</i> (Schenck&smith) | 40 | 19 | 23 |
| 2 | <i>Glomus mossae</i> (Nicol&Getd)Getd &Trappe | 25 | 17 | 13 |
| 3 | <i>Glomus geosporum</i> (Nicol&Getd)Walker | 40 | 12 | - |
| 4 | <i>Glomus microcarpum</i> (Tul, & C.Tul) | 35 | - | 12 |
| 5 | <i>Glomus consitricum</i> (Trappe) | - | 16 | 11 |
| 6 | <i>Glomus rubiforme</i> (Gerdemann &Trappe) | - | - | 9 |
| 7 | <i>Glomus maculosum</i> (Mitler & Walker) | - | 15 | 13 |
| 8 | <i>Acaulospora</i> <i>bireticulata</i> (Rothwell & Trappe) | 40 | 17 | - |
| 9 | <i>Acaulospora delicuta</i> (Walker, Pfeffer, Bloss) | - | 13 | 16 |
| 10 | <i>Acaulospora spinosa</i> (Walker & Trappe) | - | 17 | - |
| 1 | <i>Sclerosystis</i> <i>rubiformis</i> (Gerdemann & Trappe) | 19 | - | 9 |
| 12 | <i>Scutellospora</i> <i>heterogama</i> (T.H.Nicolson &Gerd) C.Walker &F.E.Sander | - | 12 | 15 |
| 13 | <i>Gigaspora albida</i> (Schenck & Smith) | 17 | 8 | 12 |
| 14 | <i>Gigaspora margarita</i> (WN.Becker & IR.Itall) | - | 14 | 7 |
| | Total number of spore in 100g of root zone soils. | 216 | 160 | 140 |

Fig.1 Frequency of AM fungal spore distripution

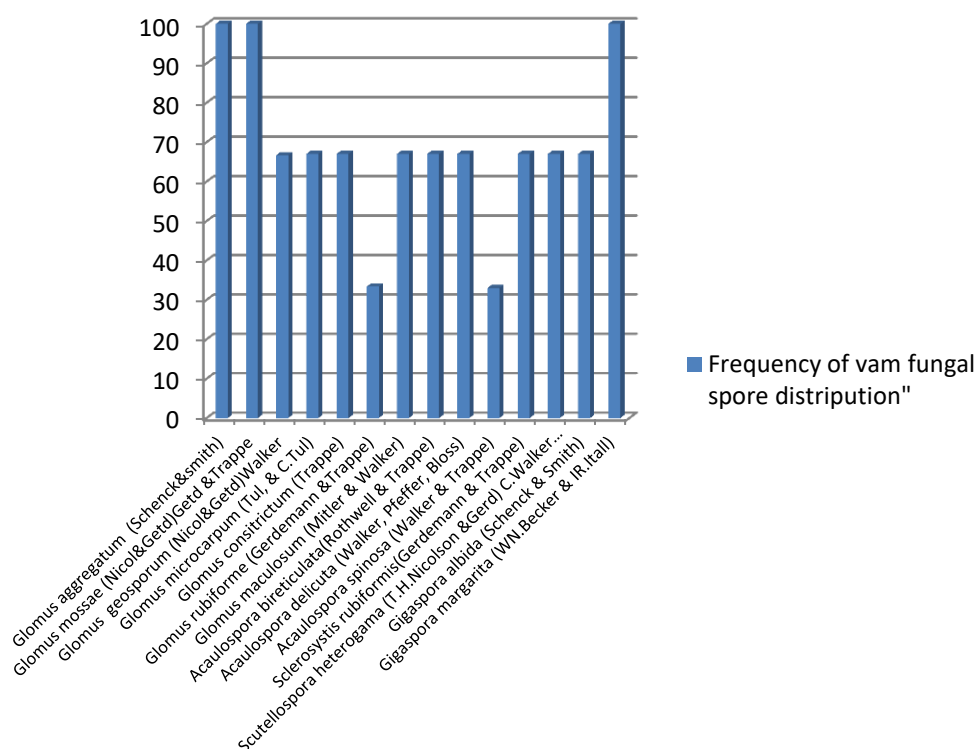
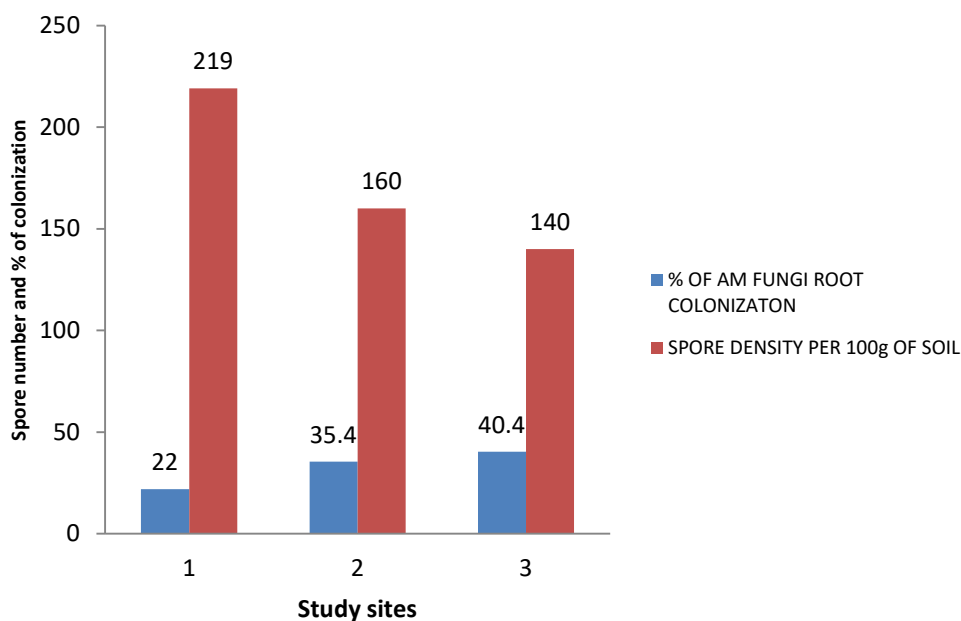


Fig.II PERCENTAGE OF AM FUNGI ROOT COLONIZATION AND SPORE DENSITY OF Avicennia marina IN MUTHUPET MANGROVE



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