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INFLUENCE OF INTRAMURAL FUNGAL SPORE CONCENTRATION IN LIBRARY ENVIRONMENT BY CULTURE PLATE METHOD AT NAGPUR CITY (MS), INDIA

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ABSTRACT: Studies on the aerobiology of indoor environments are gaining importance now-a days as exposure to these indoor areas causes serious allergic problems. Indoor air quality decreases because of the pollution. Air monitoring is useful to detect the indoor and outdoor aerospora. Indoor environment which is rich in biocomponents and fungal spores. Fungal spores are dominated in number as compared to other biocomponents. Aeromycologists were concentrating on survey of indoor environment and this analysis has helped to focus attention on the adverse effect of fungal spores as these are impacted on various substrates. This paper reviews concentration of fungal spores from indoor air on culture media like Potato Dextrose Agar (PDA) for consecutive two years September 2010 to August 2012 from University Library at Nagpur. Total 21 species belonged to 15 genera were observed on PDA. A total of 4678 fungal colonies were recorded of which 2333 colonies (49.87%) were isolated during 1st year and 2345 colonies (50.12%) were isolated in the 2nd year. 21 identified species of fungi accounted along with single unidentified group. *Aspergillus, Cladosporium, Curvularia, Alternaria, Helminthosporium, Penicillium, Nigrospora, Rhizopus, Mucor and Cercospora* were the dominant fungal colonies. The occurrence of fungal spores was correlated with weather parameters. An attempt was made to forecast atmospheric fungal concentration in library environment.

Key words: - Biocomponents, indoor environment, fungal spores, PDA, weather parameters

INTRODUCTION :

In recent times, air quality of indoor environment has become an important health concern. According to Edmonds and Benninghoff (1973), aerobiology is scientific and multidisciplinary approach focused on the transport of organisms of biologically significant materials. The contamination of indoor environment with the presence of microbial population and other chemical contaminates is certainly a major problem and it includes viruses, bacteria, fungal spores, pollen grains, algal filaments, hyphal fragments, insect parts, mites etc. All these contribute to the so called biopollutants of the atmosphere, also termed as “aerospora”.

Tilak and Vishwe (1975) studied the microbial content of air inside library and concluded that air borne microbes are responsible for deterioration of library materials. Pelczar, *et. al.,* (1993) stated that intramural study of air-spora is also importance due to its role in microbial deterioration of the microbial deterioration of the materials like paper, textile, printed surface etc. Study of aeromycoflora of library is especially important as the old books with bindery glues and fabrics support the growth of fungi. In the favorable condition they proliferate and damage the books by staining. They can destroy cellulose and decompose binding materials, leather & plastics. Microbes are airborne and often responsible for biodeterioration of storage materials in library is a serious problem (Dhavan, 1986). Sunlight and aeration is very important to maintain books in good condition for several years, and human interference may cause serious problem of deterioration of books. The airborne microbes may cause pulmonary

health risks to the users and employs of the library apart from affecting the library materials (Atluri and Padmini, 2002). Libraries are one such atmosphere where working staff, common people and students of different colleges as well as schools spend time in consulting the books journals, newspapers and other monumental works.

Under favorable conditions these microbes grows and reproduce. The adverse effects of fungal components inside library not only deteriorate paper material but significantly affect the health of library staff. According to Bhattacharjee, *et. al.,* (2010), finished paper is also subjected to microbial attack, especially of fungal attack. According to them glue also serve as substrate for fungi. Under favorable condition the paper may be stained or discolored by the product of microbial metabolism and in severe cases it may lead to perforation and even complete destruction of the paper. So keeping in mind such adverse effect of fungal flora on library materials, staff and students this investigation was carried out. This work also help aerobiolologists and allergologists to solve problems related to biodeterioration of library material and allergy.

MATERIAL AND METHOD:

Culture media: For the present research work two different culture media were used to detect the fungal spores.

Potato Dextrose Agar (PDA): Potato (peeled) 200.0 g, 2) Dextrose 20.0 g, 3) Agar 20.0 g, 4) Distilled water1000 ml. When the media was cooled to appropriate temperature Streptomycin / Ambistrin was added before pouring in petriplate to avoiding the contamination of bacteria Petriplates containing culture media were exposed in indoor air at fortnightly intervals for consecutive two years in RTMNU Library at Nagpur.

