SEASONAL MICROBIAL STUDY OF INDOOR AND OUTDOOR AIR QUALITY FROM Z.P. SCHOOLS OF AMRAVATI CITY

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Abstract: This study was carried out to have an idea of fungal diversity in school environment so that, this could later on serves as a basis for developing database of the microbial load and to have a preliminary idea of the environmental status of school. Unhygienic environmental conditions in schools premises indicator of air quality which shows the adverse effect on school children of all ages. An assessment of the air borne fungi at some Z.P. school campus, Amravati was experimentally investigated by culture plate exposure method. The investigation period for this study was from March to December 2017. Total 62 fungal species (571 fungal colonies) belonging to 33 fungal genera were isolated. Experiments were carried out at indoor and outdoor sites (Class room, Staff room, Corridor, Washroom & Ground)) of Z.P. School. Total 818 fungal colonies belonging to 20 fungal genera were isolated The highest fungal population was observed in rainy season (48.65%) and lowest in the winter season (22.86%).The most dominant air fungi isolated from each season were *Alternaria alternata., Aspergillus flavus, Cladosporium sp.* In all research site the concentration of fungi for the indoor air was higher than that of outdoor air. It was detect that the concentration of the fungal spores in the air differ from season to season probably due to variation in climatic parameters.

Keywords: Air pollution, seasonal analysis, aeromycoflora, fungi.

I. INTRODUCTION

Atmospheric pollution is one of the most burning problems of our age. The pollution has now reached advanced level that poses a potential threat to the health & well-being of the population. People spend mostly (80-90%) of their time in indoor environments such as office, school & house. The quality of the indoor and outdoor environment is not easily controlled or defined and can probably place human occupants at risk (Diriba et al., 2014). The indoor and outdoor air contain a variety of biotic air environmental pollutants, include fungi, bacteria, algae, pollen-grains, dusts, mould , yeast and other particles of biological and non biological origin. (Mentege et al., 2009). Many factors affect air pollution levels such as the climate, moisture, season, indoor humidity, temperature, and ventilation rates, maintenance activities.

Mostly outdoor air does not contain disease causing pathogen compared with indoor air has to contain disease causing pathogen especially in large gatherings area like schools, educational institute, colleges, universities and offices (Dacarro et al., 2003).

School is the second most important indoor environment, which is evaluating the quality of indoor air and health components of occupants (Godwin and Batterman 2007). In case of children, a great part of their time is spent at school for studying & working in enclosed spaces every day. Therefore, assessments of this

microenvironment are important to evaluate their time-weighted exposure to air pollutants **(**Katiyar, 2013**).** The presence of the microbial content in school environment is an important factor because it has a direct impact on the physical development, mental health and performance of the students (Naruka and Gaur, 2013).

The aim of this study was to identify and compare the data of airborne microbes present in different seasons including summer, monsoon and winter of various ZP school environment.

II. MATERIALS & METHOD

2.1 Sampling site-

Amravati is located at 20.93°N 77.75°E. It has an average elevation of 343 metres (1125 feet). Amravati has a tropical wet and dry climate with hot, dry summers and mild to cool winters. Summer lasts from March to June. The population of Amravati near about 8,54,901 lac.

2.2. School Description-

This study was focused on primary school of Zilla Parishad Amravati city, Maharashtra, India. Indoor air samples were collected from five schools of the city, according to the changing season. For this study four sampling sites (Class room, Staff room, Corridor, Washroom & Ground) from each of the 05 schools were selected according to the different intensity of human activities inside the school building.

2.3. Sampling-

Sample was taken from a sampling site by standard settling method. The culture plate exposure method was adopted for trapping the air borne micro flora. A petri plate with the PDA agar (potato, Dextrose and Agar, Hi media Company) exposed to air for 15 min & at that time petri plate were setup at a height 1.5m above floor. The time of sampling was kept uniform at all the sites, after sampling, incubated for 5 to 7 days at 26 ±1ºC. After sufficient growth of fungal colonies, observing with morphological and cultural characteristics, such as shape, colour, size and colonies were identified with the help of literature. For species identification microscopic slides were prepared using glycerin gel as mounting media and lacto phenol cotton blue stain. (Barnett, H.L. ,1969). The percentage contribution of fungal flora was calculated by the following formula.

