Occurrence and Distribution VA-Mycorrhizal Fungi in the soils polluted with Tannery Effluent.

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Abstract

The rhizosphere soils and ten dominant grass species polluted with tannery effluents were tested for the occurrence and distribution of vesicular - arbuscular mycorrhizal fungi and determined the impact of the physico chemical factors in relation to the quantitative and qualitative assessment of VAM fungi in soils polluted with tannery effluent over non polluted soil. 15 species of VAM belonging to five genera viz., Glomus, Sclerocystis, Acaulospora, Gigaspora and Scutellospora were recorded and identified. *Glomus aggrigatum* was noticed as the moist dominant effluent tolerant strain of VAM fungi in soils polluted with effluents. In the non polluted soils, all the plant species were colonized with VAM fungi. Whereas in polluted soils, eight grass species only were colonized and the percentage of root colonization was less.

Key words: Tannery effluent, VA *mycorrhizae, Glomus aggrigatum.*

Introduction

Most of the industries dump their liquid waste in streams and river producing changes in physicochemical and biological conditions of water and soil. Major industrial pollution sources in the country are mills of textaile, leather, dyes, chemicals and number of other industries, in addition to municipal and domestic waste effluents. Leather industry in one of the foreign exchange earner in India. There are 2,161 tanneries in India, which process 500,000 tonnes of hide and skins

Table 1. Physico-chemical characteristics of polluted and non-polluted soils of three different sites in Trichy Light lether Private Limited, Sempattu, Trichy.

Sl. No.	Study Sites*	pH	Ecse	Organic matter	N	P	K	Zn	Cu	Mn	Fe
Polluted Sites											
1.	Site I	6.9±0.4	2.0±0.2	5.4±0.4	96.8±4.2	24.2±4.2	348±12.0	2.4±0.2	1.7±0.12	2.04±1.2	30.56±4.2
2.	Site II	6.6±0.4	2.1±0.2	4.6 ±0.2	89.0±4.6	26.4±2.4	293±10.0	2.98±0.4	1.8±0.12	1.92 ±1.2	21.58±4.2
3.	Site III	6.4 ±0.2	3.6±0.2	3.2±0.4	87.8±4.2	28.4±2.2	24.2±10.20.	1.74±0.3	1.9±0.13	1.93±1.0	20.14 ±4.2
Non-Polluted Sits											
1.	Site I	7.2	1.9	2.2	92.8	21.3	121.0	2.4	2.1	5.6	1.2±0.1
		±0.4	±0.47	±0.02	±12.1	±12.1	±17.0	±0.2	± 0.1	±1.2	±0.3
2	Site II	7.4	1.8	2.8	89.4	28.4	135.4	2.7	1.9	5.4	1.2
		±0.4	±0.5	±0.2	±14.0	±11.4	±15.2	± 0.1	± 0.2	±1.3	±0.1
3.	Site III	7.6	1.8	2.4	77.4	34.0	140.0	2.1	1.8	4.2	1.3
		±0.2	±0.6	±0.02	±12.0	±10.4	±26.0	±0.4	± 0.1	±1.1	±0.1

Note: * * General nutrient Status of the soil

	N	P203	K20
Low	< 140	< 24.2	< 140.7
Medium	141-280	24.3 32.2	140.8 281.6
High	> 280	> 32.3	> 281.6

Table 2: Precent root colonization spore count and VAM species associated in the root zone soil it plants in polluted and non polluted sites at Trichy.

Sl. No.	Family and plant Species	Study ** Sites	Per cent root Colonization		VAM Spore Number / 100g Soil		VAM Spore Associated***	
			PS*	NPS*	PS*	NPS*	PS*	NPS*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	**Cyperaceae** *Cyperus rotundus* L.	S.I S.II S.III	-- -- --	15 -- --	-- -- --	40 -- --	-- – --	LPSC -- –
2.	**Poaceae** *Dichanthium annulatum Stapf.*	S.I S.II S.III	56 52 48	72 74 82	245 260 255	660 540 620	LAGR, SPCC ABRT, LINR ABRT, LFSC,	ABRT, AMRW,LABD, LPSC ABRT, AMRW, LABD, LFSC ABRT, LFSC, LABD, LFSC
3.	*Sorghum bicolour*	S.I S.II S.III	82 78 68	90 92 88	380 345 365	912 635 600	SCVS, ASCB, LFLV, LFSC, LINR SCVS, LAGR, LFLV SCVS, LFSC,LINR	AMRW, ASCB, LAGR AMRW, LFLV, SCVS AMRW, LFSC, LINR, SCVS
4.	*Cynodon dactylon Pars*	S.I S.II S.III	45 47 55	62 65 69	220 240 180	330 325 385	LAG LFSC LFSC	ABRT, AMRW, LABD, LMST, ABRT, LMST, SRBF ABRT, AMRW, LMST
5.	*Panicum maximum*	S.I S.II S.III	62	65	419	550	LAGR, LINR, LPSC, LINR	ABRT
6	*Saccharum bicolour (L)*	S.I S.II S.III	-- -- --	20 -- --	-- -- --	35 -- --	-- -- --	LCRD -- –
7	*Alloteropsis cimicina Stapf .*	S.I S.II S.III	42 44 48	75 72 72	280 240 250	640 650 655	ABRT, LAGR., LAGR, LINR LAGR, LINR	AELG, LPSC, LINR AELG, ASCB, GMRG, LAGR, LPSC, LINR AELG, GMRG, LAGR, LPSC, LINR
8.	*Panicum crus galli L.*	S.I S.II S.III	45 42 40	50 52 54	138 135 110	150 145 140	SRBF SRBF SRBF	ABRT, GMRG,LPSC ABRT, ASCB, LPSC ABRT, LFSC
9.	*Panicum stagninum Retz.*	S.I S.II S.III	35 30 42	35 40 42	145 120 110	145 155 165	LINR, LMCC, SPCC LINR, SPCC LINR, SPCC	GMRG, LAGR, LCRD GMRC, LAGR, LCRD GMRO
10.	*Paspalum Punclatum*	S.I S.II S.III	20 20 24	40 35 32	80 85 95	120 85 52	ABRT, LFSC LPSC ABRT, LFSC	GMRG, L1NR, LPSC. GMRG, L1NR. GMRG, L1NR

