MONITORING OF AEROMYCOFLORA IN INDOOR ENVIRONMENT AT NAGBHID, DIST. CHANDRAPUR (M.S.) INDIA

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Abstract: Fungi are the major contributor of the atmosphere, but their occurrence is depends on the geographical location and seasonal variations. They can thrive in all kinds of substrate hence they are omnipresent. Aeromycological study has great importance as fungi have its effect on human beings. The aim of present study was to evaluate the occurrence of indoor aeromycoflora at two different sites of Nagbhid during June 2012 to May 2013. Air sample was collected twice in a month by exposing petriplates containing Potato Dextrose Agar (PDA). Total 378 colonies were recorded. The fungal colonies were asses on the basis of micro and macro morphological characteristics. In this investigation, among sixteen fungi, the predominant fungi observed were *Aspergillus niger*, *A. fumigatus*, *A. flavus*, *Cladosporium* spp., *Curvularia lunata*, *Chaetomium* spp. The occurrence of fungi was correlated with meteorological factors. In addition to this the fungi without sporulation was placed in sterile type and the fungi unable to identify in unidentified group.

Keywords: Air, PDA, Meteorological Factor.

Introduction: Fungi are universal indoor and outdoor atmospheric component and are now generally recognized as important cause of respiratory allergies. Allergic reaction associated with fungi involves the lower respiratory tract more frequently than does pollen allergies (Lehrer *et. al.,* 1983). More than 80 genera of fungi have been associated with symptoms of respiratory tract allergy (Burge *et. al.,* 1982; Gravesen, 1979). Despite the clinical importance and abundant release of fungal spores, relatively few investigations have focused on relationship between airborne spores and allergic diseases (Horner *et. al.,* 1995). Allergic reaction normally occurs at the site of allergen deposition. Fungal spores have elaborate spore dispersal mechanism. Fungal spores are present in the atmosphere for long time and results in allergic reaction when inhaled by susceptible individual.

Study of aeromycology is essential because of the dominance of fungal spores in the ambient air. Study of aeromycology mainly includes identification of source, mode of release, dispersion deposition, impaction and effect of impaction on various living system. Fungal spores have some important structure that may help them to survive even in the unfavorable conditions.

Of the various types of aeromicrobiota, the fungal propagules represent about 80 to 90% from the aerospora mainly because of wind dissemination and a variety of mechanism developed by the group in efficiently liberating and dispersing the reproductive propagules. Such liberated spores get into the air and subsequently transported. Wind transport involved the upward air current velocity and downward movement of winds. All are equally responsible for transport of fungal spores (Tilak, 2009).

With this background, a systematic study of the indoor aeromycoflora of the Nagbhid region was carried out for a period of one year beginning from June 2012 to May 2013. The aim of this study was to determine the fungal flora, their identification, concentration and diversity in the indoor atmosphere. The present study probably the first attempt regarding the identification of fungal population in the indoor environment of Nagbhid.

Material and Methods: ***Location:*** Nagbhid (or Nagbhir) is a town and a tahsil, itself subdivision of Chandrapur district in Vidharbha region in the state of Maharashtra, India. Town is a central place between Nagpur-Gadchiroli- Bramhapuri-Chandrapur road links.

Selection of Study Site: Aeromycological survey was carried out at Nagbhid, Dist Chandrapur, from June 2012 to may 2013. Two sites were selected for present study viz. Site I - Primary Health care centre (PHC) and site II – Science wing of RMG College Nagbhid, Dist. Chandrapur, India. The microflora studies of this particular place have never been reported. PHC is the only government hospital for the nearby people. Most of the garbage of the city is dumped near this PHC this makes the air unhygienic for the patients coming from different area and people living nearby area.

Media Used: Potato Dextrose Agar (PDA) medium is used for the present study. This media probably provides the nutritional need of the fungi.

