ASIAN J. EXP. BIOL. SCI. SPL. 2010 :24-30

ISSN 0975-5845
AJEBS
http://www.ajebs.com

ORIGINAL ARTICLE

Aeromycoflora of Outdoor and Indoor Air of Residential Area in Nashik

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ABSTRACT

The extramural and intramural investigation was undertaken to study the outdoor and indoor aeromycoflora of the residential houses. The investigation period was of three months i.e. December 2007- February 2008. Air sampling was done daily by using Rotorod air sampler. A total of 55 fungal spores types and 5 other types have been identified from the outdoor air and 48 fungal spore types and 5 other types from the indoor air. The total number of fungal spore types and other types trapped from extramural investigation were 248685/m3 of air. The total number of fungal spore types and other types trapped from intramural investigation were 18270/m3 of air. The investigation showed a close correlation in the occurrence of fungal spore types of outdoor and indoor air. Commonly occurring spores in both were Cunninghamella, Amphisphaerella, Chaetomium, Didymosphaeria, Melanospora, Alternaria, Aspergillus, Cladosporium, Helminthosporium, Heterosporium and Nigrospora.

KEY WORD*:Extramural, Intramural, Fungal spore*

INTRODUCTION

The importance of biopollutants as a major cause of outdoor and indoor air has widely been recognized. Much work is being done on the study of airborne fungal spores and pollen grains and its impact. The Airborne fungal spores are important in the etiology of respiratory disorders [1-3]. They have been recognized to cause asthma, allergic rhinitis and other allergic diseases. The airborne fungal spores show great variation in composition and concentration and vary from place to place. Hence aeromycological study with different views is being continued [4-6]. The present extramural and intramural investigation was undertaken to study the outdoor and indoor aeromycoflora of residential area in Nashik city, which will render valuable information regarding the composition and concentration of the bioparticles in the air and the biopollutants present there [7-8].

MATERIAL AND METHODS

The air monitoring was carried out for a period of three months from December 2007 to February 2008 in the residential area of Panchavati in Nashik by using "Rotorod air Sampler". Extramural and intramural air samples were collected daily for the said period in the morning at 8 a.m. and in the evening at 6 p.m. for 30 minutes each. Slides were prepared and scanned and the spores were identified up to generic level with the help of literature [9] and reference slides.

RESULT AND DISCUSSION

The present aerobiological investigation of residential area was undertaken to study the aeromycoflora of outdoor air i.e. the air outside the residential houses and indoor air i.e. the air inside the residential houses.

During the three months survey, the total number of fungal spores encountered was 224475/m3 referable to 55 fungal types and 14500/m3 referable to 48 fungal types from outdoor and indoor air respectively (Table I). Besides fungal spores the other bioparticles i.e. miscellenous types were also recorded. The total number of other types recorded during the survey was 24210/m3 and 3770/m3 from outdoor and indoor air respectively. The Deuteromycotina dominated the airspora and exhibited the highest concentration 152395/m3 and 8270/m3 followed by Ascomycotina

40790/m3 and 3770/m3, Basidiomycotina 26230/m3 and 1825/m3, Phycomycotina5070/m3 and 635/m3 in outdoor and indoor air respectively (Table no.3).

In Phycomycotina 3 fungal spore types were recorded in outdoor and indoor air namely *Cunninghamella, Mucor and Rhizopus.* Among the three *Cunninghamella* contributed maximum in outer and indoor air i.e. 1.67% and 1.83 % respectively (Table 2).

In Ascomycotina 22 and 20 spore types were recorded in the outdoor and indoor air respectively. Among these *Melanospora*.(3.32% and 1.86%) , *Didymospharia*.(2.84% and 1.83%), *Chaetomium*.(2.43% and 3.53%), *Hypoxylon*.(1.84% and 0.93%) contributed in high concentration to the outdoor and indoor air respectively(Table 2).

In Basidiomycotina 2 spore types were recorded. Smut spores and Rust spores. Smut spores were found in high concentration and contributed 9.79% and 7.77% to the outdoor and indoor airspora respectively (Table 2).

