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RESEARCH ARTICLE

DIVERSITY OF GEOFUNGI FROM SEMMALAI HILLS OF PUDUKKOTTAI DISTRICT

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ABSTRACT

The present work was aimed in the Semmalai hills of Pudukkottai district to assess the density and diversity of fungal flora. To isolate and identify the fungi from the soil along with some physicochemical parameters like pH, electrical conductivity organic carbon and nitrogen etc., the month of January to December 2012. It has been estimated that 1.5 million fungal species are present in natural ecosystem, but only 5-10% have been described formally. During the study, a diversity of fungal strains were isolated and identified from the soil sample. Thus, the study on fungal diversity provides a basis for estimating the important functional role of fungi in soil ecosystem. The most common genera isolated from the soil samples included *Aspergillus*, *Alternaria*, *Bipolaris* and *Fusarium*.

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INTRODUCTION

Fungi play an important role in soil ecosystem and the principal decomposers of forest litter or dung, fruits or other organic materials (Carlile *et al*., 2001). Fungi are not only beautiful but also play a significant role in the daily life of human beings besides their utilization in industry, agriculture, medicine, food, textiles, bioremediation, and many other ways. Biological diversity (biodiversity) encompasses the variety of living forms like animals, plants and microbes. According to Hawksworth (2002), fungi are a major component of biodiversity, essential for the survival of other organisms and are crucial in global ecological processes. Presently the fungi as a mega-diverse group spans three kingdoms, most belonging to the fungi (Eumycota), while others are classified in the protozoa and Chromista (Straminipila) (Cavalier Smith 1998, James *et al*., 2006). Soil contains a vast array of microorganisms such as bacteria, viruses, fungi, actinomycetes, protozoa and algae (Alexander, 1977; Olowonihi, 2003). It has been found that more number of genera and species of fungi exist in soil than in any other environment (Nagmani *et al*., 2005). Contributing to the nutrient cycle and maintenance of ecosystem, fungi play an important role in soil formation, soil fertility, soil structure and soil improvement (Hao-quin *et al.,* 2008). The present study was planned to study the diversity and abundance of fungal species in the soil sample.

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MATERIALS AND METHODS

Sample site

In this present investigation, Semmalai Hills of Pudukkottai district was taken as soil sample site. Soil sample was taken from the upper 10-15 cm depth in the soil at monthly interval from pre sowing to post harvest period of one year in 2012 (January to December).

Isolation and identification of fungi

Isolation of fungi from the soil samples were carried out by dilution plate methods (Warcup 1955) using different synthetic and semi synthetic media. The fungi were identified with the help of standard literature (Barneutt 1998, Ellis 1993, Gilman, 2001, Raper and Fennel 1965 and Subramanian 1971).

Soil physicochemical properties

Collected samples were brought to the laboratory by a sterile polyethene bag and sieved through 2mm sieve at field moist conditions and determination of soil moisture content and pH was done. Air dried ground and sieved (0.25mm) samples were used for the estimation of organic C, total N, available P and K content. Moisture content was determined by weight loss after drying 10g of soil at 105°C for 24 hours and expressed as percentage dry weight. Soil pH was measured in a 1:5 water suspension using a portable digital pH meter.

Colorimetric method (Anderson and Ingram, 1993), Micro kjeldhal distillation and titration method (Jackson 1967) were applied to estimate organic carbon, total nitrogen, available phosphorus and exchangeable potassium respectively. The soil parameters were tabulated.

Fungal population in the soil sample

For population of mycoflora by serial dilution plate method (Johnson and Curl 1972) was followed by Rose Bengal Agar Medium (Martin, 1950) was used. The inoculated petriplates were incubated at 25±1°C. Colony Forming Units (CFU) were estimated by counting the number of colonies after five days. Fungi were identified according to their macroscopic and microscopic features. Identification at the species level was carried out according to the morphological characters found principally in publications by Gilman (1957), Barnett and Hunter (1972), Ellis (1993) pure cultures of fungi were maintained in test tubes slants containing Czapek Dox agar medium and preserved in deep freezer at -20°C for future work.