annually. Total annual discharge of waste water is 9,420,000m^3 (Jogdand, 1995) and is disposed into river and on land. In order to find out the potential use of the tannery effluent, an experiment was conducted at the Trichy light letter private limited, Sempattu, Thiruchirappalli of Thiruchirappalli district.

Materials and Methods

Effluent coming out of the Trichy Light lether Private Limited, Sempattu Trichy passes through an irrigated water channel. Ten grass species belonging to two families of angiosperms were selected based on their relative abundance in each study site. Plants were surveyed for colonization by VAM fungi at 3 sites polluted with tannery effluent and non-polluted soils of Sempattu of Trichy . At each site an area of 3m^2 was chosen for sampling. Both the study sites, the root samples and rhizosphere soils were collected. The soil samples were examined from VAM spore numbers after wet sieving and decantation (Gerdemann and Nicolson, 1963). The root samples were cleared with 10% KOH and stained with trypan blue in lactophenol (Phillips and Hayman, 1970). Percentage of root colonization was calculated (Krishna and Dart, 1984). Altogether, fifteen species of VAM fungi were isolated and brought into pot culture studies with plants of *Allium cepa L.* After the plants were 90 days old, the spores and sporocarps were then reisolated for identification (Schenck and Perez, 1988). Standard methods of soil physicochemical analyses were examined (Jackson, 1973).

Result and Discussion

Physico-chemical properties of soil samples of both the study sites (soil polluted with tannery effluents and non-polluted soils) were presented in Table 1. Both the control and soil polluted with effluents were of sandy clay loam and the pH of the non-polluted soil ranged from 7.2 - 7.6 while that of the polluted soils ranged from 6.4 6.9. Both study sites were deficient in phosphorus and nitrogen.

In all fifteen VAM fungal species were observed in the rhizosphere soils of both non-polluted and polluted sites. The V AM fungal species isolated from the study sites belonging to five genera viz., Acaulospora, Glomus, Gigaspora, Sclerocystis, and Scutellospora (Table 2). The number of VAM spores in the root-zone soils ranged from 0 - 912. The non-polluted soils were rich both in VAM spore number and species abundant whereas in polluted soils were less. This is an agreement with earlier findings of Ramapulla Reddy and Manoharachary, 1990. There was an impact of season on the distribution of VAM spores in polluted and non-polluted soil sites (Jagpal *et al.,* 1988). The numbers of VAM spores were more in monsoon and summer. There was a certain degree of specificity among the different species in both non-polluted and polluted sites. There are previous reports of such specificity in root zone soils (Mosse, 1981) and the occurrence of fifteen species of VAM fungi in polluted habitats in the present study is a report as Gildon and Tinker (1981) have isolated only one species of effluent tolerant VAM fungi. In present study, *Glomus aggregatum* was noticed the most dominant effluent tolerant strain of VAM fungi in polluted sites.

All the test plant species in non-polluted soil sites examined exhibited VAM colonization whereas in soil polluted with effluent sites, eight plant species were positive for VAM colonization and one plant species were non-mycorrhizal, results indicated that mycorrhizal condition is the rule and non-mycorrhizal condition is the exception and agrees with the widespread association of VAM reported in natural ecosystem (St. John and Coleman, 1983). The presence of VAM colonization in plants of industrially polluted habitats have earlier been reported (Gildon and Tinker, 1981). The per cent root colonization was comparatively more in non-polluted soil grasses than polluted soil grasses (Table -2). The minimum and maximum per cent root colonization was observed in *Cyperus rotundus* (15%) and *Alloteropsis cimicina* (92%) respectively in non-polluted sites and in polluted sites the minimum was in *Saccharum* (20%) and maximum in *Sorghum* (82%) (Table 2). The percentage root colonization was high in summer season of plant species in polluted soil sites in the per cent study as supported by (Ramapulla Reddy and Manoharachary, 1990) in industrially polluted soil sites plant species (Table 2). The number of VAM spores were more in monsoon and summer seasons in non-polluted soils and less in polluted with effluents may be due to dilution of nutrients or accumulation of nutrients and optimum moisture level or water stress and increased level of carbon, zinc and iron were noticed in soil polluted with effluents may be caused reduction in the number of VAM propagules, as supported by (Ramapulla Reddy and Manoharachary, 1990).

These results suggested that the variation in soil pH, temperature and effluent pollution seems to be the decisive factors in tropical soils influencing distribution of VAM fungi. The physico-chemical data revealed that the polluted soil was acidic to neutral with more of carbon. Zinc, Iron and other nutrients in the present study. It can be concluded that tannery effluents significantly alter the occurrence of native VAM fungi both quantitatively and qualitatively. The variation in spore population which was generally more or less in effluent site may be attributed to the season, soil edaphic characters particularly to the acidity, high moisture and organic carbon in soil.

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