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Airborne culturable Fungi in Hospital environment of Nagpur (Maharashtra)

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ABSTRACT

Observation on the Fungal airspora of some indoor & outdoor environments of Indira Gandhi medical College & Hospital, Nagpur were carried out from January 2008 to December 2009, using Petridish exposure method. A total of 18 fungal spores were recorded during the study period. Some of the dominant fungal forms encountered were *Cladosporium, Aspergilli, Peniciillium, Alternaria, Curvularia.* etc. Impact of airospores on human allergic disorders is discussed.

Key words: Airborne Fungi, Indoor air, Outdoor air, Nagpur.

The biological components of the atmosphere follow a definite aerobiological pathway starting from the source of origin, release and deposition. They have been implicated in the health disorders of plants, animal and human system. The environmental factors are also known to contribute to each of these stages. The survey of atmospheric pollen grains and fungal spores, carried out in many parts of the country, provide valuable data on their frequency in the air during various seasons of the year[3,8,13-15,17].

The hospital indoor air environment can potentially place patients at greater risk than the outside environment because enclosed spaces can confine aerosols and allow them to build up to to infectious levels[4].

Detailed information on the air-borne fungal types and concentration encountered in a specific work environment is helpful in effective diagnosis and treatment of allergic ailments and also in reducing infection in hospital environment. Recent researches carried out in different parts of the world have amply emphasized the need for monitoring of indoor air for effective management of allergic disorders of various origins[12]. keeping this in mind the present study was conducted in hospital environment to assess the mycoflora of these environments both outdoor and indoor.

Study area :

The study was carried out in "Indira Gandhi medical college & Hospital Nagpur Central avenue in the close vicinity of the area nearly 2km away from the Zero mile stone.

Hospital consisted of medical college, wards, Hostels & residential area of employees in urban area.

Colony count and Identification :

The aerobiological survey was carried out in ward no. 5 (surgery unit) Indoor and in the ground outdoor nutrient containing Petriplates (PDA) were exposed twice in a month. The data is tabulated (Table 1 & 2) and at the end totals, averages and percentage by types are given.

This data for two successive years is plotted in (Figure 1-4 with meteorological condition. In the present study , culture plate technique was used because of its simplicity[9,10].

For calculating percentage distribution of fungus at this site calculation by the following formula was made.

$$\text{Percentage of Occurrence} = \frac{\text{No. of colonies of individual sps in all the plates studied}}{\text{Total no. of colonies of all the species}} \times 100$$

