

Litter Fungi Diversity in Piranmalai Forest, Eastern Ghats, Tamilnadu, India

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Abstract

Hypomycetes play a predominant role in forest litter degradation and there is a successional pattern of fungal flora. The primary colonizers on forest litter were mostly saprophytes. The secondary colonizers were those fungi with the ability to utilize lignin and cellulose for growth. In Present study forests the role of *Alternaria sp*, *Aspergillus niger*, *Cladosporium sp*, *Curvularia lunata*, *Fusarium solani*, *Mucor racemosus*, *Nigrospora spherical*, *Penicillium sp*, *Phoma sp* and *Trichoderma koningii* are considered to be indispensable in litter degradation due to their high level of occurrence and greater survivability during the final stages of decomposition.

Key Words: Litter, Hypomycetes, Piranmalai, Diversity, Fungal flora, Eastern Ghats

Introduction

The amount and nature of litter, which is the major source of a variety of organic matter, has an important bearing of soil formations and its fertility. It is now well established that the decomposition of plant litter on the soil surface is brought about by a variety of microorganisms including bacteria, fungi and actinomycetes (Jensen 1974, Surift etal 1979, Senthilkumar etal 1993a, 1993b, Sankaran, 1994). Among these fungi are the chief colonizers and decomposers (Dickinson and Plugh, 1974). This chapter reports some ecological attributes and the succession of fungi on decomposing litters in four area of Piranmalai forest of Eastern Ghats, Tamilnadu, India.

Materials and Methods

Freshly decaying leaf litter collected from four-study area (Disturbed, undisturbed, grazing and fire wood area) during the period of January 2002 to December 2002 and they were air dried to constant moisture content. In the first week of January 2003, 20g of air dried litter of each of the four study area was transferred separately into nylon mesh bags (20x20cm, mesh size 2mm) and the openings closed firmly by stitching. Field studies on litter fungi were conducted at the native forest soil in a 3x1.5m plot. Twelve litterbags, prepared for each of the four study area were spread randomly over the soil surface in separate plots allotted in the respective forest floor.

Sampling of litterbags was initiated in January 2003, which continued at monthly intervals (12 months), until the end of decomposition in each forest. One litterbag of each species was recovered at each sampling date. The sampling during January was made from the fresh samples other than the collected material kept in litterbags. Twenty litter (stem with

attached leaf) samples measuring 2.5cm in length was randomly collected under each forest. Each sample was cut into 10 inoculate and plated in a Petri dish containing potato dextrose agar medium. Development of fungal colonies was noted from the fifth day of incubation ($22 \pm 1^\circ\text{C}$) and recorded. Fungal hyphae, spores and fruiting structures were mounted and stained with lacto phenol cotton blue. Fungal colonies were identified by their morphological characteristics (Thom and Church, 1926, Thom 1930, Gilman 1957, Ellis 1971d, Udaiyan and Hosagouder, 1991).

The quantitative aspects of fungal flora associated with different stages of litter degradation were further examined by a moist chamber incubation technique where sterilized Petri dishes with moistened filter papers served as moist chambers. This also ensured the identification of species whose isolation was not favoured by the plating technique.

Frequency of occurrence

Percentage occurrence of various fungi was calculated to assess their relative density and distribution in the litter during each sampling month.

$$\text{Percentage occurrence} = \frac{\text{number of litter samples in which a particular fungus was observed} \times 100}{\text{Total number of samples examined}}$$

The term “Percentage frequency” was used to assess the establishment and survivability of fungi in the litter (Udaiyan and Manian, 1990, 1991). Based on frequency, fungi were classified into five frequency classes as follows: rare (1-20% occurrence), Occasional (21-40%), frequent (41-60%), common (61-80%) and dominant.

$$\text{Percentage frequency} = \frac{\text{number of sampling months in which a particular fungus was recorded} \times 100}{\text{Total number of sampling month}}$$

Results

A total of 15, 20, 24 and 21 fungal genera were isolated from the decomposing litter of Disturbed, Undisturbed, Gragging and Fire wood area respectively. (Table 1-4)

The common genera found between the decomposing litters of study forests were *Absidia*, *Acremonium*, *Alternaria*, *Aspergillus*, *Curvularia*, *Dolimyces*, *Fusarium*, *Penicillium*, *Phoma*, *Rhizopus* and *Robillarda*. The litter specific fungi were also noted during decomposition in the study forests. The genera such as *Courella*, *Humicola*, *Moivedictys*, *Myrothecium*, *Sedlicobasidium* and *Ulocladium* were found only in the leaf litter of Disturbed area. Similarly, the genera such as *Aureobasidium*, *Drechslera*, *Spegazzinia*, *Eacniolle Taciolelle*, and *Thielavea* were present in the litters of Undisturbed area only.

