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Aerobiology of Devipatan region

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Abstract
Study of aerobiological bioparticles in the atmosphere of Devipatan region was carried out for a period of one year from January 2012 to December 2012. The air sampling was done with the help of Rotorod Air Sampler for 10 study centers of Devipatan region *viz*. Gonda, Colonelganj, Balrampur, Utraula, Pachperva, Jarwa, Tulsipur, Mankapur, Nawabganj and Shrawasti. The total number of bioparticles trapped on the tape was 75,210/m^3 of air. The following aero-bioparticles were found dominant: *Drechslera* 20.64%, Crystals 14.73%, Smut Spores 11.76%, *Cladosporium* 7.94%, *Nigrospora* 6.62%, *Alternaria* 5.27%, *Aspergilli* 2.85% and Rust Spores 2.84%. Other forms include Protozoan Cyst 2.40%, Insect Scales 1.87% to the total aerospora.

Keywords: Aerobiology, rotorod air sampler, Devipatan region

1. Introduction
Aerobiology is a scientific and multi-disciplinary approach focused on the transport of organisms and biologically significant materials. It is concerned with the source of organism or material their release in the atmosphere, their dispersion, deposition and impact on human and animal system. The fungal spores contribute a major portion of aerospora. The relevance of fungal spore content of the atmosphere is very important to the scientist engaged in various fields of researches. In agriculture, aerobiological studies have been mainly used in forecasting the onset of plant diseases as pointed out by Tilak (1973) [1]. The spores of pathogenic organisms start invading the air of locality two or three weeks before they infect the plants. The reports about the arrival of such spores in the air can help farmers in taking precautions. Another possible use as aerobiological studies in agriculture as well as in forestry is the determination of the changes of cross pollination and seed setting in an anemophilous plants. The aerial pollen surveys are even used to take advantage in weed control and controlling the animal and human allergenic disorders caused by these pollens, fungal spores and other organic particles. The significance of the air aerobiological studies is of crucial interest to the health and welfare of human beings and many crops in variety of ways.

2. Materials and Methods
In present investigation, the spore trapping was done by Rotorod Air Sampler (Perkin-1957) [2]. The sample were taken for half an hour at each 10 different places of Devipatan region *viz*. Gonda, Colonelganj, Balrampur, Utraula, Pachperva, Jarwa, Tulsipur, Mankapur, Nawabganj and Shrawasti. Monthly surveys were made from January 2012 to December 2012 at above places in order to obtain data and overall picture of aerospora at Devipatan region. The monthly average data is presented in the table.
The sampler relies upon the high efficiency with which small airborne particles are deposited on narrow cylinders oriented at right angles to high velocity wind at small constant speed, battery operated motor is used to whirl thin-sticky coated brass rod about its axis at a constant high speed. The apparatus function on 3 Volt D C Supply. The speed of motor with the rods in position is 2300 r.p.m. The method of observation, scanning and identification was carried out as described by Tilak and Srinivasulu (1967) [3]. The identification is based on reference slides, fungal collections, visual identification and from reference books (Tilak 1989, 2010, Ellis 1971, 1976, Sarbhoy, 1983) [4, 5, 6, 7, 8].

Table 1: Average monthly Concentration of Aero-Bioparticles present/m^3 of air (from January 2012 to December 2012) by 'ROTOROD AIR SAMPLER'

