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RESEARCH ARTICLE

DIVERSITY OF AM FUNGI IN SALT MARSH PLANTS OF SOUTH EAST COAST OF CHINAMANAI TAMIL NADU, INDIA AND SITE SOIL PARAMETERS STUDY

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ABSTRACT

In this investigation the percentage of root colonization and spore density of Vesicular Arbuscular Mycorrhizae in dominant vegetation of eighteen salt marsh plants and physic-chemical parameters of rhizophere soil were studied at South East Coast of Tamilnadu, India. Among the eighteen plants, three salt marsh plants namely, *Agiceras nicutaum* L., *Salicornia virginica* L *and Salicornia brachiata L* showed AM fungi root colonization and spore density richness. From the three study sites of coastal area, the ten species of AM fungi were noticed in rhizosphere soil and root of salt marsh plants, which are belonging to four genera viz., *Glomus, Acaulospora, Gigaspora* and *Scutellospora.*

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INTRODUCTION

The symbiotic association between certain plants and microorganisms and important role in soil fertilization and improves their growth and mineral nutrition. Among the different microorganisms Arbuscularemycorrhiaze (AM) are beneficial symbionts for plant growth. They are associate with higher plants by a symbiotic association, the symbiotic association between vesiculararbuscularemycorrhizal in soil results in greater efficiency of nutrient absorption particularly for slowly diffusing mineral ions, especially phosphorous (Smith *et al*., 2000). Costal sand dunes are of great ecological significance. They act as barriers against the action of waves and tides. AM fungi also play a vital role in primary and secondary succession of plant species, especially in low nutrient ecosystem (e.g. coastal sand dunes) Increased nutrient supply, salinity tolerance, reduced a biotic stresses and formation of wind resistant aggregates are the major benefits derived by the sand dune plant species through AM fungal association (Gemma *et al*., 1989). Coastal environment playas vital role in nation's economy by virtue of their sources, productive habitats and rich biodiversity. India has a coastline of about 7,500 kms. The coastline of Tamil Nadu has a length of about 1076 kms constitutes about 15% of the total coastal length of India and stretches along the Bay of Bengal, Indian Ocean and Arabian Sea (Ramamurthy *et al*., 2012). AM in dune systems contribute to binding of sand grains into large aggregates and to improving soil structure, factors that can influence plant succession, Because mycorrhizae (AM) are important for the survival and growth of plants and for stabilizing sand grains, In the case of saline and sodic soils, drainages poor and salt accumulates on the surface of the soil, thus adversely affecting the plant growth. The application of AM fungi is the best simple way to improve the survival of the vegetations, because these organisms are important components to the long-term health and stability of maritime sand dunes (ThangaswmySelvaraj and Hoon Kim, 2004). The symbiotic association between VAM fungi and roots provides a significant contribution to plant nutrition and growth.

VAM mycelium in soil results in greater efficiency of nutrient absorption particularly for slowly diffusing mineral ions, especially phosphorous as observed (Frey and Schuepp, 1993). VAM mycelium also enhances the uptake of nitrogen in the form of NO3 (Morte *et al*., 2000; Marschner and Dell, 1994) The increase the potassium content in plants, AM fungi also increase the uptake of Ca, Mg, Cu, Zn and Fe (Al-Karaki and Clark 1999).

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MATERIALS AND METHODS

Selection of study sites

Three different coastal study sites were selected at Tamil Nadu coastal area mangrove soil forest of coastal town present in Tamli Nadu, India. Common vegetations in all three sites were observed, and soil samples from the root zone area and vegetation root samples were collected.

Ten dominant plant sp. were selected from each study sites based on the relative abundance. (Areas are namely, Area -1, Mutupet, Area -2, Chennamanai, and Area -3, Manamelkudi).

Collection of soil and root samples

Plants were surveyed for colonization by AM fungi at three different study sites of coastal area of Tamil Nadu. At each study site all area of $3m^2$ was chose for sampling. Both the study site plant root sample and rhizosphere soil were selected for the study.