$$\text{Percentage contribution} = \frac{\text{Total number of colonies of individual species}}{\text{Total number of colonies of all species}} \times 100$$

III. RESULT AND DISCUSSION

Total, twenty genera of culturable airborne fungi were identified from the sampling sites in the Z.P. School atmosphere (Table 1). The Fungal species observed in selected schools are *Alternaria sp., Aspergillus sp., Absidia sp., Candida sp., Curvularia sp., Cladosporium sp., Drechslera sp., Fuzarium sp., Helminthosporium sp., Mucor sp, Rhizopus sp., Nigrospora sp., Pencilium and Trichothecium sp.* Within all

the identified groups of culturable airborne fungi in indoor and the outdoor air, were the dominating species are observed such as *Alternaria*, Aspergillus *Cladosporium*, similar result were found by earlier workers study conducted in the United States (Ren, P. et al., 2001), Korea (Hong, J.B., et al., 2003) and Mysore city (Shilpa B. S.et al.,2013)

The result obtained for School IV shows that the contribution of fungi was (22.74%) which is more than other school in summer season. In rainy (22.11%) and winter (22.99%) season School - I was obtained the high contribution of fungi than other school.

Occurrence of fungal spores in the air diverse season to season because of changes of weather conditions. In present study most of the fungal contribution level in both the indoor and the outdoor air was higher in the rainy (48.65%) than summer (28.48%) and winter (22.86%) season. Occurrence of a largest number of fungi during monsoon season has also been investigated in the past study (Bhati and Gaur, 1979; Rajivekumar; 1984 , Chauhan *et al.*, 1992 and Middi B. et al.,2012). This was developed due to the increase in humidity and other favorable conditions for fungal growth during the rainy seasons. Ji-Hyun Lee,(2006) also reported the microbial concentrations in both the indoor and the outdoor air were usually higher in the summer than in the winter.

In present investigation the microbial contribution found at both indoor and outdoor environment are shown in (Table-2). Higher fungal contributions were found in all indoor air, in comparison to all outdoor air of school. Stryjakowska, S.,M. et al.(2007) also reported that fungal contamination was high in the indoor than outdoor air.

Table 1- Seasonal variation of Fungal flora in selected Z.P. School of Amravati City

Sr.No	Name of Microorganism isolated (Fungi)	% of Contributions of fungi in each season		
		Summer Season (%)	Rainy Season (%)	Winter Season (%)
1	*Alternaria alternata*	15.87	15.82	12.29
2	*Alternaria sp.*	8.58	9.79	4.81
3	*Aspergillus flavus*	13.30	10.05	11.76
4	*Aspergillus fumigatus*	4.29	3.01	4.27
5	*Asperg illus niger*	1.76	1.25	5.34
6	*Aspergillus nidulans*		0.50	2.13
7	*Aspergillus terrus*	0.42	0.75	0.53
8	*Absidia sp*	7.71	1.50	1.60
9	Candida Sp	3	1.50	1.06
10	*Curvularia lunata*	2.57	4.02	7.48
11	*Curvularia sp.*	5.51	2.76	3.74
12	*Cladosporium sp*	10.30	10.80	11.76
13	*Drechslera sp*	1.28	1.75	2.13
14	*Fusarium sp. (oxysporium)*	7.29	6.03	11.76
15	*Helminthosporium sp*	3	2.01	2.67
16	*Mucor sp*	6.86	10.80	1.60
17	*Nigrospora sp*	0.85	0.50	1.06
18	*Penicillium sp*	5.57	5.52	10.69
19	*Rhizopus sp.*	6.86	10.55	1.60
20	*Trichothecium sp.*	1.28	1.005	1.60
	Total % of Contributions of fungi found in all school	**28.48**	**48.65**	**22.86**

Chart 1- Seasonal variation of Fungal flora in selected Z.P. School of Amravati City