Sr. No.	Name of Bioparticles	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sep 2012	Oct 2012	Nov 2012	Dec 2012	Total	% contribution of total airspora
1	*Alternaria*	180	160	255	860	695	470	190	410	240	180	255	75	3970	5.279
2	*Aspergilli*	25	20	175	825	475	210	55	110	0	75	80	100	2150	2.859
3	*Annellophora*	0	0	0	0	0	15	40	10	0	0	0	0	65	0.086
4	*Ascotricha*	0	0	0	0	0	0	115	0	0	0	0	0	115	0.153
5	*Beltraniella*	0	0	0	90	0	0	0	0	10	10	0	0	110	0.146
6	*Beltrania*	0	0	0	20	55	0	10	0	0	0	0	5	90	0.120
7	*Botryodiplodia*	0	0	0	0	0	0	0	0	15	0	0	0	15	0.020
8	*Bactrodesmium*	0	0	0	0	0	10	0	0	0	0	0	0	10	0.013
9	*Bispora*	5	0	0	30	0	40	70	10	10	0	0	0	165	0.219
10	*Cercospora*	0	5	0	5	0	15	0	20	175	35	45	45	345	0.459
11	*Circinella*	0	0	0	0	0	10	0	0	0	0	0	0	10	0.013
12	*Codinaea*	0	0	0	0	0	0	0	15	0	0	0	0	15	0.020
13	*Cladosporium*	440	380	535	50	105	1285	620	380	605	735	610	230	5975	7.944
14	*Corynespora*	0	0	15	170	110	35	0	25	75	45	55	0	530	0.705
15	*Curvularia*	115	195	90	105	190	90	175	405	225	255	110	25	1980	2.633
16	Cordella	0	0	0	0	0	0	40	20	15	0	0	0	75	0.100
17	*Drechslera*	270	160	635	190	195	175	350	630	7295	4375	980	270	15525	20.642
18	*Diplococcium*	0	0	0	5	0	0	0	0	0	0	0	0	5	0.007
19	*Diplodia*	0	0	0	0	0	15	10	0	0	0	0	0	25	0.033
20	*Didymosphenia*	0	0	0	0	0	20	40	5	0	0	0	0	65	0.086
21	*Dictyostelium*	0	0	0	0	0	0	0	0	5	25	10	0	40	0.053
22	*Epicoccum*	30	55	95	665	75	55	15	5	5	0	65	10	1075	1.429
23	*Excipularia*	0	0	0	30	0	0	0	0	0	0	0	0	30	0.040
24	*Erysiphe*	35	20	0	0	0	0	0	0	0	0	0	85	140	0.186
25	Exosporium	0	0	0	0	0	15	25	0	0	0	0	0	40	0.053
26	*Fusarium*	0	65	40	0	35	0	0	0	5	10	5	0	160	0.213
27	*Fusariella*	0	0	0	0	0	0	0	0	0	0	20	0	20	0.027
28	*Helminthosporium*	5	10	0	35	0	0	0	0	0	200	90	0	340	0.452
29	*Heterosporium*	0	0	0	0	0	0	0	0	0	35	0	5	40	0.053
30	*Haplosporella*	25	0	0	0	0	25	20	20	35	45	45	10	225	0.299
31	*Harknessia*	0	10	0	0	5	5	5	0	0	0	0	0	25	0.033
32	*Hypoxylon*	0	0	0	0	0	135	0	0	0	0	0	0	135	0.179
33	*Hysterium*	0	0	0	30	0	0	0	0	10	0	0	0	40	0.053
34	*Hirudinaria*	0	15	10	0	0	0	0	0	0	0	5	0	30	0.040
35	Lacillinopsis	0	0	0	0	0	140	25	5	0	65	25	5	265	0.352
36	*Lophiostoma*	0	0	0	0	0	5	20	0	90	0	0	0	115	0.153
37	Mitteriella	0	0	0	0	0	0	0	0	5	5	0	0	10	0.013
38	*Melanospora*	0	0	0	5	5	5	60	20	20	20	30	0	165	0.219
39	Menispora	0	0	0	10	0	0	0	0	0	0	0	0	10	0.013
40	*Memnoniella*	5	45	0	0	55	40	25	0	5	20	80	0	275	0.366
41	*Melanographium*	0	0	0	10	0	5	5	10	10	5	0	0	45	0.060
42	*Nigrospora*	20	75	300	220	65	145	85	280	3070	355	235	130	4980	6.621
43	*Oidium*	0	40	25	0	30	10	5	10	0	0	0	20	140	0.186
44	*Pestalotia*	0	0	0	0	0	5	0	0	0	0	0	0	5	0.007
45	Phaeotrichoconis	0	0	0	5	0	0	0	0	0	0	0	0	5	0.007
46	*Periconia*	20	5	60	115	65	45	0	30	0	25	5	15	385	0.512
47	*Pyricularia*	0	0	0	0	0	40	20	20	30	35	0	0	145	0.193
48	*Pleospora*	0	0	0	10	10	20	0	20	0	0	0	0	60	0.080
49	*Pithomyces*	5	15	20	30	0	5	0	0	30	35	10	30	180	0.239
50	*Pseudobeltrania*	0	0	0	25	0	0	15	0	0	0	0	0	40	0.053
51	*Paecilomyces*	0	0	0	0	240	0	0	0	0	0	0	0	240	0.319
52	*Pseudocercospora*	0	0	0	0	0	5	0	0	0	0	0	0	5	0.007
53	Pseudocorynespora	0	0	0	0	0	0	0	0	15	35	0	0	50	0.066
54	Rust Spore	135	225	755	255	120	60	65	65	180	50	180	50	2140	2.845
55	*Scopulariopsis*	0	0	0	0	0	0	0	0	0	0	0	35	35	0.047
56	*Sirodesmium*	0	0	0	5	0	0	0	0	0	5	0	0	10	0.013
57	*Sporormia*	0	0	0	0	0	25	15	25	30	0	0	0	95	0.126
58	*Sordaria*	0	0	0	0	0	385	255	80	10	40	0	0	770	1.024
59	*Sporidesmium*	0	0	0	70	10	35	40	55	0	25	0	0	235	0.312
60	Smutspores	160	280	5355	260	90	525	180	165	375	860	110	485	8845	11.760
61	*Stachybotrys*	0	5	0	10	5	35	40	145	125	80	25	0	470	0.625
62	*Spegazzinia*	5	0	0	0	0	0	0	0	10	25	5	0	45	0.060
63	*Sclerospora*	5	0	0	0	0	15	0	0	0	0	15	0	35	0.047
64	*Saccharomyces*	0	140	110	140	0	235	25	225	0	130	70	0	1075	1.429

