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## Research Article

### A SURVEY OF BIOAEROSOLS OVER GROUNDNUT FIELDS AT NEWASA DIST. AHMEDNAGAR (M.S.)

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#### ABSTRACT

Monitoring of bio aerosols over groundnut fields was undertaken for two consecutive Kharif crop seasons during the years 2012 and 2013 at Newasa, Dist. Ahmednagar (M.S.), to study a definite correlation between the air borne micro organisms, meteorological parameters, growth stages of the crop plants and their impact in bringing about the disease incidence to the ground nut crop plants. A volumetric Tilak Air Sampler was used to trap airborne biological components, which incidentally provided continuous quantitative and qualitative data. Present investigation also mainly aimed to study the population of fungal morphotypes prevailing in the ambient air over the ground nut fields in two Kharif Crop seasons. Prevailing weather conditions during two Kharif seasons showed significant influence on the genesis and liberation of spores of fungal morphotypes and eventually affected the total composition of airspora quantitatively and qualitatively. During the period of present study, many already known allergenic pollen and fungal spores were recorded and have been estimated for their percentage contribution.

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#### INTRODUCTION

Groundnut (*Arachis hypogea* L.) is an important food and oil seed crop in tropical and subtropical regions. It is native to South America, where, the genus *Arachis* is distributed over a wide range of environment from South of the Amazon to 34<sup>0</sup>s altitude and from the eastern coast to the eastern slopes of the Andes (Gregory *et.al.* 1980). Lukose *et.al.* (2008) reported this crop as the world's fourth most important source of edible oil and important source of vegetable protein. Patil *et.al.* (2009) reported ground nut as the single largest source of edible oils in India and constitutes roughly about 50% of the total oil seed production.

Groundnut is subjected to various fungal, viral and bacterial diseases which are airborne or soil borne. Of late, Alternaria Leafspot and veinal necrosis caused by *Alternaria alternata* (Fries) Keissler is becoming increasingly important. Among foliar fungal diseases, early and late leaf spots commonly called as "Tikka" disease and rust, are economically important. The forecasting of airborne fungal diseases can be attempted if the information of the airspora of this crop is available. In view of the above, the present aerobiological investigation was carried out at Newasa, Dist. Ahmednagar (MS.) over groundnut fields (*Arachis hypogea* L.) Var. JL-24 for two consecutive

Kharif seasons 2012 and 2013 using volumetric Tilak Air sampler. Besides, daily record of Rainfall, wind velocity, average mean temperature and wind velocity and this information was obtained from Mahatama Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar.

#### MATERIALS AND METHODS

An air monitoring was carried out by operating continuous volumetric Tilak Air Sampler (Tilak and Kulkarni, 1970) located in the centre of Groundnut field with its orifice facing the west and kept at a constant height of 0.75 meter, above the ground level. In the present study, the crop cultivated was Groundnut (*Arachis hypogea* L.) Var. JL-24 Two acres land area was devoted for cultivation of ground nut for two consecutive Kharif Seasons ie. First Kharif season from 15<sup>th</sup> July 2012 to 8<sup>th</sup> November 2012 and Second Kharif season from 15<sup>th</sup> July 2013 to 7<sup>th</sup> Novembmer 2013 respectively.

Air sampling was initiated eight days prior to the sowing of seeds of groundnut in the experimental fields and continued for eight days even after its harvesting the same crop. The daily meteorological data of temperature, relative humidity ad rainfall was maintained as obtained from Mahatama Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar.

