

# VOLUMETRIC LOAD OF AIRBORNE DEUTEROMYCETES SPORES AT HAJIPUR (VAISHALI), BIHAR (INDIA)

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Volumetric concentration of airborne bioparticles was investigated at Hajipur between Feb. 2006 and Jan. 2008 using Tilak Air Sampler. Out of a total of 80 airspora components, 50 belonged to Deuteromycetes contributing 69.9% of the total aeromicrobiota. Annual as well as seasonal variations of the spore types have been determined. *Alternaria*, *Aspergillus*, *Cladosporium*, *Curvularia*, *Epicoccum*, *Fusarium*, *Helminthosporium*, *Nigrospora* and *Penicillium* have been identified as dominant allergenic components. Phytopathogenic and allergenic significance of the spores have also been estimated.

## INTRODUCTION

Determination of volumetric concentration of airspora components with emphasis on their annual, seasonal and diurnal variations constitutes an important aerobiological study of any region. This kind of study has an added advantage of providing a reliable database to phytopathologists and allergologists to plan their respective investigations on plant diseases and human allergic disorders.

The present communication is a part of comprehensive aerobiological study over two successive years (Feb., 2006-Jan., 2008) at Hajipur (85° 13'E and 25°40'N), the headquarters of Vaishali district and a famous fruit and vegetable growing region of North Bihar. Trapping and identification of airspora have provided substantial data on spore incidence. Efforts have been made to work out annual and seasonal variations of Deuteromycetes spores and their phytopathogenic and allergenic significance.

## MATERIAL AND METHODS

Sampling of airspora was conducted by using electricity operated Tilak Air Sampler (Tilak and Kulkarni, 1970) at two sampling stations-Paswan chowk and Gandhi Chowk of Hajipur. Paswan Chowk, the first sampling station represented an open site with dense vegetal cover while Gandhi Chowk represented an area of sparse vegetation. The Sampler was installed at a height of 4 m from the ground level. Tilak Air Sampler provides volumetric data of airspora concentration in terms of No. of spores / m<sup>3</sup> of air.

Permanent slides were prepared as per the procedure described by Tilak and Srinivasulu, (1967). Identification of bioparticles so trapped was made on the basis of morphological characters observed during scanning and with the help of several mycological papers and standard description of fungi (Barnett, 1960; Ellis, 1971; Subramanian, 1971; Barron, 1972, Kendrick and Carmichael, 1973).

Information on the floristic composition of the region which determines the nature and diversity of airspora composition as well as its daily and seasonal variation was obtained by regular and systematic field surveys for the whole period of investigation. Daily records of temperature and relative humidity were maintained for the whole period of investigation.

## RESULTS AND DISCUSSION

Out of 80 airspora components investigated, 50 belonged to Deuteromycetes which dominated the airspora with highest incidence of 69.90% of the total airspora. Out of 50 Deuteromycetes spore types, 38 belonged to Moniliales, 8 to Sphaeropsidales, 3 to Melanconiales and 1 to Mycelia sterilia. Dominance of spore types was determined by their percentage contribution to the total airspora. The average percentage contribution of Deuteromycetes spore types ranged between 0.11 % (*Phaeotrichoconis*) and 37.50 % (*Cladosporium*). Apart from *Cladosporium* which contributed 37.50% to the total airspora, *Alternaria* (5.16 %), *Periconia* (5.19 %), *Curvularia* (5.12 %) and *Helminthosporium* (1.04%) were recorded as airspora dominants. The highest concentration of *Cladosporium* has been investigated everywhere in the world and may be designated as "Universal dominant". Higher saprophytic growth ability and high fecundity in *Cladosporium* are supposed to lead to their higher incidence in the atmosphere. Spore liberation being passive, gentle wind currents and other mechanical turbulence release large quantities of spores in the air. The mist-pick-up mechanism may play a role in the dispersal of *Cladosporium* (Gregory, 1961). The nearby Ganga water may add up to the local humid conditions. Low humidity and high temperature conditions might have lowered their aerial occurrence as observed during the dry months of April and May. In the airspora composition, the order of dominance was : Deuteromycetes (69.96%), other types (9.61%), Basidiomycetes (8.60%), Phycomycetes 6.15% and Ascomycetes (5.68%).

