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An investigation of the soil mycoflora in sugarcane field of Thanjavur District-Tamilnadu

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ABSTRACT

Soil is a complex ecosystem, delimited by physicochemical parameters that hold enormous number of living organisms. This study deals with the seasonal variations in soil fungal population of traditional sugarcane field in Thanjavur district, Tamil Nadu viz Orathanadu and Pattukottai. About 49 different species belonging to Phycomycetes and Deuteromycetes were isolated by using PDA medium and identified by using standard manual. The dominant species were Aspergillus niger, A. flavus followed by Botrytis cinera, Trichoderma viride, T.harzianum, T.koeningii, T.glaucum, Penicillium chrysogenum and P.citrinum from the sugarcane field soils of Orathanadu in various seasons whereas, in Pattukottai soils the dominant species were A.niger, Botrytis cinera followed by A.oryzae, Fusarium oxysporum, Gliocladium virens, P.chrysogenum and T.viride respectively. Total fungus in two station, they are 27 species belong to 11 genera were identified from Orathanadu station and 32 species belong to 13 genera were identified from Pattukottai station.

Key words: Sugarcane field, Biodiversity, Fungal population, Phycomycetes.

INTRODUCTION

Soil is a complex ecosystem, delimited by physicochemical parameters that hold enormous number of living organisms. Nevertheless, microbes are the least unstated mechanism of soil by both agronomists and soil practitioners. On the farm several soil organisms offer benefits to crop growing in an ecosystem, but are not well understood. The soil microbes decompose the plant and animal residues entering the soil and convert them into soil organic matter, which influences on soil physical, chemical and biological properties and on creating a complimentary medium for biological reactions and life support in the soil environment. Nonetheless, enhanced site-specific

diversity typically results in higher levels of below ground microbial diversity and production (Olson *et al*., 2000).

Large quantities of readily decomposable organic matter are added to agricultural soils every year as crop residues or animal wastes and have a significant outcome on soil microbial commotion. The plant species growing on the soil also equally influence the population and species composition of the soil fungi. (Hackle *et al*., 2000).

Microfungi play a focal role in nutrient cycling by regulating soil biological activity (Arunachalam *et al*., 1997). However, the rate at which organic matter is decomposed by the microbes is interrelated to the chemical composition of the substrate as well as environmental conditions. There have been a number of studies on the distribution of soil microfungi in agricultural field. Some studies dealt with the influence of plant community (Chung *et al*., 1997) and others attempted to examine seasonal trends (Kennedy *et al*., 2005).

This study deals with the seasonal variations in soil fungal population of traditional agricultural field in South India.

MATERIALS AND METHODS

Collection of soil samples

About eight soil samples were collected from the two villages, viz Orathanadu, Pattukottai in Thanjavur District – Tamil Nadu. The soil samples were taken during the four seasons in sugarcane field.

Sampling Schedule

Soil sample was collected in each sampling station seasonally for a period of one year from January 2009 to December 2009. The climate is monsoonic and the calendar year has been divided into four season viz., Post monsoon (January - March), Summer (April - June), Pre monsoon (July - September) and Monsoon (October- December).

Soil Analysis

The mechanical and chemical analysis of the soils were made with the help of Lamotte's soil testing outfit, Nitrogen and Organic, etc., were estimated as outlined in piper's book (1950).

Isolation of Soil Mycoflora

Dilution Plating Method

Dilution technique described by Warcup (1950) was used to isolate the fungi from soil sample weighting 1 g was diluted in 10 ml of distilled water. One ml. of the diluted sample was poured and spread on petriplates containing sterilized PDA medium (Extract from 250g of potato (boiled and filtered), dextrose 20g, agar 15 g and distilled water 1000 ml pH 7.0) in replicates. The inoculated plates were incubated in a dust free cupboard at the room temperature for 3 days. One percent streptomycin solution was added to the medium before pouring into petriplates for preventing bacterial growth.

Observation

The colonies growing on PDA plates with different morphology were counted separately. A portion of the growing edge of the colony was picked up with the help of a paw of needles and mounted on a clean slide with lactophenol cotton blue stain. The slide was gently heated in a sprit lamp so as to facilitate the staining and remove air bubbles, if any. The excess stain was

removed with the help of tissue paper and then the cover slip was sealed with transparent nail polish. The slide was observed under a compound microscope.