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**Table 1** Reveals Seasonwise Comparative Total Airspora And Its Percentage Contribution To The Total Airspora of Two Kharif Seasons Over Groundnut Fields From July 2012 To November 2012 And From July 2013 To November 2013

Sr. NO	Spore types	I Kharif Season		II Kharif season		Total spore conc./ m <sup>3</sup> of air	% Contribution to the total airspora
		spore conc./ m <sup>3</sup> of air	% Contribution	spore conc./ m <sup>3</sup> of air	% Contribution		
<b>MYXOMYCOTINA</b>							
1	<i>Physarum</i>	1988	0.47	1428	0.38	3416	0.43
2	<i>Stemonitis</i>	5502	1.29	3402	0.91	8904	1.11
	<b>TOTAL</b>	<b>7490</b>	<b>1.76</b>	<b>4830</b>	<b>1.29</b>	<b>12320</b>	<b>1.54</b>
<b>ZYGOMYCOTINA</b>							
1	<i>Albugo</i>	3836	0.90	3556	0.95	7392	0.93
2	<i>Cunninghamella</i>	3878	0.91	3472	0.93	7350	0.92
3	<i>Mucor</i>	5194	1.22	4956	1.33	10150	1.27
4	<i>Phytophthora</i>	3304	0.78	3458	0.93	6762	0.85
5	<i>Rhizopus</i>	6258	1.47	5670	1.52	11928	1.49
6	<i>Sclerospora</i>	5096	1.20	4942	1.32	10038	1.26
	<b>TOTAL</b>	<b>27566</b>	<b>6.48</b>	<b>26054</b>	<b>6.98</b>	<b>53620</b>	<b>6.71</b>
<b>Ascomycotina</b>							
1	<i>Amphisphaerella</i>	2184	0.51	2002	0.54	4186	0.52
2	<i>Apiorhynchostoma</i>	518	0.12	602	0.16	1120	0.14
3	<i>Ascotricha</i>	1918	0.45	2044	0.55	3962	0.50
4	<i>Bitrimonospora</i>	1554	0.37	2240	0.60	3794	0.48
5	<i>Bombardia</i>	2660	0.63	826	0.22	3486	0.44
6	<i>Chaetomium</i>	3864	0.91	4662	1.25	8526	1.07
7	<i>Claviceps</i>	3822	0.90	4032	1.08	7854	0.98
8	<i>Cucurbitaria</i>	2590	0.61	2520	0.68	5110	0.64
9	<i>Didymosphaeria</i>	4186	0.98	4312	1.16	8498	1.06
10	<i>Hypoxylon</i>	3248	0.76	3808	1.02	7056	0.88
11	<i>Hysterium</i>	2856	0.67	3220	0.86	6076	0.76
12	<i>Leptosphaeria</i>	4550	1.07	4508	1.21	9058	1.13
13	<i>Lophiostoma</i>	3892	0.91	3878	1.04	7770	0.97
14	<i>Massarina</i>	2870	0.67	3612	0.97	6482	0.81
15	<i>Melanospora</i>	3920	0.92	4270	1.14	8190	1.03
16	<i>Othia</i>	1988	0.47	784	0.21	2772	0.35
17	<i>Pleomassaria</i>	3164	0.74	3878	1.04	7042	0.88
18	<i>Pleospora</i>	3038	0.71	3878	1.04	6916	0.87
19	<i>Pringsheimia</i>	4774	1.12	1778	0.48	6552	0.82
20	<i>Sordaria</i>	4942	1.16	4592	1.23	9534	1.19
21	<i>Trematosphaeria</i>	3066	0.72	2632	0.71	5698	0.71
22	<i>Valsaria</i>	3682	0.87	3542	0.95	7224	0.90
	<b>TOTAL</b>	<b>69286</b>	<b>16.28</b>	<b>67620</b>	<b>18.12</b>	<b>136906</b>	<b>17.14</b>
<b>Basidiomycotina</b>							
1	Basidiospores	18886	4.44	7098	1.90	25984	3.25
2	Smut spores	30898	7.26	25676	6.88	56574	7.08
3	Uredospores	8918	2.10	8946	2.40	17864	2.24
	<b>TOTAL</b>	<b>58702</b>	<b>13.80</b>	<b>41720</b>	<b>11.18</b>	<b>100422</b>	<b>2.57</b>
<b>Deuteromycotina</b>							
1	<i>Alternaria</i>	23590	5.54	19488	5.22	43078	5.39
2	<i>Aspergillus</i>	16282	3.83	15582	4.18	31864	3.99
3	<i>Beltrania</i>	2870	0.67	4102	1.10	6972	0.87
4	<i>Bispora</i>	3906	0.92	6342	1.70	10248	1.28
5	<i>Cephalophora</i>	714	0.17	1428	0.38	2142	0.27
6	<i>Ceratophorum</i>	2632	0.62	3248	0.87	5880	0.74
7	<i>Cercospora</i>	12894	3.03	13706	3.67	26600	3.33
8	<i>Chaetomella</i>	2996	0.70	3206	0.86	6202	0.78
9	<i>Chlamydomyces</i>	2464	0.58	2450	0.66	4914	0.62
10	<i>Cladosporium</i>	64064	15.06	33698	9.03	97762	12.24
11	<i>Corynespora</i>	2688	0.63	4018	1.08	6706	0.84
12	<i>Curvularia</i>	8722	2.05	7448	2.00	16170	2.02
13	<i>Dictyoarthrinium</i>	1806	0.42	2114	0.57	3920	0.49
14	<i>Dictyosporium</i>	2758	0.65	3570	0.96	6328	0.79
15	<i>Diplodia</i>	3430	0.81	4606	1.23	8036	1.01
16	<i>Epicoccum</i>	9072	2.13	7378	1.98	16450	2.06
17	<i>Exosporium</i>	2044	0.48	4494	1.20	6538	0.82
18	<i>Fusariella</i>	5390	1.27	5124	1.37	10514	1.32
19	<i>Fusarium</i>	7350	1.73	4158	1.11	11508	1.44
20	<i>Haplosporella</i>	3150	0.74	3206	0.86	6356	0.80
21	<i>Helminthosporium</i>	10892	2.56	11018	2.95	21910	2.74
22	<i>Heterosporium</i>	6258	1.47	7126	1.91	13384	1.68
23	<i>Lacellina</i>	2618	0.62	2324	0.62	4942	0.62
24	<i>Memnoniella</i>	7252	1.70	6076	1.63	13328	1.67
25	<i>Nigrospora</i>	10374	2.44	9800	2.63	20174	2.53
26	<i>Papularia</i>	3024	0.71	3262	0.87	6286	0.79