Collection of Sample: Petriplates were exposed for 5 minutes twice in a month at each site. They were incubated at room temperature for the growth of fungal colonies. After exposing, the Petri plates containing the samples were incubated for 3 to 5 days at room temperature (25 to 28°C).
Identification: The slides were prepared by using lacto phenol cotton blue stain. The fungal colonies were identified by colony morphology and characteristics of sporulation. The species were identified on the basis of micro and macro morphology; and reverse and surface coloration of colonies grown on the PDA media. The fungi were identified up to genus level and in some cases up to species level. The identification of the colonies was done with the help of standard literatures (Subramanian, 1971; Barnett and Hunter, 1972; Nagamani *et. al.,* 2005).

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

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

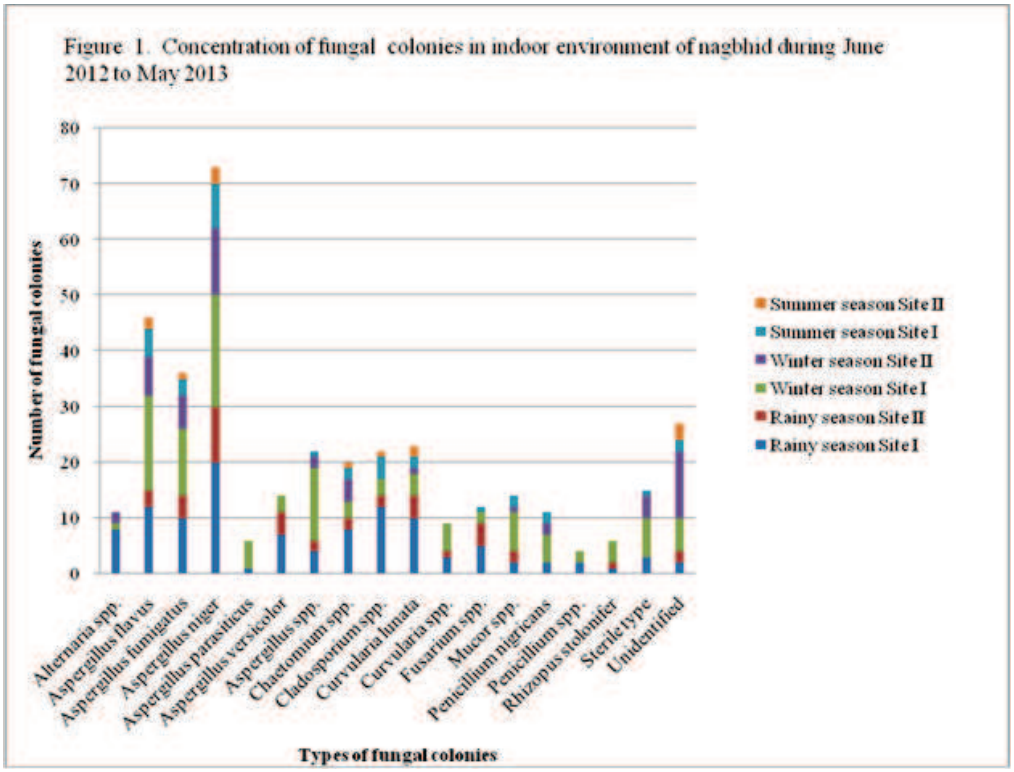
Results and Discussion: Total 378 colonies of fungi were analyzed during June 2012 to May 2013. In this investigation, sixteen fungi were identified and the fungi with sterile mycelia and unidentified colonies were placed in separate group. Maximum numbers of colonies were identified during winter seasons (178) followed by rainy (154) and summer season (46) (Table 1). Variation in concentration of fungal spores was found in different seasons (figure 1). Occurrence of more number of colonies during the winter indicated that fungi were very specific to temperature and humidity. Five species of *Aspergillus* viz. *Aspergillus niger*, *A. flavus*, *A. fumigatus A. parasiticus. A. versicolor* was identified while some specieses of *Aspergillus* was unidentified and placed in separate group. *Aspergillus* colonies were dominant during July to December. The dominant fungi observed was *Aspergillus niger* (20.92%), *A. flavus* (12.17%), *A. fumigatus* (9.52%), *Curvularia lunata* (6.08%), *Chaetomium* spp. (5.29%), *Cladosporium* spp. (5.82%) (figure 2). Site I (PHC) was more unhygienic as compare to the site II (Science wing of RMG College). This probably the reason of occurrence of more number of colonies in site I.