The percentage of occurrence and frequency of various fungal species present in the Disturbed area given in (Table 1). It was higher for the species of *Aspergillus niger*(74) and it was followed by the *Alternaria sp*(58), *Fusarium solani*(57), *Phoma sp*(46), *Penicillium sp*(42) and *Mucor sp*(34). Of the 36 species isolated, 6 were dominant, 10 were frequent, 13 were occasional and 7 were rare. The dominant species present in this litter at all times of sampling during decomposition were *Alternaria sp*, *Aspergillus niger*, *Fusarium solani*, *Mucor sp*, *Penicillium sp* and *Phoma sp*.

The percentage occurrence of the fungal species in the Undisturbed area leaf litter during various sampling months in descending order were: *Penicillium sp* (69), *Aspergillus sp* (66), *Fusarium Solani* (56), *Phoma sp* (53), *Aspergillus niger* (31)

Nigrospora spherical (30). The distribution of frequency classes among the 34 species isolated were as follows: 6 were dominant, 3 were frequent, 20 were occasional and 5 were rare. The dominant species found in the decomposing litter were *Aspergillus niger*, *Aspergillus sp*, *Fusarium solani*, *Nigrospora spherical*, *Penicillium sp* and *Phoma sp*. (Table 2)

In Grazing area leaf litter the species with highest mean percentage occurrence in descending order were: *Penicillium sp* (71), *Aspergillus niger* (70), *Phoma sp* (67), *Cladosporium cladosporioides* (59), *Alternaria sp* (46), *Fusarium solani* (45), *Nigrospora spherical* (36) and *Curvularia lunata* (32). Thirty species were isolated, 9 were dominant, 2 were frequent, 13 were occasional and 6 were rare. The dominant species in the litter of Grazing area were *Alternaria sp*, *Aspergillus niger*, *Cladosporium*, *Curvularia lunata*, *Fusarium solani*, *Nigrospora spherical*, *Penicillium sp*, *Phoma sp* and *Trichoderma sp*. (Table 3).

In Fire wood area leaf litter the mean percentage occurrence of fungi was followed in order: *Penicillium sp* (76), *Nigrospora spherical* (69), *Mucor racemosus* (64), *Phoma sp* (62), *Trichoderma sp* (56), *Aspergillus niger* (55) and *Fusarium solani* (55). The distribution of frequency classes among the fungal species were: 7 dominant, one frequent, 18 occasional and 3 rare. The dominant species in the decomposing litter of Fire wood area were *Aspergillus niger*, *Fusarium solani*, *Mucor racemosus*, *Nigrospora spherical*, *Penicillium sp*, *Phoma sp* and *Trichoderma sp*. (Table 4).

Discussion

It is evident from the results that numerous hypomycetes and the type of fungal species occurring changes as decomposition progresses colonize tropical litter. Although fungi capable of infecting the living leaf (*Alternaria spp*) or colonizing the phylloplane (eg *Aspergillus spp*, *Chaetomium lunasporium*, *Curvularia lunata*, *Rhizopus spp*) appear first, they give way to other colonies with greater ability to degrade the dead leaf (eg *Ascochyta vulgaris*, *Scytalidium lignicola*, *Trichoderma spp*) which is a component of litter. Senthilkumar *et al.*, (1993) also found similar trend of fungal infection and establishment in the litters of tropical vegetation.

The results showed that a good number of fungi were common to all four study area while few others were restricted to each of litter. This may be due to the occurrence of species specific fungi (Macauley and Thrower, 1996). But the possibility of a chance occurrence of certain species of fungi on a particular litter can not be over ruled. However, in spite of this difference a general pattern of colonization by fungi is evident in this study.

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Table 1. Percentage occurrence and frequency of fungal species associated with the decomposing litter of Distrubed area.