27	<i>Periconia</i>	2296	0.54	2772	0.74	5068	0.63
28	<i>Pestalotia</i>	1330	0.31	2030	0.54	3360	0.42
29	<i>Pithomyces</i>	5390	1.27	5880	1.58	11270	1.41
30	<i>Pyricularia</i>	4284	1.01	4508	1.21	8792	1.10
31	<i>Sirodesmium</i>	2590	0.61	2870	0.77	5460	0.68
32	<i>Sporidesmium</i>	2184	0.51	2226	0.60	4410	0.55
33	<i>Tetraploa</i>	4382	1.03	2940	0.79	7322	0.92
34	<i>Torula</i>	9114	2.14	7252	1.94	16366	2.05
35	<i>Trichothecium</i>	4494	1.06	5362	1.44	9856	1.23
<b>TOTAL</b>		<b>255304</b>	<b>60.00</b>	<b>224812</b>	<b>60.24</b>	<b>480116</b>	<b>60.11</b>
<b>OTHER TYPES</b>							
1	Hyphal Fragments	2506	0.59	2618	0.70	5124	0.64
2	Insect Parts	1750	0.41	2338	0.63	4088	0.51
3	Plant Parts	1316	0.31	1008	0.27	2324	0.29
4	Pollen grains	1554	0.37	2198	0.59	3752	0.47
<b>TOTAL</b>		<b>7126</b>	<b>1.67</b>	<b>8162</b>	<b>2.19</b>	<b>15288</b>	<b>1.91</b>
<b>Grand Total</b>		<b>425474</b>	<b>100</b>	<b>373198</b>	<b>100</b>	<b>798672</b>	<b>100</b>

The bio aerosols trapped over the groundnut field, were expressed as number of spores / m<sup>3</sup> of air. The identification of different spore types was mainly based on comparative spore morphological characters and spore description. It was further confirmed by comparing the characters of spore types with reference slides prepared from the fungal material in and around the experimental fields. This study is in relation to airborne bio components together with disease incidence at different growth stages of groundnut crop and its relevance with the prevailing meteorological parameters.

