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Occurrence of VAM fungi in Kalasalingam University campus

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Abstract
We did the 26 species of vesicular arbuscular mycorrhizal fungal spores in the rhizosphere soil of plant species belonging to 14 families was reported in Kalasalingam University campus. Interestingly 23 types of VAM species found in both tree and horticultural plants of the Kalasaligam University campus, among them VAM spores were predominantly in the genus of *Glomus* (16) and followed by *Selerocystis*, (3) *Acaulospora* (2), *Gigaspora* (3) and *Enterophosphora* (2*)* was found. A further soil character was analyzed by pH, EC, Total nitrogen, phosphorus, and potassium and micro elements.

Keywords: VAM fungi, soil characteristics, pH, EC, microelements.

1. Introduction
VAM fungus associates with the roots of higher plants and thus mycorrhizal association plays a significant role for the proper absorption of minerals by the root system and thus influences the general growth of higher plants. Mycorrhizal colonization of higher plants become infected with fungi, the plant root gets modified to accommodate the fungus. Mycorrhizal association are not specific i.e., fungus can associate with many plants and a plant can accommodate many fungi. It is symbiotic association. Fungus lives on sugars provided by the plant cells. The growth of the fungus does not damage the plant cells. The fungus helps the plant to absorb water and minerals from the soil. Plant with mycorrhizal association can absorb two to three times more minerals like nitrogen, phosphorus and potassium Fungus can produce various growth promoting substances and antimicrobial substances. Mycorrhizae are found in pines, birches and orchids. Pines and birches show stunted growth if mycorrhiza are absent. Many orchids cannot live without mycorrhizae and their seedling grow only when root become associated with it.

VAM fungi are ubiquitous symbioses between fungi and plants in natural and man-made ecosystems, such as tropical forests, agrosystems, savanas, semideserts, and sand dunes (Hayman, D. S. 1982) [1]. The term vesicular-arbuscular mycorrhiza (VAM) denotes the formation of special structures, namely vesicles and arbuscules, by the colonizing fungi in the host plant tissue, especially in the inner cortex of the root. These fungi have profound effects on host plants, resulting in greater water usage, enhanced resistance to drought and diseases, elevated rates of photosynthesis, and improved rates of growth under both normal and stress conditions. Rosendahl, C. N. and Rosendahl, S. 1991; Bethlenfalvay, G. J. 1992) [8, 9].

Arbuscular mycorrhizal fungi are widespread in their occurrence and distribution (Hayman 1982, Hariram and Santhaguru1995) [1, 2]. these fungi are beneficial to angiosperms by increasing uptake of water nutrients, disease resistance and rooting of cutting. In general, AM fungal spore population very with the type of soil, host plant geographic area, a biotic factors and associate plant symbionts. Among the soil factors, pH, salinity, moisture, texture, temperature and fertility are associated with some of the variability of VAM fungi. Although the occurrence of VAN in Indian soils has been reported baseline studies are still neededfor serval habitats. Hence, a comprehensive survey was made to determine the VAM fungal status of rhiosphere soils of some plant species in Kalasalingam University.

In India, large land areas have unfavourable acid and saline soil conditions (Tata, and Wadhawani, 1992) [4]. In the case of saline and sodic soils, drainage is poor and salt accumulates on the surface of the soil, thus adversely affecting the plant growth. The application of VAM 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. (Koske and Polson, 1984) [5] VAM in dune systems contribute to binding of sand grains into large aggregates and to improving soil structure, factors that can influence plant succession. Nicolson, 1960, Koske *et al* 1975) [6, 7]. The present study 26 species of vesicular arbuscular mycorrhizal fungal spores in the rhizosphere soil of plant species belonging to 25 families was reported in Kalasalingam University campus. Interestingly 23 types of VAM species found in both tree and horticultural palnts of the Kalasaligam University campus, among them VAM spores were predominantly in the genus of *Glomus (16)* and followed by *Selerocystis (3) Acaulospora (2), Gigaspora (3)* and *Enterophosphora (2)* was found. A further soil character was analyzed by pH, EC, Total nitrogen, phosphorus, and potassium and micro elements.

