**A PRELIMINARY STUDY ON THE STATUS OF VESICULAR ARBUSCULAR MYCORRHIZAL ASSOCIATIONS WITH MANGROVE PLANTS IN SRI LANKA**

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**ABSTRACT**

The symbiosis between Arbuscular Mycorrhizal Fungi (AMF) and mangrove plant species was investigated in five mangrove swamps in Sri Lanka. Soil samples were collected from rhizosphere areas of dominant mangrove plants in Sarasalai area in Jaffna, Kakkapalliya in Pambala, Negambo lagoon, Trincomalee, and Manmunai Batticaloa, from a depth of 0-20 cm on from March to September 2018, during low tide period. Collected soil samples were clay loam in texture. For all five composite samples AMF spores were extracted using wet sieving and decanting method. Most common mangrove plants species were identified and their underground growing root tips were extracted to assess the colonization percentage of AMF. The results were compared using a one-way ANOVA in Minitab 16.0. AMF were mostly found in the form of hyphae and were commonly associated with most of the mangrove species investigated. AMF species belonging to *Glomus,* *Gigaspora, Scutellospora* and *Acaulospora* were identified in all areas. Root colonization was observed in all species. AM fungal root colonization varied by plant species and site. *Lumnitzera racemosa* was common to Jaffna and Pambala and the colonization potential was high in Jaffna compared to that of Pambala, but was not significant (at p < 0.554). *Rhizophora apiculata* in Pambala and Negambo was not significantly different (p<5) so as *Avicennia marina* in Pambala Batticaloa and Tricomalee. Furthermore, colonizing AMF species can be identified and recommended for inoculating mangrove seedlings in deforested areas for better growth and development of sustainable mangrove ecosystem.

**KEY WORDS:** Arbuscular mycorrhizae, Mangrove plants, root colonization;

**INTRODUCTION**

Arbuscular Mycorrhizal Fungi (AMF) inhabit most terrestrial ecosystems, from tropical temperate and arctic-alpine ecosystems (Shi et al. 2006; Muthukumar & Udaiyan 2000; Haselwandter & Read 1980). The importance and functional significance of AMF in terrestrial ecosystems have been well documented. Ecological functions of AMF include helping to increase plant to withstand adverse soil conditions, severe climatic conditions and increasing plant productivity in natural plant communities (Brundrett and Kendrick 1996). Over the last twenty five years, the presence of AMF in wetland plants has been investigated, and it is evident that AMF occur in wetland ecosystems (Miller 2000). Mangroves form the dominant interface ecosystems between the land and sea in the tropics (Ong et al. 1995). They are formed on sheltered muddy shores where land is extending seaward by accretion (Richards 1996). Mangroves are facultative halophytes, characterized by regular tidal inundation and fluctuating salinity (Gopal and Chauhan 2006). In Sri Lanka, mangroves are scattered mainly along the North-Western, North-Eastern and Eastern coasts bordering lagoons and river estuaries. These are not widely spread and found as narrow strips of vegetation. The area covered by mangroves today is estimated to be 120 km2 in extent which is about 0.12% of the total land area of the country (Ransara et al., 2 012). The symbiosis between AMF and mangrove plant species was investigated in five mangrove swamps in Sri Lanka. This is the first time to investigate the AMF mangrove interactions in Sri Lanka.

**METHODOLOGY**

**Study site.**

Sarasalai area in Jaffna, Kakkapalliya in Pambala, Negambo lagoon, Trincomalee, and Manmunai Batticaloa

**Soil sampling and root extraction**

From two representative plots from each area, 5 soil samples (each soil sample is a composite of 5 soil samples) were collected (5 from each) from a depth of 0–20 cm. All samples from each area were used as replicates for the spore count. Soil samples were collected in ziplock. polythene bags, and were brought to the laboratory and stored at 4°C until analyses. Five most common mangrove plants species were identified and their root samples were extracted to assess the colonization potential of AMF (Mafaziya et al. 2015).