In Deuteromycotina 28 and 26 spore types were recorded in outdoor and indoor air respectively. Dominant spore types recorded in this group were *Nigrospora*(7.76% and 8.32%), *cladosporium*(7.61% and 1.45%),, *Alternaria*(7.36% and 3.64%), *Aspergillus*(4.72% and 2.90%), *Helminthosporium*(4.63% and 0.47%), *Papularia*(4.61% and 0.60%) in the outdoor and indoor air respectively(Table 2). Among the other types Hyphal fragments contributed maximum 4.98% in outdoor air and insect scales 9.63% in indoor air.

Thus Smut spores, *Nigrospora, Cladosporium, Alternaria, Aspergillus* which were dominant in the outdoor air were also recorded in significant concentration in theindoor air.The Human pathogenic fungal spores recorded in outdoor and indoor air are *Rhizopus, Mucor, Aspergillus, Alternaria, Cladosporium and Diploidia*. The allergic fungal spore types recorded in both places are *Aspergillus, Alternaria,Chaetomium, Cladoporium, Curvularia, Drechlera, Epicoccum, Helminthosporium, Mucor and Rhizopus*

Table 1 Variation in the Monthly concentration of extramural and intramural spore type to the total airspora

Name of the Spore	Extramural			Total	Intramural			
	Dec	Jan	Feb		Dec	Jan	Feb	Total
I] PHYCOMYCOTINA								
1. *Cunninghamella* Matr.	1360	1485	1320	**4165**	120	135	80	**335**
2. *Mucor* Micheli.Nov.pl.	135	105	130	**370**	75	40	55	**170**
3. *Rhizopus* Enrenb	185	175	175	**535**	55	45	30	**130**
II] ASCOMYCOTINA								
1. *Amphisphaerella*	210	180	220	**610**	85	50	60	**195**
2. *Bombardia* Fr.	195	245	180	**620**	55	95	50	**200**
3.*Botryosphaeria*	450	645	585	**1680**	10	25	15	**50**
4. *Chaetomium*	1530	2870	1635	**6035**	185	255	205	**645**
5. *Cucurbitaria* Gray ex. Grev.	105	65	100	**270**	35	10	20	**65**
6. *Didymosphaeria* Fuck.	2315	2040	2715	**7070**	110	90	135	**335**
7. *Hypoxylon* Bull ex. Fr.	1520	1535	1520	**4575**	70	55	45	**170**
8. *Hysterium* Tode ex.Fries	155	105	165	**425**	80	85	50	**215**
9. *Lacanidion* Endl.	120	95	130	**345**	----	---	---	**0**

10. *Leptosphaeria* Ces.and de.Not.	310	510	370	**1190**	----	---	--	**0**
11. *Lophiostoma* Ces.and de.Not.	320	475	420	**1215**	65	90	75	**230**
12. *Massaria*	380	720	240	**1340**	-----	-----	---	**0**
13. *Meliola* Fr.	125	115	120	**360**	50	30	15	**95**
14. *Melanospora* Corda.	2705	2955	2605	**8265**	140	110	90	**340**
15.*Parodiella*	185	155	205	**545**	15	10	15	**40**
16. *Passereniella* Beri.	390	595	360	**1345**	90	115	70	**275**
17.*Pleospora*	230	385	195	**810**	15	45	15	**75**
18. *Rosellina* Ces.and de.Not.	295	260	285	**840**	110	60	70	**240**
19. *Sordaria* Ces.and de.Not.	385	370	365	**1120**	105	70	45	**220**
20. *Sporormia* de Not.	125	100	120	**345**	-----	-----	-----	**0**
21. *Teichospora* Fuck.	430	425	530	**1385**	70	80	95	**245**
22. *Xylaria* Hill ex.Grev.	135	120	145	**400**	45	40	50	**135**
III] BASIDIOMYCOTINA								
1. Smut spores	7550	8840	7950	**24340**	450	505	465	**1420**
2. Rust spores	605	570	705	**1880**	130	110	165	**405**
IV] DEUTEROMYCOTINA								
1. *Alternaria* Nees.	5335	7830	5135	**18300**	215	255	195	**665**
2. *Aspergillus* Mach ex.Fr.	3895	3840	3995	**11730**	180	185	165	**530**
3. *Bispora* Corda.	405	335	415	**1155**	175	170	175	**520**
4. *Botryodiplodia* Sacc.	270	240	290	**800**	----	10	10	**20**
5. *Cladosporium* Link.	6250	6355	6330	**18935**	85	70	110	**265**
6. *Cordana* Preuss.	105	95	100	**300**	20	----	20	**40**
7. *Cornyspora*	120	105	85	**310**	20	20	15	**55**
8. *Curvularia* Boed.	2215	2330	2115	**6660**	95	140	70	**305**
9. *Dendryphiopsis* Huhhes.	115	75	105	**295**	------	------	-----	**0**
10. *Dictyosporium*	1800	2170	1700	**5670**	120	80	60	**260**
11. *Diplodia* Fr.	1045	1215	1125	**3385**	90	110	90	**290**
12. *Drechslera* Ito.	2745	2725	2925	**8395**	------	------	------	**0**
13. *Epicoccum* Link.	440	485	400	**1325**	90	110	65	**265**
14. *Exosporium* Link.	530	880	410	**1820**	90	125	60	**275**
15. *Fusariella* Link.	185	190	165	**540**	50	70	30	**150**
16. *Fusarium*	50	70	75	**195**	-----	5	5	**10**
17. *Gleosporium* Desm and mont.	305	280	330	**915**	-----	-----	------	**0**
18. *Haplosporella* Speg.	2940	3375	2840	**9155**	190	205	185	**580**