Materials and Methods

Soil samples and wet sieving and decanting

Soil samples from rhizosphere of plant species belonging 25 families were collected at the depth of the 10-20cm from the soil surface and VAM spores and sporocarps were isolated by the decanting and wet sieving technique.

Spore collection and soil analysis

The spores retained on the sieves of 44um to 106um dimension were scored. The soils samples were air dired, mixed thoroughly and analysed for pH, EC and NPK conten and microelements. The pH and EC were measured from a soil souspension prepared by mixing soil and distilled water (1:10 W/V). Soil N soil K and soil P were estimated from the samples

Results and Discussion

In the higher plants during the symbiotic function and/or process of growth and development are subjected to numerous biotic and abiotic stresses. These stresses they encounter play a major role in effecting the productivity in agriculture. Interestingly, 70 % of plant species are harboured by AM fungi and this interaction plays a major role in influencing plant growth, nutrient absorption, and protection against pathogenic microbes. In addition to their interaction with plants, they are also known to interact with microorganisms in the rhizosphere. In our Kalasalingam University were the distribution of VAM fungal spores in the rhizospores of plant species belonging to 14 families is presented in Table-1were recorded, of which 14 species belonging to *Glomus*, (Table -1 and Fig-1), 4 species belonging to *Sclerocystis*, 3 species belonging to *Acaulospora*, 1 species belonging to *Gigaspora* and *Scutellospora* axillary cells and 1 species belonging to *Enterophospora.*

Table-1: Shown in occurrence of VAM in Kalasalingam University campus.

S. No	Name of the VAM fungi					
	Acaulospora	***Enterophospora***	***Gigaspora***	***Glomus***	***Sclerocystis***	***Scutellospora***
1	*A. bireticulata*	*E. albida*	*G. alibida*	*G. radiatum*	*S. indica*	*S. albida*
2	*A. scrobireticulata*			*G. clarum*	*S. packistanica*	
3	*A. spinosa*			*G. deserticola*	*S. pachycaulis*	
4				*G. etunicatum*	*S. sinuosa*	
5				*G. diphanum*		
6				*G. fasiculaturm*		
7				*G. invermaium*		
8				*G. intraradics*		
9				*G. mossae*		
10				*G. microcarpum*		
11				*G. macrocarpum*		
12				*G. microagreegatum*		
13				*G. scitanium*		
14				*G. tubaeformis*		

Characteristics of soil

The soil characteristics viz pH, EC and NPK content are presented in Table-2. The pH of the soil samples ranged from 5.7to 8.0 ad EC from 0.1 t 1.5 dSm^{-1}. According to Khaliel (1988), pH is the only ddaphic factor which determines the abundance of VAM fungi, However, pH did not influence of mycorrhizal spores density that pH influences the species or the number of spores of VAM fungi. Most soil samples had low N (21 to 105mg kg-1air dired soil) and high K (117 to 341 mg kg-1 aired dried soil) content. In contrast, 86.3% of the soil samples had a high P content. High soil P and N content caused a reduction infection and number of VAM spores. However, our study demonstrates the richness of species or number of spores of VAM fungi in low soil N content.

Table-2: Soil analysis of Kalasalingam University campus in different location of soil samples.

S. No	Soil samples/Places	Parameters									
		Macronutrients in mg/kg of soil			Micronutrients in mg/kg of soil				Physical Character		
		N	P_2O_5	K_2O	Zn	Mg	Mn	Fe	Tempe rature	EC dSm^{-1}	pH
1	KLU-core	66.2	22.2	221	0.0017	0.9	0.002	0.003	31	0.4	6.9
2	KLU-swimming fool	57.0	23.0	199	0.0022	0.01	0.0071	0.06	28	0.5	6.9
3	KLU-Ladies hostel	51.9	26.2	267	0.0033	0.001	0.0013	0.0015	30	0.3	7.0
4	KLU-COE	60.9	20.1	300	0.0021	0.0012	0.0013	0.81	32	0.4	7.1
5	KLU-n-CADE math	58.8	19.9	198	0.0018	0.1	0.0016	0.1	25	0.4	6.7