## RESULTS

During period of present investigation, aerobiological surveys were conducted for two Kharif seasons i.e. First Kharif season from 15<sup>th</sup> July to 8<sup>th</sup> November 2012 and Second Kharif season from 15<sup>th</sup> July to 7<sup>th</sup> November 2013. In all 72- bioaersols were trapped with 68 -fungal spore types and 4- other types over groundnut fields respectively. The other types comprising hyphal fragments, insect parts, plant parts and pollen grains. From among the trapped 62 fungal spore types, in two Kharif seasons, 35 belonged to the group Deuteromycotina, 22 to Ascomycotina, 6 to Zygomycotina, 4 to other types, 3 to Basidiomycotina and 2 to Myxomycotina. During the period of investigation, in first and second Kharif seasons (2012 and 2013) the group Deuteromycotina contributed maximum 60.00% and 60.24% with 255304/m<sup>3</sup> and 224812/m<sup>3</sup> of air respectively, followed by Ascomycotina with 16.28% and 18.12% with 69286/m<sup>3</sup> and 67620/m<sup>3</sup> of air, Basidiomycotina 13.80% and 11.18% with 58702/m<sup>3</sup> and 41720/m<sup>3</sup> of air. Grand total of spores in first and second Kharif seasons was 425474/m<sup>3</sup> and 373198/m<sup>3</sup> of air respectively. (Table 1)

However, during the period of first and second Kharif seasons 2012 and 2013, it was evident that September 2012 and August 2013 months were found registered with maximum monthly average percent contribution by the group Deuteromycotina 30.48% and 31.27% with maximum concentration 77812/m<sup>3</sup> and 70308/m<sup>3</sup> of air was recorded in September in both the seasons (Table 1) respectively.

In both the Kharif crop seasons, the Deateromycotina dominated the total airspora. It may be due to high fecundity efficiency well attributed with the fungal spore types belonging to the group hypomycetes (15.06%), smut spores (7.26% and 6.88%), *Alternaria* (5.54% and 5.22%), *Aspergillus* (3.83 and 4.18%), *Cercospora* (3.03% and 3.67%), basidiospores (4.44% and 1.50%), *Helminthosporium* (2.56% and 2.95%).

*Nigrospora* (2.44% and 2.63%), Uredospores (2.10% and 2.40%) *Epicoccum* (2.13% and 1.98%), *Torula* (2.14% and 1.94%), *Curvularia* (2.05% and 2.00%) a contributed significantly to the total airspora during first as second Kharif seasons i.e. 2012 and 2013 respectively. These findings matched with the reports of Reddy (1990) and Goud (1993) from Andhra Pradesh, Thite (1998) Aher *et al* (2002) and Sonawane (2004) from Maharashtra, who reported these spores from the air over the groundnut fields from different regions. McElhenney and Mc Govern (1970) suggested the possible role of those spore types as inhalant allergens along with actinomycetes and airborne Algae. Arsule (2013) and Dere *et al* (2013) also recorded these spore types from the ambient air over groundnut fields and vegetable market respectively.

The effect of rains, relative humidity and wind velocity, was recorded immediately after the rainfall on *Didymosphaeria*, while spores of *Leptosphaeria*, *Pleospora*, *Pringsheimia* and *Sordaria* sometime after the raining. These results are in conformity with the results recorded by Tilak, 1988 and 1989, Quazi 19851. Spore types of group Basidiomycotina contributed 13.8% and 11.18% respectively during 1<sup>st</sup> and 2<sup>nd</sup> Kharif seasons. The occurrence of spore types of Basidiomycotina was also continuous in both the Kharif seasons. It may be due to rainy conditions with maximum relative humidity with moderate temperature ranging from 22.5 to 26.8<sup>o</sup>c. The occurrence of spore types of Basidiomycotina, therefore, could be correlated with the rainfall rather than the vegetation of the area. Earlier workers such as Sreeramulu and Ramalingam (1966), Sreeramulu(1967), Quazi (1985), Kalkar and Patil (1997), Kadam *et al* (2008) and Arsule (2013) also conducted the aerobiological surveys as obtained results which matched with the obtained present results.