19. *Helminthosporium* Link.	3945	4215	3345	**11505**	25	45	15	**85**
20. *Heterosporium* Klotzsch.	2510	2725	2610	**7845**	195	265	205	**665**
21. *Nigrospora* Zinm.	6375	6430	6485	**19290**	490	510	520	**1520**
22. *Odium* Sacc.Link.	3190	2900	2960	**9050**	120	70	70	**260**
23. *Papularia* Fr.	3655	3785	4025	**11465**	25	40	55	**120**
24. *Periconia* Tode ex.schco.	195	165	185	**545**	40	35	55	**130**
25. *Pestalotia*	70	85	105	**260**	35	55	50	**140**
26. *Tetracoccosporium*	25	40	40	**105**	-----	20	10	**30**
27 . *Tetraploa*	35	185	120	**340**	--	100	50	**150**
28. *Torula*	775	545	785	**2105**	460	140	340	**940**
V] OTHER TYPES								
1. Hyphal Fragments	4055	3925	4415	**12395**	560	240	700	**1500**
2.Insect scales	1455	995	1545	**3995**	720	340	700	**1760**
3. Pollen grains	1030	1155	1180	**3365**	40	90	130	**260**
4. Protozoan cyst.	970	1030	855	**2855**	20	50	40	**110**
5. Unidentified spores.	625	530	445	**1600**	55	45	40	**140**
Total				**248685**				**18270**