6	KLU-Biotech	49.0	18.2	209	0.0011	0.011	0.01	0.91	34	0.4	7.7
7	KLU-Polytechnic	64.7	28.0	234	0.0018	0.0015	0.001	0.01	26	0.5	6.8
8	KLU-MH3	64.0	20.7	256	0.0010	0.1	0.1	0.001	30	0.3	7.2
9	KLU-MH1	39.0	10.2	387	0.0013	0.0001	0.01	0.9	31	0.2	7.9
10	KLU-Libray	56.7	16.6	331	0.0015	0.0061	0.009	0.055	32	0.4	7.7

Morphology of VAM fungal crops

Arbuscular mycorrhizal colonization was characterized by the formation of an appressorium on the root surface and hyphal coils in few outer cortical cells near the point of entry (Fig. 1a, b). Six families had both *Arum*- and intermediate-type AM morphologies (Table -3).

Table-3: Shown in Kalasalingam University campus in different location of rhizosphere soil samples and spore population in different location.

S. No	Name of the location in KLU	Name of the plant species	Name of the VAM fungi	Total number of spores/sporocarps/gram soil	Root colonization and Percent infection	Name of VAM fungi Major in the field
1	KLU-core	*Ficus benghalensis*	*Glomus mosseae*	144	23±0.1	189
			Sclerocystis indica	29		
			Gigaspora sp.	16		
2	KLU-swimming fool	*Azhadirachta indica*	*Glomus claurm*	123	67±0.04	288
			Glomus invermaiam	56		
			Glomus macrocarpus	109		
3	KLU-Ladies hostel	*Clerodentron inermi Allamanda sp.*	*Glomus fasciculaturm*	178	81±0.002	229
			Glomus etunicatum	51		
4	KLU-COE	*Bahinia* Albizia lebbeck	*Sclerocystis pakistanica*	61	54±0.004	584
			Enterphospora sp.	23		
			Glomus tubaeformis	89		
			Glomus pansiholus	321		
			Gigaspora spinosa	110		
6	KLU-n-CADE math	*Samania saman Rubia cardifolia*	*Glomus invermaium*	87	52±0.1	405
			Glomus pansiholus	301		
			Glomus sp.	17		
	KLU-Biotech	*Azhadirachta indica Bahinia Delonix regia Beutia frontazoa*	*Glomus pansiholus*	96	89±0.5	1071
			Sclerocystis siuosa	71		
			Glomus pansiholus	290		
			Sclerocystis siuosa	12		
			Glomus etunicatum	166		
			Gigaspora albida	219		
			Sclerocystis pakistanica	51		
			Enterphospora sp.	69		
			Gigaspora sp.	*10*		
7	KLU-Polytechnic	*Cassia sp.*	*Glomus etunicatum*	190	43±0.11	334
			Sclerocystis pakistanica	10		
			Enterphospora	53		
			Glomus diphanum	81		
8	KLU-MH3	*Pnecosteman lanceolate Bahinia Ficus bengalensis Delonix regia*	*Glomus microcarpum*	222	92±0.003	631
			Glomus intraradics	166		
			Glomus radiatum	210		
			S.pachycaulis	17		
			Glomus macrocarpum	16		
9	KLU-MH1	*Beutia frontazoa*	*Scutellospora albida*	212	86±0.41	291
			Acaulospora spinosa	67		
			Acaulospora crobireticulata	12		
10	KLU-Library	*Pongamia glaberata Pithaculobium*	*A. albida*	269	52±0.12	527
			A. spinosa	39		
			Glomus clarum	219		