Most of the Deuteromycetes spore types showed the dry-spore characteristics and their concentration was observed higher usually 2-3 days after rainfall. The concentration of Moniliales was higher than that of Sphaeropsidales. This might have been due to the former's high fecundity and presence of their spores on exposed conidiophores which facilitates their easy spore discharge. The conidia of Sphaeropsidales are under the impact of controlled environment within pycnidium.

Different Deuteromycetes spores were observed to cause disease infections on leaf of tomato, lady's finger and banana, etc. Airborne Deuteromycetes spores have also been proved to be potential agents of human allergy manifestations tested

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through intradermal sensitivity symptoms on allergy patients. Allergenic Deuteromycetes spores encountered include *Alternaria*, *Aspergillus*, *Cladosporium*, *Curvularia*, *Epicocum*, *Fusarium*, *Helminthosporium*, *Nigrospora* and *Penicillium*. Percentage contribution of different spore groups to the total airspora (Mean of the two consecutive sampling years), percentage contribution of Deuteromycetes spores to the total airspora, variation in the yearly mean concentrations of Deuteromycetes spores, estimated average seasonal contribution of spore groups and variation in concentration of some prominent Deuteromycetes spores (no./m<sup>3</sup>) in two consecutive sampling years have been presented in Table-I, II, III, IV and V respectively.

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**TABLE -I : Percentage contribution of different spore groups to the total airspora (Mean of the first year from 1<sup>st</sup> February, 2006 to 31<sup>st</sup> January, 2007 and second year from 1<sup>st</sup> February, 2007 to 31<sup>st</sup> January, 2008)**

S.No.	Spore group	No. of spores /m <sup>3</sup> of air	Percentage contribution to the total air spora
1.	Phycomycetes	444556	6.15
2.	Ascomycetes	410200	5.68
3.	Basidiomycetes	621516	8.60
4.	Deuteromycetes	5050186	69.96
5.	Other types	693196	9.61

**TABLE -II : Percentage contribution of deuteromycetes spore types to the total airspora (Mean of the first year from 1<sup>st</sup> February, 2006 to 31<sup>st</sup> January, 2007 and second year from 1<sup>st</sup> February, 2007 to 31<sup>st</sup> January, 2008)**

S.No.	Spore group	No. of spores /m <sup>3</sup> of air	Percentage contribution to the total air spora
1.	<i>Cladosporium</i> Link. ex. Fr.	2709938	37.50
2.	<i>Periconia</i> Tode. ex. Schw.	374906	5.19
3.	<i>Alternaria</i> Nees. ex. Wallr.	372708	5.16
4.	<i>Curvularia</i> Boedjn.	370216	5.12
5.	<i>Nigrospora</i> Zimm.	238224	3.30
6.	<i>Lacellina</i> Sacc.	122584	1.70
7.	<i>Torula</i> Pers. ex. Fr.	114100	1.58
8.	<i>Aspergillus</i> Link.	99848	1.38
9.	<i>Pithomyces</i> Berk. & Br.	99442	1.37
10.	<i>Helminthosporium</i> Link ex. Fr.	75474	1.04
11.	<i>Memnoniella</i> Hohnel.	68726	0.95
12.	<i>Papularia</i> Fries	38514	0.53
13.	<i>Gloeosporium</i> Cke. & Masee	36820	0.51
14.	<i>Melanconium</i> Link	31178	0.43
15.	<i>Cercospora</i> Fries	28000	0.40
16.	<i>Lacellinopsis</i> Subram	24668	0.34
17.	<i>Botryodiplodia</i> Sacc.	22274	0.31
18.	<i>Pyricularia</i> Sacc.	20958	0.30