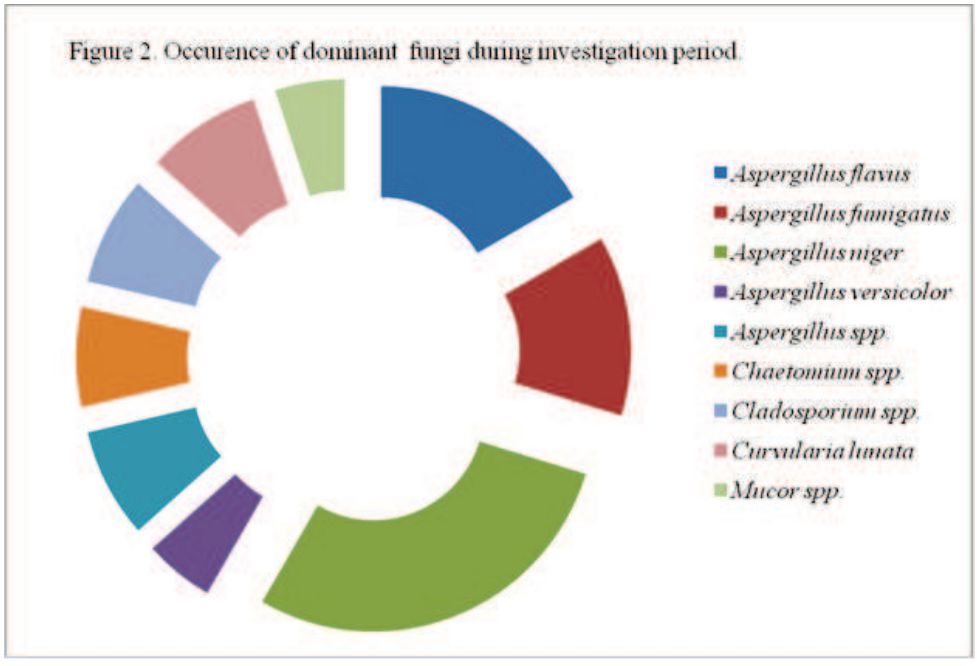
Incidence of fungal species was dependant on seasonal variations. During rainy season, number of fungal colonies isolated was found to be increased. During summer days number of fungi and their incidence was less. There was a close relation found between number of fungi isolated with relative humidity and temperature. Increased in humidity increased the occurrence of fungal colonies.

Genus *Aspergillus* (including all species) was found to be dominant during the study. During this aeromycological study fungi showed monthly and seasonal variations in their concentration. Dominance of *Aspergillus* was reported by Subba Reddi *et. al.* (2004) from Visakhapatnam, Mishra *et. al.* (2008) from U.P., Sullia and Khan (1980) from Bangalore.

De-Ana *et. al.* (2006) registered the highest presence of *Aspergillus*, *Cladosporium* and *Penicillium* in indoor environment in autumn. Sen and Asan (2009) observed *Penicillium* (28.61%), *Cladosporium* (16.08%) and *Alternaria* (15.98%) as the most frequent fungal genera. *Penicillium* (40.61%) and *Cladosporium* (15.92%) were the dominant genera of indoor air while *Alternaria* (20.62%) and *Penicillium* (19.71%) were isolated most frequently from outdoor air.

Present study showed that winter season and rainy season favored the occurrence of fungi. The fungal population was not found to be homogenous throughout the year and thus showed seasonal variations.





Maximum concentration of fungi was encountered during the period from June to February. These months showed high relative humidity and low temperature. The total number of fungi generally decreases from March to May. Agarwal *et. al.* (1969) reported the peak period of fungal incidence from September to November and February to April at Delhi. Mishra and Kamal (1971) at Gorakhpur observed the highest fungal incidence during December. It was found that survival of air borne fungi depend on several factors such as wind velocity, distance from the source , time in air, relative humidity and species itself.