Microphotography of the individual fungal species was also taken using Nikon phase contrast microscope, Japan.

Identification

Colony colour and morphology were noted besides hyphal structure, spore size, shapes and spores bearing structures. They were compared with the standard works of Raper and Thom (1949), Van Arx (1974). Ainsworth *et al*., (1973); Raper and Fennell (1965) and Ellis (1976) among others for identification of the species.

Presentation of Data

Number of species is referred as species diversity. Populations density expressed in terms of colony forming unit (CFU) per gram of soil with dilution factors.

In order to arrers the dominance of individual species in species site percentage contribution was worked out as follows

$$\% \text{ contribution} = \frac{\text{No. of colonies of fungus in a sample}}{\text{Total number all colonies of all the species in a sample}} \times 100$$

RESULTS AND DISCUSSION

Fungal Diversity in Sugarcane Soils

Altogether eight soil samples from 2 different stations representing the entire Thanjavur District were examined for fungal diversity. The study resulted the presence of 49 species of fungi in all of them 3 species belonging to two genera were Phycomycetes and the remaining 46 species belonging to 17 genera were assignable to Deuteromycetes.

Table-1

Fungal species		
Phycomycetes	16. *A. oryzae*	33. *C. renegalensis*
1. *Absidia glauca*	17. *A. repens*	34. *Fusarium semitectum*
2. *Rhizopus nigricans*	18. *A. ruber*	35. *F. solani*
3. *R. stolonifer*	19. *A. rugulosis*	36. *F. oxysporum*
Deuteromycetes	20. *A. sulphureus*	37. *Gliocladium virens*
4. *Aspergillus awamori*	21. *A. sydowi*	38. *Helminthosporium* sp.
5. *A. Chevalieri*	22. *A. tamari*	39. *Humicola* sp.
6. *A. flavipes*	23. *A. terreus*	40. *Hyalopus ater*
7. *A. flavus*	24. *A. terricola*	41. *Masoniella* sp.
8. *A. fumigatus*	25. *A. ustus*	42. *Neurospora crassa*
9. *A. fusispora*	26. *A. versicolor*	43. *Penicillium chrysogenum*
10. *A. granulosis*	27. *A. wentti*	44. *P. citrinum*
11. *A. humicola*	28. *Bipolaris oryzae*	45. *P. conidia*
12. *A. luchuensis*	29. *Botrytis cinera*	46. *Trichoderma glaucum*
13. *A. nidulans*	30. *Chaetomium* sp.	47. *T. harzianum*
14. *A. niger*	31. *Cladosporium* sp.	48. *T. koeningii*
15. *A. ochraceous*	32. *Curvularia lunata*	49. *T. viride*

Table-2 Total number of colonies, mean density and percentage contribution of fungi recorded during different season from Thanjavur District (Jan 2009 – Dec 2009)
Station 1 – (Orathanadu)