RESULTS AND DISCUSSION

In the present study, totally 367 colonies of fungi were isolated from the collected soil sample. The colonies were distributed in 43 different species belonging to 16 genera of mycoflora. The following genera like *Allomyces, Alternaria, Aspergillus, Bipolaris, Cercospora, Curvularia, Dreschslera, Fusarium, Helminthosporium, Neurospora. Penicillium, Phoma, Rhizopus, Trielavia, Trichoderma* and *Verticillium* were isolated respectively. From the genera the maximum number of species were belonging to the genera Aspergillus. A total number of 15 species of Aspergillus were isolated from soil sample. Minimum number of species were belonging to general like *Allomyces, Bipolaris, Cercospora, Dreschslera, Neurospora, Phoma, Trielavia* and *Verticillium* with a single species. In the present study, the soil samples was collected in month wish of the year from January to December 2012. In these months maximum number of colonies (21) were isolated in the month of January and December 2012, minimum number of colonies (0.1) were isolated in the month of April, May and June 2012. Maximum percentage of contribution belongs to *Aspergillus candidus*. Minimum percentage of contribution belongs to *Aspergillus sydowi*. The isolated fungi were tabulated in Table 1.

Table 1. Isolation of soil fungi (number of colonies×10^3 g ^{7} dry weight of the soil) from Semmalai village of Pudukkottai (Dt)-2012

S.No	Name of the organisms	2012												Total no of colonies	Percentage of Contribution (%)
		Jan	Feb	Mar	April	May	Jun	July	August	Sept	Oct	Nov	Dec		
1	*Allmyces arbuscules*	7	10	12	-	-	-	14	13	13	11	13	17	09	75
2	*Alternaria brunsil*	13	-	15	02	-	01	13	-	14	-	11	19	08	66
3	*A.cinerariae*	10	10	11	01	02	-	12	14	-	08	15	-	09	75
4	*A.palandui*	12	-	-	-	-	-	-	13	14	04	14	19	06	50
5	*A.tenuis*	13	13	11	02	-	-	11	14	11	14	12	18	10	83
6	*Aspergillus candidus*	10	11	19	05	04	05	18	19	17	06	19	-	12	100
7	*A.flavus*	08	14	-	01	-	-	13	-	-	13	12	-	06	50
8	*A.fumigates*	01	12	14	02	-	-	13	13	12	11	11	19	10	83
9	*A.koningi*	21	11	14	-	03	-	13	10	11	11	13	-	09	75
10	*A.luchuensis*	18	10	13	03	-	02	12	-	-	15	14	18	09	75
11	*A.niger*	21	15	-	06	05	04	12	13	14	13	14	-	10	83
12	*A.ochraceous*	-	14	12	02	-	-	13	14	12	12	13	19	09	75
13	*A.oryzae*	16	12	14	-	-	03	11	-	11	08	12	-	08	66
14	*A.sulphureus*	09	13	-	-	08	05	14	12	13	10	15	17	10	83
15	*A.sydowi*	17	-	13	-	-	-	11	-	13	11	-	-	05	41
16	*A.terreus*	18	12	12	-	-	-	09	10	-	13	10	19	08	66
17	*A.tericola*	16	-	14	03	03	-	12	14	15	11	13	21	10	83
18	*A.ustus*	07	11	-	-	-	01	14	12	-	12	12	-	07	58
19	*A.variecolor*	-	12	11	-	-	03	15	-	11	13	14	18	08	66
20	*A.versicolor*	18	14	-	-	-	02	-	13	13	12	12	-	07	58
21	*Bipolaris turcica*	19	12	-	-	06	02	13	12	-	14	14	-	08	58
22	*Cercospora andrpogonis*	17	13	14	-	-	-	-	-	14	07	11	-	06	50
23	*Curvularia andropogonis*	01	08	11	02	-	03	14	11	12	11	12	18	11	91
24	*C.indica*	18	11	13	-	-	01	12	13	-	12	15	19	09	75
25	*C.lunata*	14	14	-	06	05	06	14	-	14	16	13	-	09	75