Preparation of slides and identification

After exposing, the petriplates were left at room temperature for 7 to 8 days until the colonies matured. The slides were prepared by using lacto phenol cotton blue stain and then colonies were identified for both i.e morphology and characteristic sporulation. Then developing colonies were counted, examined, and identified up to generic level. Examination and identification of fungal spores was carried out with the help of standard literature (Ainsworth, 1973 ; Burnett, 1960 ; Booth, 1971; Ellis, 1971 ; Hawhsworth, 1983 ; Kendrik, 1971 ; Neergaard, 1979 ; Thom and Raper, 1945 ; Tilak, 1989).

RESULT AND DISCUSSION:

Investigation has been carried out mainly because of the allergenic constituents and their origin from air. From ancient time it has been established that the inhalation of fungal spores causes acute symptoms in allergic individuals. PDA nutrient medium is used collection of air samples for the detection of fungi. During investigation period 21 species belonged to 15 genera were observ**ed.** A total of 4678 colonies were recorded of which 2333 colonies (49.87%) observed during 1st year and 2345 colonies (50.12%) in the 2nd year. **21** identified species of fungi accounted along with single unidentified group. During investigation period *Aspergillus, Cladosporium, Curvularia, Alternaria, Helminthosporium, Penicillium, Nigrospora, Rhizopus, Mucor* and *Cercospora* were the dominant fungal colonies during the study period. *Cladosporium* was a major component of library environment was many workers (Tilak and Kulkarni, 1972; Tilak and Pillai, 1988; Verma and Khare; 1985; Shukla et. al., 1989). Tilak, *et. al.,* (1981) 11 types were found to destroy the paper. Tilak (1982) who emphasized the need of using two trapping methods during aerobiological surveys one for the microscopic assessment of the total aerospora and other for the identification of predominant types in

nature. Pillai (1983) isolated the fungi like *Chaetomium, Aspergillus, Penicillium* and *Curvularia* from the deteriorated book papers, subsequently in the culture filtrate and showed that all the fungi possessed cellulolytic activity. Atluri and Padmini (2002) reported the altogether 3296 fungal colonies on PDA nutrient medium of which 95.05% were spores forming. They studied that *Aspergillus* was represented by 13 species, *Curvularia* by Six species, *Alternaria* by five species, *Fusarium* by four species & *Penicillium* by two species.

Common aeroallergenic fungi includes *Alternaria, Aspergillus, Candida, Chaetomium, Cladosporium, Curvularia, Epicoccum, Fusarium, Helminthosporium, Nigrospora.* Correlation between total airborne fungi and meteorological parameters was analyzed statistically. During study period seasonal occurrence of *Aspergillus flavus* (11.10%, 11.54%) was dominant in winter followed by rainy (10.78%) and summer season (9.81%). The predominance of *Aspergillus* sp. in libraries has been studied by Burge *et. al.,* (1977). Predominance of Aspergillus in the indoor air of library were also reported from Chennai (Nandimuthu and Vittal, 1995). In winter season the percentage of fungal colonies in both the years was 41.28% and 40.46% respectively. Concentration of fungal colonies were comparatively less in summer and rainy season.

During the study period August and December was the month of highest incidence of fungal colonies while May and June were the lowest incidence of fungal colonies in 1st and 2nd year respectively from library environment. The airborne microbes may cause pulmonary health risks to the users and employees of the library apart from affecting the library materials.

Indoor environment of library showed that *Chaetomium* was the cellulose degrading fungi and common on books. During the investigation period *Chaetomium* was recorded in the library environment. It was observed from library environment at Aurangabad (Pillai, 1983). According to Bagool (1993) *Chaetomium* is known colonizer of paper in libraries.

