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Studies on Bionano Aerosol of the College Library Environment

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Abstract

The studies were undertaken to identify and to find out the concentration of the various aero allergenic bio particles in the indoor environment of the College library. The aeroflora of indoor and outdoor environment of library in Ozar (MIG) College was investigated for the period of six months from October 2013 to March 2014 by Himedia Petri plate air sampler No. LA-030 with Himedia readymade Rose Bengal Chloramphinicol Agar culture plates techniques. The air sampling in the library environment reveals variety of air borne nano particles including dust, insect scales, scars of rodents, lignocellulosic hairs, spores of lower and higher plants including the fungal spores. There were total 18 air borne fungal colonies were isolated and identified in the ambient air of college library. Aspergillus (28.57% and 17.48%), Penicillium (4.29% and 8.90%) and Cladosporium (12.44% and 13.29%) were found to be all time occurrence and shown predominance in the outside and inside the library environment respectively. Lignocellulosic degrading fungus like Chaetomium (2.86% and 7.06%) was also recorded in high humid and low temperature conditions, Alternaria, Fusarium Helminthosporium, Trichoderma, Rhizopus, Curvularia, Tetraploa, Periconia, Stemphyllum and some unidentified colonies were recorded in high concentration during the investigation with little variation in their concentration. Repeated exposure to the library environment causes some health hazards like sneezing, watery eyes, coughing and uneasy feelings in some sensitive individuals which is in relation with the meteorological parameters and concentration of allergic spores present in the ambient air of the library.

Keywords: Library, Bionano, Airborne fungi, Weather conditions

Introduction

Libraries are the main information and knowledge centres for the educational institutes. Due to suspended air borne particles in the library environment, both the readers and books get infected at more or less percentage. The enclosed environment of the library offer unique substrate such as binding glue, paper and other organic material which support the active fungal growth. Because of light weight and microscopic nature, the spores of fungi remain suspended in the air for long period. The concentration of these bioparticles shows great variation from time, season, altitude and weather conditions (Lacey 1991). Today, more than 300 million of the world population is known to suffer from one or other allergic ailments affecting the socioeconomic quality of the life. The respiratory allergy is the most severe disorder including asthma, rhinitis, dermatitis, hay fever, skin rashes, sneezing, coughing, running nose, watering eyes etc. The major causative agents for the respiratory allergy are pollen grains, fungal spores, dust, mites, insect debris etc (Pande 2012).

Since the study of allergic airospora of library environment is of great importance and continuous exposure to the library causes the respiratory disorders, A very meagre studies were reported on similar matter (Burge 1978, Vittal 1985,Tripathi 1987, Singh 1990,Agashe 1991, Verma 1996, Tilak 1997 Saoji 1997, Giri 2012,) hence the present work is undertaken to study the allergic air borne fungal spores in the ambient air of library.

Material and method

The town Ozar (MIG), Maharashtra, is well known for its grape and onion production and similarly for air craft production at Hindustan Aeronautics Limited. The arts, Science and Commerce College, Ozar (MIG) was established along with central library in the year 1984. The total carpet area of the library is 1901 sq. fts consisting total 24,130 valuable books including text, reference books, periodicals and journals worth of Rs.27, 38018/- up to year March 2014. The books are arranged subject wise and kept on open and closed steel racks keeping 3" distance between the racks.

The air sampling in the College library was done by using Himedia air sampler No. 030 with ready made Himedia Rose Bengal Chloramphinicol nutrient media plates. The air sampler was loaded with nutrient media plates and placed on the reading table for 10 minutes every forth night between 11.00 am to 11.30 am, i. e during peak hours of book transactions. The sampling of the air was done outside and inside the library environment from the months of October 2013 to March 2014. After the exposure, the petriplates are brought to the botany laboratory for the incubation at the temperature 25-27 0C for 4-5 days. The Colony Forming Units (CFU) were counted and Total Fungal Counts (TFC) were expressed as Colony Forming Units per cubic meter of air (CFUs/M3)

The fungal colonies detected per unit volume of air is calculated as under

$$\text{CFUs/M3} = \frac{\text{Number of Colonies on nutrient medium plates (N C)X 25}}{\text{Sampling time in minus (T)}}$$

After the incubation period of 5-6 days the colonies were appeared on the nutrient medium petriplates. These colonies were counted and identified up to genus level with the help of available literature (Barnett, Tilak and Inswarth etal.)