Table 2 Total spore concentration and percentage concentration of each spore

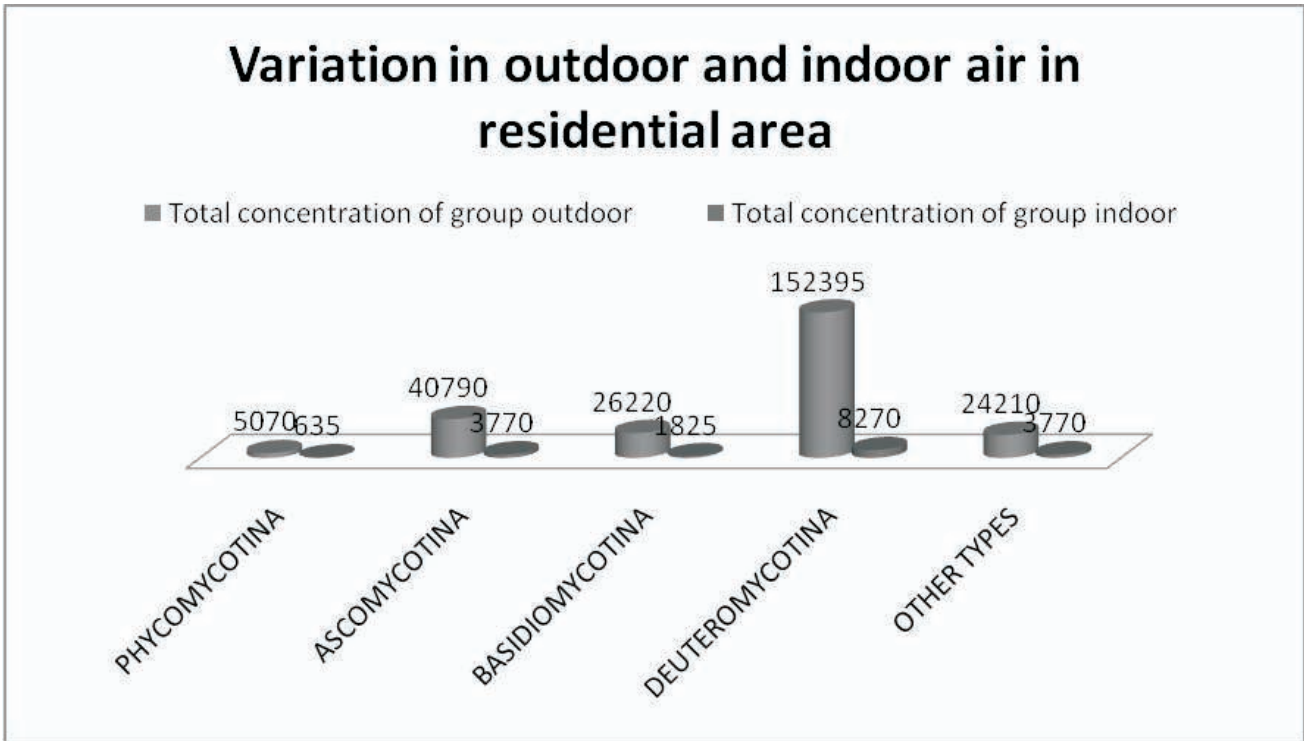
Name of the Spore	Total outdoor spore/m3 of air	Total indoor spore/m3 of air	% Conc. of outdoor air	% Conc. of indoor air
I] PHYCOMYCOTINA				
1. *Cunninghamella* Matr.	4165	335	1.67	1.83
2. *Mucor* Micheli.Nov.pl.	370	170	0.15	0.93
3. *Rhizopus* Enrenb	535	130	0.22	0.71
II] ASCOMYCOTINA				
1. *Amphisphaerella*	610	195	0.25	1.07
2. *Bombardia* Fr.	620	200	0.25	1.09
3.*Botryosphaeria*	1680	50	0.68	0.27
4. *Chaetomium*	6035	645	2.43	3.53
5. *Cucurbitaria* Gray ex. Grev.	270	65	0.11	0.36
6. *Didymosphaeria* Fuck.	7070	335	2.84	1.83
7. *Hypoxylon* Bull ex. Fr.	4575	170	1.84	0.93
8. *Hysterium* Tode ex.Fries	425	215	0.17	1.18

