

# Seasonal Variations in Fungal Spore Concentration over Sunflower Field at Rajewadi

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**Abstract:** Air is one of the most important ingredients like soil and water of the environment. The biologically important pollutant of the atmosphere includes pollen, fungal spores, algal filaments etc. In addition to these the hyphal fragments and Insect parts are frequently found in the atmosphere. Aerobiology is a science, which deals with the source of organisms or the other materials and their release into the atmosphere, transport, deposition and their impact on various kinds of living beings like plants, animals and human beings. Such studies are also known as "microbiology of the atmosphere". Aerobiology is the interdisciplinary science and is closely associated with mycology, palynology, meteorology, allergy, entomology, air pollution, phytogeography, bio deterioration and cosmobiology.

**Keywords:** cosmobiology

## I. INTRODUCTION

Air is one of the most important ingredients like soil and water of the environment. The biologically important pollutant of the atmosphere includes pollen, fungal spores, algal filaments etc. In addition to these the hyphal fragments and Insect parts are frequently found in the atmosphere. Aerobiology is a science, which deals with the source of organisms or the other materials and their release into the atmosphere, transport, deposition and their impact on various kinds of living beings like plants, animals and human beings. Such studies are also known as "microbiology of the atmosphere". Aerobiology is the interdisciplinary science and is closely associated with mycology, palynology, meteorology, allergy, entomology, air pollution, phytogeography, bio deterioration and cosmobiology

Sunflower (*Helianthus annus* L.) is cultivated throughout the world because of its economic value and Importance. Sunflower, as an oil seed crop was introduced in India In 1969. Since then it is becoming popular in our country as an oil seed crop. Being a short duration crop, it is especially suited to low rainfall area. It has a good potential because of its high oil content with better quality oil useful for preparation of vanaspati Ghee, manufacturing of soaps and cosmetic and its edible importance.

The present research work constitutes the seasonal variations in the fungal air spora over sunflower (Var.N.S.R.H.-36 Shresta) field in two seasons at Rajewadi in Renapur tehsil of Latur district in the Marathwada region of Maharashtra and an attempt has been made to compare with meteorological conditions and growth stages of the crop.

## II. MATERIALS AND METHODS

The present aerobiological investigations were carried out by using "Tilak air sampler" (Tilak and Kulkarni, 1970). This sampler was awarded Government of India prize for important substitution. Airspora studies were carried out by keeping Tilak air sampler in the center of sunflower (*Helianthus annur* L.) var. N.S.RH. 36 (Shresta) field at a constant height of 1.5 feet from ground level with orifice towards crop at village Rajewdi just 2 km away from Renapur tehsil of Latur district in the Marathwada region of Maharashtra.

The studies were conducted for two Rabi crop seasons, I season (from 1/11/2023 to 28/02/2024) and II season (from 01/11/2024 to 28/02/2025). The air sampling was carried out from the date of sowing of seeds and continued till few days after harvesting of crop. Observations on growth of crop were done time to time and the infected plant parts were collected. Other materials and methods used in the present study are same as described by Tilak and Srinivasulu (1967). The identification of spore types made with the help of standard literature by Ellis (1971), Tilak (1980) and Nair et al (1986) and also with the visual Identification by comparing with the reference permanent spore slides.

### **III. RESULTS AND DISCUSSION**

A glance at the listed types revealed that out of 54 components, 49 belonged to fungal spore types and 5 were of other types. Out of that, 32 belonged to Deuteromycetes, 10 belonged to Ascomycetes, 4 belonged to Basidiomycetes and 3 belonged to Phycomycetes. The class Deuteromycetes spore types dominated the airspora by exhibiting the highest concentrations in both the seasons. These spores were shared by dominant group Deuteromycetes (51.32%, 67.74%) followed by Basidiomycetes (39.35%, 26.33%). Ascomycetes (5.81%, 8.56%), other types (3.10%, 1.92%) and Phycomycetes (0.36%, 0.40%) (Figures indicating first and second season, percentage contribution of the group, Table-1).

Some dominant spore types are (figures indicating I and II season percentage contribution of the spore to the total airspora) Cladosporium (26.13%, 31.32%) was dominant spore type to the total airspora followed by Smut spore (22.86%, 16.71%), Rust spore (11.58%, 4.47%), Helminthosporium (5.19%, 6.06%), Basidiospores (4.30%, 4.27%), Cercospora (2.64%, 4.12%), Aspergillus (2.80%, 4.07%) and Alternaria (2.01%, 3.129%). The lowest percentage was contributed by Ceratophorum (0.06%, 0.18%) La followed by Exosporium (0.05%, 0.12%) (Table-2).

