

Study of Aeromycoflora in College And University Libraries in Amravati City Maharashtra, India.

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Abstract : Aeromycoflora simply refers to the airborne fungal contributors of the environment. A large number of airborne microfungi propagules were found in indoor and outdoor environments and generally widely distributed in nature. Indoor aerospora is reported to be responsible for deterioration of paintings, museum items and books. In the present research attempt were made to determine the aeromycoflora of indoor and outdoor environment of some college and university libraries in the Amravati City of Maharashtra state of India. The assessments of aeromycoflora of these libraries were performed in between January 2017 to April 2017. The aim of this study was to determine aeromycoflora, their identification, concentration and diversity in both indoor and outdoor environment. The culture plate exposure method was employed for the isolation of fungal species. The prevailing presence of *Aspergillus niger*, *Alternaria alternata*, *Rhizopus sp.* and *Penicillium sp.* were accounted for a high percentage in indoor environment whereas outdoor environment showed clear dominance of *Aspergillus flavus*, *Aspergillus niger*, *Cladosporium sp.* and *Penicillium sp.* Among all the fungal spore types the taxonomic group Deuteromycotina showed dominance in total spore contribution.

Keywords: Aeromycoflora, *Aspergillus*, *Alternaria*, Indoor and outdoor environment in libraries

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I. Introduction

Aeromycoflora simply refers to the airborne fungal contributors of the environment. The term aerobiology was coined by American plant pathologist Fred Campbell Meier to denote the airborne fungal spores, pollen grains and other airborne microbes (1). Fungal spores represent major fraction of bioaerosol with more than 80,000 species of which the majority are cosmopolitan in origin (2). A large number of airborne microfungi propagules were found in indoor and outdoor environments and generally widely distributed in nature. Several microfungi species have the potential adverse effect to cause allergies, spoilage of foods and many other adverse health effects (3-8). Indoor aerospora is reported to be responsible for deterioration of paintings (9,10) museum items (6,7) and books (8,9,10). Books, papers and other documents preserved in libraries are important and valuable cultural heritage for nation and knowledge of all kinds in these articles are passed continuously to future generation (12). These are considered as precious legacies as they have capacity to remind people about their religion and traditional ethnicity. It is the urgent need to conserve these materials in libraries and archival setting. The aeromycoflora of outdoor and indoor environment causes bio-deterioration and damage to books and other materials (13). Investigation by previous researchers showed that some fungi like *Aspergillus candidus*, *A.niger*, *A.versicolor*, *Cladosporium cladosporioides*, *C.herbarum*, *Penicillium brevicompactum*, and *P.chrysogenum* can increase the allergic reactions (14). The symptoms of these fungal components include sinus and eye irritation, headache, tiredness, sore throat, weakness and severe asthma (15). To assess the presence of the fungal aeroflora and their role in allergic reactions in college and university libraries studies were carried out by different researchers (16,17,18,19,20,21,22)

In the present research attempt were made to determine the aeromycoflora of indoor and outdoor environment of some college and university libraries in the Amravati City of Maharashtra state of India. The assessments of aeromycoflora of these libraries were performed in between January 2017 to April 2017. The aim of this study was to determine aeromycoflora, their identification, concentration and diversity in both indoor and outdoor environment.

II. Material And Methods

The culture plate exposure method was employed for the isolation of fungal species. Indoor and outdoor aeromycoflora were isolated on PDA (Potato Dextrose Agar) media on weekly intervals with petri-plates of 10cm diameter from January 2017 to April 2017. Petri-plates were exposed for 10 minutes in two sections of two college libraries and one university library namely-1. Brijlal Biyani Science College 2. Bhartiya Mahavidyalaya 3. Sant Gadge Baba Amravati University, Amravati in Amravati city of Maharashtra state of

India. One section comprises of reading room and the other where books are stored in racks. The exposed petri-plates were brought into the laboratory and incubated at $28 \pm 1^\circ \text{C}$ for 7 days. After 3rd, 5th and 7th days of incubation the fungal colonies were counted. At the end of 7th days of incubation the fungus was isolated and pure culture was maintained. For the purpose of identification and microphotography, slides were prepared with lacto-phenol cotton blue as the standard stain. Isolates were identified with the help of available literature (Barnett, 1969; Nigmani et al. 2006). Micro-photography was performed by digital microscopes in the laboratory of Department of Botany, Brijlal Biyani Science College Amravati.