The spore types such as *Cercospora* sp, rusts, *Alternaria* sp. etc. were recorded and found to be pathogenic and eventually were trapped in the air over the groundnut fields.

The *Cercospora* (with *C. personata* and *C. arachidicola*) spore types with 3.03% and 3.67% with 12894/m<sup>3</sup> and 13706/m<sup>3</sup> were recorded during first and second Kharif seasons. The Tikka disease was evident and severe in both the Kharif seasons. However, the occurrence of *Cercospora* spores in air and the disease incidence to the crop were noted in the month of October 2012. However, severe infection and infestation to the groundnut crop was observed in the month of October 2013 when there was outbreak of precipitation 119.3 mm probably

the rainfall might be found congenial to detach and discharge the conidia from the infected leaves of the host (Table 2).

During both the Kharif seasons of 2012 and 2013 fungal spore types like *Rhizopus*, rust spores, *Alternaria*, *Aspergillus*, *Cercospora*, and *Fusarium* were recorded significantly throughout. *Alternaria* sp. showed its significant occurrence in the air over groundnut fields, so also the incidence of rust spores in the ambient air over Groundnut fields in both the Kharif seasons. Moderate range of temperature, Relative Humidity and precipitation might have been found responsible for the rust disease inception. (Table 2). Present results match with the findings of the earlier workers like Tilak, 1984, 1996, Kalkar and Patil (1997), Pande (2001) Mahajan and Pande (2002) Aher et al (2002, 2004), Aher and Pande (2004), Kadam et al (2008), Arsule and Pande (2012), Arsule (2012 and 2013).

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**Table 2** Reveals Monthly Concentration of Airborne Pathogenic Fungal Spore Types During First And Second Kharif Seasons (2012 And 2013) Over Groundnut Fields Respectively

Sr. No	Spore Type	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		Total Spore conc./m3 of air	Total Spore conc. /m3 of air
		Spore conc./m3 of air		Spore conc./m3 of air		Spore conc./m3 of air		Spore conc./m3 of air		Spore conc./m3 of air			
		I	II	I	II	I	II	I	II	I	II		
1	<i>Rhizopus</i>	1148	1274	1750	1918	2226	1778	1134	700	0	0	6258	5670
2	Uredospores	1624	882	1750	1862	4032	4172	1330	1610	182	420	8918	8946
3	<i>Alternaria</i>	3892	2744	6622	6734	6748	6622	5978	3024	350	364	23590	19488
4	<i>Aspergillus</i>	2982	2506	5670	5950	5628	5684	2002	1442	0	0	16282	15582
5	<i>Cercospora</i>	0	0	2968	3220	3948	4746	4928	5474	1050	266	12894	13706
6	<i>Fusarium</i>	1316	2548	1638	1610	2940	0	1456	0	0	0	7350	4158
	TOTAL	10962	9954	20398	21294	25522	23002	16828	12250	1582	1050	75292	67550

### Summary

Aerobiological investigations were conducted for two consecutive Kharif seasons of 2012 and 2013 at Newasa, Dist. Ahmednagar, over Groundnut fields (*Arachis hypogea* L.) Var JL-24 by installing Tilak Air Sampler.

- Analysis of airspora study revealed 72 types of component. The order of dominance of spore group revealed Deuteromycotina group as the dominant followed by Ascomycotina, Basidiomycotina, Zygomycotina and Myxomycotina (Table 1).
- *Cladosporium* spore type was found to be the most dominant, followed by smut spores, *Alternaria*, *Aspergillus*, *Cercospora* etc.
- *Rhizopus*, rust spores, *Alternaria*, *Aspergillus*, *Cercospora* and *fusarium* etc. were recorded as pathogenic and occurred with high concentration.
- Prevailing weather conditions showed pronounced influence on genesis and liberation of spores and affected the airspora composition qualitatively and quantitatively.
- Already known allergenic and fungal spores were estimated for their percent contribution.

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