S.No	Name of the organisms	Post monsoon		Summer		Pre monsoon		Monsoon		Total number of colonies	% of contribution
		TNC	MD	TNC	MD	TNC	MD	TNC	MD		
1.	*Absidia glauca*	3	1	-	-	2	0.66	1	0.33	6	2.5751
2.	*Aspergillus awamori*	2	0.66	1	0.33	4	1.33	3	1	10	4.2918
3.	*A. flavus*	6	2	4	1.33	3	1	2	0.66	15	6.4377
4.	*A. fumigates*	4	1.33	3	1	2	0.66	5	1.66	14	6.0085
5.	*A. fusispora*	4	1.33	3	1	1	0.33	3	1	11	4.7210
6.	*A. luchensis*	3	1	2	0.66	3	1	1	0.33	9	3.8626
7.	*A. niger*	8	2.66	4	1.33	4	1.33	6	2	22	9.4420
8.	*A. repens*	2	0.66	1	0.33	-	-	1	0.33	4	1.7167
9.	*A. ruber*	3	1	2	0.66	1	0.33	2	0.66	8	3.4334
10	*A. rugulosis*	5	1.66	4	1.33	4	1.33	6	2	19	8.1545
11	*A. sydowi*	6	2	5	1.66	4	1.33	2	0.66	17	7.2961
12.	*A. terreus*	4	1.33	1	0.33	2	0.66	-	-	7	3.0042
13.	*A. terricola*	2	0.66	2	0.66	1	0.33	1	0.33	6	2.5751
14.	*A. ustus*	-	-	-	-	1	0.33	2	0.66	3	1.2875
15.	*A. versicolor*	3	1	3	1	2	0.66	1	0.33	9	3.8626
16.	*A. wentti*	1	0.33	-	-	2	0.66	1	0.33	4	1.7167
17.	*Botrytis cinera*	5	1.66	2	0.66	-	-	2	0.66	9	3.8626
18.	*Chaetomium sp.*	1	0.33	1	0.33	-	-	1	0.33	3	1.2875
19.	*Cladosporium sp.*	3	1	2	0.66	4	1.33	2	0.66	11	4.7210
20.	*Curvularia lunata*	-	-	1	0.33	1	0.33	2	0.66	4	1.7167
21.	*Fusarium oxysporum*	4	1.33	4	1.33	1	0.33	1	0.33	10	4.2918
22.	*F. solani*	2	0.66	1	0.33	-	-	1	0.33	4	1.7167
23.	*Helminthosporium sp*	3	1	2	0.66	3	1	2	0.66	10	4.2918
24.	*Masoniella sp.*	1	0.33	-	-	-	-	1	0.33	2	0.8583
25.	*Neurospora crassa*	-	-	2	0.66	-	-	1	0.33	3	1.2875
26.	*Penicillium chrysogenum*	3	1	3	1	2	0.66	4	1.33	12	5.1502
27.	*P. conidia*	-	-	-	-	1	0.33	-	-	1	0.4291
										233	

27 species belonging to 11 genera
TNC-Total number of colonies, MD – Mean Density, Post monsoon – January, Summer – April, Pre monsoon – July, Monsoon – October

Table-3 Total number of colonies, mean density and percentage contribution of fungi recorded during different season from Thanjavur District (Jan 2009 – Dec 2009)Station 2 – (Pattukkottai)

S.N0	Name of the organisms	Post monsoon		Summer		Pre monsoon		Monsoon		Total number of colonies	% of contribution
		TNC	MD	TNC	MD	TNC	MD	TNC	MD		
1.	*Aspergillus chevalieri*	-	-	-	-	1	0.33	1	0.33	2	1.0362
2.	*A. flavipes*	-	-	2	0.66	3	1	4	1.33	9	4.6632
3.	*A. flavus*	6	2	3	1	2	0.66	1	0.33	12	6.2176
4.	*A. granulosis*	3	1	2	0.66	1	0.33	4	1.33	10	5.1813
5.	*A. humicola*	1	0.33	2	0.66	1	0.33	3	1	7	3.6269
6.	*A. nidulans*	1	0.33	2	0.66	1	0.33	4	1.33	8	4.1450
7.	*A. niger*	7	2.33	6	2	5	1.66	3	1	21	10.8808
8.	*A. ochraceous*	1	0.33	2	0.66	3	1	3	1	9	4.6638
9.	*A. oryzae*	6	2	5	1.66	3	1	5	1.66	19	9.8445
10.	*A. rugulosis*	2	0.66	1	0.33	1	0.33	3	1	7	3.6269
11.	*A. sulphureus*	1	0.33	-	-	-	-	3	1	4	2.0725
12.	*A. tamari*	2	0.66	1	0.33	1	0.33	3	1	7	3.6269
13.	*A. terreus*	-	-	3	1	4	1.33	6	2	13	6.7357
14.	*Bipolaris oryzae*	2	0.66	-	-	3	1	4	1.33	9	4.6632
15.	*Botrytis cinera*	3	1	3	1	2	0.66	3	1	11	5.6994
16.	*Curvularia lunata*	-	-	1	0.33	-	-	1	0.33	2	1.0362
17.	*C. senegalensis*	1	0.33	-	-	1	0.33	1	0.33	3	1.5544
18.	*Fusarium semitectum*	-	-	-	-	1	0.33	1	0.33	2	1.0362
19.	*F. oxysporum*	1	0.33	1	0.33	-	-	1	0.33	3	1.5544
20.	*Gliocladium virens*	2	0.66	-	-	1	0.33	1	0.33	4	2.0725
21.	*Helminthosporium sp.*	-	-	1	0.33	1	0.33	1	0.33	3	1.5544
22.	*Humicola sp.*	2	0.66	1	0.33	-	-	1	0.33	4	2.0725
23.	*Hyalopus ater*	-	-	-	-	1	0.33	1	0.33	2	1.0362
24.	*Masoniella sp.*	1	0.33	1	0.33	-	-	1	0.33	3	1.5544
25.	*Penicillium chrysogenum*	-	-	1	0.33	1	0.33	-		2	1.6562
26.	*P. citrinum*	-	-	-	-	2	0.66	1	0.33	3	1.5544
27.	*Rhizopus nigricans*	1	0.33	1	0.33	-	-	-	-	2	1.0362
28.	*R. stolonifer*	-	-	-	-	1	0.33	1	0.33	2	1.0362
29.	*Trichoderma glaucum*	1	0.33	-	-	-	-	1	0.33	2	1.6362
30.	*T. harzianum*	-	-	1	0.33	-	-	-	-	1	0.5181
31.	*T. koeningii*	2	0.66	-	-	1	0.33	1	0.33	4	2.0725
32.	*T. viride*	1	0.33	-	-	1	0.33	1	0.33	3	1.5544
										193	