Results and discussion

Studies reveals the total 18 types of fungal colonies recorded in the ambient air of the library. High concentration of fungal colonies were recorded in the library environment (326) than outside the library. Highest concentration of colonies was recorded to be of *Aspergillus* (inside 28.57 % and ouside 17.485 %). *Cladosporium* (13.19% and 12.14 %), *Penicillium* (8.9 % and 4.29%) , *Helminthosporium* (6.13 % and 5.0%) and *Alternaria* (4.29% and 7.86%) to the total colonies recorded inside and the outside the library environment respectively.

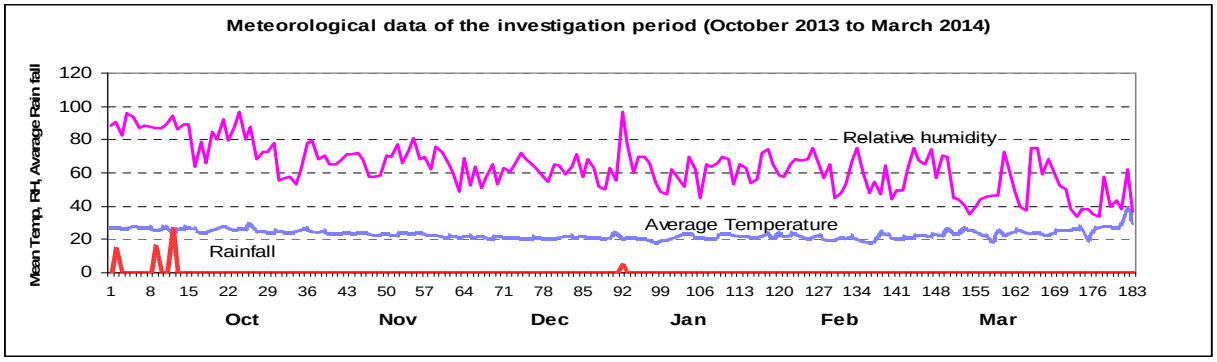
As indicated by Nandimuthan (1995) and Tripathi (1987) the present studies also reveals high concentration of fungal colonies during the high humid, low temperature conditions in the month of December 2013 and January 2014 than in high temperature and low humid conditions in the month of February and March 2014. Since the study of allergic airospora of library environment is of great importance and continuous exposure to the library causes the respiratory disorders, A very meagre studies were reported on similar matter (Tilak S T (1982), Verma K S (1987), Tripathi S N (1987), Nandimuthan (1995), Shaney (2001), Sharma (2004), Tiwari K L (2004) and Mujumdar (2005).

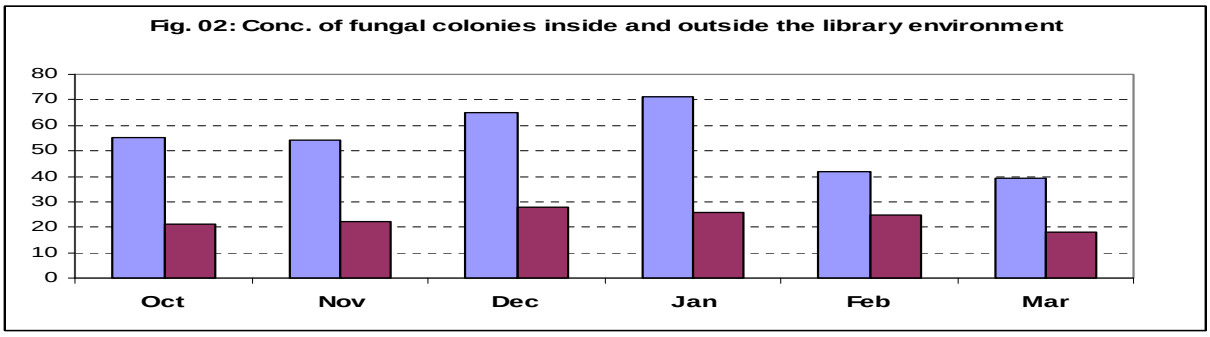
In addition to the cellulose, the paper also contains the lignin, hemicellulose, pectin, waxes, tannins and minerals useful for the fungal growth. Beside the impurities formed during the paper production are helpful for the nutrition of fungi (Tilak S T 1985). The cellulytic activity of some paper deteriorating fungi produces endogluconase enzymes which damages the paper quality of the library book (Verma K S