Percentage contributions of individual species were calculated as per the standard formula:

$$\text{\% of Contribution} = \frac{\text{Total No .of Colonies of One species}}{\text{Total No. of colonies of all species}} \times 100$$

III. Result And Discussion

The result of aeromycological survey conducted in the three libraries shows that libraries are full of aeromycoflora in indoor and outdoor environment both. A total of 11 types of fungal spores were identified from indoor and outdoor environment in the library of Brijlal Biyani Science College Amravati, with single sterile hyphae and rest 10 spore types (table 1 and 2). According to their occurrence in the exposed petriplate samples, the highest population in terms of percentage occurrence were of *Aspergillus niger* (indoor- 17.14 %) and *Alternaria alternaria* and *Rhizopus* sp.(outdoor 16%) and *Aspergillus flavus* *Candida* sp. and *Rhizopus* sp (indoor-14.28 % and outdoor-66%). From Bhartiya Mahavidhyalay’s library total 9 fungi were isolated out of which 8 were spore types and one was sterile hyphae (table3 and 4). Highest population in the indoor and indoor population was of *Aspergillus flavus* (31.03% -indoor and 18.51%). In the library of Sant Gadge Baba Amravati University total 10 fungal species were reported out of which 9 were spore types and one was sterile hyphae. Highest population among the exposed petriplate samples were of *Rhizopus* sp. (16.66%) and *Candida* sp.(13.33%) in the indoor environment and *Alternaria alternata* (16.66%) and *Cladosporium* sp.(16.66%) and *Rhizopus* sp (16.66%) in the outdoor environment.

Alternaria alternata, *Aspergillus* sp. *Rhizopus* sp. *Penicillium* sp. and unidentified sterile hyphae types were present more frequently in indoor. Alternatively, *Aspergillus flavus*, *Aspergillus niger*, *Cladosporium* sp., *Penicillium* sp. and sterile hyphae forms were found to be more prevalent in outdoor section. Among all the fungal spore types the taxonomic group Deuteromycotina showed dominance in the total spore contribution.

Table1. Total count and percentage contribution of fungal colony from indoor environment of the Brijlal Biyani Science College Library, Amravati.

Spore types	Day I	Day II	Day III	Total no. of colonies	% Count of Fungal colonies
<i>Alternaria alternata</i>	2	-	-	2	5.71
<i>Candida</i> sp.	-	3	-	5	14.28
<i>Aspergillus niger</i>	2	-	4	6	17.14
<i>Aspergillus flavus</i>	2	3	-	5	14.28
<i>Cladosporium</i> sp.	-	1	2	3	8.75
<i>Humicola</i> sp.	2	-	-	2	5.71
<i>Penicillium</i> sp.	-	-	2	2	5.71
<i>Rhizopus</i> sp.	1	2	-	5	14.28
<i>Amblysporium</i> sp.	-	4	-	4	11.42
Sterile hyphae	-	1	-	1	2.85
Total	9	14	8	35	100.13

Table 2. Total count and percentage contribution of fungal colony from outdoor environment of the Brijlal Biyani Science College Library, Amravati.

Spore types	Day I	Day II	Day III	Total colonies no.of	% count of fungal colony
<i>Alternaria alternata</i>	4	-	-	4	16
<i>Aspergillus niger</i>	3	-	-	3	12
<i>Aspergillus flavus</i>	-	-	2	2	8
<i>Cladosporium</i> sp	-	2	-	2	8
<i>Humicola</i> sp	1	2	-	3	12
<i>Penicillium</i> sp	2	-	-	2	8
<i>Rhizopus</i> sp.	-	3	-	3	16
<i>Sterile hyphae</i>	2	-	-	2	8

Total	12	7	2	25	88
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Table 3. Total count and percentage contribution of fungal colony from indoor environment of the Bhartiya Mahavidyalay Library, Amravati.

