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Volumetric Survey Of Microbial Population Over Bajra Fields Nearby Village Area At Ambajogai

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ABSTRACT

Atmospheric Survey of microbial population, using continuous Volumetric Tilak Air Sampler, was carried out at Ambajogai for two consecutive Kharif seasons during 2022 and 2023 over bajra fields.

A total of 109, in airspora analysis, different microbial components were identified. Airspora analysis revealed 109 types of airborne biocomponents of which 1 belonged to zygomycotina, 22 to Ascomycotina, 6 to Basidiomycotina, 74 to Deuteromycotina and 6 to other types.

Cladosporium, stood first in order of dominance among the total catches in both the seasons with mean contribution to the total airspora 27.36%, it was followed by Curvularia 4.14 % Helminthosporium 4.11 %, - Nigrospora 3.94 %, Alternaria 3.18 % and Periconia 3.04 %.

The spore load was observed maximum in the month of September and October in both the Kharif Seasons. Meteorological data was maintained throughout the period of investigation and was obtained from Meteorological Centre Ambajogai.

KEY WORDS: - Airspora, Bajra, Meteorological data.

INTRODUCTION

Bajra (Pennisetum typhoides (Burm. f.) Stapf and Hubb.) is one of the common millets that serves as the poor man's food grain in India, Pakistan and some parts of Africa. In India, it covers an area of about 12 million hectors, distributed almost over the entire country, it is affected by various fungal and pest diseases. If the information on the airspora of this crop is available, then the forecasting of airborne fungal diseases can be attempted. However, such type of work was carried out in some parts of India (Gaikwad, 1974; Chakre, 1979; Tilak, 1984; Tilak and Ramachanderrao, 1987.

Climate and Average Weather Year-Round in Ambajogai

In Ambajogai, the wet season is muggy/ sticky/sultry unpleasantly warm and the air contains a lot of water and overcast, the dry season is mostly clear, and it is hot year-round. Over the course of the year, the temperature typically varies from *14°C* to *38°C* and is rarely below *11°C* or above *41°C*.

Topography

For the purposes of this report, the geographical coordinates of Ambajogai are 18.733 deg latitude, 76.386 deg longitude, and 2,077 ft elevation.

The topography within *2 miles* of Ambajogai contains only *modest* variations in elevation, with a maximum elevation change of *417 feet* and an average elevation above sea level of *2,080 feet*. Within *10 miles* contains

only *modest* variations in elevation (*883 feet*). Within *50 miles* also contains *very significant* variations in elevation (*1,516 feet*).

The area within *2 miles* of Ambajogai is covered by *cropland* (*56%*), *artificial surfaces* (*15%*), and *grassland* (*13%*), within *10 miles* by *cropland* (*72%*) and *grassland* (*11%*), and within *50 miles* by *cropland* (*72%*) and *grassland* (*10%*).

Precipitation.

A *wet day* is one with at least *0.04 inches* of liquid or liquid-equivalent precipitation. The chance of wet days in Ambajogai varies significantly throughout the year.

The *wetter season* lasts *4.5 months*, from *May 29* to *October 12*, with a greater than *24%* chance of a given day being a wet day. The month with the most wet days in Ambajogai is *July*, with an average of *13.8 days* with at least *0.04 inches* of precipitation.

The *drier season* lasts *7.5 months*, from *October 12* to *May 29*. The month with the fewest wet days in Ambajogai is *February*, with an average of *0.6 days* with at least *0.04 inches* of precipitation.

Among wet days, we distinguish between those that experience *rain alone*, *snow alone*, or a *mixture* of the two. The month with the most days of *rain alone* in Ambajogai is *July*, with an average of *13.8 days*. Based on this categorization, the most common form of precipitation throughout the year is *rain alone*, with a peak probability of *46%* on *July 16*.

Average temperature

The *hot season* lasts for *2.0 months*, from *March 28* to *May 30*, with an average daily high temperature above *36°C*. The hottest month of the year in Ambajogai is *May*, with an average high of 37*°C* and low of *26°C*.

The *cool season* lasts for *3.5 months*, from *October 14* to *January 30*, with an average daily high temperature below *30°C*. The coldest month of the year in Ambajogai is *December*, with an average low of *15°C* and high of *27°C*.

Rainfall

Ambajogai experiences *extreme* seasonal variation in monthly rainfall.

The *rainy* period of the year lasts for *6.7 months*, from *April 28* to *November 19*, with a sliding 31-day rainfall of at least *0.5 inches*. The month with the most rain in Ambajogai is *September*, with an average rainfall of *5.8 inches*.

The *rainless* period of the year lasts for *5.3 months*, from *November 19* to *April 28*. The month with the least rain in Ambajogai is *February*, with an average rainfall of *0.1 inches*.

Humidity

The humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night.

Ambajogai experiences *extreme* seasonal variation in the perceived humidity.

The *muggier period* of the year lasts for *5.7 months*, from *May 14* to *November 3*, during which time the comfort level is *muggy*, *oppressive*, or *miserable* at least *25%* of the time. The month with the muggiest *days* in Ambajogai is *July*, with *29.9 days* that are *muggy* or worse.