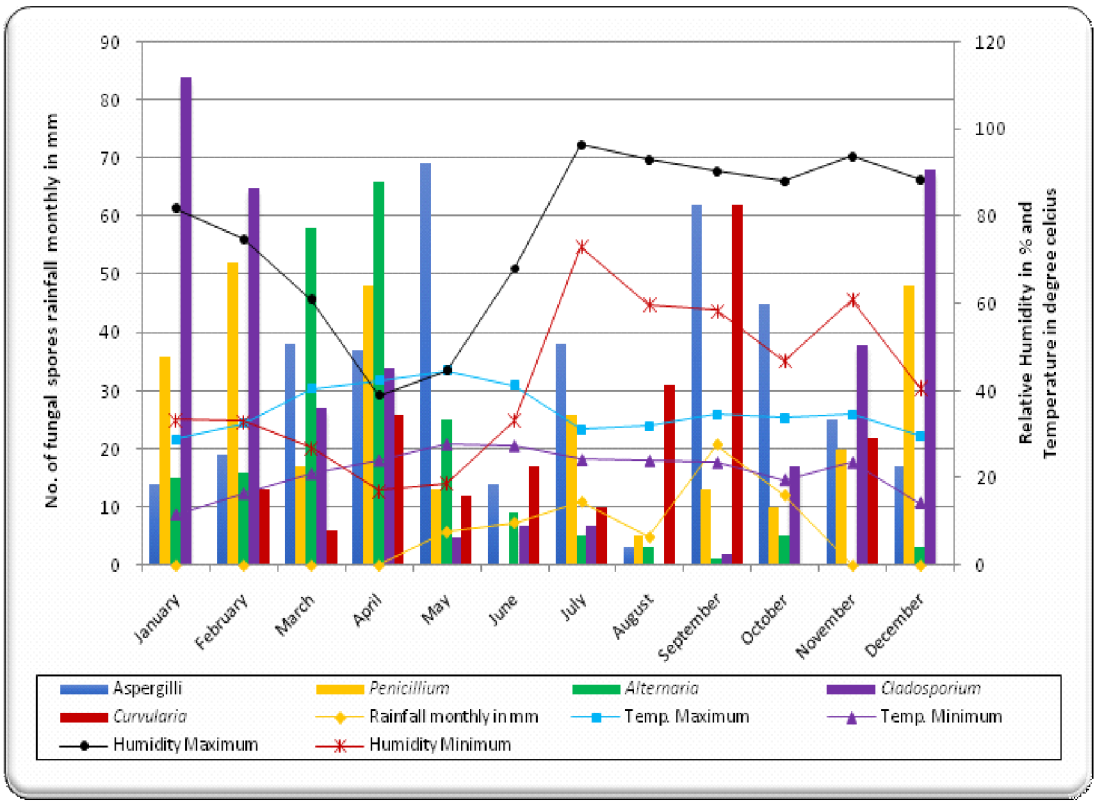

Fig. 1. Incidence of predominant air borne fungi on PDA during January 2008 to December 2008 from indoor environment of Site B*

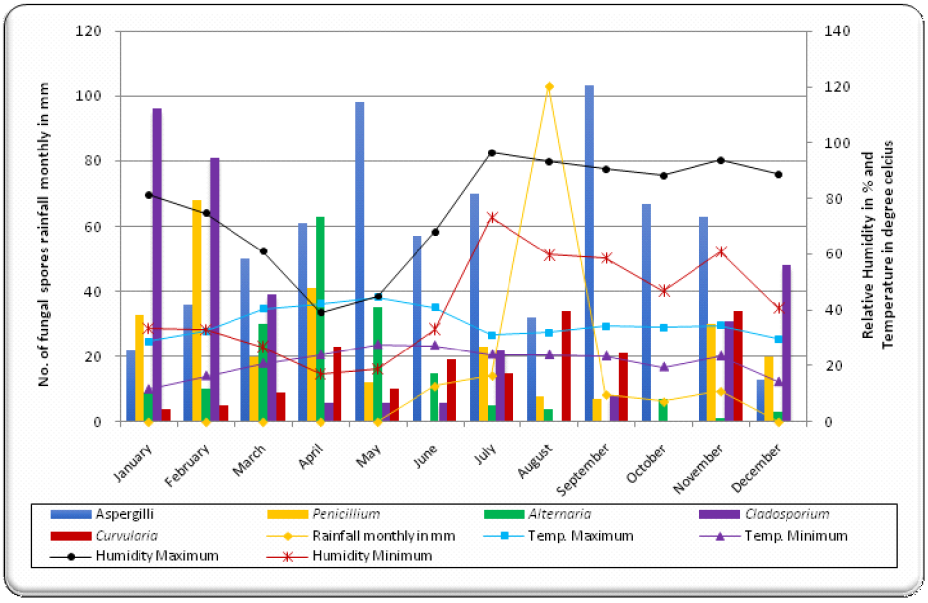

Fig. 2. Incidence of predominant air borne fungi on PDA during January 2009 to December 2009 from indoor environment of Site B*

* - Indira Gandhi Medical College and Hospital.

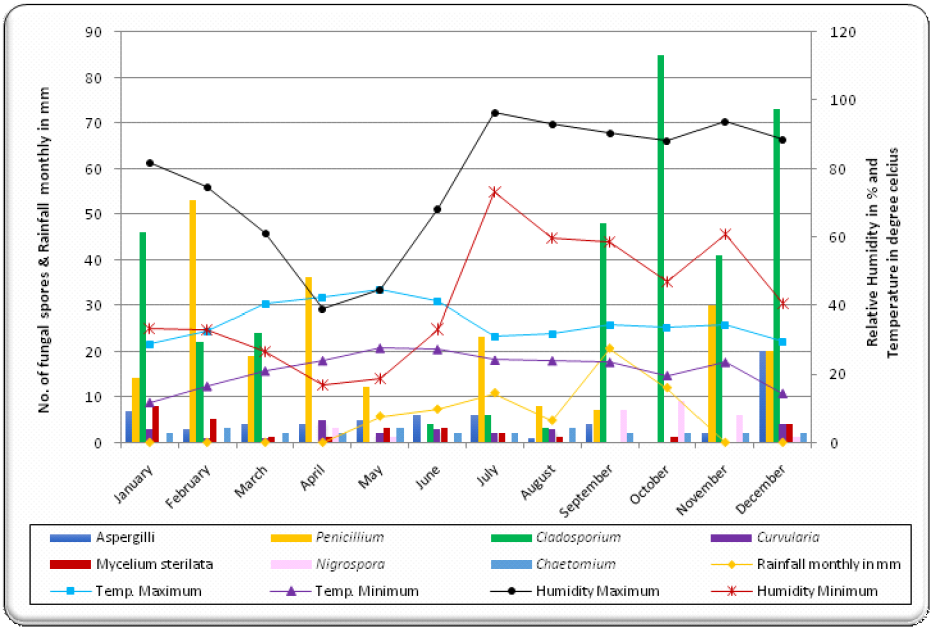

Fig. 3. Incidence of predominant air borne fungi on PDA during January 2008 to December 2008 from Outdoor environment of Site B*