Table 1. Physico-chemical characteristics of the different study sites soils

S. No.	Physical and Chemical Pharameters	Muthupet			Cinnamanai			Manamelkudi		
		Site 1	Site 2	Site 3	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
1	pH	8.04	7.89	8.27	7.49	7.45	7.89	7.57	7.94	7.30
2	Soil colour	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
3	Soil texture	clay	clay	clay	Clay	Clay	Clay	Sand	Clay	Fine Sand
4	Sodium, mg/kg	87.0	83.0	89.0	82.0	81.2	80.0	79.0	81.0	80.0
5	Total nitrogen, mg/kg	139	127	142	122	118	123	104	112	92
6	Total phosphorous, mg/kg	16.40	14.30	17.20	14.80	13.98	14.10	12.50	13.24	11. 17
7	Potassium, mg/kg	127	119	130	112	110	114	102	107	96
8	Calciam, mg/kg	14.7	13.2	15.9	13.9	12.3	13.2	12	13.2	11.24
9	Magesium, mg/kg	40.15	37.42	44.18	4.85	4.25	4.37	8.5	8.7	7.4
10	Zinc, mg/kg	260	224	275	375	372	383	100	109	97
11	Copper, mg/kg	1.27	1.07	1.37	1.25	1.21	1.23	1.07	0.97	1.02
12	Manganus, mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13	Aluminium	2.2	1.24	2.3	1.8	1.2	1.5	0.2	0.15	0.1

BDL: Below detective level General nutrient status of the soils (Anonmymous, 1988), N p205 K20
Low <140<24.2<140.7, Medium141-280243-32.2140.8-281.6, High>280>32.2>281.6

Table 2. percentage of root colonization and spore density of AM fungi in Muthupet Mangrove

Plant Botanical Name	% of AM Root Infection			Spores		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
Avicennia marina (Forssk)Vierh.	22	34	48	125±1.29	79±0.52	57±0.71
Suaeda maritime L	75	72	69	395±1.08	472±1.54	469±0.93
Agiceras cornicutaum L	79	89	84	460±1.58	493±0.88	519±1.58
Agiceras nicutaum.L	55	48	52	373±0.93	324±1.22	320±1.41
Eleocharis calva R.Br.	64	27	29	266±0.52	275±1.16	260±0.78
Azima tetracantha Lam	52	33	37	357±1.74	333±1.08	350±1.24
Acanthu ilicifolius L	69	79	74	430±1.58	457±1.79	465± .70
Suaeda maritime L. Dumort	52	37	36	376±1.85	429±1.70	426±0.96
Crambe maritime L	22	27	23	326±2.12	348±1.98	336±1.56
Suaeda monoica Forssk.ex.j.Gmelin	49	46	34	421±1.33	468±1.52	458±0.60

Table 3. percentage of root colonization and spore density of AM fungi in Cinnamanai i Mangrove

Plant Botanical Name	% of AM Root Infection			Spores		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
Avicennia marina (Forssk)Vierh.	88	84	82	538±0.57	538±1.54	565±1.22
Suaeda nudiflora Moq L. Dumort	38	35	32	355±1.52	357±1.52	361±1.00
Suaeda fruticosa L Forrssk	80	87	84	497±1.15	498±0.57	522±1.52
Salicornia ramosissima	75	71	67	464±1.15	466±2.64	496±0.59
Salicornia virginica L	92	95	91	657±2.8	659±2.08	597±0.57
Suaeda vera var brevifolia (Boiss.)	62	57	52	357±0.97	357±1.00	457±1.73
Hieracium sp L	66	64	59	423±1.73	422±3.21	366±2.51
salicornia rubra L	50	46	48	342±2.51	346±1.52	356±1.29
Suaeda monoica Forssk. ex J.F. Gmel.	75	67	64	466±1.00	468±0.57	456±2.22
Agiceras nicutaum L	38	31	29	326±2.64	320±3.51	356±1.88

Table 4. percentage of root colonization and spore density of AM fungi in Manamelkudi Mangrove