Name of Fungi	Percentage occurrence									* Mean occurrence	Percentage Frequency	Frequency Class
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep			
<i>Absidia cylindrospora</i>	20	15	-	-	-	-	-	-	-	4	22	O
<i>Acremonium sp</i>	-	-	25	20	-	-	15	-	-	7	33	O
<i>Alternaria alternate</i>	30	30	-	-	-	-	-	-	-	7	22	O
<i>Alternaria solani</i>	30	35	40	45	-	-	-	-	-	17	44	F
<i>Alternaria sp</i>	40	40	60	55	65	60	50	45	50	46	100	D
<i>Aspergillus flavus</i>	15	25	20	30	-	-	-	-	-	10	44	F
<i>Aspergillus niger</i>	60	55	70	75	85	75	75	70	65	70	100	D
<i>A.terreus</i>	25	30	-	-	-	-	-	-	-	6	22	O
<i>Aspergillus sp</i>	15	-	-	-	-	-	-	-	-	2	11	R
<i>Cladosporium cladosporioides</i>	55	60	75	70	80	85	70	60	50	59	100	D
<i>Cladosporium herbarum</i>	15	20	-	-	-	-	-	-	-	4	22	O
<i>Curvularia clavata</i>	15	-	-	-	-	-	-	-	-	2	11	R
<i>C.lunata</i>	40	45	45	50	30	25	30	15	10	32	100	D
<i>Doliomyces mysorensis</i>	25	20	-	-	-	-	-	-	-	5	22	O
<i>Fusarium solani</i>	35	45	40	55	70	60	50	45	35	45	100	D
<i>Fusarium spp</i>	15	20	-	-	-	-	30	-	-	7	33	O
<i>Nigrospora spherica</i>	35	35	25	60	45	40	35	40	35	36	100	D
<i>N. saccharina</i>	-	-	-	20	-	-	-	-	-	2	11	R
<i>Penicillium citrinum</i>	15	-	-	-	-	-	-	-	-	2	11	R
<i>Penicillium corylophilum</i>	-	-	-	-	-	-	25	-	-	3	11	R
<i>Penicillium sp</i>	60	50	75	85	90	75	70	70	60	71	100	D

<i>Phoma sp</i>	30	50	70	80	85	85	80	70	55	67	100	D
<i>Rhizopus oryzae</i>	30	40	-	-	-	-	-	-	-	8	22	O
<i>Rhizopus sp</i>	20	30	35	-	-	-	-	-	-	9	33	O
<i>Robillarda sessilis</i>	15	20	-	-	-	-	-	-	-	4	22	O
<i>Robillarda sp</i>	-	-	-	-	-	25	30	-	-	6	22	O
<i>Syncephalastrum racemosum</i>	15	-	-	-	-	-	-	-	-	2	11	R
<i>Trichoderma koningii</i>	30	45	55	60	65	80	70	30	25	5	100	D
<i>Trichoderma viride</i>	15	25	20	-	-	-	-	-	-	7	33	O

* Values represent the mean of all sampling months: R=Rare; O=Occasional; F=Frequent; D=Dominant.

Table 2. Percentage occurrence and frequency of fungal species associated with the decomposing litter of undisturbed area.

Name of Fungi	Percentage occurrence									* Mean occurrence	Percentage Frequency	Frequency Class
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep			
<i>Absidia cylindrospora</i>	15	25	30	-	-	-	-	-	-	8	33	O
<i>Acremonium sp</i>	20	30	-	-	-	40	-	-	-	10	33	O
<i>Alternaria sp</i>	30	25	35	-	-	-	-	-	-	10	33	O
<i>Aspergillus flavus</i>	15	-	-	-	-	-	-	-	-	2	11	R
<i>A. nidulans</i>	-	-	-	20	25	-	-	-	-	5	22	O
<i>A. niger</i>	45	55	55	40	65	70	65	50	30	55	100	D
<i>Aspergillus sp</i>	25	20	30	-	-	-	-	-	-	8	33	O
<i>Chaetomium erraticum</i>	5	10	-	-	-	-	-	-	-	2	22	O
<i>Chaetomium lunasporium</i>	10	20	15	-	-	-	-	25	-	8	44	F
<i>C.spirale</i>	10	-	-	-	-	-	-	-	-	1	11	R
<i>Colletotrichum dematium</i>	20	25	-	-	-	-	30	-	-	8	33	O
<i>Curvularia.lunata</i>	15	15	20	-	-	-	-	-	-	6	33	O
<i>C.senegalensis</i>	20	30	-	-	-	-	-	-	-	6	22	O
<i>Doliomyces mysorensis</i>	-	-	25	35	40	-	-	-	-	11	33	O
<i>Emericella nidulans</i>	5	15	10	-	-	-	-	-	-	3	33	O
<i>Fusarium oxysporum</i>	10	-	-	-	-	-	-	-	-	1	11	R
<i>Fusarium solani</i>	40	50	65	85	75	65	50	35	30	55	100	D
<i>Melanospora sp</i>	10	20	-	-	-	-	-	-	-	3	22	O
<i>Mucor racemosus</i>	60	65	75	70	80	70	60	50	45	64	100	D
<i>Nigrospora spherica</i>	65	65	75	85	85	75	70	60	45	69	100	D
<i>Penicillium sp</i>	70	80	85	90	85	85	70	60	55	76	100	D
<i>Phoma sp</i>	50	60	65	70	75	80	70	50	40	62	100	D
<i>Phoma hebarum</i>	40	30	25	-	-	-	-	-	-	11	33	O
<i>Pithomyces chartarum</i>	-	-	-	-	-	-	-	20	30	6	22	O
<i>Rhizopus sp</i>	15	25	-	-	-	-	-	-	-	4	22	O
<i>Robillarda sessilis</i>	-	-	20	30	40	-	-	-	-	10	33	O
<i>Robillarda sp</i>	20	15	-	-	-	-	-	30	-	7	33	O
<i>Scytalidium lignicola</i>	-	-	-	-	-	-	-	25	30	6	22	O
<i>Trichoderma koningii</i>	45	50	60	75	70	65	55	45	40	56	100	D