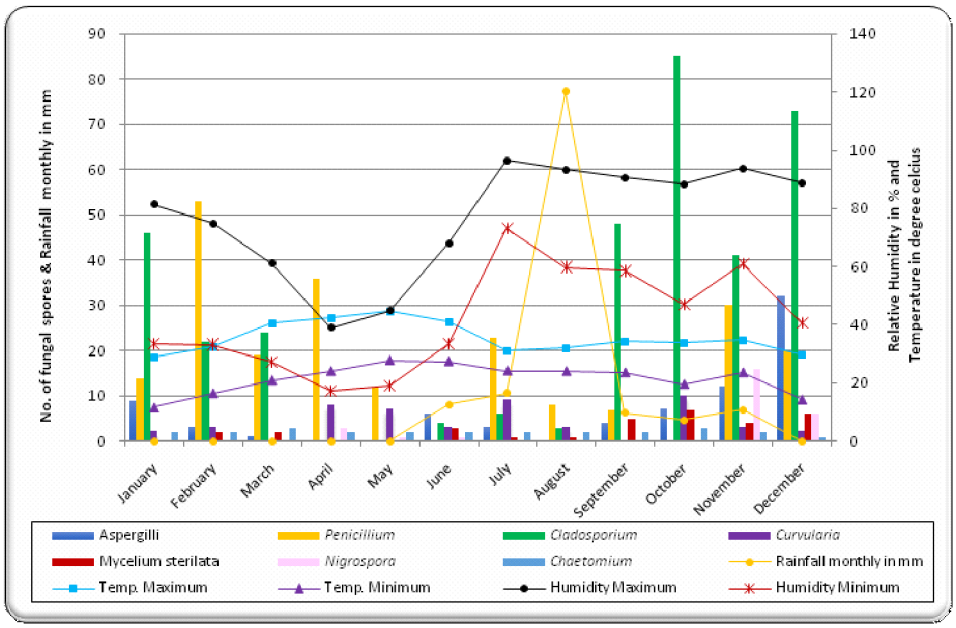

Fig. 4. Incidence of predominant air borne fungi on PDA during January 2009 to December 2009 from Outdoor environment of Site B*

* - Indira Gandhi Medical College and Hospital.

The present study revealed that total concentration of airborne Fungi isolated in indoor air of hospital ward was 3380 colonies while it was 1815 colonies in outdoor air As many as 15 Genera with unidentified Fungal spores & miscellaneous group in indoor air and one genus with miscellaneous group in outdoor air were isolated Dominant Fugal genera isolated from the hospital air were *Cladosporium*, Aspergilli, *Penicillium*, *Alternaria Curvularia* (Frg 1-4) most of these genera isolated have been reported to be associated with human allergies or with the respiratory tract disorders[6].

In the present investigation, *Cladosporium* contributed 699 colonies in indoor air, while it contributed 721 colonies in outdoor air of hospital[19] from Yokohana, Japan recorded *Cladosporium* spp as predominant one, followed by *Alternaria* spp. and *Penicillium*.

Aspergilli are the second most important genus causing human infections. The importance of this fungus increases in regions with dry and hot climate. In addition many *Aspergilli* isolated produce aflatoxin B_1, the most toxic and potent hepatocarcinogenic natural compound[7].

The concentration of *Penicillium* was 550 colonies in indoor air, whereas it was 449 colonies in outdoor air. Dominant *Penicilli* in hospital air in the present study which are reported to be allergenic and mycotoxigenic[1].

Table -1. Monthwise occurrence of species of fungi isolated on PDA medium during January, 2008 to December, 2009 from indoor environment of site B