32 species belonging to 13 genera

TNC-Total number of colonies, MD – Mean Density, Post monsoon – January, Summer – April, Pre monsoon – July, Monsoon – October

Stationwise Occurence
Altogether 27 species belong to 11 genera (1 Phycomycetes, 26 Deuteromycetes) were identified from Orathanadu and 32 species belong to 13 genera (2 Phycomycetes, 30 Deuteromycetes) were identified from Pattukottai.

Species Composition
Among the 17 genera recorded, the genus *Aspergillus* was considered by more number of (24 species) followed by *Trichoderma* (4 species) *Fusarium* and *Penicillum* (3 species each). All other genera were represented one species each (Table 1).

Species Diversity
Altogether 49 species to 17 genera (3 Phycomycetes, 46 Deuteromycetes) were identified from the station. (Orathanadu, Pattukottai).

In the present investigation the survey was conduct to find out the fungal diversity in two different stations such as Orathanadu and Pattukottai totally 49 species isolated belonging 17 genera from the soil of sugarcane field. Number of Deuteromycetes were representing by 46 species remaining 3 species are Phycomycetes. The dominant species were *Aspergillus niger, A. flavus* followed by *Botrytis cinera, Trichoderma viride, T.harzianum, Penicillium chrysogenum, T.koeningii, T.glaucum,* and *P.citrinum* from the sugarcane field soils of Orathanadu in various seasons whereas, in Pattukottai soils the dominant species were *A.niger, Botrytis cinera* followed by *A.oryzae, Fusarium oxysporum, Gliocladium virens, P.chrysogenum* and *T.viride* respectively.

Recentely Kalai selvi and Panneerselvam (2011) studied that seasonal and depthwise variation of soil fungal population in Thanjavur dist, Tamilnadu viz Nadur, Orathanadu, Punnainallur and Tholkappiyar Square totally 30 different species belonging to Ascomycetes and Phycomycetes were isolated by using PDA medium. The dominant species were *Aspergillus niger*, *Cunninghamella* sp. followed by *Trichoderma viride.* During rainy season maximum fungal count was recorded in sub soil layer.

Evendentely Madhan raj *et al*., (2010) reported that 45 soil samples were collected from 8 different station along the entire Tamilnadu coast and examined by dilution plating method to access the fungal diversity and their population density. Totally 24 fungal species representing 12 genera recorded *Aspergillus* was constituted by more number of (9 species) followed by *Penicillium* (3species) *Fusarium* and *Monodictys* (2species each).

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