S.No.	Spore group	No. of spores /m3 of air	Percentage contribution to the total air spora
19.	<i>Fusarium</i> Liuk. ex Fr.	20748	0.28
20.	<i>Sclerotium</i> Tode	18340	0.25
21.	<i>Epicoccum</i> Link. ex Wallr.	16030	0.22
22.	<i>Spegazzinia</i> Sacc.	15610	0.22
23.	<i>Cordana</i> Preuss. em Sacc.	10332	0.14
24.	<i>Penicillium</i> Link. ex Fr.	10066	0.13
25.	<i>Deighthoniella</i> (Syd.) Ellis	8806	0.12
26.	<i>Fusariella</i> Sacc.	8596	0.12
27.	<i>Dicityoarthrinium</i> Haghes	8344	0.11
28.	<i>Corynespora</i> Gussow	8246	0.11
29.	<i>Haplosporella</i> Speg.	6986	0.10
30.	<i>Bipolaris</i> Shoemaker	6916	0.10
31.	<i>Sphaeropsis</i> Sacc.	6692	0.09
32.	<i>Trichoconis</i> Clem.	6622	0.09
33.	<i>Bispora</i> Corda.	6188	0.08
34.	<i>Stemphylium</i> Wallr.	5796	0.08
35.	<i>Heterosporium</i> Klotzsch. ex Cooke	5376	0.07
36.	<i>Diplodia</i> Fr.	5194	0.07
37.	<i>Beltrania</i> Penzig.	4620	0.06
38.	<i>Oidium</i> Sacc.	3766	0.05
39.	<i>Trichothecium</i>	3682	0.05
40.	<i>Arthrinium</i> Kunze ex Fr.	2604	0.03
41.	<i>Herknessia</i> Cooke	2058	0.03
42.	<i>Hendersonula</i> Speg.	1736	0.024
43.	<i>Hendersonia</i> Sacc.	1680	0.023
44.	<i>Tetraploa</i> Berk. & Br.	1470	0.020
45.	<i>Exosporium</i> Link. ex Wallr.	1288	0.018
46.	<i>Zygosporium</i> Mont.	1162	0.016
47.	<i>Sirodesmium</i> de Not.	1050	0.014
48.	<i>Beltraniella</i> Subram	910	0.012
49.	<i>Camposporium</i>	896	0.012
50.	<i>Phaeotrichoconis</i>	798	0.011

**TABLE-III : Variation in the yearly mean concentration and the percentage contributions of the Deuteromycetes spore types to the total airspora in 2006-07 & 2007-08**

S.NO.	Spore types	Yearly mean concentration(No./m <sup>3</sup> )		Percentage contribution to the total airspora	
		2006-07	2007-08	2006-07	2007-08
1.	<i>Cladosporium</i> Link. ex. Fr.	1260294	1449644	33.79	41.46
2.	<i>Periconia</i> Tode. ex. Schw.	158676	216230	4.25	6.18
3.	<i>Alternaria</i> Nees. ex. Wallr.	164654	208054	4.41	5.95
4.	<i>Curvularia</i> Boedijn.	173726	196490	4.66	5.62
5.	<i>Nigrospora</i> Zimm.	140252	97972	3.76	2.80
6.	<i>Lacellina</i> Sacc.	68376	54208	1.83	1.45
7.	<i>Torula</i> Pers. ex. Fr.	72142	41956	1.93	1.20

