RESULTS
AND
CONCLUSION

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The occurrence of airborne biocomponents in ambient air is not homogenous throughout year. The reason for this may be due to change in environmental conditions viz. temperature, relative humidity, rainfall and wind velocity. They play very vital role in distribution of airborne components in the atmosphere.

During present aerobiological study of "Krantisinha Nana Patil, General Hospital, Satara" from October 2006 to September 2007, a total number of 26,199 fungal (Table: 2 and Table: 3) and bacterial mycopollutants (Table: 7) were recorded. Out of these, fungal spores accounts for about 6,790 (25.91%) and bacteria about 19,409 (74.08%) [Histogram: 3]. Fungal colonies were 69% in indoor and 31% in outdoor environment (Histogram: 4 and Pie-charts: 1 and 2). Bacteria comprise 56.08% and 43.91% in indoor and outdoor respectively (Histogram: 5, Pie-charts: 3 and 4).

The survey of airborne microbes reveal good results. There are 51, different types of fungal components were found in the airspora. Out of these, one belongs to class-Actinomycetes, 2 genera of class-Mastigomycotina and class-Zygomycotina each, 5 from class-Ascomycotina and 41 forms are recorded from the class-Deuteromycotina (Table: 4).

The comparative results obtained from indoor and outdoor air of hospital indicate, fungal colonies are found more in indoor than in outdoor (Table: 5 and 6). According to Gregory (1973), Madeline and Linton (1974), the microbial flora of indoor air depends on the number and kind of organisms present and the mechanical movements within the enclosed space. The observations made by Tilak and associates (1985) and Singh et al. (1990) indicate that, within enclosed environment apart from external source, the secondary sources of fungi could be located within the building as several fungi have ability to grow on numerous substrates available therein.

The class-Deuteromycetina is the most dominant group, accounting as far as 96.21% of total fungal airspora. The forms were present maximum during rainy season and somewhat in equal proportion in winter and summer seasons of survey study years. The other groups contribute viz. class-Zygomycotina 2.65%, class-Ascomycotina 0.31%, class-Actinomycetes 0.71% and class-Mastigomycotina 0.71% of the total fungal airspora. In winter, airspora constitute 28 forms of fungi. The maximum numbers of fungal spores were found in the month of December and

January. During this season, different 16 forms were recorded so far, while in October and November, only 12 and 10 different genera were observed, respectively.

In the summer season, the aeromycoflora of hospital building recorded with 21 genera. It is the month of May, where maximum number of colonies were noted but the highest forms occurred in February i.e. 14.

45 different forms of fungi were recorded during rainy season and found maximum in August. The density of species (18.76%) was found more in September. The results of spore occurrence in air was found to be more or less similar to results reported at Vijaywada by Alturi and Appanna (1990), at Raipur by Tiwari and Sahu (1994) and at Kanpur by Kant and Pathak (1988).

As far as the spores of fungi imperfecti are concerned, total 42 genera were observed. They were found maximum during rainy season. The various forms were recorded with remarkable variations in their composition. Among the 42 genera recorded so far, *Cladosporium* was most abundant, contributing 44.37% of the total aeromycoflora. The spores of *Aspergillus* (29.39%) stands at second position. In the indoor as well as outdoor air, the other genera *Phialophora* (3.53%), *Penicillium* (3.43%), and *Alternaria* (2.75%) were recorded as subdominant genera. *Cladosporium* had maximum growth in September (12.16%) and minimum in May (0.08%). *Aspergillus* and *Phialophora* have peak periods in May, whereas *Alternaria* and *Penicillium,* have maximum air concentration in November and September respectively. All these four genera were recorded with least percentage in April except for *Alternaria,* which was recorded, least in July. Spores of *Ampulliferina* (0.22%) were observed in peak concentration in November while those of *Bacillispora* in August. The spore catch of *Curvularia* was found abundant during winter and gradually declined in summer. Spores of *Fusarium* were recorded in maximum extent during monsoon and very very scanty during summer season.