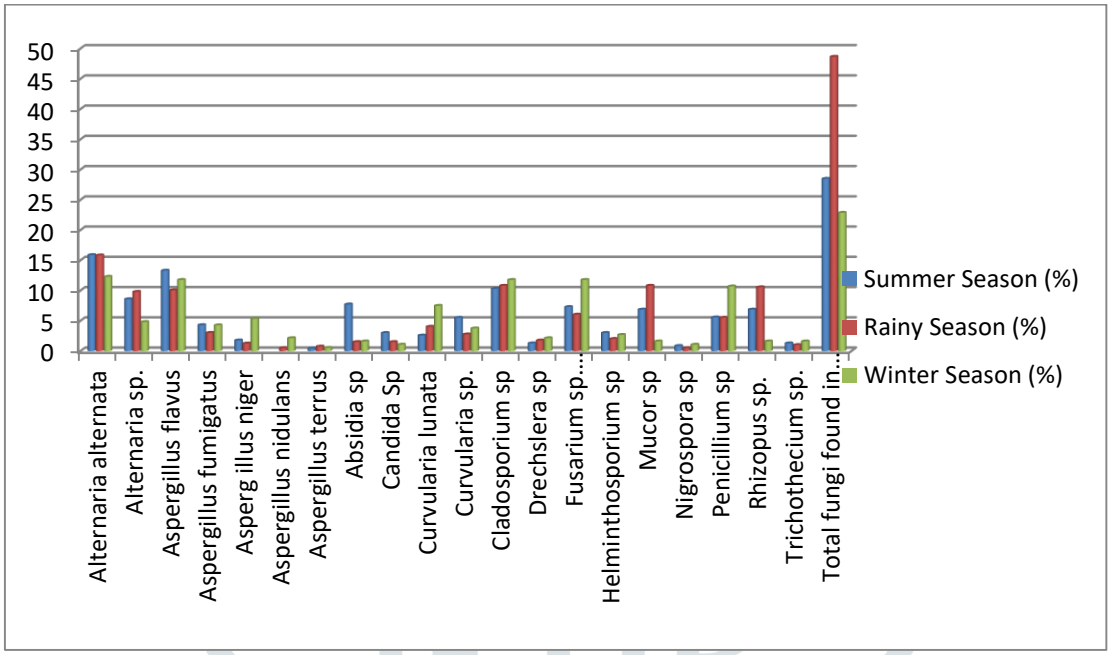


Table 2- % of Contributions of fungi in indoor and outdoor environment of selected Z.P. School of Amravati

School	Summer Season			Rainy Season			Winter Season		
	Total colony	% of Contributions of fungi		Total colony	% of Contributions of fungi		Total colony	% of Contributions of fungi	
		Indoor	outdoor		Indoor	outdoor		Indoor	outdoor
School I	48	72.91	27.08	88	65.90	34.09	43	72.09	27.90
School II	50	70	30	77	70.12	29.87	36	75	25
School III	44	70.45	29.54	79	60.75	39.24	36	80.55	19.44
School IV	53	67.92	32.07	81	66.66	33.33	36	82.5	17.5
School V	38	71.05	28.94	73	63.01	36.98	36	72.22	27.27

Chart 2- % of Contributions of fungi in indoor and outdoor environment of selected Z.P. School of Amravati