"±" sign indicate 25 replicates

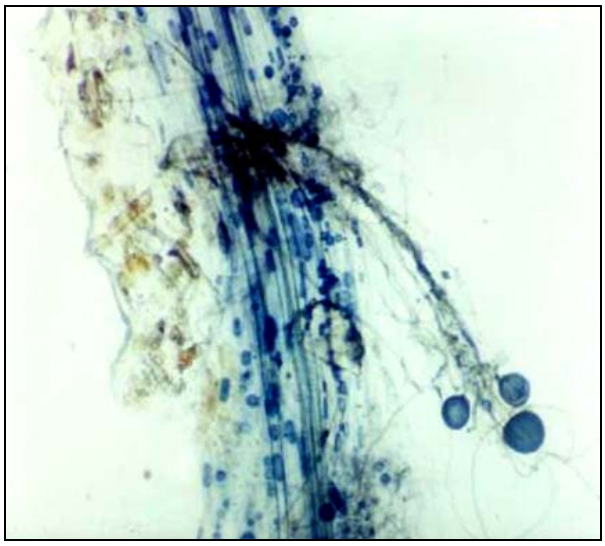

Fig 1: Shown in morphology of root infection of *Glomus clarum* in Kalasalingam University plant species.

AM fungal species

AM fungal spores from 24 species in six genera of *Acaulosporaceae, Gigasporaceae, Glomaceae, Sclerocystisaceae, Enterophosporaceae and Scutellosporaceae* were isolated from the crop rhizospheres from Kalasalingam University campus (Fig 2a, b c and d). These included three species in *Acaulospora*, fourteen in *Glomus* and one each in *Gigaspora* and *Scutellospora*. AM fungal spores of eight species occurred in KLU campus.

Characters of VAM species on root colonization and spore population

VAM fungi characteristically increase nutrient mobilization through biological weathering by breaking down complex minerals and organic substances serves as a biological deterrent and physical barrier to root colonization based on the percent infection by soil pathogens. VAM fungi typically provide tolerance to heavy metal accumulation by restricting the translocation of metals from roots to shoots, as the ions are absorbed on the cell wall of the hyphae in the via of root. It also provides the host plant with growth hormones such as IAA, cytokinin and GA3 (Allen and Allen 1980). During the colonization of high phenolic content in higher plants (Morandi, 1996). Similarly our report based on root colonization of different plant species was analysed (Table-3), The maximum root colonization of VAM infection found in KLU-MH3 92±0.0031% and followed by more than 80-89% of AM infection in KLU-MH1, KLU-Biotech and KLU-ladies hostel. Interestingly very low level of VAM infection found in KLU-Core have 23±0.1%. (Table-3)(Fig-1)-. The maximum spore population have in KLU-Biotech have 1071 spores/gram of soil in a surrounding the plants species of rhizospheric soil. However, the lowest population in 189 spores /gram of soil in KLU-core building very less than KLU-Biotech plant species.