Table 11: The fungal components and their occurrence in respective months.

Sr. No.	Genus	Month
1.	*Arthrobotryum*	August
2.	*Blastomyces*	August to September, December
3.	*Candida*	January, April, July, September and December
4.	*Coniosporium*	January, May, August
5.	*Curvularia*	February, April, September, November to December
6.	*Dendrospora*	January, September and December
7.	*Drechsclera*	February, April to May, August to October
8.	*Fulvia*	March
9.	*Haplosporangium*	May, July, October,
10.	*Humicola*	September, December
11.	*Leptosporomyces*	August
12.	*Madurella*	June
13.	*Memnoniella*	January to February
14.	*Microsporum*	July
15.	*Nigrospora*	September to December
16.	*Oidiodendron*	September
17.	*Periconia*	January, March, June, August to September
18.	*Rhinocladiella*	August
19.	*Sporothrix*	August
20.	*Torula*	January, March, April, July and November
21.	*Trichosporonoides*	July to August
22.	*Trimmatostroma*	January to March and September
23.	*Tripospermum*	August
24.	*Ulocladium*	February, March and August
25.	*Virgaria*	August

The class-Zygomycotina is other group (2.65%) represented by indoor (1.82%) and outdoor (0.83%), amongst other mycopollutants occurred. The class-Zygomycotina is represented by only two genera *Mucor* (0.72%) and *Rhizopus* (2.04%). *Rhizopus* was recorded throughout the investigation period, had maximum

percentage in November (1.47%) and least growth was observed in June (0.04%). Colonies of *Mucor* were recorded in winter season and maximum in rainy season, while in summer it was not recorded at all. April is the peak growth period (0.97%) and in December (0.01%) it is least represented in air.

Class-Ascomycotina (0.31%) stands next in abundance to class-Zygomycotina in the total mycoflora of indoor airspora. These forms were accounted as 0.21% of the total fungal airspora and 0.31% to the total airspora. This group was represented by 5 genera. The forms as *Gymnoascus* and *Narasimhella* were found in July (0.04%) and August (0.07%) i.e. in the monsoon season only. *Dichlaena* (0.05%) and *Eidamella* (0.07%) were recorded in July, October and June and July respectively, where as *Chaetophoma* (0.13%) recorded in successive four-month observations and the data shows a peak concentration in April.

Class-Mastigomycotina and class-Actinomycetes forms are least recorded (0.17%) in this investigation. Class-Mastigomycotina includes *Cladochytrium* (0.13%) and *Nowakowskiella* (0.20%). *Cladochytrium* were recorded in July to August only. *Nowakowskiella* showed its presence in September and November. Class- Actinomycetes was represented only by a single genus *Actinomyces* (0.19%). *Actinomyces* colonies were maximum in April and minimum in the beginning of monsoon i.e. in June.

In the present investigation the dominant genera found are *Cladosporium* 44.37%, followed by *Aspergillus* 29.39%. The other forms viz. *Phialophora* (3.53%), *Penicillium* (3.43%), *Alternaria* (2.75%) and *Rhizopus* (2.04%), were recorded as subdominant genera in the indoor atmosphere.

The spore concentration of *Allescheriella* (0.01%), *Pseudotorula* (0.01%), *Catenophora* (0.02%), *Custingophora* (0.02%) was in very low percentage. *Allescheriella* and *Custingophora* recorded only in August, while *Sarcinella*, *Catenophora* and *Pseudotorula* recorded in January, February and July respectively.

As far as the number of species are considered *Aspergillus* is represented by 10 species, viz. *Aspergillus alliaceous* Thom. and Church., *A. flavus* Link., *A. nanus* Mont., *A. rugulosus* Thom. and Raper., *A. scleritiorum* Huber., *A. stelatus* Curzi., *A. unguis* (Emil-Weil. and Gaudin.) Thom. and Raper., *A. ustus* (Bainer.) Thom. and Church., *A. versicolor* (Vuill.) Tiraboschi. and *A. wentii* Wehmer. There are four species of *Alternaria* viz. *A. carthami* Chowdhury., *A. helianthi* Tubaki. and Nishihara., *A. macrospora* Zimm. and *A. passiflorae* Simmonds.