**Separation and identification of spores**

A 50 g soil from each sample was used for spore extraction by wet sieving decanting method asdescribed by Brundrett et al., (1996). The material retained on 250, 125, 63 and 45 µm sieves was collected on glass fiber filter papers separately (Whatman GF/A) and AMF spores and and differentiated into morphotypes under reflected light on stereomicroscope (Olympus SZ 61), and identified in to generic level based on the descriptions given in the International Culture Collection of Arbuscular and Vesicular-Arbuscular Mycorrhizal Fungi (INVAM, West Virginia, USA; <http://invam.caf.wvu.edu>) (Mafaziya et al. 2015).

**AMF root colonization assessment**

Roots were cleared in a water bath by heating with 10% (w/v) KOH at 60-90°C for 1 hour. Once cleared, a few drops of Chlorazol Black E (CBE) solution was added and heated again for about 20 minutes to several hours (until the root samples were stained properly) at 90°C. The excess stain was then washed off, acidified with 1% HCl solution before mounting roots on a glass slide with few drops of 50% Glycerol (Brundrett et al.,1996). The colonization percentage was calculated using the grid-intersect method (Mafaziya et al. 2015).

**DISCUSSION AND RESULTS:**

Table 1: Presence and the extent of root colonization by AMF in mangrove plants

|  |  |  |
| --- | --- | --- |
| Botanical Name  | Family  | Mycorrhizal colonization |
|  |  | Jaffna | Pambala | Negambo | Batticaloa | Trincomalee |
|  |  | C% | C% | C% | C% | C% |
| *Lumnitzera racemosa* | Acanthaceae | 9.3 | 7.9 |  |  |  |
| *Excoecaria agallocha* | Euphorbiaceae | 22.8 |   |  |  |  |
| *Acanthus ilicifolius* | [Acanthaceae](https://en.wikipedia.org/wiki/Acanthaceae) | 3.2 |  |  |  |  |
| *Rhizophora apiculata* | Rhizophoraceae |  | 2.6 | 2.8 |  |  |
| *Bruguiera gymnorrhiza* | Rhizophoraceae |  | 16.2 |  |  |  |
| Ceriops tagal | Rhizophoraceae |  | 0 |  |  |  |
| *Avicennia marina* | [Avicenniaceae](https://www.google.lk/search?q=avicennia&stick=H4sIAAAAAAAAAOPgE-LUz9U3sMjIS8tWgjJzi0u0LLOTrfSTMvNz8tMr9fOL0hPzMotz45NzEouLM9MykxNLMvPzrDIy0zNSixRQRQEcAf0LUwAAAA&sa=X&ved=2ahUKEwjeh9X965HdAhULpY8KHR4NCOoQmxMoATAUegQIChAo) |  | 8.3 |  | 2.3 | 3.2 |
| *Soneratia* | Lythraceae |  |  |  | 4.9 |  |

C% -Percentage colonization of roots by Vesicular Arbuscular Mycorrhizae

AMF species belonging to *Glomus, Gigaspora, Scutellospora* and *Acaulospora* were identified in all areas

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Vesicles

Hyphae

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*Fig. 1 Typical AMF structures observed in mangrove plant species*

The occurrence of AMF in wetland ecosystems has been frequently reported in the recent years (Ipsilantis and Sylvia 2007). Some investigations were carried out in mangrove swamps. In our study, in all species studied AMF colonization was found.

No studies have been conducted in mangrove ecosystems in Sri Lanka to date. In our investigation, most of the studied plant species had Vesicular Arbuscular Mycorrhizal associations. AMF inoculation during an early stage of regeneration or replantation process of mangrove plants can be used for better establishment of the seedlings since mangrove recovery is extremely hard to achieve in spite of fertilizers applied. Therefore, these plants can be grown with minimal expenses using AMF inoculants as a means of protecting and conserving them.

**CONCLUSION:**

colonizing AMF species can be identified and recommended for inoculating mangrove seedlings in deforested areas for better growth and development of sustainable mangrove ecosystem. Further studies have to be carried out to confirm this justification.

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