S.NO.	Spore types	Yearly mean concentration(No./m <sup>3</sup> )		Percentage contribution to the total airspora	
		2006-07	2007-08	2006-07	2007-08
8.	<i>Aspergillus</i> Link.	57372	42476	1.54	1.22
9.	<i>Pithomyces</i> Berk. & Br.	43764	55678	1.17	1.59
10.	<i>Helminthosporium</i> Link ex. Fr.	39816	35658	1.07	1.02
11.	<i>Memnoniella</i> Hohnel.	49574	19152	1.33	0.55
12.	<i>Papularia</i> Fries	15960	22554	0.03	0.65
13.	<i>Gloeosporium</i> Cke. & Masee	9100	27720	0.24	0.79
14.	<i>Melanconium</i> Link	27790	3388	0.75	0.10
15.	<i>Cercospora</i> Fries	8834	19166	0.24	0.55
16.	<i>Lacellinopsis</i> Subram	17976	6692	0.48	0.19
17.	<i>Botryodiplodia</i> Sacc.	11340	10934	0.30	0.31
18.	<i>Pyricularia</i> Sacc.	8568	12390	0.23	0.35
19.	<i>Fusarium</i> Link. ex Fr.	10752	9966	0.29	0.29
20.	<i>Sclerotium</i> Tode	11410	6930	0.31	0.20
21.	<i>Epicoccum</i> Link. ex Wallr.	6020	10010	0.16	0.29
22.	<i>Spegazzinia</i> Sacc.	8232	7378	0.22	0.21
23.	<i>Cordana</i> Preuss. em Sacc.	3766	6566	0.10	0.19
24.	<i>Penicillium</i> Link. ex Fr.	6818	3248	0.18	0.09
25.	<i>Deightoniella</i> (Syd.) Ellis	5376	3430	0.10	0.10
26.	<i>Fusariella</i> Sacc.	5096	3500	0.14	0.10
27.	<i>Dcityoarthrinium</i> Hughes	4634	3710	0.13	0.11
28.	<i>Corynespora</i> Gussow	5278	2968	0.14	0.09
29.	<i>Haplosporella</i> Speg.	2940	4046	0.08	0.12
30.	<i>Bipolaris</i> Shoemaker	6888	28	0.19	0.0008
31.	<i>Sphaeropsis</i> Sacc.	4522	2170	0.12	0.06
32.	<i>Trichoconis</i> Clem.	4130	2492	0.11	0.07
33.	<i>Bispora</i> Corda.	1988	4200	0.05	0.12
34.	<i>Stemphylium</i> Wallr.	3332	2464	0.09	0.07
35.	<i>Heterosporium</i> Klotzsch. ex Cooke	3304	2072	0.09	0.06
36.	<i>Diplodia</i> Fr.	3878	1316	0.10	0.04
37.	<i>Beltrania</i> Penzig.	2450	2170	0.07	0.06
38.	<i>Oidium</i> Sacc.	546	3220	0.02	0.09
39.	<i>Trichothecium</i>	2590	1092	0.07	0.03
40.	<i>Arthrinium</i> Kunze ex Fr.	1190	1414	0.03	0.04
41.	<i>Herknessia</i> Cooke	812	1246	0.02	0.04
42.	<i>Hendersonula</i> Speg.	574	1162	0.02	0.03
43.	<i>Hendersonia</i> Sacc.	700	980	0.02	0.03
44.	<i>Tetraploa</i> Berk. & Br.	910	560	0.02	0.02
45.	<i>Exosporium</i> Link. ex Wallr.	742	546	0.02	0.02
46.	<i>Zygosporium</i> Mont.	700	462	0.02	0.01
47.	<i>Sirodesmium</i> de Not.	924	126	0.02	0.003
48.	<i>Beltraniella</i> Subram	462	448	0.012	0.012
49.	<i>Camposporium</i>	480	56	0.02	0.001
50.	<i>Phaeotrichoconis</i>	518	280	0.014	0.008

**TABLE-IV : Estimated average seasonal percentage concentration of each spore group (2006-07 & 2007-08)**

S. No.	Spore group	Summer season (March-June)		Rainy Season (July-Oct.)		Winter season (Nov.-Feb)	
		2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
1.	Phycomycetes	0.31	0.66	97.30	90.69	2.39	8.65
2.	Ascomycetes	12.62	7.21	74.23	74.52	13.15	18.27
3.	Basidiomycetes	13.95	2.72	77.99	65.98	8.06	31.30
4.	Deuteromycetes	15.32	8.47	43.81	43.79	40.87	47.74
5.	Other types	31.60	16.68	32.77	28.87	35.63	54.45

**TABLE-V : Variation in concentration of some prominent allergenic Deuteromycetes spores (no./m<sup>3</sup>) in two consecutive sampling years (2006-07 and 2007-08)**

S.No.	Spore types	2006-07		2007-08	
		Total years conc.	%- age contribution	Total year's conc.	% age contribution
1.	<i>Alternaria</i>	164654	4.41	208054	5.95
2.	<i>Aspergillus</i>	57372	1.54	42476	1.22
3.	<i>Cladosporium</i>	1260294	33.79	1449644	41.46
4.	<i>Curvularia</i>	173726	4.66	196490	5.62
5.	<i>Epicoccum</i>	6020	0.16	10010	0.29
6.	<i>Fusarium</i>	10752	0.29	9996	0.29
7.	<i>Helminthosporium</i>	39816	1.07	35658	1.02
8.	<i>Nigrospora</i>	140252	3.76	97972	2.80
9.	<i>Penicillium</i>	6818	0.18	3248	0.09