**RESEARCH ARTICLE**

# INTRAMURAL AEROMICROBIOTA OF LIBRARY AT PUNE, MAHARASHTRA, INDIA.

**Jogdand SB and Ingole AC**

Science Research Centre, Dept. of Botany, BVDU, Y. M. College, Erandawne, Pune-411038.

## ABSTRACT

Intramural aerobiological investigations have been carried out using Rotorod air sampler for a period of six months from 1st January 2013 to 30th June 2013 in the college library. Totally Sixty three aerobiocomponants have been encountered including eight other types and fifty fivespore types belonging to Phycomycotina, Ascomycotina, Basidiomycotina and Deuteromycotinahave been encountered. Half yearly findings revealed Aspergilli(23%) to be dominant followed by *Cladosporium* (22%) and *Nigrospora*(18%). Fourteen types of ascospores which were absent from January to May 2013 have been reported in the month of June due to rain fall(48 mm) responsible for their release, higher RH(82%) and moderate temperature(19°C). They act as bioindicators for the rain fall, increase in RH and decrease in temperature. Thus environmental parameters play determintal role in the aerospora. Class wise percentage contribution of library aerospora in the order of dominance have revealed Deuteromycotina (63.39 -24,055/m3) followed by other types (21.975-8342/m3), Basidiomycotina(8.99-3415/m3),Ascomycotina (5.281-1890/m3) and Phycomycotina (0.355-135/m3) .However, Myxomycotina members have not been found during the study period. The smut spores have been obtained during the study and the probable source has been found to be the smut disease of Cynodon grass around the library. The prominent health hazards among the library personnel and users have been noticed so far and damage to the library material have been worked out.

**Keywords** Intramural environment, Aerospora, Air sampling, Biodetrioration, Allergy, Bioteriogens and Allergens.

## INTRODUCTION

People spend their most of the day time in indoor environment. Assessment of indoor air quality is of chief and immense importance, during this six months study. Aeromycology of the intramural environment constitute one of the major aspects mainly because of the dominance of fungal spores in the aerospora (Tilak, 1991). The number of fungal spore types and their diversity vary with time of day, weather, seasons, Geographical location and the presence of local sources. The highest number of airborne spores was found in temperate and tropical region and the least in desert. (Lacey, 1981). There is impact of aerobiocomponants on plants, animals and human beings (Agarwal et al., 1969).

Since fungal spores have been identified as a major cause of bio deterioration of all kinds of stored products hence cannot be over looked throughout the world,leading to both qualitative and quantitative loss. Library materials like cellulose form the basic constituent of papers, glue in bounded books and leather as a bonding materials, all forming an ideal substrate for growth , sporulation and proliferation of fungi. Inhalation of mold spores dispersed from moldy books during handling was a common process. The

***Corresponding Author***

Email: jogdand.sudam@gmail.com

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occurrence of dermatitis, respiratory and cardiac diseases along with allergic manifestations in library handlers and workers is a major problem. Therefore this study on air borne fungi has being conducted in the YMC library of Punehaving 160 km distance from Mumbai located toward the southern direction at the Latitude 18°32' N, Longitude 72° 51' E and at Altitude 560m (1840 ft) above sea level.

## MATERIAL AND METHODS

The site selected was library of Yashwantrao MohiteCollege B.V.D.U., Erandawne, Pune. Material for the experiment is the books, racks, papers, periodicals and intramural aeromicrobiota grown over them which is studied by air sampling method using Rotorod air sampler of Perkins (1951) and modified by Harrington (1957). It consists of battery operated motor which rotates at 2300rpm. The two brass rods (6.2cm long) fixed on horizontal arm connected to motor at 8cm distance from each other oriented at right angles to dashing air at high velocity.Petroleum jelly coated two cello fane tapeswere fixed on the two arms of the sampler.

Air sampling was carried out by Rotorod air sampler which have been operated daily for half an hour (between 2pm and 2.30 pm), in the YMC library at 1 meter height from ground level, from 1st January 2013 to 30th June 2013.The two strips of loaded (deposited) cello fane tapes from Rotorod sampler were mounted on a clean slide using melted glycerin jelly in the laboratory. The total number of spore/m3 of air at that particular site and height of that time was obtained by multiplying each spore types by its conversion factor (5).

## RESULT

Qualitative and quantitative analysis of intramural aeromicrobiota revealed 63 types of airborne biocomponents amounting to 37,962 spore/$m^3$.The totally 55 fungal sporetypes have been reported amounting to29,620 spore/$m^3$ and 8 other types (8,342/$m^3$).