9. *Lacanidion* Endl.	345	0	0.14	0.00
10. *Leptosphaeria* Ces.and de.Not.	1190	0	0.48	0.00
11. *Lophiostoma* Ces.and de.Not.	1215	230	0.49	1.26
12. *Massaria*	1340	0	0.54	0.00
13. *Meliola* Fr.	360	95	0.14	0.52
14. *Melanospora* Corda.	8265	340	3.32	1.86
15.*Parodiella*	545	40	0.22	0.22
16. *Passereniella* Beri.	1345	275	0.54	1.51
17.*Pleospora*	810	75	0.33	0.41
18. *Rosellina* Ces.and de.Not.	840	240	0.34	1.31
19. *Sordaria* Ces.and de.Not.	1120	220	0.45	1.20
20. *Sporormia* de Not.	345	0	0.14	0.00
21. *Teichospora* Fuck.	1385	245	0.56	1.34
22. *Xylaria* Hill ex.Grev.	400	135	0.16	0.74
III] BASIDIOMYCOTINA				
1. Smut spores	24340	1420	9.79	7.77
2. Rust spores	1880	405	0.76	2.22
IV] DEUTEROMYCOTINA				
1. *Alternaria* Nees.	18300	665	7.36	3.64
2. *Aspergillus* Mach ex.Fr.	11730	530	4.72	2.90
3. *Bispora* Corda.	1155	520	0.46	2.85
4. *Botryodiplodia* Sacc.	800	20	0.32	0.11
5. *Cladosporium* Link.	18935	265	7.61	1.45
6. *Cordana* Preuss.	300	40	0.12	0.22
7. *Cornyspora*	6660	305	2.68	1.67
8. *Curvularia* Boed.	295	0	0.12	0.00
9. *Dendryphiopsis* Huhhes.	5670	260	2.28	1.42
10. *Dictyosporium*	3385	290	1.36	1.59
11. *Diplodia* Fr.	8395	0	3.38	0.00
12. *Drechslera* Ito.	1325	265	0.53	1.45
13. *Epicoccum* Link.	1820	275	0.73	1.51
14. *Exosporium* Link.	540	150	0.22	0.82

15. *Fusariella* Link.	915	0	0.37	0.00
16. *Fusarium*	9155	580	3.68	3.17
17. *Gleosporium* Desm and mont.	11505	85	4.63	0.47
18. *Haplosporella* Speg.	7845	665	3.15	3.64
19. *Helminthosporium* Link.	19290	1520	7.76	8.32
20. *Heterosporium* Klotzsch.	9050	260	3.64	1.42
21. *Nigrospora* Zinm.	11465	120	4.61	0.66
22. *Odium* Sacc.Link.	545	130	0.22	0.71
23. *Papularia* Fr.	195	10	0.08	0.05
24. *Periconia* Tode ex.schco.	260	140	0.10	0.77
25. *Pestalotia*	105	30	0.04	0.16
26. *Tetracoccosporium*	340	150	0.14	0.82
27 . *Tetraploa*	2105	940	0.85	5.15
28. *Torula*	310	55	0.12	0.30
V] OTHER TYPES				
1. Hyphal Fragments	12395	1500	4.98	8.21
2. Insect scales	3995	1760	1.61	9.63
3. Pollen grains	3365	260	1.35	1.42
4. Protozoan cyst.	2855	110	1.15	0.60
5. Unidentified spores.	1600	140	0.64	0.77
Total	248685	18270	100	100

Table 3 Total airspora and percent concentration of each spore group during present investigation

Sr.No.	**Name of the Spore**	**Total concentration of group**		**Total % contribution**	
		Outdoor	**indoor**	**outdoor**	**Indoor**
1	PHYCOMYCOTINA	5070	635	2.04	3.48
2	ASCOMYCOTINA	40790	3770	16.40	20.63
3	BASIDIOMYCOTINA	26220	1825	10.54	9.99
4	DEUTEROMYCOTINA	152395	8270	61.28	45.27
5	OTHER TYPES	24210	3770	9.74	20.63
	Total	248685	18270	100	100



CONCLUSION

The present aeromycological survey of residential area shows that the airspora of indoor air has its origin in outdoor air. The outdoor and indoor airspora show a close correlation qualitatively and quantitatively. Similarity has been found in fungal biodiversity in the outdoor and indoor survey i.e. out of 55 fungal spore types recorded from outdoor air, 48 fungal spore types were recorded from indoor air. The predominance of fungal spore types, the dominance of Deuteromycotina followed by other fungal groups, concentration of individual fungal spore types, dominant fungal spore types, Allergic and pathogenic spore types show close correlation in occurrence and concentration in the outdoor and indoor airspora.

Impact of airborne fungal spores including their release, dissemination, deposition and effect is of great significance to identify the health hazards and physiological disorders in living beings. Study of this aspect is highly interdisciplinary in nature and has tremendous scope to find the significant application in human health. Exposure to outdoor and indoor airborne inhalant mold allergens develops respiratory symptoms and airway diseases and allergies. Thus clean environment is of prime importance to reduce the fungal spore load in the air.

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