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The monitoring of airborne mycoflora in the indoor air quality of library

Swapna Kalbende, Lalchand Dalal*, Mousumi Bhowal

**Department of Botany, J. B. College of Science, Wardha.*
Department of Botany, Hislop College, Nagpur.

ABSTRACT

Air is the most important content in the environment. Various microbiological factors are present in the environmental air. Aerobiological studies are of great importance as they provide qualitative and quantitative information about airborne fungi in a given region. In the present investigation, the mycoflora from two sections of a library of Wardha city were investigated between May, 2010 to April, 2011. In this study, 17 species in 11 genera were trapped, isolated and identified. From Ist and IInd sections of library, 329 and 453 fungal colonies were observed respectively. The study was under taken by petri-plate exposure method using PDA (Potato Dextrose Agar) and CZA (Czapek Dox Agar) media in a 10 cm diameter petri-plate. A total of 11 fungal genera obtained were identified and the rest which are not identified were kept as unidentified fungi. Aspergillus niger (I-19.45% and II-22.07%) and Aspergillus fumigatus (I-18.24% and II-10.59%) were the dominant fungal species in the present experimental study than the other rest form of fungi.

Keywords: Mycoflora, PDA, CZA, Petri-plate exposure method, *Aspergillus niger*.

INTRODUCTION

The term aerobiology was first coined by the American plant pathologist "Fred cambell meier" in 1930. So the term aerobiology came in use since 1930 to denote the airborne fungal spores, pollen grains and other airborne micro-organisms. The outdoor environment is never completely free from the incidence of microbial propagules, which are collectively called as "air spora". The term "air spora" is suggested by Gregory in 1952.

As aerobiology deals in large parts with bio-particles present in air, it contributes a lot in enumeration of types of bio-particles present. Among all the air borne bio-particles, fungal spores constitute the greatest and most important portion in air [1]. On this basis, of the recent aerobiological investigations, it can be broadly classified into two categories as Indoor or Intramural aerobiology and Outdoor or Extramural aerobiology [2]. The indoor aeromycology includes the study of indoor aeromycoflora of libraries [3-5], hospitals [6-9], museum [10, 11], recidential and office environment [12], poultry shed [13, 14], school and public institutions [15] etc.

Books and documents in libraries are valuable cultural heritage as books and papers carry all kinds of knowledge through the barriers of time and have a capacity to pass them to the youngsters in future. Papers and books are considered as precious legacies that remind people of their culture, religion and ethnic tradition. They deserve to be maintained and conserved in their original condition in some special places such as libraries.

The fungi present in indoor air of library causes bio-deterioration of books and other materials in library, as these books provide nutrient source for the growth of fungi. Due to the bio-deterioration, books may be damaged, deteriorated or discoloured in pictures and prints [16, 17]. The bio-deterioration of books may be caused by the influence of the environment [18]. The changes in the weather condition, affects airspora both qualitatively and quantitatively [19]. The relative humidity, temperature and rainfall play a key role in the occurrence of fungal spores in the indoor air of library [20]. In addition to this, fungal growth on materials is initiated by conidia from airspora which have fallen on the surface and germinates [21].

Aero-mycology deals with the study of air borne fungi and their spores. Fungi have both beneficial and nuisance effects on our lives. From the negative point of view they destroy our food, fabrics, leather and other similar articles. They are also responsible for causing a large number of diseases in the plants like Rust, Smut, Blight, Mosaic etc. They can also cause diseases in humans like athlete's foot, and skin infection like Dermatophytosis or ring worm infection or tinea is by far the most common disease in human beings [22]. Several more serious diseases are caused by fungi, because fungi are more chemically and genetically similar to animals than other organisms. This makes fungal diseases very difficult to treat.