Genus *Cladosporium* is represented by three species; *Cladosporium chlorocephalum* (Fresen.) Mason. and M.B. Ellis., *C. herbarum* (Pers.) Link. Ex. S.F., *C. spongiosum* Berk. and Curt., *Candida* with two species; *Candida albicans* (Robin.) Berkout. and *C. stellatoidea* Jones. and Martin., Genus *Fusarium* had two species viz. *Fusarium solani* (Martius.) Saccardo. and *F. oxysporum* Schl. Ex. Fries. F., *Periconia britanica* M. B. Ellis. and *P. kambakkamensis* Subram. also recorded during study period.

Bacterial colonies were found maximum in rainy season (34.80%), in optimum percentage in summer season (34.80%) and in minimum concentration in winter season (24.29%); (Histogram: 2). In rainy season, July was the peak period (13.58%) and least growth was noted in September (3.69%). Least percentage in airspora was investigated during winter season (24.29%). Within winter season also, maximum colonies were observed in November, while least in January. Growth is also observed in summer season, in which high percentages of colonies were recorded in February (18.91%) and least in May (1.62%). As far as month-wise occurrence is considered, bacterial colonies were recorded maximum in February and in minimum percentage in May.

Each human being breathes 15,000 to 20,000 liters of air per day. Air pollutants and aeroallergens alter the quality of this air. Fungal spores are predominating in the aerospora. The percentage of fungal spores in air is approximately ten times more than that of "other particles". The source of such airborne fungal spores, is other substrates present on the ground level. The inhalation of fungal spores is the main causative factor for respiratory allergic diseases. Extensive work on the allergenicity of fungal spores has been carried out in India. During the present investigation important 14mycopollutants were recorded in Satara civil hospital. They are, viz. *Actinomyces, Alternaria, Aspergillus, Blastomyces, Candida, Cladosporium, Curvularia, Drechsclera, Fusarium, Histoplasm, Humicola, Memnoniella, Microsporum, Mucor, Nigrospora, Oidiodendro, Penicillium, Periconia, Pithomyces, Rhizopus* and *Sporothrix* etc.

Table 12: Asthma, Allergy, Mycoses and the related mycopollutants observed in hospital airspora.

2.	Allergy	*Alternaria, Aspergillus, Blastomyces, Candida, Cladosporium, Fusarium, Penicillium, Rhizopus, Mucor, Sporothrix.*
1.	Asthma	*Alternaria, Aspergillus, Blastomyces, Cladosporium, Fusarium, Penicillium, Rhizopus, Mucor.*
3.	Mycoses	*Actinomyces*- Actinomycoses. *Aspergillus*- Aspergillosis. *Blastomyces*- Blastomycoses. *Candida*- Candidiasis. *Cladosporium*- Cladosporiosis. *Histoplasma*- Histoplasmosis *Madurella*- Maduramycosis. *Microsporum*- Tinea capitis. *Penicillium*- Penicillosis. *Rhizopus, Mucor*- Mucormycosis. *Sporothrix*- Sporotrichosis.

The data of the OPD patients of the hospital was studied, to correlate the aeromycopollutants. Near about 6,950 patients were found, visited. Out of these 95.18%, were suffering from skin diseases, 3.16% are of asthma and 1.02% of other allergy patients (Table: 8 and Histogram: 6). Maximum skin disease patients are recorded in September (Histogram: 7), while asthma and allergy patients (Histograms: 8 and 9) are noted maximum in March and November respectively (OPD register of the hospital 2006-2007).

The present investigation indicates that in spite of the large number of methods attempted for preventing such airborne pathogens, the air of hospital environment is never free of them. Further attempts are necessary to reduce these viable airborne particles, which would ultimately help in reducing the infections in the hospitals.