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SHORT COMMUNICATION

Aeromycoflora of mixed forest and Rubber plantation sites of Tripura

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The aeromycoflora in the mixed forest and rubber plantation have been studied by petriplate exposure method and Burkard Personal Air sampler for non-culturable fungi .The survey revealed 9 fungal genera and several sterile hyphae. The most predominant fungus was *Cladosporiu*m sp found in both the sampling sites. Sixteen genera were identified based on the spores collected by the non-viable methodology from both the sites. Ascospore was registered in a highest number of isolate in both the sites with regards to the genera with spore percentage. This study provides baseline information on composition of air borne fungi in mixed forest and rubber plantation of Tripura.

Key words: Aeromycoflora, *Cladosporium* sp, ascospores

Fungi from a wide variety of genera have a great capacity to colonise on kinds of substrate and develop in extreme environmental conditions, on soils, plants and animal sources. Spores from these fungi are usually airborne. The atmosphere of earth contains air borne virus, bacteria, protozoa, pollen grains, different propagules and vegetative cells of algae, fungi, lichens, bryophytes and pteridophytes. The composition and concentration of airborne fungal flora are, therefore largely determined by geographical location, meteorogical factor, vegetation and human activities as well as by a wide range of interrelated environmental and biological factors. Concentration of fungal spores in the atmosphere are influenced by the process involved in their production,release and deposition. Fungi thrive better in moist and warm places. Fungal spores in aquatic environments may be transferred to the air by wave action. Fungi in conjunction with bacteria break-down leaf litter rapidly. The airborne fungi along with other microbes play an important role in the energy turnover of the mangrove ecosystem. Their main habitats may be trunk, aerial roots, soil and the mangrove canopy. Only few studies reported a large number of fungi on leaves, barks, roots, fruits and soil but no study has previously been conducted on airborne microflora of mangroves at Pakistan's coast. Therefore, it was imperative to record and quantify the abundance and diversity of air-borne fungi and bacteria colonies in mangrove ecosystem to ensure the conservation of these forests. Agricultural operations are considered the most important sources of organic dusts and bio-aerosols in rural areas. The major objective of this study was to assess the abundance of airborne fungi.

Two different sites, mixed forest and rubber plantation were selected for the sampling of air borne fungi. Sampling was done monthly from January

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2015 to March2015. Cultivable airborne fungi were sampled using petriplate exposer method .using malt extract agar media and to check bacterial contamination. Streptomycin was added in the medium. At each selected location, three Petri plates containing sterile culture media were exposed horizontally for ten minutes. After that, the exposed Petri plates were sealed with paraffin strip and taken into the laboratory and incubated at 25 ± 2^{0}C for five days. The fungal colonies developed on the culture media were examined and identified with the help of standard mycological books and manuals. Percent of the fungal colonies developed on the plates were calculated.

The sampling was carried out by Burkard personal sampler placed at ground level. The slides in Burkard personal sampler were mounted with vaseline. After sampling the slides were observed under compound microscope to count the number of different fungal spore species. The fungal spore counts of the samples collected by the Burkard personal sampler at a suction rate of 10 liters/ minute were expressed in terms of number per m^3 of the air.

In our study, almost all airborne fungi isolated grew in filamentous forms and gave rise to characteristic colonies on the MEA medium. Nine genera and several sterile hyphae have been identified based on the Petriplate exposer methodology. The common fungi obtained from both sites during the sampling were *Aspergillus* sp, *Curvularia* sp., *Fusarium* sp, *Penicillium* sp, *Phoma* sp., *Mucor* sp., *Mortierella* sp, and *Nectria* sp. As shown in the Table 1 and 2, in mixed forest the percentage of *Cladosporium* sp was 57.48% , *Fusarium* sp 8.97 %, Penicillium sp 7.97 %, *Aspergillus* sp 4.65 %, *Curvularia* sp 3.99 % , *Phoma* sp 1.66 %, *Mortierella* sp 1.33 %, *Mucor* sp 0.66 % , *and Nectria* sp 0.66 % (Table 1). In contrast the percentage of *Cladosporium* sp in rubber plantation was 43.75 %, *Curvularia* sp 15.63 , % *Penicillum* sp 7.97 % , *Aspergillus* sp 8.59 % *Fusarium* sp 7.03% and *Phoma* sp 0.78 %. *Mucor* sp, *Mortierella* sp, *Nectria* sp, *Alternaria* sp ,Sterile hyphae of total viable fungi are found only in mixed forest, whereas, Unidentified sp.1, Unidentified sp.2, of total viable fungi are restricted to rubber plantation (Table 1 and 2). The amost predominant fungus was *Cladosporium* sp found in both the sampling sites .This great abundance of fungi in different environments is due to ease of dispersion of fungal spores in the air in both environments.