* Values represent the mean of all sampling months: R=Rare; O=Occasional; F=Frequent; D=Dominant.

Table 3. Percentage occurrence and frequency of fungal species associated with the decomposing litter of Grazing area.

Name of Fungi	Percentage Occurrence							*Mean Occurrence	Percentage Frequency	Frequency Class
	Jan	Feb	Mar	Apr	May	Jun	July			
<i>Absidia cylindrospora</i>	20	30	35	-	-	-	-	12	43	F
<i>Acremonium sp</i>	20	-	-	-	-	-	-	3	14	R
<i>Alternaria sp</i>	40	50	55	75	75	60	50	58	100	D
<i>Aspergillus flavus</i>	15	25	30	-	-	-	-	10	43	F
<i>A. niger</i>	60	80	85	85	75	70	65	74	100	D
<i>Aspergillus sp</i>	30	40	45	-	-	-	-	16	43	F
<i>Cladosporium cladosporioides</i>	45	-	-	-	-	-	-	6	14	R
<i>Curvularia.lunata</i>	30	25	-	-	-	-	-	8	29	O
<i>Curvularia oxysporum</i>	15	30	25	-	-	-	-	10	43	F
<i>Coniella granata</i>	-	-	-	-	20	30	-	7	29	O
<i>Doliomyces mysorensis</i>	-	-	-	-	-	-	40	6	14	R
<i>Fusarium oxysporum</i>	-	20	30	35	-	-	-	12	43	F

<i>Fusarium solani</i>	50	55	55	65	70	60	45	57	100	D
<i>Fusarium sp</i>	15	20	-	-	-	-	-	5	29	O
<i>Hemicola grisea</i>	-	-	-	-	-	10	-	1	14	R
<i>Monodictys sp</i>	15	20	-	-	-	-	25	9	43	F
<i>Mucro sp</i>	40	45	50	50	30	15	5	34	100	D
<i>Myrothecium roridum</i>	10	20	-	-	-	-	-	4	29	O
<i>Myrothecium sp</i>	-	-	25	20	-	-	-	6	29	O
<i>Penicillium ciclopium</i>	20	30	-	-	-	-	-	7	29	O
<i>Penicillium digitatum</i>	-	-	-	-	-	25	30	8	29	O
<i>Penicillium sp</i>	25	30	40	50	65	50	35	42	100	D
<i>Pestalotiopsis sp</i>	15	-	-	-	-	-	-	2	14	R
<i>Phoma sp</i>	40	45	60	55	60	40	25	46	100	D
<i>Pyrenochaeta sp</i>	10	-	-	-	-	-	-	1	14	R
<i>Rhizopus nigricans</i>	20	30	35	-	-	-	-	12	43	F
<i>Rhizopus sp</i>	15	25	-	-	-	-	-	6	29	O
<i>Robillarda spp</i>	15	-	-	-	-	-	-	2	14	R
<i>Robillarda sessilis</i>	-	-	-	-	20	30	-	7	29	O
<i>Seolecobasidium variable</i>	-	-	10	-	-	20	-	4	29	O
<i>Scytalidium lignicola</i>	20	30	-	-	-	-	-	7	29	O
<i>Syncephalastrum racemosum</i>	15	-	30	40	-	-	-	12	43	F
<i>Trichoderma glaucum</i>	20	-	-	-	30	35	-	12	43	F
<i>Trichoderma sp</i>	30	35	-	-	-	-	-	9	29	O
<i>Trichoderma viride</i>	-	-	-	-	-	40	30	10	29	O
<i>Ulocladium atrum</i>	25	30	40	-	-	-	-	14	43	F