Among Phycomycetes, 3 spore types were observed Albugo, Cunninghamella and Rhizopus. These spores are occurred during the month of December with a high concentration during present survey. Maximum concentration of these spores was associated with high relative humidity and comparatively low temperature. Gregory (1961) reported that during the morning hours, the occurrence of rapid changes in atmospheric humidity resulted in the detachment of spores in various members of Phycomycetes and fungi Imperfecta. Similar observations were also recorded by Tilak and Babu (1982).

The Ascomycetes spore types ranked third in the order of dominance, represented with 5.81% and 8.56% to the total airspora during first and second seasons respectively, The presence of many ascospore types in the airspora revealed the abundance of parasitic and saprophytic forms in and around the fields. The effect of rainfall on ascospores discharge was either immediate or delayed, Analysis of airspora revealed that the spores like Didymosphaeria and Leptosphaeria showed immediate spore liberation after rainfall while the spores like Chaetomium, Pleospora were found to be released long after the rain.

The present investigation clearly revealed that the Importance and Impact of the rainfall on the spore release of Ascomycetes, as has been suggested by Meredith (1961, 1962, 1963) that the Incidence and maximum release of ascospores in the air was profoundly influenced by various meteorological parameters rather than vegetation in the area.

The class Basidiomycetes has 4 spore types to the total airspora. These were Basidiospores, Ganoderma, Rust spores and Smut spores. The analysis of epidemiology of Rust (*Puccinia helianthi*) over sunflower crop during Rabi seasons have clearly brought out that moderate temperature, high relative humidity and rainy days preferably at the tillering and flowering growth stages of the crop favoured the large spore concentration in the atmosphere and disease Incidence in the field. A clear correlation was found between Increase in the spore load in the air, disease Incidence and growth stages of the crop. During both seasons, the rust spores were trapped in the atmosphere. The rust spore concentration was high in the month of December (43624/m<sup>3</sup> of air) in first season and in second season it was less in the month of December (18364/m<sup>3</sup> of air) as compare to first seasons. Dhawale and Mayee (1988) recorded that the rust of sunflower causes losses to the tune of 45% in an epidemic year in Maharashtra.

The class Deuteromycetes as a whole dominated the air spora representing highest percentage contribution (51.32% and 62.74%) In first and second seasons respectively and with large number of spore types (32) to the total airspora. Cladosporium, which has been always a dominant fungus, contributed 26.13% and 31.32% to the total airspora followed by Helminthosporium (5.19%, 6.06%), Cercospora (2.64%, 4.12%), Aspergillus (2.80%, 4.07%), Alternaria (2.01%, 3.12%) during first and second seasons respectively. Dominance of Cladosporium in the airspora was recorded earlier by many workers in India and abroad and hence it is recorded as a universally dominant spore type. It always occurred in clumps hence called as "conidial units if dispersal". The spores were trapped almost throughout the sampling period. In the present investigation it was clearly evident that the maximum concentration of Cladosporium spores coincided with seed forming stage of the crop. The early rains and shedding of the leaves might have acted as the substratum for the growth and dispersal of Cladosporium spores in the atmosphere.

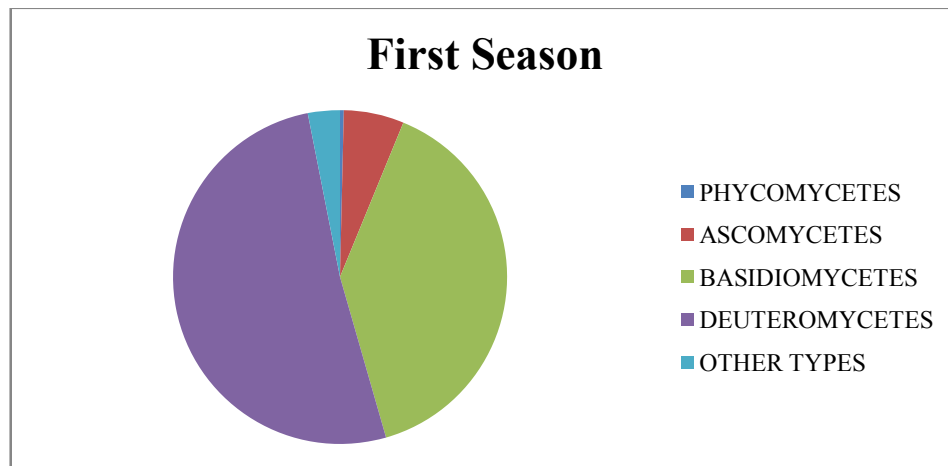
In addition to these usual taxonomic spore groups, an artificial group "Other types" constricted a bulk concentration. This group ranked fourth in the order of dominance and its contribution was 3.10% and 1.92% during first and second seasons respectively. This group comprised of hyphal fragments, Insect parts, pollen, protozoan cysts and unclassified spore group. During the present investigation, presence of hyphal fragments was recorded in abundance. Their percentage contribution to the total air spora was 1.10% and 0.48% during first and second seasons respectively