1987) indicate the role of fungi in book deterioration. Agashe (1991) also reported 23 types of fungal colonies in the indoor environment of library at Bengaluru. Giri S K (2012) reported 36 fungal spore types from the ambient air of library at Nagpur adding highest concentration of *Aspergillus*, *Cladosporium*, *Alternaria* and *Rhizopus* spores. Predominance of *Aspergillus* and *Cladosporium* in the present studies is in relation with the reports of Vittal (1985) and Singh (1990).

Table : 01

Sr No	Fungal colony	Number of colonies recorded on Petri plates (Out side the library)									Number of colonies recorded on Petri plates (Inside the library)								
		Oct	Nov	Dec	Jan	Feb	Mar	Total	% Conc	CFU /M3	Oct	Nov	Dec	Jan	Feb	Mar	Total	% Conc	CFU /M3
1	*Alternaria* Nees.	2	3	2	2	-	2	11	7.86	39.29	3	4	1	2	1	3	14	4.29	0.00
2	*Aspergillus* Mich.Ex.Fr.	3	3	7	10	12	5	40	28.57	142.86	12	7	11	12	7	8	57	17.48	03.57
3	*Cercospora* Fries.	-	-	2	2	1	1	6	4.29	21.43	3	2	2	-	-	2	9	2.76	2.14
4	*Chaetomium Kunze Ex Fr*	-	-	-	2	1	1	4	2.86	14.29	3	5	4	6	3	2	23	7.06	2.14
5	*Cladosporium* Link.	2	4	5	3	2	1	17	12.14	60.71	12	3	10	11	4	3	43	13.19	53.57
6	*Curvularia* Boed.	-	-	-	-	2	1	3	2.14	10.71	-	-	3	4	1	-	8	2.45	8.57
7	*Epicoccum* Link.	-	-	-	2	-	-	2	1.43	7.14	2	1	-	2	1	1	7	2.15	5.00
8	*Fusarium* Link..	2	1	-	-	-	-	3	2.14	10.71	3	2	4	3	5	4	21	6.44	5.00
9	*Helminthosporium Link*	-	1	2	1	2	1	7	5	25.00	2	4	6	4	3	1	20	6.13	1.43
10	*Nigrospora* Zimm.	-	-	2	1	1	-	4	2.86	14.29	-	-	1	1	2	-	4	1.23	4.29
11	*Penicillium* Link	3	2	1	-	-	-	6	4.29	21.43	3	5	7	8	4	2	29	8.9	03.57
12	*Phoma* Desm.	-	-	-	-	-	-	-	0	0.00	-	1	-	-	-	-	1	0.31	.57
13	*Periconia Tode Ex Schw*	-	-	-	1	1	-	2	1.43	7.14	-	1	2	1	1	-	5	1.53	7.86
14	*Pringsheimia* Schultz.	-	1	-	-	-	-	1	0.71	3.57	-	-	-	1	1	-	2	0.61	.14
15	*Rhizopus* Enrenb.	2	1	1	-	2	2	8	5.71	28.57	3	5	2	3	1	-	14	4.29	0.00
16	*Stemphyllum* Weber	2	1	3	1	-	-	7	5	25.00	2	5	3	7	2	1	20	6.13	1.43
17	*Trichoderma Persoon*	2	1	1	-	-	-	4	2.86	14.29	3	4	2	2	4	5	20	6.13	1.43
18	*Unclassified Group*	3	4	2	1	1	4	15	10.71	53.57	4	5	7	4	2	7	29	8.9	03.57
	Total	21	22	28	26	25	18	140	100	500.00	55	54	65	71	42	39	326	00	164.2





The cellulose degrading fungi like *Chaetomium* was also recorded (7.6% and 2.86 %) indicating the threat to the stored books in the library environment. The studies inside and outside the library environment is of great importance since the library environment is loaded with the biopollutants that can be harmful to the health of the library users, beside reducing the life of books (Agashe S N 1991)

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