Continue……

26	*Dreschslera avenacea*	15	-	12	-	02	05	12	14	-	16	12	18	09	75
27	*Fusarium monilifome*	21	13	-	-	-	05	12	-	14	-	15	-	06	66
28	*F.oxysporum*	-	14	13	-	-	-	14	12	-	15	11	17	07	58
29	*Helminthosporium oryzae*	12	12	-	-	-	-	11	-	11	13	13	-	06	50
30	*H.velutinum*	19	11	12	-	-	05	15	13	14	11	13	19	10	83
31	*Neurospora sphaerica*	07	13	13	-	-	-	-	08	16	14	-	16	07	58
32	*Penicillium citrinum*	21	14	14	05	-	05	14	11	13	09	14	21	10	83
33	*P.funiculosum*	02	11	11	03	-	-	11	13	14	14	14	20	10	83
34	*P.janthinellum*	19	13	14	-	-	-	11	11	14	11	14	17	09	75
35	*P.purpurrescens*	16	12	-	-	01	-	12	11	11	15	11	21	09	75
36	*P.turbatum*	-	13	12	-	-	-	11	12	12	-	-	20	08	66
37	*Phoma humycola*	-	15	14	-	-	-	12	13	13	15	14	16	08	66
38	*Rhizopus nigricans*	21	12	13	-	-	03	14	11	14	14	14	19	10	83
39	*R.stolonifer*	19	11	14	05	01	-	12	11	13	12	13	20	11	91
40	*Trielavia terricola*	17	-	-	-	-	-	11	-	13	-	-	17	04	33
41	*Trichoderma koningi*	18	12	11	-	02	03	13	11	13	11	09	16	11	91
42	*T.viride*	20	16	13	06	-	05	11	13	12	15	12	-	10	83
43	*Verticillium sp*	20	07	09	-	-	-	11	12	10	11	10	19	09	75

Table 2. Studies on the physicochemical parameter of Semmalai Soil samples- 2012

S.No	Parameter	January	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
1	pH	6.9	5.5	5.3	4.6	4.6	4.4	5.3	5.6	5.7	5.7	5.2	7.6
2	Electron conductivity (dsm^{-1})	2.40	1.99	1.98	1.09	1.07	1.04	1.89	12.01	2.03	1.99	1.98	2.55
3	Organic carbon (%)	8.99	6.45	6.43	4.12	4.23	4.56	6.54	6.21	6.43	6.34	6.21	8.76
4	Nitrogen (%)	17.02	15.5	15.43	12.43	12.4	12.67	15.34	15.5	15.3	15.5	15.8	17.54
5	Organic matter (%)	1.89	1.23	1.43	0.98	0.87	0.76	1.32	1.21	1.23	1.43	1.13	1.78
6	Phosphorus (%)	0.38	0.12	0.01	0.03	0.06	0.21	0.22	0.25	0.25	0.24	0.25	0.56
7	Potassium (%)	2.37	2.12	2.09	2.06	2.10	2.13	2.15	2.11	2.14	2.13	2.12	2.56
8	Sodium (%)	0.62	0.45	0.15	0.19	0.21	0.41	0.42	0.44	0.45	0.41	0.48	0.71
9	Calcium (%)	2.65	2.41	2.14	2.13	2.17	2.39	2.41	2.42	2.47	2.48	2.41	2.63
10	Magnesium (%)	2.06	1.89	1.56	1.65	1.49	1.83	1.87	1.78	1.98	1.94	1.96	2.01
11	Sulphur (%)	0.24	0.20	0.15	0.17	0.19	0.19	0.20	0.97	0.87	0.76	0.95	0.26
12	Zinc (ppm)	2.54	2.23	2.22	2.10	2.09	2.10	2.21	2.22	2.24	2.25	2.24	2.51
13	Copper (ppm)	1.30	1.19	1.17	1,09	1.06	1.08	1.18	1.16	1.18	1.19	1.17	2.53
14	Iron (ppm)	16.35	14.65	12.98	12.65	12.54	14.67	14.87	14.76	1469	14.43	14.76	16.33
15	Manganese (ppm)	5.46	4.65	4.87	3.42	3.21	3.62	4.76	4.98	4.54	4.76	4.67	5.65
16	Chromium (ppm)	0.39	0.21	0.24	0.12	0.11	0.14	0.25	0.25	0.28	0.26	0.25	0.41
17	Nickel (ppm)	0.66	0.45	0.04	0.02	0.02	0.01	0.45	0.44	0.46	0.45	0.47	0.37
18	Cobalt (ppm)	0.21	0.17	0.16	0.10	0.09	0.06	0.17	0.15	0.19	0.16	0.19	0.23
19	Cadmium (ppm)	0.19	0.10	0.18	0.05	0.04	0.06	0.16	0.19	0.18	0.16	0.18	0.08