65	*Tetraploa*	5	20	25	0	0	15	20	20	5	5	10	10	135	0.179
66	Torula	5	5	15	40	35	25	30	20	70	55	15	20	335	0.445
67	Tetracoccosporium	5	0	5	35	60	25	15	0	30	15	25	5	220	0.293
68	*Trichothecium*	0	0	0	0	30	15	0	25	15	20	0	0	105	0.140
69	*Trochophore*	0	0	0	0	0	15	0	0	0	0	0	0	15	0.020
70	*Virgatospora*	0	0	0	0	0	0	0	5	5	0	0	0	10	0.013
71	Algae	40	15	40	10	40	25	20	150	75	70	60	55	600	0.798
72	Crystals	475	85	1220	0	0	0	0	985	7365	290	305	355	11080	14.732
73	Epidermal Hairs	30	30	60	100	50	145	25	70	65	15	25	15	630	0.838
74	Hyphal Fragments	60	70	160	235	115	40	120	175	140	85	165	80	1445	1.921
75	Insect Parts	5	0	0	15	0	0	10	15	5	10	10	10	80	0.106
76	Insect Scales	60	60	85	95	180	20	240	215	85	200	130	40	1410	1.875
77	Lichen	45	45	5	155	230	210	150	45	20	150	165	60	1280	1.702
78	Pollen Grains	40	60	195	70	70	70	40	100	30	75	105	10	865	1.150
79	Protozoan Cysts	95	65	125	75	70	65	60	90	955	120	25	60	1805	2.400
80	Unidentified	25	30	70	130	0	110	5	25	120	5	20	65	605	0.804
81	Xylem Fibre	0	0	0	0	0	105	0	20	0	0	0	10	135	0.179
	Grand Total	2375	2410	10480	5240	3515	5295	3395	5180	21715	8955	4225	2425	75210	100