* Values represent the mean of all sampling months: R=Rare; O=Occasional; F=Frequent; D=Dominant.

Table 4. Percentage occurrence of fungal species associated with the decomposing litter of Fire wood area.

Name of fungi	Percentage Occurrence								*Mean occurrence	Percentage Frequency	Frequency Class
	Jan	Feb	Mar	Apr	May	Jun	July	Aug			
<i>Absidia cylindrospora</i>									14	50	F
<i>Acremonium sp</i>	20	30	-	-	-	-	-	-	6	25	O
<i>Alternaria sp</i>	30	20	-	-	-	-	-	-	6	25	O
<i>Alternaria alternate</i>	30	40	-	-	-	50	-	-	15	38	O
<i>A.dianthicola</i>	10	-	-	-	-	20	-	-	4	25	O
<i>A.tenuissima</i>	-	15	20	30	-	-	-	-	8	38	O
<i>Aschochyta vulgaris</i>	30	35	-	-	-	-	-	-	8	25	O
<i>Aspergillus carneus</i>	15	20	-	-	25	-	-	-	8	38	O
<i>Aspergillus flavus</i>	20	-	-	-	-	-	-	-	3	13	R
<i>A.niger</i>	40	35	40	25	20	15	50	20	31	100	D
<i>A. nidulans</i>	35	25	-	-	-	-	20	-	10	38	O
<i>A. terreus</i>	50	-	-	-	-	25	-	-	5	25	O
<i>Aspergillus sp</i>	30	60	65	80	85	75	70	65	66	100	D
<i>Aureobasidium pullulans</i>	25	30	35	-	-	-	-	-	11	38	O
<i>Chaetomium spirale</i>	10	15	20	-	-	-	-	-	6	38	O
<i>Chaetomium spirale</i>	15	-	-	-	-	-	-	-	2	13	R
<i>Cladosporium cladosporioides</i>	10	-	-	-	-	-	-	-	1	13	R
<i>Cladosporium cladosporioides</i>	20	25	-	-	-	-	-	-	6	25	O
<i>Colletotrichum dematium</i>	15	-	-	-	-	-	-	-	2	13	R
<i>Colletotrichum dematium</i>	25	30	-	-	-	-	-	-	7	25	O
<i>Curvularia.lunata</i>	30	40	-	-	45	-	-	-	14	38	O
<i>C.senegalensis</i>	55	65	70	75	60	55	40	25	56	100	D
<i>Doliomyces mysorensis</i>	25	15	30	35	40	55	20	15	30	100	D
<i>Doliomyces mysorensis</i>	60	65	70	85	80	65	60	65	69	100	D
<i>Drechslera halodes</i>	35	40	50	65	70	75	55	30	53	100	D
<i>Fusarium solani</i>	20	25	30	40	-	-	-	-	14	50	F
<i>Nigrospora spherical</i>	25	30	-	-	-	-	-	-	8	25	O
<i>Penicillium sp</i>	15	20	30	35	-	-	-	-	13	50	F
<i>Phoma sp</i>	20	-	-	-	-	-	-	-	3	13	R
<i>Rhizopus nodusus</i>	10	15	-	-	-	-	-	-	3	25	O
<i>R.stolonifer</i>	25	20	15	-	-	-	-	-	8	38	O
<i>Rhizopus sp</i>	-	-	-	30	35	-	-	-	8	25	O

<i>Robillarda sessilis</i>	15	20	-	-	-	-	-	-	4	25	O
<i>Robillarda sp</i>	-	-	-	-	-	-	20	30	6	25	O
<i>Spegazzinia lobulata</i>											
<i>S.tessartha</i>											
<i>Taeniolella exilis</i>											
<i>Thielavia terricola</i>											

* Values represent the mean of all sampling months: R=Rare; O=Occasional; F=Frequent; D=Dominant.