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COMPARATIVE ANALYSIS OF HOUSE DUST MYCOFLORA AND AEROMYCOFLORA IN RELATION TO HUMAN HEALTH

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The aim of the present study was to assess the comparative analysis of dust mycoflora and aeromycoflora at home and at workplace in Jabalpur (M.P.). The trapped airspora was studied using Anderson two stage sampler and to screen dustmycoflora, serial dilution method was employed and PDA (potato dextrose agar) media used for isolation and preservation of fungal flora. As a result of this investigation altogether 24 types of fungal cultures were isolated using Anderson two stage sampler, which belongs to 12 different fungal genera. Out of these 12 genera, 10 genera belong to Deuteromycotina and 2 to Zygomycotina and Total 18 fungal isolates were recorded belonging to different genera. Out of 18, three species belong to Zygomycotina and remaining 14 belong to Deuteromycotina per gram dust in 10^{-2} dilution. *Aspergillus niger* was most dominant in all fungal forms and occurred with 363.59 CFU/m^3, followed by *Penicillium nigricans* 310.64 CFU/m^3, *Alterneria alternata* 289.46 CFU/m^3 and *Penicillium* sp. 229.45 CFU/m^3. and the most common genera isolated from the dust of home/occupational area are *Aspergillus* and *Penicillium* respectively. *Aspergillus clavatus* and *Penicillium chrysogenum* found in dust, was not present in air.

Keyword : Fungal spores; House dust; Mycoflora.

Introduction

Micro-organisms are introduced into the air by various sources, the principal source being dust particles, containing dry vegetative cells and spores. The quality of air in the environment where one lives or works can have potential effects on human health. There are strong indications that in many parts of the world, our home, schools and workplace are heavily contaminated with air-borne molds and other contamination[1].

Fungi are known to be source of aeroallergen and when it coincide with pollen grain and dust causing allergic disease like asthma, rhinitis, nasal eosinophillia and also dermatitis, especially in children[2-7] because children have immature organs, immune system, and nervous system that make them more sensitive[8].

Indoor air quality is becoming an important public issue. Inhalation of certain type of airborne spores and their metabolites, within the building is now widely accepted as one of the important causes of some respiratory disorders. Keeping in view all the above facts that today indoor air quality is being in primary concern. Present study was proposed to assess the air quality of residential environment and this work will be absolutely supportive in the management of quality of intramural environments and aware people to the effects of allergic disorders. The main Objective of the study is comparative analysis of house dust mycoflora and aeromycoflora and correlation of aeromycoflora of dust and human health.

Material and Method

Air sampling and airborne dust sampling was carried out monthly during the period from December 2010 to May 2011.This study was conducted in work place and residential environments.

Survey and dust collection is done from the 4 place residential (Yadav colony, Civil line, Ghamapur, Shastri Nagar) and one work place (R.D.University campus) Air sample and dust sample were collected. Air sample were collected from indoor and outdoor environment of the selected sites. Dust sample were collected from ceiling fan of the same five sites which were chosen for the air sampling.

Aeromycoflora were trapped by Anderson two stage air sampler[9]. Plates exposed for 10 minutes thus conversion factor for Anderson sampler. Serial dilution agar plate method or viable plate method was used for the isolation and enumeration of dust aeromycoflora[10].

Results and Discussion

As a result of this investigation altogether 24 types of

Table 1. Quantitative distribution of indoor and outdoor fungal flora at selected sites (Jan. 2011).