Plant Botanical Name	% of AM Root Infection			Spores		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
Avicennia marina (Forssk) Vierh	72	81	73	459±1.72	527±1.52	467±2.64
sarcocornia A.J.Scott	66	65	72	426±1.52	458±1.15	421±1.46
Arugampul	86	79	81	589±2.51	601±1.73	671±1.98
Salicornia ramosissima L	27	23	28	327±2.08	354±1.00	277±0.96
Azima tetracantha Lam.	8	11	13	132±1.00	145±2.08	133±.2.30
Salicornia europaea L	19	27	23	221±0.57	313±0.57	298±1.88
Salsola soda L	71	76	73	473±1.52	528±2.64	453±3.05
Salicorania virginica L	29	32	38	315±2.64	317±2.64	326±0.44
Agiceras nicutaum L	67	58	61	429±	383±1.26	357±1.82
Suaeda vera Forssk. ex J.F. Gmel.	27	26	32	258±1.44	225±1.52	272±1.52

The soil samples were examined for AM spore numbers after wet sieving and decantation (Gerdemann and Nicolson, 1963). The root samples were stained with trypan blue in lactophenol (Phillips and Hayman, 1970). Percentage of root colonization was calculated (Krishna and Dart, 1984). The isolated AM fungal species were brought in to pot culture studies with plants of *Allium cepa L*. After 90 days, the spore and sporocarps were reisolated for identification (Schenck and Peresz, 1988). Study site soils were examined by standard physic chemical method (Jackson, 1973).

RESULT AND DISCUSSION

Soil physic-chemical characteristics of the three study sites were found to be alkaline (Table 1). The alkaline nature of the mangrove soil has already been reported (ThangaswmySelvaraj and Hoon Kim, 2004). All these study sites were generally deficient in phosphours. The other soil elements showed only minor variations, have reported imbalance and distribution of microbial ecosystem in soil. At the three study sites, all the plants were mycorrhizal. In this investigations root colonization and spore density of ten AM fungal species (Table 5) in eighteen salt marsh plants from study areas were evaluated. These saline tolerant AM fungi species belongs to four genera viz., *Glomus*, *Acaulospora*, *Gigaspora* and *Scutellospora.* Among the eighteen salt marsh plants the three plants were highly colonized from AM fungi and spores counted.

The plant *Agiceras cornicutaum* L showed highest percentage of root colonization and density of spores up to 89 and 519±1.58 respectively at Muthupet coastal (Table2). *Salicornia virginica* L was noticed the AM fungal *colonization* in range of 95% and spore richness was 659±2.08 at Cinnamanai sites (Table 3). In the sites of Manalmelkudi *Salicornia brachiata* L showed the highest root colonization was 86% and spore richness in the rhizophere soil was 671±1.98 (Table 4).

Table 5. VAM fungal species identified in the root-zone soils at three coastal study sites

S. No.	Identified VAM fungal species	Abbreviation
1	*Gigaspora gigantea*	GGGT
2	*Gigaspora margarita*	GMRG
3	*Glomus aggregatum*	LAGR
4	*Glomus fasciculatum*	LFSC
5	*Glomus geosporum*	LGSP
6	*Glomus macrocarpum*	LMCC
7	*Glomus mosseae*	LMSS
8	*Scutellospora nigra*	CNGR
9	*Acaulospora bireticulata*	ABRT
10	*Acaulospora scrobiculata*	ASCB

From this study it refers that AM fungal species can tolerate the salinity and adverse conditions of coastal zone. AM fungi can colonize with plant's roots and assist it to stabilize in salinity soils. Soils of all three area were alkaline (pH 7.45-8.27), type. The alkaline nature of coastal soils in India has already been reported. (Monoharan *et al*., 2008) Total nitrogen, available phosphorus, and available potassium of the soil ranged from 110.7 to 143.3, 14.8 to 27.5, and 194.5 to 252.6 kg/acre, respectively (Table 1). Sediments were analyzed for organic matter, N, P, and K contents. So highs micro nutrients and macro nutrients preset in Muthupets sites and anther cinnamani and manaelkudi.

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