Spore Type		January		February		March		April		May		June		Jully		August		September		October		November		December		Total	Average	Percentage
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II			
Cunninhamella	2008			2	3	1	2																			8	0.33	0.49
	2009			3	2	1	1																			7	0.29	0.39
Aspergilli	2008	6	8	9	10	20	18	21	16	32	37	6	8	18	20	1	2	30	32	25	20	10	15	7	10	381	15.88	23.66
	2009	10	12	21	15	29	21	32	29	48	50	27	30	30	40	15	17	50	53	32	35	30	33	5	8	672	28.00	37.96
Penicillium	2008	11	25	11	41	6	11	20	28	5	8			17	9	2	3	11	2	3	7	8	12	34	14	288	12.00	17.88
	2009	12	21	18	50	7	13	17	24	5	7			12	11	2	6	7				8	22	4	16	262	10.92	14.80
Smuts	2008	3	4																	11	12	2	1			33	1.38	2.04
	2009	6	2																			1				9	0.38	0.50
Alternaria	2008	7	8	9	7	30	28	31	35	10	15	4	5	3	2	1	2		1	3	2			2	1	206	8.58	12.79
	2009	4	5	6	4	10	20	40	23	23	9	6	9	4	1	3	1			6	1		1	1	2	179	7.46	10.11
Cercospora	2008											1	1					2	4	1		1	1			11	0.46	0.68
	2009											2									2	2	4		1	11	0.46	0.62

Cladosporium	2008	39	45	30	35	10	17	18	16	3	2	4	3	4	3	2			2	12	5	20	18	30	38	356	14.83	22.11
	2009	46	50	48	33	19	20	2	4	4	2		6	7	15			6	2			12	19	25	23	343	14.29	19.37
Curvularia	2008			9	4	4	2	12	14	4	8	9	8	7	3	9	22	24	38			15	6			198	8.25	12.29
	2009	2	2	2	3	5	4	8	15	2	8	6	13	15		6	28	10	11			18	16			174	7.25	9.83
Helminthosporium	2008							3	8	1	5						3				2		1			23	0.96	1.42
	2009							1	3		2					1	2									9	0.38	0.50
Torula	2008			3	4															1	1			2	3	14	0.58	0.86
	2009	1		2	3																	1		2	1	**10**	0.42	0.56
Nigrospora	2008							1	2	1								1	6			2	4	1		**18**	0.75	1.11
	2009							1	2		1	1								2	7	4	15		6	**39**	1.63	2.20
Pithomyces	2008			1	1																	1	1			**4**	0.17	0.24
	2009			1																						**1**	0.04	0.05
Bitrimonospora	2008			2	2					1	1	2	1	1	2			2				2		1		**17**	0.70	1.05
	2009			1	1					1	2	1	2	1	1			2				1		1		**14**	0.58	0.79

Chaeto-mium	2008	1	1	1		2		1	2	1	1	1	1	1	1	2	1	1	1	1	1	1				**22**	0.91	1.36
	2009	1	1	1		2	1		1	1	1	1	2	1	1	1	1		1	1	1	1				**20**	0.83	1.21
Fusarium	2008			2	1	3	1	1			1	2	1	1	2			1	1			2				**19**	0.79	1.18
	2009			1		2	1				1	1		2				1	1			1				**11**	0.45	0.62
Unidenti-fied fungal spores	2008							1	2																1	**4**	0.17	0.24
	2009							1			2													1		**4**	0.17	0.22
Miscella-neous	2008													1	1		1							2	3	**8**	0.33	0.49
	2009													2		1								1	1	**5**	0.21	0.28
Total	2008	67	91	79	108	76	79	109	123	58	79	29	28	53	43	17	34	72	87	57	50	64	59	79	70	1610	67.08	
	2009	82	93	104	111	75	79	102	101	84	85	45	62	74	69	29	55	76	68	41	46	79	110	40	58	1770	75.75	
Percen-tage	2008	4.16	5.65	4.90	6.70	4.72	4.90	6.77	7.63	3.60	4.84	1.80	1.73	3.29	2.67	1.05	2.11	4.47	5.40	3.54	3.10	3.97	3.66	4.90	4.34	99.91		
	2009	4.63	5.14	5.87	6.27	4.23	4.46	5.76	5.70	4.57	4.80	2.54	3.50	4.18	3.89	1.63	3.10	4.29	3.84	2.31	2.59	4.46	6.21	2.25	3.27	98.49		

Table-2. Monthwise occurrence of species of fungi isolated on PDA medium during January 2008 to December 2009 from outdoor environment of site B

Spore Type		January		February		March		April		May		June		Jully		August		September		October		November		December		Total	Average	Percentage
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II			
Cunning-hamella	2008			1	2	1	1																			5	0.21	0.55
	2009			3	1	1	1																			6	0.25	0.66
Aspergilli	2008	7		1	2	4		2	2	2	3	5	1	4	2	1		2	2				2	20		62	2.58	6.82
	2009	2	7		3	1						6		3				2	2	4	3	4	8	30	2	77	3.21	8.49
Penicillium	2008	11	20	10	30	6	8	10	15	5				12	9	2	3	11	2	3	7	8	12	30	13	227	9.46	24.97
	2009	12	2	18	35	7	12	16	20	5	7			11	12	2	6	7				8	22	4	16	222	9.25	24.50
Smuts	2008	2	3																	10	9	1	2			27	1.13	2.97
	2009	4	1																				1			6	0.25	0.66
Torula	2008		2		1																	1		2	1	7	0.29	0.77
	2009		3																					2	3	8	0.33	0.88
Alternaria	2008			1		1		5		2	3			2			1		2				4			21	0.88	2.31
	2009				4	5	4	12	1	4			2					1	1	2	2	3	3	5		49	2.04	5.40