The occurrence of more number of fungal colonies in the hospital area is due to its unhygienic condition and probably due to the dumping of household garbage or municipal waste near this area. There was no proper mechanism for further treatment of this waste. This results in huge population of microbial forms specially the saprophytic ones. Because of this huge amount of spore were released in the atmosphere. During winter seasons the concentration of spores was comparatively more as compared to rainy and summer seasons. During winter seasons especially in the month of November some rainy day was recorded with sudden increase in the humidity which might be the reason of increase in the concentration of fungi in the nearby area. The high number of colony forming fungi in the site was due to lack of efficient maintenance probably. The staff members and patients are constantly being exposed to these spores of which a good number are known for their hypersensitive reactions leading to respiratory problems like bronchial responsiveness (asthma), hypersensitivity pneumonitis, allergic alveolities such as bronchopulmonary aspergillosis, bronchoalveolar lavage or transbronchial lung problem (John, 1985; Bennett, 1995; Sugar, 1995).

The negligence of proper cleaning and maintenance of PHC became a good source of the fungi which may cause a potential health hazard. The present study suggested that the dumping waste near the study area should be treated properly to avoid infection to the people in this area. The present study will be helpful for solving the problems regarding indoor air quality particularly fungi and other associated matter. It will also be helpful for allergologists, allergy patients and common man to solve allergic problems.

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Table 1: Occurrence of Airborne Fungi in Indoor Environment during June 2012 to May 2013

S.N	Name of Fungi	Rainy season				Winter season				Summer Season				Total no. of colonies	Total %
		Site I	Site II	Total	%	Site I	Site II	Total	%	Site I	Site II	Total	%		
1	*Alternaria* spp.	8	-	8	5.19	1	2	3	1.69	-	-	0	0.00	11	2.91
2	*Aspergillus flavus*	12	3	15	9.74	17	7	24	13.48	5	2	7	15.91	46	12.17
3	*Aspergillus fumigates*	10	4	14	9.09	12	6	18	10.11	3	1	4	9.09	36	9.52
4	*Aspergillus niger*	20	10	30	19.48	26	12	38	21.35	8	3	11	25.00	79	20.90
5	*Aspergillus parasiticus*	1	-	1	0.65	5	-	5	2.81	-	-	0	0.00	6	1.59
6	*Aspergillus versicolor*	7	4	11	7.14	3	-	3	1.69	-	-	0	0.00	14	3.70
7	*Aspergillus* spp.	4	2	6	3.90	13	2	15	8.43	1	-	1	2.27	22	5.82
8	*Chaetomium* spp.	8	2	10	6.49	3	4	7	3.93	2	1	3	6.82	20	5.29
9	*Cladosporium* spp.	12	2	14	9.09	3	-	3	1.69	4	1	5	11.36	22	5.82
10	*Curvularia lunata*	10	4	14	9.09	4	1	5	2.81	2	2	4	9.09	23	6.08
11	*Curvularia* spp.	3	1	4	2.60	5	-	5	2.81	-	-	0	0.00	9	2.38
12	*Fusarium* spp.	5	4	9	5.84	2	-	2	1.12	1	-	1	2.27	12	3.17
13	*Mucor* spp.	2	2	4	2.60	7	1	8	4.49	2	-	2	4.55	14	3.70
14	*Penicillium nigricans*	3	-	3	1.95	5	2	7	3.93	2	-	2	4.55	12	3.17
15	*Penicillium* spp.	2	-	2	1.30	2	-	2	1.12	-	-	0	0.00	4	1.06
16	*Rhizopus stolonifer*	1	1	2	1.30	4	-	4	2.25	-	-	0	0.00	6	1.59
17	Sterile type	3	-	3	1.95	7	4	11	6.18	1	-	1	2.27	15	3.97
18	Unidentified	2	2	4	2.60	6	12	18	10.11	2	3	5	11.36	27	7.14
	Total	113	41	154	100.00	125	53	178	100.00	33	13	44	100.00	378	100.00

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