Sixteen genera were identified based on the spores collected by the non-viable methodology from both

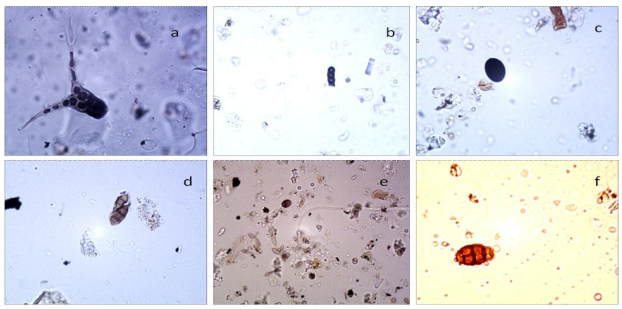

Fig. 1 : Non viable fungi collected from two sampling sites, a= *Tetraploa* sp, b= *Torula* sp, c= *Nigrospora* sp, d= Ascospores, e= *Cladosporium* sp, f= *Pithomyces* sp

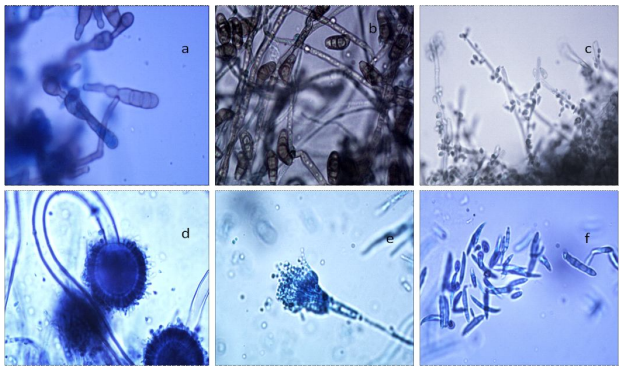

Fig. 2 : Viable fungi collected from two sampling sites, a= *Alternaria* sp, b= *Curvularia* sp, c= *Cladosporium* sp, d= *Aspergillus* sp, e= *Penicillium* sp, f= *Fusarium* sp

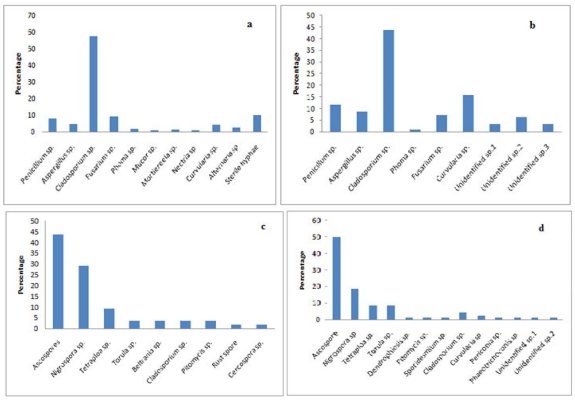

Fig. 3 : Percentage of viable and non viable fungi, a= Percentage of viable fungi in mixed forest, b= Percentage of viable fungi in rubber plantation, c= Percentage of non viable fungi in rubber plantation= Percentage of non viable fungi in mixed forest

the sites mixed forest and rubber plantation (Table 3 and 4). Most of the spores were from anamorphic fungi (i.e., *Beltrania* sp, *Cercospora* sp, *Curvularia* sp, *Nigrospora* sp, *Periconia* sp, *Pithomyces* sp, *Tetraploa* sp and *Torula* sp),but also some Ascomycetes (Ascospores) were found. In mixed forest, Ascospores was 50 %, *Nigrospora*

Table 1 : Total viable fungi in mixed forest

Fungal genera	January	February	March	Total count	%
Penicillium sp.	12	10	2	24	7.97
Aspergillus sp.	3	4	7	14	4.65
Cladosporium sp.	40	75	58	173	57.48
Fusarium sp.	3	10	14	27	8.97
Phoma sp.	5	0	0	5	1.66
Mucor sp.	2	0	0	2	0.66
Mortierella sp.	3	0	1	4	1.33
Nectria sp.	0	2	0	2	0.66
Curvularia sp.	0	0	12	12	3.99
Alternaria sp	1	5	2	8	2.66
Sterile hyphae	15	5	10	30	9.97
Total	84	111	106	301	

Table 2 : Total viable fungi in Rubber plantation

Fungal genera	January	February	March	Total count	%
Penicillum sp.	7	6	2	15	11.72
Aspergillus sp.	6	1	4	11	8.59
Cladosporium sp.	15	24	17	56	43.75
Phoma sp.	1	0	0	1	0.78
Fusarium sp.	0	2	7	9	7.03
Curvularia sp.	0	0	20	20	15.63
Unidentified sp.1	0	1	3	4	3.13
Unidentified sp.2	0	4	4	8	6.25
Total	29	38	57	124	