3. Results

Besides dust particles, a total record was 81 types of bio particles in which fungal spores, algae and algal fragments, hyphal fragments, epidermal hairs, insect scale, insect parts, pollen grains, protozoan cysts, lichen fragments, crystals including unidentified particles were trapped on the exposed cellotape. The total number of bio particles trapped on the tape was 75210/m^3. The maximum contribution was (20.64%) by *Drechslera* followed by Crystals (14. 73%), Smut spores 11.76%, *Cladosporium* 7.94%, *Nigrospora* 6.62%, *Alternaria* 5.27%, *Aspergilli* 2.85% and Rust Spores 2.84%. Other forms include protozoan cyst 2.40%, Insect Scales 1.87%, Lichens 1.70%, Pollen grains 1.15%, Algae 0.79%, Hyphal fragments 1.92%, Insect part .10%, Epidermal hairs 0.83% and Xylem fibre 0.17% as shown in the table. The weather record showed that minimum temperature in the study period was 11 ^{0}C and maximum 40 ^{0}C, relative humidity 4% and 83%. Rainfall 9.4 mm and 554.4 mm respectively. The total rainfall recorded was 1235.20mm as shown in figure.

4. Discussion

In present investigation out of 81 bioparticles, 70 belong to fungi and 10 belong to other types as shown in the table. The maximum contribution was of fungi. The *Drechslera* was the most abundant followed by crystals, smut spores, *Cladosporium*, *Nigrospora* & *Alternaria*. Similar observations were recorded by Agashe & Anuradha (1998) [9], Dosi & Kulkarni (1981) [10], and Wadhwani (1979).

In this study the maximum load of bioparticles was observed in the month of September (21715/m^3) followed by March (10480/m^3) and October (8955/m^3), whereas the decreased spore load was observed in the months of July (3395/m^3), December (2425/m^3) and in February (2410/m^3). The decrease in the spore load was due to the rainfall and low temperature in these months. The result of present investigation clearly shows that rainfall has its immediate impact on the spores' release of Ascomycetes as has been studied by Meredith (1961 & 1962) [11, 12, 13]. The smut spores were recorded throughout the period of investigation. The maximum spore load (5355/m^3) was recorded in the month of March as shown in the table. It was due to the smut disease spread was found on sugarcane, wheat, and on wild plants like grasses etc. in the study area. Similar findings were observed by Upadhyay & Jain (2005) [14] and Ghosal & Bhattacharya (2012) [15].

The remarkable contribution was made by *Drechslera*, crystals, smut spores, *Cladosporium*, *Nigrospora*, *Alternaria* etc. dominated aerospora of this region and hence called as "aerospora dominants". All these bio components were collected at various places on various substrates as heterotrophs. *Drechslera* spore dominance may be due to its presence on certain plants like *Capsicum* sp., *Nyctanthes* sp., *Hordeum* sp., *Saccharum* sp., Zea sp. and on number of grasses as well as on saprophytes on various substratum. *Alternaria* spores also found as dominant type because in the study area number of crop plants, vegetable plant, oil plant and wild plants eg. *Brassica* sp., *Solanum* sp., *Daucos* etc. were found infected by this fungus. It was also found as saprophyte on various substratum in the sampling area. *Cladosporium* spore dominance may be regarded as a universal dominant because of the similar earlier records made by various workers from India & abroad. *Nigrospora* also recorded in higher concentration because the study area was the belt of sugarcane and paddy crops & this fungus was reported on these crops as well as on grasses & fodder yielding plants.

In the present investigation, some of the spore types, infact were either parasitic or saprophytic which commonly occurred in the aerospora of Devipatan Mandal. On the basis of spore load present in particular months or season and considering to climatic conditions and observing the growing crop, the disease forecasting can be done which will help the farmers in taking necessary steps regarding the protection of their crops.

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