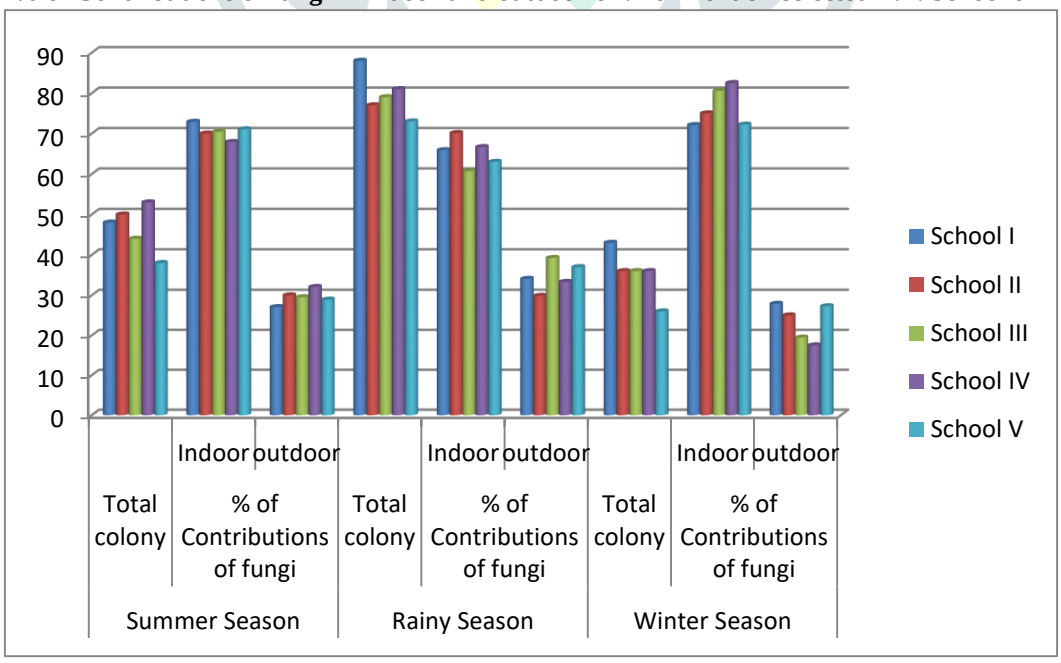
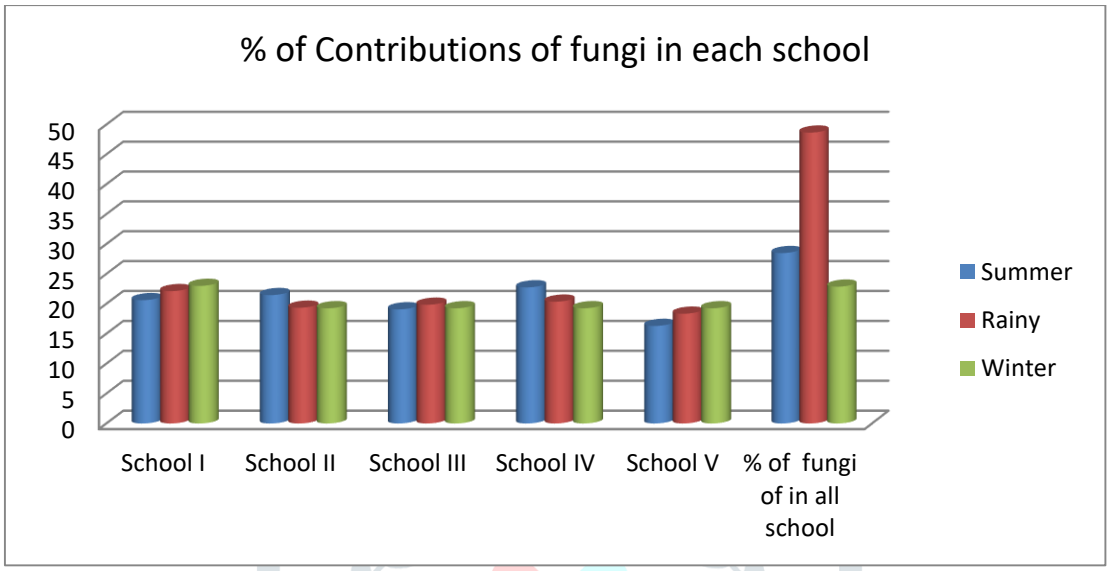


Table 3- % of Contributions of fungi in each selected Z.P. School of Amravati

Season	% of Contributions of fungi in each school					Total fungi found in all school	% of Contributions of fungi in all school
	School I	School II	School III	School IV	School V		
Summer	20.60	21.45	19.07	22.74	16.30	233	28.48
Rainy	22.11	19.34	19.84	20.35	18.34	398	48.65
Winter	22.99	19.25	19.25	19.25	19.25	187	22.86

Chart 3- % of Contributions of fungi in each selected Z.P. School of Amravati



IV. CONCLUSION

From the result and discussion it was concluded that higher concentration of air borne fungi in monsoon season than in the summer and winter at the indoor air in comparison to the outdoor air. This may have resulted because of the favorable conditions available for the growth of fungi like humidity and deficiency of cleanliness.

Various types of fungal species were reported, out of which some are adverse and cause some health problems to the student and staff members. *Cladosporium* and *Penicillium* were also associated with respiratory symptoms with increased asthma (Su et al., 1992). *Asperigillus* were most infections, it could cause a Symptoms of aspergillosis include watering eyes, persistent cold, joint pain and prolonged muscle cramps. (Vonberg and Gastmeier, 2006). For better environment is best way to adopt high level of hygienic conditions and clean room technology

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