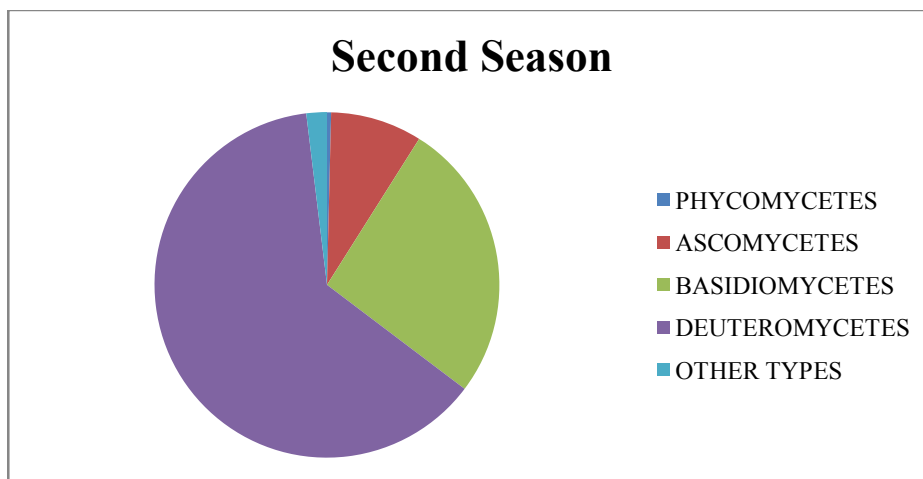
From the present studies it is clearly evident that there is a clear co-relationship between spore concentration and meteorological parameters. Among the meteorological factors, rainfall has shown important role in spore release. The temperature played a minor role on the concentration of the various spore types, whereas the relative humidity and rainfall showed the direct impact on the rise or fall in the spore concentration. Thus the meteorological factors play an important role in seasonal variation of plant pathogen and ultimate plant disease.

Thus, the aerobiological investigations are essential and should be carried out for the study of transport of pathogen from place to place and their ultimate role in disease development. This investigation is useful for providing an efficient and better disease forecasting system for each and every important crop of our country, which would be ultimately help the farmers to save their crops.

**Table-1: Classwise percentage contribution of each group to the total airspora during first season (1/11/2023 to 28/02/2024) and II season (from 01/11/2024 to 28/02/2025).over Sunflower field.**

Sr. NO.	CLASS	First Season		Second Season	
		Spore Concentration	Percentage Concentration	Spore Concentration	Percentage Concentration
1	PHYCOMYCETES	2212	0.36	3654	0.40
2	ASCOMYCETES	34664	5.81	77602	8.56
3	BASIDIOMYCETES	234360	39.35	238546	26.33
4	DEUTEROMYCETES	305732	51.32	568498	62.74
5	OTHER TYPES	18494	3.10	17444	1.92
	<b>TOTAL</b>	<b>595462</b>	<b>99.94</b>	<b>905744</b>	<b>99.95</b>





**Table-2.:** Season wise comparative total airspora and percentage contribution of different spore types over sunflower field during (1/11/2023 to 28/02/2024) and II season (from 01/11/2024 to 28/02/2025) over Sunflower field.