The soil sample was analysed for physicochemical parameters like pH, electric conductivity, organic carbon, nitrogen, organic matter, phosphorus, sodium, calcium, magnesium, sulphur, zinc, copper, iron, manganese, chromium, nickel, cobalt and cadmium. The pH of the soil was found to be acidic to neutral. The values of the soil parameters were given in the Table 2.

However, the distribution of soil microbial population is determined by a number of environmental factors like pH, Moisture content and soil organic matter (Kennedy *et al.,* 2005) higher fungal population during rainy and autumn seasons to supported the findings of other workers (Arunachalam *et al*., 1997), which perhaps is due to prevailing favorable moisture and temperature setting during the period of leaf litter and other plant residues are decomposed faster during rainy season and sufficient soil organic matter and humus accumulates that may have enhanced the colonization of the soil microbes in subsequent period.

The soil pH, organic content and water also the main factors affecting the fungal population and diversity (Yu *et al*., 2007, Dong *et al*., 2004). The Organic carbon, nitrogen, phosphorus, potassium are important for fungal diversity. In the absence of any of these the growth and sporulation of moulds as well as other microorganisms were recorded. The plant also species growing on the soil also equally influence the population and species composition of the soil fungi.

Hackl *et al*. (2000) indicated that the plant species growing on the soil also equally influence the population and composition of species of the soil fungi. Dominance of the genus *Aspergillus* sp. in the present study sites may be due to their greater rate of spore production and dispersal and partly due to their resistance over extreme environmental conditions (Schimel, 1995).

Soil can be managed to optimize its fertility and health under natural and agricultural land uses, so as to benefit fungal diversity. Due to the dispersed nature of the soil asset, a broad but consistent and economically appealing approach to its protection is needed.

Conclusion

From the present study it was concluded that soil depends on varoius factors of the soil such as pH, organic contents and moisture. The fungal diversity have to be studied, there is need for a wider study area so as a complete representation of the fungal diversity and beneficial aspects of these significant microbes. It is important to study microbial diversity not only for basic scientific research, but also to understand the link between diversity, community study and functions of fungi. This work has provided a more complete knowledge of fungal diversity in Semmalai Hills soil sample of Pudukkottai district of Tamilnadu.

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REFERENCES

Alexander, M., 1977. Introduction to soil Microbiology, John Wiley & Sons, New York.

Anderson, J.M and Ingram, J.S.I., 1993. Tropical Soil Biology and Fertility. A Handbook of Methods. Second edition. CAB International, Wallingford, Oxon. UK. 221 p.

Arunachalam, K., Arunachalam, A., Tripathi, R.S. and Pandey, H.N. 1997. Dynamics of microbial population during the aggradations phase of selectively logged sub-tropical humid forest in north-eastern India. *Tropical Ecology*; 38: 333-341.

Barnett H.L and Hunter, B.B., 1998. Illustrated Genera of Imperfect Fungi, IV edition. Published by APS Press St. Paul, Minnesota.