MATERIALS AND METHODS

Various investigative techniques were employed in aero-mycological studies. The gravity petri-plate exposure method were employed for the isolation of fungal species employed PDA (Potato Dextrose Agar) and CZA (Czapek Dox Agar) media at monthly intervals with petri-plates of 10cm diameter from May 2010 to April 2011. Petri-plates were exposed for 10 minutes in two sections of a library of Wardha city. 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 ± 1^0C. for 4-5 days. At the end of incubation period the fungal colonies were counted, isolated and identified with the help of available literature (Barnett, 1969; Nigmani et al. 2006). For species identification, specimen microscopic slides were prepared with the help of glycerine jelly as mounting media and lacto-phenol cotton blue as the standard stain.

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

$$\% \ Contribution = \frac{Total\ no.of\ colonies\ of\ one\ species}{Total\ no.of\ colonies\ of\ all\ species} \times 100$$

Metrological parameters like temperature (°C), relative humidity (%) etc. had profound effect on air-borne fungal species both qualitatively and quantitatively and should be concerned. Temperature and Humidity were recorded in the libraries during the sampling period using a Hygrometer. (Table- I)

RESULTS AND DISCUSSION

The data depicted in the Table II shows that, a total of 17 species in 11 genera were trapped, isolated or recovered and identified. These identified species were *Aspergillus niger, A. fumigatus, A. flavus, A. caespitosus, A. nidulans, Aspergillus parasiticus, Penicillium citrinum, Alternaria alternata, Alternaria tenuissima, Curvularia lunata, Fusarium spp., Rhizopus spp., Mucor spp., Chaetomium spp., Helminthosporium spp., Geotrichum spp., Drechslera spp.*

According to their occurrence in the exposed petri-plates samples, the total population in terms of percentage occurrence were presented in Fig.1. *Aspergillus niger* (I-19.45%) and (II-22.07%), *Aspergillus fumigatus* (I-18.24%) and (II-10.59%) followed by *Curvularia lunata* (I-10.33%) and (II-8.39%) were of high occurrence. *Penicillium citrinum* (I-6.69%) and (II-7.95%), *Alternaria alternata* (I-7.29%) and (II-6.62%), *Alternaria tenuissima* (I-4.26%) and (II-7.95%), *Rhizopus spp.* (I-4.26%) and (II-5.30%), *Aspergillus nidulans* (I-3.65%) and (II-7.95%), *Aspergillus flavus* (I-4.86%) and (II-6.62%) were of moderate occurrence. Seven genera were of low occurrence, namely *Aspergillus caespitosus* (I-2.43%) and (II-2.87%), *Aspergillus parasiticus* (I-1.22%) and (II-0.66%), *Fusarium spp.* (I-1.52%) and (II-1.55%), *Mucor spp.* (I-2.13%) and (II-1.10%), *Chaetomium spp.* (I-2.43%) and (II-1.77%), *Helminthosporium spp.* (I-2.43%) and (II-2.21%), *Geotrichum spp.*(I-2.74%) and (II-2.43%), *Drechslera spp.* (I-1.82%) and (II-1.77%). *Aspergillus niger* dominated the airspora and exhibited the highest concentration in both the sections of library.

Table I: Average temperature and relative humidity recorded from two sections of Gandhi Gyan Library of Wardha City.

Months	Temperature (°C)		Humidity (%)	
	I	II	I	II
May	41.0	39.9	37	41
June	33.8	32.2	69	74
July	32.1	28.5	78	88
August	33.6	31.1	71	75
September	32.4	32.0	68	67
October	30.2	28.4	74	79
November	29.9	29.3	75	76
December	24.8	24.9	66	62
January	26.5	25.1	62	64
February	27.0	26.5	58	58
March	29.8	29.1	55	57
April	32.2	31.7	52	50