Sr.NO.	CLASS/Spore	First Season		Second Season	
		Spore Concentration	Percentage Concentration	Spore Concentration	Percentage Concentration
	<b>PHYCOMYCETES</b>				
	<i>Albugo</i>	756	0.026	1638	0.180
	<i>Cunninghamella</i>	952	0.159	1344	0.148
	<i>Rhizopus</i>	504	0.084	672	0.074
	<b>TOTAL</b>	<b>2212</b>	<b>0.369</b>	<b>3654</b>	<b>0.402</b>
	<b>ASCOMYCETES</b>				
	<i>Bitrimonospora</i>	2646	0.413	4340	0.479
	<i>Calospora</i>	1862	0.312	5978	0.66
	<i>Chaetomium</i>	4718	0.792	14434	1.593
	<i>Didymosphaeria</i>	8596	1.443	18704	2.065
	<i>Hypoxyton</i>	1610	0.270	2058	0.227
	<i>Leptosphaeria</i>	9254	1.554	15442	1.704
	<i>Melanospora</i>	392	0.065	2408	0.265
	<i>Pleospora</i>	2114	0.355	4578	0.505
	<i>Sordaria</i>	1288	0.216	3892	0.429
	<i>Xylaria</i>	2366	0.397	5768	0.636
		<b>34664</b>	<b>5.817</b>	<b>77602</b>	<b>8.563</b>
	<b>BASIDIOMYCETES</b>				
	<i>Basidiospores</i>	25648	4.307	38738	4.276
	<i>Ganoderma</i>	3598	0.604	7938	0.876
	<i>Rust spores</i>	68978	11.583	40502	4.471
	<i>Smut spores</i>	136136	22.862	151368	16.712
		<b>234360</b>	<b>39.356</b>	<b>238546</b>	<b>26.335</b>
	<b>DEUTEROMYCETES</b>				
1	<i>Alternaria</i>	11998	2.014	28308	3.125

2	<i>Aspergillus</i>	16688	2.802	36890	4.072
3	<i>Beltrania</i>	1512	0.253	1274	0.140
4	<i>Biospora</i>	1372	0.230	1778	0.196
5	<i>Botryodiplodia</i>	686	0.115	2688	0.296
6	<i>Botrytis</i>	938	0.157	1148	0.126
7	<i>Caeratothorium</i>	392	0.065	1638	0.180
8	<i>Cercospora</i>	15778	2.649	37352	4.123
9	<i>Cladosporium</i>	155624	26.135	283696	31.321
10	<i>Cordana</i>	2212	0.371	3038	0.335
11	<i>Colletotrichum</i>	2898	0.486	2534	0.279
12	<i>Curvularia</i>	8218	1.380	11438	1.262
13	<i>Dicoccum</i>	448	0.075	2548	0.281
14	<i>Diplodia</i>	1512	0.253	1344	0.148
15	<i>Epicoccum</i>	2688	0.451	7812	0.862
16	<i>Exosporium</i>	350	0.058	1162	0.128
17	<i>Fusarium</i>	1008	0.169	1484	0.163
18	<i>Haplosporella</i>	812	0.136	2464	0.272
19	<i>Helminthosporium</i>	30926	5.193	54978	6.069
20	<i>Hendersonia</i>	1736	0.291	1008	0.112
21	<i>Heterosporium</i>	1442	0.242	3136	0.346
22	<i>Lacellina</i>	1932	0.324	2842	0.313
23	<i>Memnoniella</i>	8694	1.460	17192	1.898
24	<i>Nigrospora</i>	7028	1.180	12558	1.386
25	<i>Papularia</i>	4060	0.681	2352	0.259
26	<i>Periconia</i>	6888	1.156	14070	1.553
27	<i>Pithomyces</i>	2632	0.442	3598	0.397
28	<i>Pseudotorula</i>	1526	0.256	5488	0.605
29	<i>Pericularia</i>	9870	1.657	17934	1.98
30	<i>Spegazzinia</i>	798	0.134	1932	0.213
31	<i>Torula</i>	2548	0.427	1512	0.166
32	<i>Tricoconis</i>	518	0.087	1302	0.143
		305732	51329	568498	62.748
	<b>OTHER TYPES</b>				
1	<i>Hyphal fragments</i>	6608	1.109	4396	0.485
2	<i>Insect scales</i>	4438	0.745	6328	0.698
3	<i>Pollen</i>	5992	1.006	4774	0.527
4	<i>Protozoan cysts</i>	378	0.063	1162	0.128
5	<i>Unclassified Group</i>	1078	0.181	784	0.086
		18494	3.104	17444	1.924
		<b>595462</b>	<b>99.97</b>	<b>905744</b>	<b>99.97</b>

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