S.No	Fungal isolates	SITE I		SITE II		SITE III		SITE IV		SITE V		Total			CFU/m³			Percentage (%)		
		I	O	I	O	I	O	I	O	I	O	I	O	T	I	O	T	I	O	T
	Zygomycotina																			
1	*Mucor sp.*	1	2	3	2	1	1	1		2	2	8	7	15	26.8	23.45	50.25	1.2	1.32	1.36
2	*Rhizopus stolonifer*	1	1	2	3	3		5	5	2	1	13	10	23	43.55	33.5	77.05	2.17	1.9	2.09
3	*Rhizopus sp.*	5	4	2	1	3	5	3	4			13	14	27	43.55	46.9	90.45	2.17	2.6	2.45
	Deuteromycotina																			
4	*Alternariaalternata*	5	5	4	9	7	9	13	9	12	11	41	42	84	137.35	144.05	281.4	7.08	8.13	7.65
5	*Alternaria sp.*	8	2	8	4	4	5	3	6	7	8	30	25	55	100.5	83.75	184.25	5.25	4.7	5
6	*Aspergillus flaves*	4	6	2	3	4	6	4	2	4	2	18	19	37	60.3	63.65	123.95	3.04	3.6	3.36
7	*Aspergillus fumigatus*		1	2	2	2	3	6		3	7	13	13	26	43.55	43.55	87.1	2.17	2.5	2.36
8	*Aspergillus nidulance*		11	2	3	3		2	1	2	2	9	17	26	30.15	56.95	87.1	1.7	3.24	2.36
9	*Aspergillus niger*	8	2	10	11	10	9	12	10	9	10	49	42	91	164.15	140.7	304.85	9.31	7.79	8.28
10	*Aspergillus terreus*	4	4	1	2		1	2	1	2	2	9	10	19	30.15	33.5	63.65	1.7	1.9	1.73
11	*Aspergillus versicolor*	1	3	3	2	2	2	1	2	1	2	8	11	19	26.8	36.85	63.65	1.2	2.1	1.73
12	*Aspergillus sp.*	7	7	7	7	2	6	8	1	11	6	35	27	62	117.25	90.45	207.7	7.33	5.15	5.64
13	*Cladosporium cladosporides*	4	4	10	6	5	6	3	10	6	6	28	32	60	93.8	107.2	201	5.74	6.1	5.46
14	Cladosporium herbarum	2	1	8	1	5	7	3	5	9	6	27	20	47	90.45	67	157.45	4.62	3.9	4.28
15	Cladosporium sp.	8	3		7	5	4	6	6	3	6	22	26	48	73.7	87.1	160.8	3.64	4.9	4.37
16	*Curvularia lunata*	1		6	3	4	4	3	5	8	7	22	19	41	73.7	63.65	137.35	3.64	3.6	3.73
17	*Curvularia sp.*	6	1	1	1	4	1	2	5	2	3	15	11	26	50.25	36.85	87.1	2.52	2.1	2.36
18	*Drechslera sp.*	1	4	4	3	5	2	4	5	6	3	20	17	37	67	56.95	123.95	3.3	3.3	3.36
19	*Fusarium sp.*	4			2	1	4	2		4	1	11	7	18	36.85	23.45	60.3	1.4	1.31	1.63
20	*Penicillium nigricans*	9	7	9	7	9	9	9	10	11	11	47	44	91	157.45	147.4	304.85	8.13	7.6	8.29
21	*Penicillium sp.*	6	5	6	8	6	5	7	8	10	6	35	32	67	117.25	107.2	224.45	7.23	6.1	6.2
22	*Scopulariopsis sp.*	1			1	2	2	2	2		3	5	8	13	16.75	26.8	43.55	0.76	1.51	1.19
23	*Stachylidium sp.*	4	3	3		1	2	1		4		13	5	18	43.55	16.75	60.3	2.17	0.95	1.64
24	*Trichoderma sp.*	2	3	4	3	5	1	2	5	2	3	15	15	30	50.25	50.25	100.5	2.42	2.9	2.74
25	*Unidentified spp.*	14	11	11	14	9	11	17	8	13	10	64	54	118	214.4	180.9	395.3	10.11	10.7	10.75
	TOTAL	106	90	108	105	102	105	121	110	133	118	570	528	1098	1908.5	1768.8	3678.3	100	100	100.01

Conversion factor of andersion sampler for 10 minutes - No. of colony X 3.35

I =INDOOR

O = OUTDOOR

T =TOTAL

Table 2. Concentration of dust fungal flora at selected sites (Dec. 2010-May, 2011)

S.No.	Fungal isolates	SITE I 10^{-2}	SITE II 10^{-2}	SITE III 10^{-2}	SITE IV 10^{-2}	SITE V 10^{-2}	Total 10^{-2}	CFU/ml 10^{-2}
	Zygomycotina							
1	*Mucor sp.*	1		4	1	2	8	8×10^{-2}
2	*Rhizopus stolinifer*	5	4	2	3	1	15	15×10^{-2}
3	*Rhizopus sp.*			2	1	4	7	7×10^{-2}
	Deuteromycotina							
4.	*Alterneria alternata*	1	3	1	3	10	18	18×10^{-2}
5	*Alterneria sp.*	4	10	8	14	7	43	43×10^{-2}
6.	*Aspergillus clavatus*	6	3	3	6	1	19	19×10^{-2}
7.	*Aspergillus flaves*	2		2	2	4	10	10×10^{-2}
8.	*Aspergillus fumigatus*	3	3	3	5	3	17	17×10^{-2}
9.	*Aspergillus nidulance*	1	3	4	2	3	13	13×10^{-2}
10.	*Aspergillus niger*	2	1	3	2	12	21	21×10^{-2}
11.	*Aspergillus terreus*	8	7	9	9	4	37	37×10^{-2}
12.	*Aspergillus sp.*	2		3	2	7	14	14×10^{-2}
13.	*Cladosporium cladosporioder*	4	7	5	5	5	26	26×10^{-2}
14.	*Cladosporium sp.*	2	1	3	4	3	13	13×10^{-2}
15.	*Fusarium sp.*	5	2	2	3	5	17	17×10^{-2}
16.	*Penicillium chrysogenum*	2	1	2	8	12	25	25×10^{-2}
17.	*Penicillium nigricant*	4	8	7	6	8	33	33×10^{-2}
18.	*Penicillium chrysogenum*	8	10	7	2	4	31	31×10^{-2}
	Unidentified spp.	9	10	9	11	10	49	49×10^{-2}
	Total	70	73	79	89	105	416	416×10^{-2}