Abbreviations: I = Reading room, II = *Book store room.*

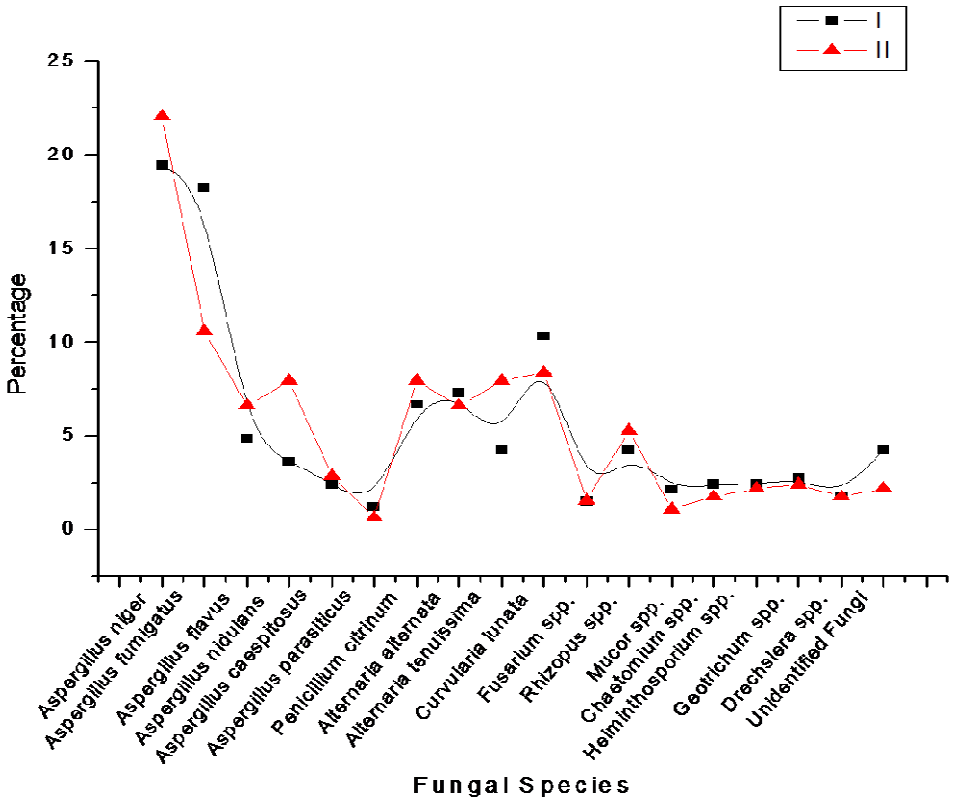
Table II: Number of colonies and % contribution of Aero-mycoflora isolated from two different sections of Gandhi Gyan Library of Wardha City

Fungal types	Sections of Library	Fungal colonies	Total %
Aspergillus niger	I	64	19.45
	II	100	22.07
Aspergillus fumigatus	I	60	18.24
	II	48	10.59
Aspergillus flavus	I	16	4.86
	II	30	6.62
Aspergillus nidulans	I	12	3.65
	II	36	7.95
Aspergillus caespitosus	I	08	2.43
	II	13	2.87
Aspergillus parasiticus	I	04	1.22
	II	03	0.66
Penicillium citrinum	I	22	6.69
	II	36	7.95
Alternaria alternata	I	24	7.29
	II	30	6.62
Alternaria tenuissima	I	14	4.26
	II	36	7.95
Curvularia lunata	I	34	10.33
	II	38	8.39
Fusarium spp.	I	05	1.52
	II	07	1.55
Rhizopus spp.	I	14	4.26
	II	24	5.30
Mucor spp.	I	07	2.13
	II	05	1.10
Chaetomium spp.	I	08	2.43
	II	08	1.77
Helminthosporium spp.	I	08	2.43
	II	10	2.21
Geotrichum spp.	I	09	2.74
	II	11	2.43
Drechslera spp.	I	06	1.82
	II	08	1.77
Unidentified Fungi	I	14	4.26
	II	10	2.21
Total	I	329	--
	II	453	

Abbreviations: I = Reading room, II = Book store room.