Spore types	Day I	Day II	Day III	Total no.of colonies	% count of fungal colony
<i>Mucor sp.</i>	-	3	-	3	10.34
<i>Aspergillus niger</i>	2	-	1	3	10.34
<i>Aspergillus flavus</i>	3	1	5	9	31.03
<i>Aspergillus candidus</i>	1	-	2	3	10.34
<i>Fusarium sp.</i>	-	1	-	1	3.44
<i>Penicillium sp.</i>	-	-	2	2	6.89
<i>Rhizopus</i>	-	3	-	3	10.34
<i>Cladosporium sp.</i>	1	-	2	3	10.34
<i>Sterile hyphae</i>	-	-	2	2	6.89
Total	7	8	14	29	99.95

Table 4. Total count and percentage contribution of fungal colony from outdoor environment of the Bhartiya Mahavidyalay Library, Amravati.

Spore types	Day I	Day II	Day III	Total no.of colonies	% count of fungal colony
<i>Mucor sp.</i>	2	1	-	3	11.11
<i>Aspergillus niger</i>	1	2	1	4	14.81
<i>Aspergillus flavus</i>	-	2	3	5	18.51
<i>Aspergillus candidus</i>	-	2	-	2	7.40
<i>Fusarium sp.</i>	-	2	-	2	7.40
<i>Penicillium sp.</i>	-	-	3	3	11.11
<i>Rhizopus sp.</i>	4	1	-	4	14.81
<i>Cladosporium sp.</i>	-	2	-	2	7.40
<i>Sterile hyphae</i>	-	-	2	2	7.40
Total	7	12	9	27	99.95

Table 5. Total count and percentage contribution of fungal colony from indoor environment of Sant Gadge Baba Amravati University Library.

Spore types	Day I	Day II	Day III	Total NO.of colonies	% count of fungal colony
<i>Alternaria alternata</i>	-	3	-	3	10
<i>Aspergillus niger</i>	-	3	-	3	10
<i>Amblyosporium sp.</i>	2	-	1	3	10
<i>Helminthosporium sp.</i>	1	2	-	3	10
<i>Candida sp.</i>	-	3	1	4	13.33
<i>Penicillium sp.</i>	1	-	-	1	3.33
<i>Rhizopus sp.</i>	-	4	1	5	16.66
<i>Cladosporium sp.</i>	2	-	1	3	10
<i>Sterile hyphae</i>	-	-	2	2	6.66
<i>Mucor sp.</i>	-	-	3	3	10
TOTAL	6	15	9	30	99.98

Table 6. Total count and percentage contribution of fungal colony from outdoor environment of Sant Gadge Baba Amravati University Library.

Spore types	Day I	Day II	Day III	Total No.of colonies	% count of fungal colony
<i>Alternaria alternata</i>	-	3	1	4	16.66
<i>Amblyosporium sp.</i>	-	2	1	3	12.5
<i>Helminthosporium sp.</i>	2	-	-	2	8.33
<i>Candida sp.</i>	-	-	2	2	8.33
<i>Penicillium sp.</i>	2	-	-	2	8.33
<i>Rhizopus sp.</i>	-	3	1	4	16.66
<i>Cladosporium sp.</i>	-	4	-	4	16.66
<i>Sterile hyphae</i>	-	3	-	3	12.5

TOTAL	4	15	5	24	91.64
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IV. Conclusion

Indoor aeromycoflora from library is known to be significant in respect of allergic as well as air borne diseases and also involve in deterioration of cellulosic and non-cellulosic materials. The present research reveals that there are diverse mycoflora in indoor and outdoor environment of the libraries. The further detail study based on the atmospheric parameters could provide data for better understanding the correlation between abiotic and biotic factors. The effect of airborne fungal spores on human health is also point of concern which could be studied by the use of preliminary data provided in this research article. Exposure to indoor airborne inhalant mould allergens develops respiratory symptoms, airways disorders and allergies may impose the direct impact on students and other human population inside and outside these libraries.

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