CONCLUSION:

Present two consecutive year study of air-monitoring was particularly aimed at enlisting allergens from air from library environment at Nagpur. This work presents information on the presence of fungal propagules in indoor air, settled house dust, allergen in settled and its correlation with meteorological parameters and occurrence of allergy cases. Knowledge about the possibility of predicting the presence of fungi in indoor locations from their characteristics, and on the other hand for the evaluation of control measures aimed at reducing the presence of fungi in intramural places and minimizing allergic or other health problems. In order to improve indoor air quality, continuous aerobiological surveys for long time should be conducted at various indoor locations to know the occurrence and concentrations of aero microbiota causing health problems to human beings. Outcome of such studies can be used in the management of hygiene and health.

To combat with the problems associated with allergens in air of indoor environment, following recommendations were made-

i. Outdoor allergens should be avoided by not allowing footwares which are the major source of entry of such matter with other sources too.

ii. Proper ventilation, cleaning and air conditioning will also help in reducing the concentration of fungi as well as dust

iii. To use good quality of air purifiers. Air filters should be changed frequently/regularly. Cleanliness should be maintained. Use of disinfectants, Vacuum cleaning recommended.

iv. Use of antimicrobial chemicals like shirlan, thymol crystals, potassium lactate, acetaldehyde, ammonia and others resist or inhibit the growth of fungi. To maintain suitable

temperature (about 17-28^0 C) and moderate humidity.

v. Maintenance of AC/HVAC/etc to control airborne infections. Use of pest control methods regularly. Moisture control is found to be important in improving air quality, hence regular maintenance of pipe lines, avoidance of leakage is essential to cut down the growth of indoor air-spora. It is possible through good drainage system.

Occupants/servants/ workers in such environment should maintain hygiene. They can use clean clothes/ uniform particularly at workplaces, while working they should use nasal filters or at least cover the face in order to restrict entry of biopollutants.

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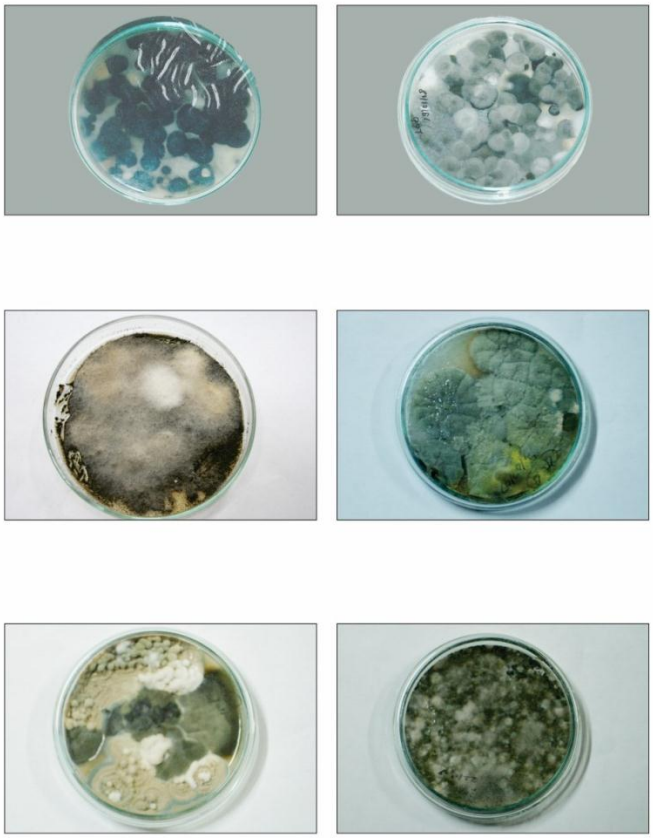
Table: Number of colonies isolated on culture media during investigation period of two years (September 2010 to August 2012) from RTMNU Library

Sr. No.	Dominant fungal colonie	Percentage
1.	*A. niger*	10.03%
2.	*A. fumigatus*	9.21%
3.	*Cladosporium cladosporides*	8.61%
4.	*Cladosporium sp.*	6.99%
5.	*Curvularia lunata*	5.58%
6.	*Curvularia sp.*	4.32%
7.	*Alternaria alternata*	4.1%
8.	*Alternaria sp.*	4.87%
9.	*Penicillium* sp	4.53%
10.	*Chaetomium* sp.	3.91%

Fungal colonies on PDA nutrient media



Photographs of Fungal spore