Out of 55 types of fungal spores in the order of dominance, 37 belonged to Deuteromycotina (63.58%-24,055spore/$m^3$), 3 to Basidiomycotina (9.025%-3,415spore/$m^3$), 14 to Ascomycotina (4.995%-1,890spore/$m^3$) and 01 type belonged to Phycomycotina(0.357%-135spore/$m^3$).Eight other types(22.05%-8,342/$m^3$) have been reported in the order of dominance including cellulose fibers (6.264%), fungal hyphae(5.167%), epidermal hairs (4.876%), insect wings (2.59%), insect scales (1.995%), Pollen grains (0.965%), algalfilaments (0.172%) and unidentified types.

**Table 1**: Average percentage contribution of some of the dominant fungal spores to the total aerospora during six months (i.e. January to June 2013) from library of YMC.

| Sr. No. | Types of spores | January | February | March | April | may | June | Total | Average % |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Ascospores | 0 | 0 | 0 | 0 | 0 | 2.24 | 2.24 | 2.24 |
| 2. | Aspergillus | 14.1 | 16 | 14 | 12.04 | 15.4 | 19 | 90.54 | 15.09 |
| 3. | Bispora | 3.7 | 2.03 | 1.4 | 0.78 | 1.09 | 0.97 | 9.97 | 1.61667 |
| 4. | Chaetomium | 2.7 | 0.3 | 0 | 0 | 0 | 1.73 | 4.73 | 1.576667 |
| 5. | Cladosporium | 16.3 | 15 | 14.46 | 14 | 4.54 | 17 | 81.3 | 13.55 |
| 6. | Collitrotricum | 9 | 0 | 0 | 0 | 0 | 0 | 9 | 9 |
| 7. | Hysterium | 0 | 0 | 0 | 0 | 0 | 0.65 | 0.65 | 0.65 |
| 8. | Nigrospora | 8.69 | 14.01 | 10 | 10 | 11 | 14 | 67.7 | 11.28333 |
| 9. | Rosellina | 0 | 0 | 0 | 0 | 0 | 3.12 | 3.12 | 3.12 |
| 10. | Smut spore | 10 | 8.21 | 7.6 | 8.1 | 6.18 | 6.3 | 46.39 | 7.731667 |

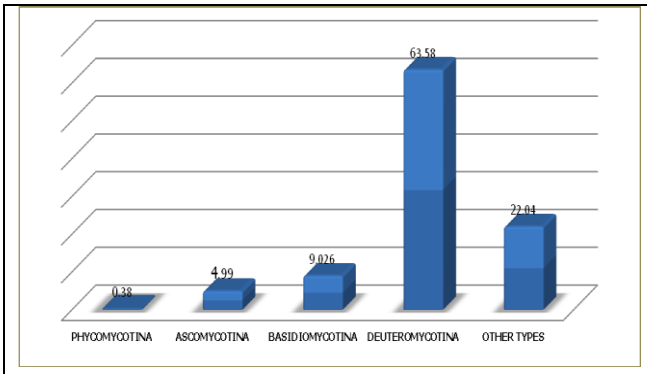



**Fig 1:** Average class wise percentage contribution of aerospora to the total aerospora during `study period (six months i.e. January to June 2013)

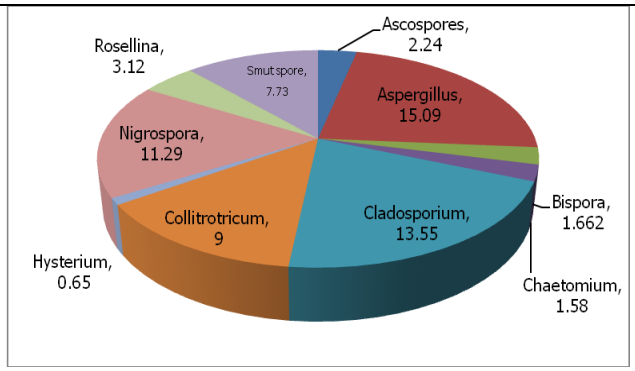



**Fig. 2**: Average percentage contribution of some of the dominant fungal spores to the total aerospora during six months (i.e. January to June 2013) from library of YMC.

**Fig. 2 to 7:** Month wise quantitative analysis of intramural environmental aerospora during six months (i.e. January to June 2013) from YMC library.