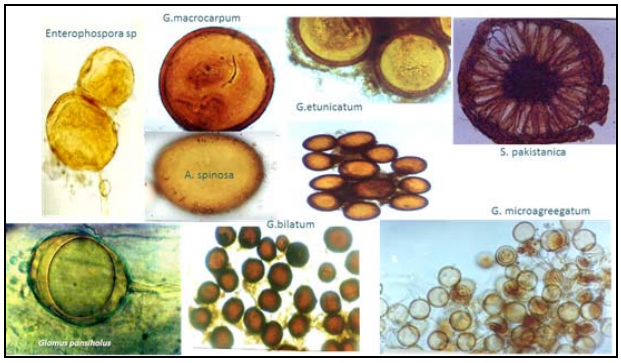

Fig 3a

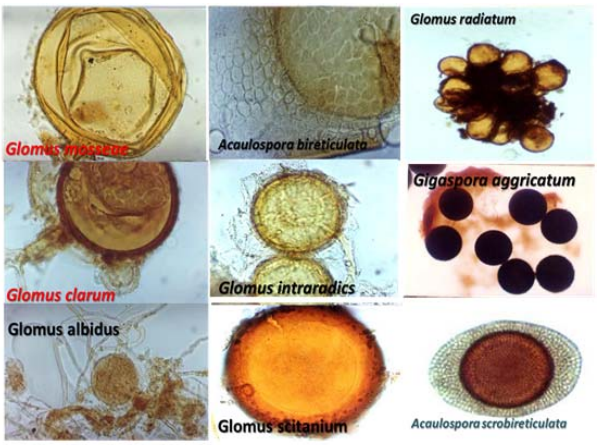

Fig 3b

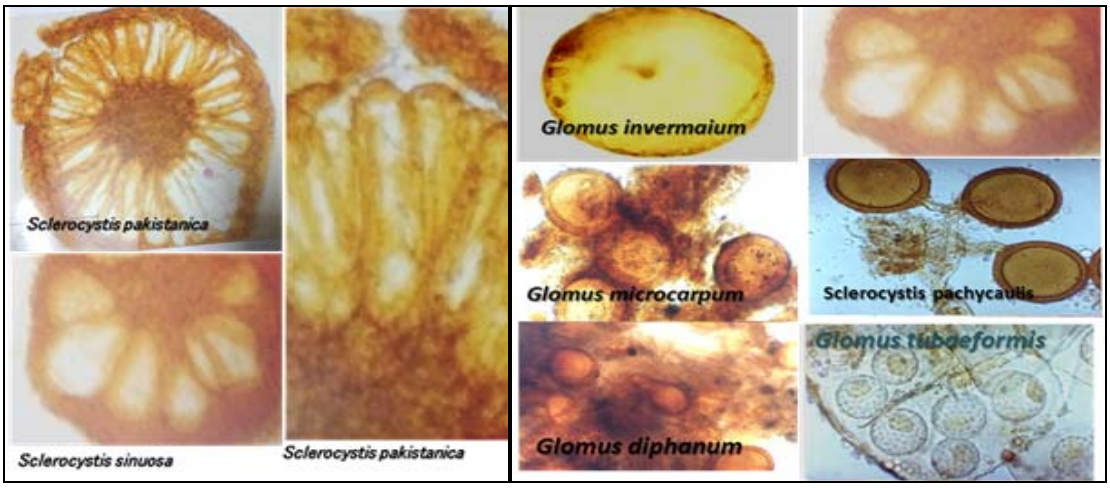

Fig 3c

Fig 3: Shown in different VAM species of in Kalasalingam University campus

Conclusion

Kalasalingam University campus in an around 130 acres has mostly planted trees and horticultural crops. We have analysed different locations in our campus was analyzed them VAM fungi. Interestingly twenty three types of VAM species found in both tree and horticultural plants of rhizospheric soil in the Kalasaligam University campus, among them VAM spores were predominantly was found in the genus of *Glomus (16)* and followed by *Selerocystis,(3) Acaulospora (2), Gigaspora (3)* and *Enterophosphora (2)* was found. A further soil character was analyzed by pH, EC, Total nitrogen, phosphorus, and potassium and micro elements.

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References

1. Hayman D S. Influence of soil fertility on activity and survival of vesicular-arbuscular mycorrhizal fungi. Phytopathol. 1982; 72:1119-1125.
2. Hariram N, Santhaguru K. Occurence of Vesicular arbuscular mycorrhizal fungi in Maduari J. Ecobiol. 1995; 7(4):243-248.
3. Hariram N, Santhaguru K. Vesicular-arbuscular mycorrhizal association in some plant species of Madurai. J. Microbial Ecol. 1993; 3:135-139.
4. Tata SN, Wadhawani AM. Handbook f agriculture. ICAR, New Dehli, India, 1992.
5. Koske RE, Polson WR. Are VA-mycorrhizae required for sand dune stabilization Bioscience. 1984; 34:420-424.
6. Nicolson TH. Mycorrhiza in the Gramineae. II. Development in different habitats, particularly sand dunes, *Trans. Br. Mycol. Soc*. 1960; 43:132-145.
7. Koske R E, Sutton JC, Sheppard BR. Ecology of *Endogone* in Lake Huron sand dunes. Can. J. Bot. 1975; 53:87-93.
8. Rosendahl CN, Rosendahl S. Influence of vesicular-arbuscular mycorrhizal fungi (*Glomus* spp.) on the response of cucumber (*Cucumis sativus*) to salt stress. Environ. Exp. Bot. 1991; 31:313-318.
9. Bethlenfalvay GJ. Mycorrhizae in crop productivity. In *Mycorrhizae in sustainable agriculture*, Bethlenfalvay, G. J. and Linderman, R. G. (eds.). American Society of Agronomy, Madison, WI, USA. 1992; 54:1-27.