Table 3 : Total non viable fungi in mixed forest

Fungal genera	January	February	March	Total	Counts (CFU/m^3)	%
Ascospore	21	12	13	46	460	50
Nigrospora sp	6	2	9	17	170	18.48
Tetraploa sp.	4	2	2	8	80	8.7
Torula sp.	2	2	4	8	80	8.7
Dendrophiosis sp.	1	0	0	1	10	1.09
Pitomyces sp.	1	0	0	1	10	1.09
Sporidesmium sp.	1	0	0	1	10	1.09
Cladosporium sp.	2	1	1	4	40	4.35
Curvularia sp.	1	0	1	2	20	2.17
Periconia sp.	0	0	1	1	10	1.09
Phaeotrichoconis sp.	0	0	1	1	10	1.09
Unidentified sp.1	0	1	0	1	10	1.09
Unidentified sp.2	0	0	1	1	10	1.09
Total	39	20	33	92		

Table 4 : Total non viable fungi in Rubber plantation

Fungal genera	January	February	March	Total	Counts (CFU/m^3)	%
Ascospores	7	5	12	24	240	43.64
Nigrospora sp.	6	4	6	16	160	29.09
Tetraploa sp.	2	1	2	5	50	9.09
Torula sp.	2	0	0	2	20	3.64
Beltrania sp.	2	0	0	2	20	3.64
Cladosporium sp.	1	0	1	2	20	3.64
Pitomyces sp.	1	1	0	2	20	3.64
Rust spore	0	1	0	1	10	1.82
Cercospora sp.	0	1	0	1	10	1.82
Total	21	13	21	55		

sp 18.48 %, *Tetraploa* sp 8.7 %, *Torula* sp 8.7%, *Cladosporium* sp 4.35 %, *Curvularia* sp. 2.17 %, *Phaeotrichoconis* sp 1.09 % *Pitomycis* sp 1.09 %, *Sporidesmium* sp 1.09 %, *Cladosporium* sp 4.35 %, *Periconia* sp 1.09 %, and *Dendrophiosis* sp 1.09 % whereas in rubber plantations , Ascospores was 43.64 %, *Nigrospora* sp 29.09 %, *Tetraploa* sp 9.09 %, *Torula* sp 3.64 %, *Beltrania sp* 3.64 *Cladosporium* sp 3.64 % *Pitomycis* sp 3.64 % ,Rust spore 1.82 %,. *Cercospora* sp. 1.82.%. With regard to the genera with percentage of the spores (referred to the non-viable method), only Ascospores, *Nigrospora* sp, *Teraploa* sp, *Torula* sp *Curvularia* sp and *Cladosporium* sp were registered in a considerable number of isolates in both the sites (Table 3 and 4). *Dendrophiosis* sp, *Sporidesmium* sp , *Curvularia* sp , *Periconia* sp, *Phaeotrichoconis* sp ,Unidentified sp .2 of total non-viable fungi are found only in mixed forest .Whereas, *Beltrania* sp , Rust spore, *Cercospora* sp, of total non viable fungi are restricted to rubber plantation (Table 3 and 4).

This study of aeromycoflora in the natural habitat, combining a methodology based on identification by direct microscopy with the isolation and identification of viable propagules. In this study, 26 genera have been characterised in the atmosphere of the two sites, 16 of which recognised by non-culture-based methodology. The result revealed most reproductive of fungi were *Cladosporium* sp, *Fusarium*, *Penicillium* sp, *Aspergillus* sp *Curvularia* sp, *Phoma* sp , *Mortierella* sp, *Mucor* sp and *Alternaria* sp.

In mixed forest maximum colony recorded in February (111 colonies) but least number of colonies was recorded in January (84 colonies) whereas in rubber plantation maximum colony recorded in March (57 colonies) but least number of colonies was recorded in January (29 colonies) (Table 1 and 2).

The importance of *Cladosporium* sp has been corroborated by the high number of isolate obtained by the cultivation-based method. This taxon shows great percentage in both the sampling sites. *Cladosporium* sp showed the broadest spectrum range. On the other hand, *Aspergillus* and *Penicillium* showed moderate occurrence and the other fungal genera showed low and rare occurrence. Presence of different fungi in high attitude has also been observed by Sharma *et al,* (2011).

In the present investigation it was found that fungal genera was found maximum in mixed forest compared to rubber plantation in both cases viable and non viable and that might be due to maximum no. of plants in mixed forest, the amount of substrata available for colonisation more in mixed forest than to rubber plantation.

On the basis of the above investigations, it may be concluded that the mixed forest and rubber plantation is rapidly and extensively recolonised by airborne pathogenic fungi, possibly due to the fast decomposition of leaf litter. The proposed fungi of the mixed forest and rubber plantation can help in assessing the comparison and abundance of fungal species in different habitats.

Consequently it might be concluded that the natural habitat is a unique habitat where there are diverse sanctuaries for fungi. In the present study the identification of 26 fungal species form natural habitat revealed that although the natural habitat is also a potential substrate for harboring a large number of fungi.

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