Barnett, H.L. and Hunter, B.B., 1972. Illustrated Genera of Imperfect Fungi. Burgess Publishing Company. Minneapolis.

Carlile, M.J., Watkinson, S.C. and Graham, W.G. 2001. The Fungi. Second edition.San Diego, California: Academic Press,

Cavalier Smith, T. 1998. A revised six- kingdom system of life. *Biol. Rev*; 73: 203 266.

Dong A.R., Lv G.Z., Wu Q.Y., Song R.Q. and Song F.Q. 2004. Diversity of soil fungi in Liangushui natural reserve, Xiaoxing aniling forest region. *J. Northeast Forestry University*, 32(1): 8-10.

Ellis M.B. 1993. Dematiaceous Hypomycetes, CAB International. Published by Common wealth Mycological Institute, Kew, Surrey, England.

Gillman, J.C., 1957. Manual of Soil Fungi. Oxford and I.B.H Publishing company (Indian reprint).

Gilman J.C. 2001. A Manual of Soil Fungi, 2nd Indian Edition, Biotech Books Delhi.

Hackl E., Bachmann G. and Boltenstern-Zechmeister S., 2000. Soil microbial biomass and rhizosphere effects in natural forest stands. *Phyton*, 40, 83-90.

Hao quin Pan, Jin- Feng Yu, Yue- ming Wu, Tian- Yu Zhang and Hong- Feng Wang. 2008. Area: *J. Zhejiang Univ. Sci. B;* 9(10): 829-834.

Hawksworth D.L. 2002. Tropical Mycology Vol.2, Micromycetes CABI. 1 11.

Jackson, M. L. 1967. Soil chemical analysis New Delhi : Prentice Hall of India Pvt. Ltd.

James, T.Y., Kauff, F. and Schoch, C.L. 2006. Reconstructing the early evolution of the fungi using a six gene phylogeny. *Nature*, 443: 818- 822.

Johnson, Leander F., and Elroy A. Curl. 1972. Methods for Research on the Ecology of Soil-Borne Plant Pathogens. 426 So. Sixth St., Minneapolis Burgess Publishing Company.

Kennedy, N.M., Gleeson, D.E., Connolly, J. and Clipson, N.J.W. 2005. Seasonal and management influences on bacterial community structure in an upland grassland soil. *FEMS Microbiol Ecol*., 53:329-337.

Martin J.P. 1950. Use of acid, rose bengal, and streptomycin in the plate method for estimating soil fungi. *Soil Sci*., 69:215-232.

Nagmani A, Kunwar, IK. and Manoharachary, C. 2005. Handbook of Soil Fungi. Published by I. K. International Pvt, Ltd. New Delhi.

Olowonihi, E T. 2003. Studies on the distribution of Bacteria and Fungi in the five soil series of University of Ilorin Teaching and Research Farm. An M.Sc Thesis Dissertation submitted to the Department of Crop production, Faculty of Agriculture. University of Ilorin. pp.6-18 (2).

Raper K.B. and Fennell D.I. 1965. The Genus *Aspergillus*, The Williams and Willkins Company, Baltimore.

Schimel, J. 1995. Ecosystem Consequences of Microbial Diversity and Community structure. Ecological studies. Chapin and Korner (Eds.), Vol. 113, Springer-Verlag, Berlin, Heidelberg, pp: 239-254.

Subramanian C.V. 1974. Hyphomycetes, Published by ICAR, New Delhi.

Warcup, J.H., 1955. On the origin of colonies of fungi developing on soil dilution plates. *Transactions of the British Mycological Society*, 38(3) : 298–301.

Whittaker, R.H. 1969. New concept of kingdoms of organisms. *Science,* 163: 150 160.

Yu C., Lv D.G, Qin S.J., Du G.D. and Liu G.C. 2007. Microbial flora in *Cerasus sachalinensis* rhizosphere. *Chinese. J. Appl. Ecol*., 18 (10), 2277-2281.

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