Aspergillus fumigatus, *Aspergillus parasiticus*, *and Mucor spp*. showed their highest occurrence in the reading room while the other fungal species having their highest occurrence in the room where books are stored. Fungal flora was collected from the two sections of a library, out of these fungal flora collected from room where books are stored in

racks showed the highest isolated number of fungal colonies than that of the fungal colonies isolated from the reading room.



I = Reading room, II = Book store room.

Figure 1: Percentage contribution of fungal species

CONCLUSION

From the result and discussion it was concluded that, mycoflora of indoor environment of library, various types of fungal species were isolated, out of which some are harmful to the books stored in the library and also cause some health problems like asthma and some other respiratory disorders to the readers and visitors. Indoor concentrations of fungal spores in the IInd section of library were found to be higher than that of the Ist section, it may be because of the favourable conditions for the growth of fungi like stored books and the dust present on the books, deficiency of cleanliness and the humidity.

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REFERENCES

[1] J Salvaggio and A Lars, *J. of Aller. and Clin. Immunol*., **1981**, 68, 327-364.
[2] ST Tilak, Aerobiology, *Vaijayanti Prakashan*, Aurangabad, **1982**, 1-211.
[3] ST Tilak and M Saibaba, *IJ. PI. Nature*, **1984**, 1(2), 1-10.
[4] RN Tripathi, *Water Air Soil Pollut*., **1987**, 34, 125-137.
[5] SM Nitrini, GR Matle and MH Matle, In: *Preprints of 2nd Int. Conf. on Biodeterioration of Cultural Property-2*, Yokohama, Japan, **1992**, 221-227.

[6] M Babu, Indoor air mycoflora and its relevance to human to human allergy. Part II Ph.D. thesis, Marathwada University, Aurangabad, **1983**.
[7] VW Greene, D Vesley, RG Bond and GS Michaelsen, *Appl. Microbiol*., **1962**, 10, 561-566.
[8] WC Noble and YM Clayton, *Journal of General Microbiology*, **1963**, 32, 397.
[9] N Joshi, L Singh, P Rawat and P Chaudhary, *International Journal of Plant Sciences*, **2006**, 1 (1), 107-110.
[10] YY Barve and RP Thakre, Investigation of the Deterioration of Paintings by Fungi. Published in 2nd Int. Conf. on Biodeterioration of Materials, Yokohoma, Japan, **1992**.
[11] A Ary, AR Shah and S Sadasivan, *Current Science*, **2001**, 81 (7), 793-798.
[12] SJ Reynolds, AJ Striefel and CE McJilton, *Am. Ind. Hyg. Assoc. J*., **1990**, 51, 601-604.
[13] HL Chute and M Gershaman, *Poultry Sciences*, **1961**, 49, 568-571.
[14] ST Tilak and M Saibaba, *Ind. Vet. J*., **1986**, 63, 356-361.
[15] S Gravesen, L Larsen and P Skov, *Ecology Disease*, **1983**, 2, 411-413.
[16] RL Hughes, In : *Biodeterioration of Materials* (Ed. by Walters A.H., and Elphick, J.J., Amsterdam : Elsevier Publishing Co., Ltd), **1968**, 281-289.
[17] T Ohtsuki, *Trans. Mycol. Soc*., (Japan), **1982**, 23, 165-175.
[18] S Chingduang, L Manoch, S Tantayaporn, C Voongkaluang and P Siriacha, In : *Preprints of 3rd Int. Conf. on Biodeterioration of Cultural Property-3*, Bangkok, Thailand, **1995**.
[19] DD Cunningham, Microscopic examination of air. Government Printer, Calcutta, **1873**, 58.
[20] VF Marchisio and D Airarudi, *Mycologia*, **2001**, 93(5), 831-840.
[21] MLE Florian, *Leather conservation News*, **1994**, 10, 1-29.
[22] S Madhavi, MV Rama Rao and K Jyothsna, *Scholars Research Library Journal, Annals of Biological Research*, **2011**, 2(3), 88-93.