fungal cultures were isolated using Anderson two stage sampler, which belongs to 12 different fungal genera (Table 1). Out of these 12 genera, 10 genera belong to Deuteromycotina and 2 belong to Zygomycotina. Altogether 1098 (3678.3 CFU/m^3) fungal colonies were isolated. Out of these 570 (1909.5 CFU/m^3) colonies were isolated from indoor environment and 528 (1768.8 CFU/m^3) colonies from outdoor environment. *Aspergillus niger* and *Penicillium nigricans* was most dominant in all fungal forms and occurred with 304.85 CFU/m^3, followed by *Alterneria alternata* 281.46 CFU/m^3 and *Penicillium* sp. 224.45 CFU/m^3.

According to Rippon[11] *Aspergillus* species are the most frequent fungal species in every natural substrate. The higher fungal incidence of *Aspergillus* and *Penicillium* in indoor is probably as a result of their saprophytic ability. These fungi are also termed as indoor fungi. Verma and Soni[12] sampled Jabalpur city using petriplates method and 28 fungal genera were identified in which the major type were *Aspergillus* sp. (11%), *Cladosporium* (32.1%), *Curvularia* (5.6%), *Penicillium* (4.78%), *Alternaria* (3.52%) and *Fusarium* (1.23%).

Monthly incidence of fungal spores with the total months in indoors and outdoors showed a clean view of the distribution of fungi. In present study the month of December contributed the maximum spores in both indoor and outdoor air followed by the month of March. Other months, especially December to February were recorded to have significant fungal colonies. Less number of fungal spores were recorded in the months of April and May in indoor and intermittently in the month of May in outdoor.

Qualitative and quantitative assessment of dust mycoflora was done during study period of six months at different selected sites in 10^{-2} dilution. Total 18 fungal isolates were recorded belongs to different genera (Table 2). Out of 18, three species genera belong to Zygomycotina and remains 14 belong to Deuteromycotina per gram dust. *Aspergillus* was also a common genus here, with 13 species followed by *Penicillium* (8 species), *Alternaria* (5 species), *Fusarium, Mucor* and *Trichoderma* (4 species each), *Scytalidium* and *Stachybotrys* (3 species each). Two species were isolated from each of the genera *Cladosporium, Curvulari* and *Rhizopus.* Verma and Bhandari[13] reported that *Aspergillus* sp. is most dominant contributing 58.8% and the other dominant spores were *Fusarium* sp., *Curvularia* sp. and *Cladosporium* sp. in intramural Brolier and layer environment.On the other hand, one species each of *Botrytis, Embellisia, Epicoccum,*

Eurotium and *Ulocladium* were isolated from the school dust of Riyadh city. *Aspergillus apicalis* exhibited the highest number of colonies per gram of school dust among the fungal species followed by *Aspergillus clavatus* with 84 colonies per gram of school dust *Aspergillus,* which yielded the highest number of dust species, and the second ranking *Penicillium* were also recorded earlier as the most prevalent genera in air of Riyadh city[6,14,15]. *Aspergillus* and *Penicillum* species together with other common genera like *Alterneria, Fusarium, Mucor, Trichoderma, Cladosporium* and *Curvularia* which are prevalent genera in school dust are also common in different types of environments and dusts[16-18]. These genera were reported as common genera of house dust[6].

As pointed out, many people are unaware of the roles fungi play in the world around them and researches on fungal diseases are not given the seriousness, they deserve. This kind of investigation is especially necessary in the developing countries where interventions for indoor mold toxicity and remediation, as well as health care facilities, are still far from adequate.

The concentration of airborne fungal not only differ from place to place but also within the same area due to both environmental and anthropogenic reasons. Monthly variation also recorded due to slight differences in meteorological parameters in different month. The data collected will be of great interest not only for the botanists but also for the clinicians and allergic patients. It will be helpful in establishing correlation between fungal allergens in air and dust and symptoms of hypersensitive patients, thus achieving effective management of allergic disorders.

It is concluded that aerobiological sampling and dust evaluation of different geographical regions is essential to identify the dominant fungal types of an area and assess their allergenicity. The data is helpful for allergologists in identifying the potential allergy risk reasons and thus managing respiratory disorders of local inhabitants.

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