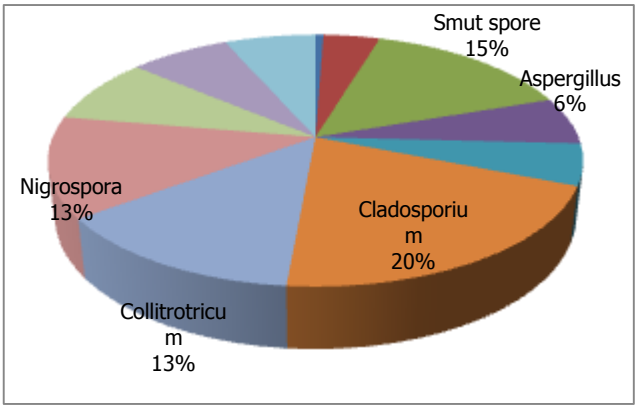



**Fig. 3:** Percentage contribution of aerospora in January 2013.

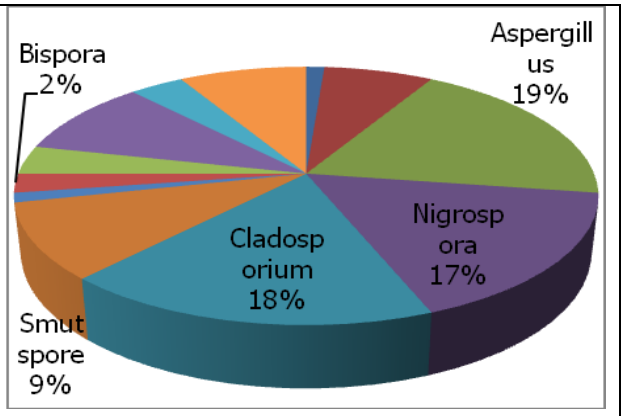



**Fig. 4:** Percentage contribution of aerospora in February 2013.

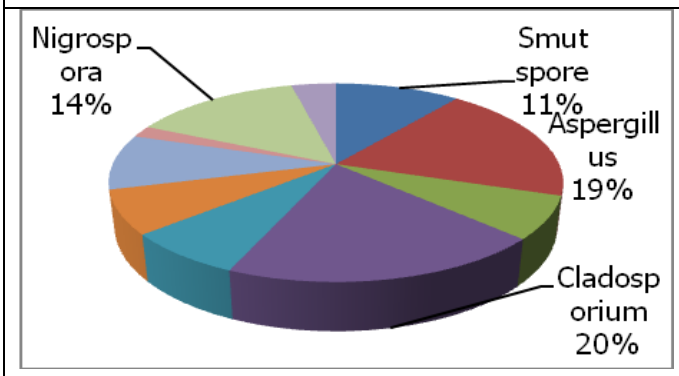



**Fig 5:** Percentage contribution of aerospora in March 2013.

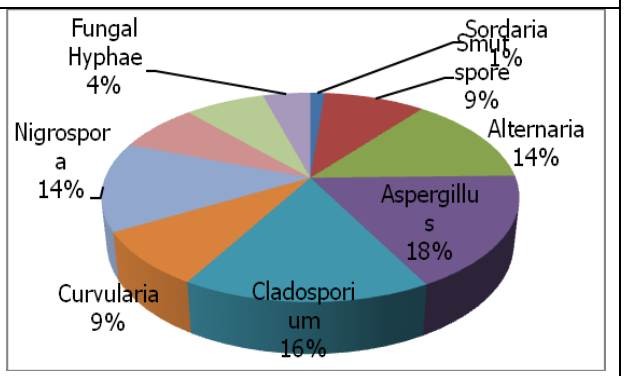



**Fig 6:** Percentage contribution of aerospora in April 2013

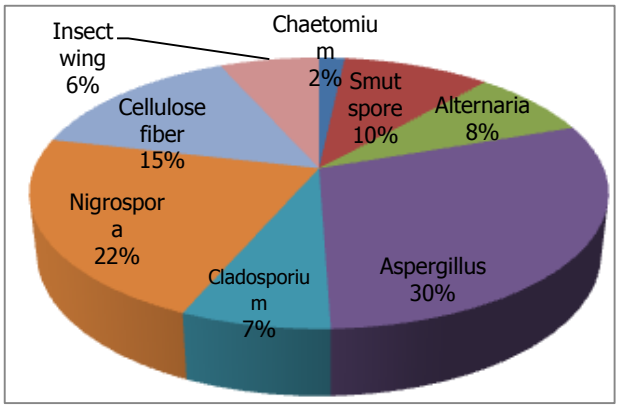



**Fig 7:** Percentage contribution of aerospora in May 2013.

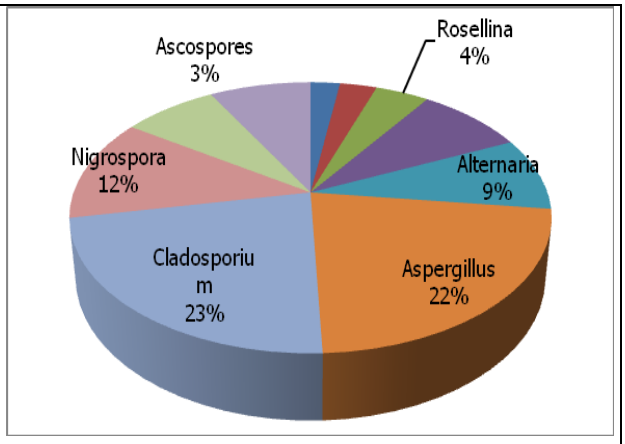
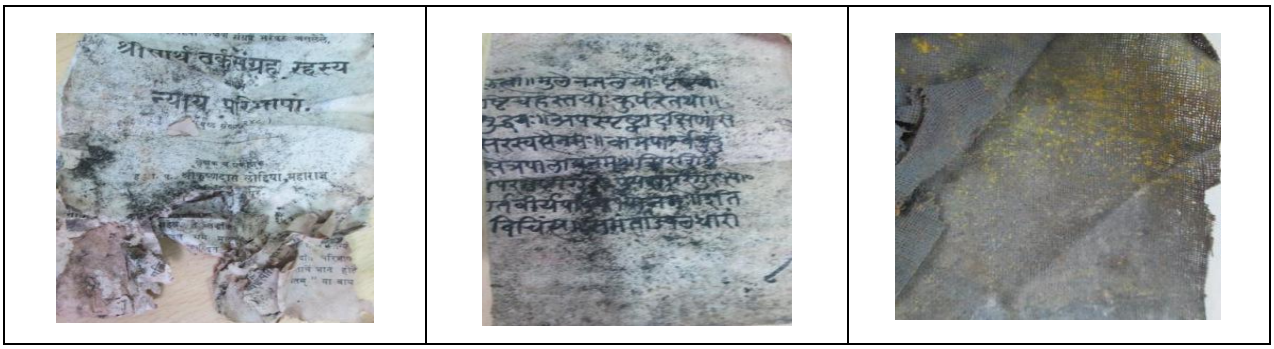



**Fig 8:** Percentage contribution of aerospora in June 2013.

**Fig 9 :** photographs of deteriorated books pages and bonding materials:



Average Percentage contribution of fungal sporesinthe order of dominance have been recorded during six months such as *Aspergillusspp (*15.09%), *Cladosporium*(13.55%), *Nigrospora*(11.29%), *Smut spore*(7.76%) while other spore types revealed less percentage contribution.Fourteenascospore types have been recorded only in June after the rain fall (48mm) in the order of dominance such as *Rosellinia,* unidentified *ascospores, Chaetomium, Didymosphaeria, Sordaria,Leptosphaeria* etc.These spores acted as bioindicator of rain fall.

## DISCUSSION:

The present aerobiological investigation was undertaken to study the intramural environmental aeromicrobiota from library located at Yashwantrao Mohite College, Pune. The study was carried out to find out cause of biodetrioration of stacked books, news papers, journals, periodicals, paper materials and wooden book racks, due to airborne microbes, which cause health hazards amongthe students, readers, workers and book handlers due to inhalation of airborne microbes from the book materials.

In present study *Aspergillus spp(*15.09%), *Cladosporium* (13.55%),*smut spores* (7.76%) were dominant.According to Takahashi (1997), Sen and Asan (2001) and El-Morsy (2006) *Cladosporium* spores dominate theaerospora in hot climates. These results coincide with our findings.According to Shaheen (1992) the abundance of *Cladosporium* throughout the year may be attributed to the structural features of the spores such as small size, thin exine and smooth wall which favour and facilitated the transport of aerospora.