Cladospo-rium	2008	18	16	17	15	14		13			2		4		2	1	3	3	35	60	55	40	16	10	45	369	15.38	40.59
	2009	35	11	14	8	22	2						4	4	2	2	1	2	46	35	50	11	30	60	13	352	14.67	38.85
Curvularia	2008	3		1		1		5			2		3	2		2	1							4		24	1.00	2.64
	2009		2	1	2			6	2		7	1	2	6	3	1	2			10		3			2	50	2.08	5.51
Helmintho-sporium	2008							3	8	1	5								3				2		1	23	0.96	2.53
	2009							1	3		2							1	2							9	0.38	0.99
Mycelium-sterilata	2008	6	2	3	2	1			1	1	2	2	1	2					1		1				4	29	1.21	3.19
	2009			2		2				1	2	1		1		5		2	5				4		6	31	1.29	3.42
Nigrospora	2008							1	2		1							1	6	2	7	2	4		1	27	1.13	2.97
	2009							1	2		1		1									4	12	6		27	1.13	2.98
Pithomyces	2008			1	1																		1			3	0.13	0.33
	2009																					1				1	0.04	0.11
Bitrimono-spora	2008		1	1					2	2	1	1	2	1	1										2	14	0.58	1.54
	2009		1	1					1	1	1	1	3	1	1										2	13	0.54	1.43

Chaetomium	2008	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	27	1.125	2.97
	2009	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1		25	1.04	2.75
Fusarium	2008			3	1		1	1	1		1		2	2	1			1	1						2	17	0.70	1.87
	2009			1	2								1	1	1			1							3	10	0.41	1.10
Miscelaneous	2008	2	3			1	3	4	1		4	2				1	2			3						26	1.08	2.86
	2009			2	3	4	5	3	2					2		2	2			2	2					29	1.21	3.20
Total	2008	50	48	41	55	30	14	45	33	15	25	11	15	26	16	9	11	19	53	79	80	53	44	67	70	909	37.88	
	2009	54	28	43	59	43	26	40	32	12	21	10	14	30	14	13	12	17	57	54	57	35	81	107	47	906	37.75	
Percentage	2008	5.50	5.28	4.51	6.05	3.30	1.54	4.95	3.63	1.65	2.75	1.21	1.65	2.86	1.76	0.99	1.21	2.09	5.83	8.69	8.80	5.83	4.84	4.37	7.70	99.99		
	2009	5.96	3.09	4.74	6.50	4.74	2.86	4.41	3.53	1.32	2.31	1.10	1.54	3.31	1.55	1.43	1.32	1.87	6.29	5.96	6.29	3.86	8.94	11.81	5.18	99.91		

In the present findings the other dominant species were *Alternaria* 455 colonies, *Curvalaria* 446 colonies, *Aspergilli* and *Penicillum* are the dominant fungal genera they have also been reported in hospital of Delhi by Singh *et.,al*[18].

Sen and Asan[16] observed *Penicillium* (28.61%), *Cladosporium*(16-08%) and *Alternaria* (15-98) as the most frequent genera *Penicillium* (40.61%), *Cladosporium* (15.92%) were the dominant genera of indoor air while *Alternaria* (92.62%) and *Penicillium* (19.71%) were isolated most frequently from outdoor air[20]. The total colony count of the year 2008 was 25119 and that of 2009 was 2676. The increased colony count of the year 2009 could be due to different weather conditions.

The weather is a delicate balance of various factors, namely temperature, humidity, rainfall and wind effect of its variability on liberation, dispersal and deposition of spores is known to be complex. As such, day to day or year to year spore content of a patch of a Mass of air is variable and cannot be related directly to any one of these constituents in isolation.

In the present investigation many species whose allergenecity and pathogenicity have been proved were isolated., This suggests that in diagnosis and treatment of allergy to airborne mold spores, the most important pre-requisite is a through understanding of the mold spores content of the indoor as well as outdoor air. All these findings will contribute to the well being of many allergic, immuno compromised patients and hospital workers who spend their maximum time in hospital.

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