The impact of environmental parameters on aerospora during January 2013 revealed increase

representing 50 fungal spore types at average temperature 21.3$^0$C and RH 67.6%.Decrease in temperature accompanied by rise in RH have been found responsible for the increase in aerospora.While during April 2013 rise in average temperature (29.5 $^0$ C) and fall in RH (44.5 %.) have been found responsible for decrease of aerospora representing 33 fungal spore types. Thus environmental parameters proved profound impact on the aerospora clearly. The smut spores have been obtained during the study and the probable source has been found to be the smut disease of Cynodon grass around the library.

Fourteen types of ascospores which were absent from January to May 2013 because of absence of rains have been reported in the month of June only due to rain fall(48 mm), higher RH(82%) and moderate temperature(19$^o$C). They act as bioindicator for the rain fall, increase in RH and decrease in temperature. Thus environmental parameters play determintal role in the release of ascospores and total aerospora. The various biodeteriogens obtained during the study have been found to cause biodetrioration of books, papers as evidenced from the damaged papers shown below, binding materials, threads and fabrics etc. especially during rainy season when these goods were stored uncared in damp places, leading to health disorders among the visitors. (Fig 9.)

## CONCLUSION:

Findings revealed 63 types of aerobiocomponents causing biodetrioration of library materials as evidenced by damaged valuable ancient literature major biodeteriogens recorded are *Cladosporium, Aspergillus, Chaetomium, Alternaria, curvularia etc.* The visitors have been found suffering from various health disorders like itching, sneezing, cough, fever etc. due to these airborne microbes leading to allergic manifestations.

Hence, this work is significant for protection of valuable ancient literature, management of biodeteriogens and health conservation of visitors.

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