The month with the fewest *muggy days* in Ambajogai is *February*, with *0.6 days* that are *muggy* or worse.

Sunny days/ Solar Energy

Solar energy reaching the surface of the ground over a wide area, taking full account of seasonal variations in the length of the day, the elevation of the Sun above the horizon, and absorption by clouds and other atmospheric constituents. Shortwave radiation includes visible light and ultraviolet radiation.

The average daily incident shortwave solar energy experiences *some* seasonal variation over the course of the year.

The *brighter* period of the year lasts for *2.5 months*, from *March 7* to *May 23*, with an average daily incident shortwave energy per square meter above *6.7 kWh*. The *brightest* month of the year in Ambajogai is *April*, with an average of *7.1 kWh*.

The *darker* period of the year lasts for *3.0 months*, from *June 20* to *September 21*, with an average daily incident shortwave energy per square meter below *5.3 kWh*. The *darkest* month of the year in Ambajogai is *July*, with an average of *4.9 kWh*

MATERIALS AND METHODS

Air sampling was carried out by operating a continuous Volumetric Tilak Air Sampler (Tilak and Kulkarni 1970) in 3 acres field of bajra var.B.K. 560 in the Agricultural college, bajara field Ambajogai, the sampler was installed in the centre of crop field at 1.5 Meters height. The field was used for cultivation of bajra for two Kharif Seasons i.e. first from 1st August 2022 to 31st October 2022, and second from 10th July 2023 to 31st October 2023. Air Sampling was started one week before the sowing of seeds and continued till a period of one week after Crop harvesting (Table -1)

The slides were prepared as described earlier by Tilak and Srinivasulu (1967).

The identification of the trapped spore types was based on 1) Morphological characters. 2) Visual identification by comparison with reference slides and 3) Cultural characters.
The daily meteorological data viz. temperature, relative humidity and rainfall of the trapping site was recorded.

RESULTS AND DISCUSSION

In the present investigation 109 types of biocomponents were reported of which 103 were fungal spore types and others include algal parts, epidermal hairs, hyphal fragments, insect scales, pollen grains and protozoan cysts. Spores belonging to Deuteromycotina contributed the highest mean percentage (72.12 %) to the total airspora preceded by Basidiomycotina (9.89 %), Ascomycotina (9.06 %), other types (8.59 %) and Zygomycotina (0.36 %). Occurrence of different spore types in both the seasons did not show much variation, never the less in general total concentration of the airspora was slightly more in second season (Table 2). The most regularly occurring spore types like Cladosporium, Curvularia, Helminthosporium, Nigrospora Alternaria, Periconia, Memmoniella, Hyphal fragments, Basidiospores (coloured), Urediniospores.

Smut spores etc. dominated the atmospheric microbial population in both seasons and contributed 26.98 % and 27.74 %, 4.34 % and 3.95 %, 4.01 % and 4.22 %, 3.94 % and 3.94 %, 3.71 % and 3.92 %, 3.20 % and 2.88 %, and 2.88 %, 3.13 % and 1.80 %, 2.98 % and 3.11 %, 2.89 % and 2.54 %, 2.67 % and 1.46 % respectively (Table-3).

Regarding the pathogenic spore types like Alternaria, Cercospora, Curvularia, Helminthosporium, Pyricularia. Puccinia, Uridiniospores, Smut spores etc. were also reported frequently and contributed 3.71 % and 3.92 %, 1.27 % and 1.19 %, 4.34 % and 3.95 %, 4.01 % and 4.22 %, 0.19 % and 0.13 %, 2.89 % and 2.54 % and 2.69 % and 1.46 % respectively. The spores of Alternaria were trapped on 45 days showed their maximum concentration (1624/m^3 and 1750/m^3) in the months of November 2022 and September 2023. The spores of rust were trapped on 51 days and showed their highest daily incidence (140/m^3 and 154/m^3 of air) on 13th October 2022 and 18th & 25th September 2023 the spores of Curvularia, Helminthosporium were trapped throughout the period of investigation with maximum concentration (1708/m^3 of air and 1862/m^3 of air) in the months of October 2022 and September 2023.

The total spore count (182074/m^3 of air) in the second Kharif season was slightly higher than (153848/m^3 of air). This was correlated with prevailing meteorological parameters during both the Kharif seasons, where

in it was observed that during the first kharif season total recorded rainfall was 250 mm. with total number of rainy days 28 and moderately low temperature, where as in second Kharif season the total recorded rainfall was 628.8 mm with total number of rainy days 42-days and moderately low recorded range of temperature.

In general, the total airspora studies in first and second Kharif seasons, showed that there is no spore free period with maximum concentration in October in first Kharif and in September in second Kharif seasons respectively. The spore of Deuteromycotina in both the Kharif seasons showed continuous progressive increase in the total concentration since the beginning to the end of the air sampling. The higher incidence of dominant spore types like Cladosporium, Curvularia, Helminthosporium, Nigrospora, Alternaria, Periconia etc. in the air over bajra fields in both the Kharif seasons was observed in the months of September and October, when there was a recorded of monthly mean temperature 28.5°C and 29.5°C, relative humidity 75.5 and 80.2 %, and 85 mm and 150 mm rainfall. This probably justifies high incidence of spores on rain preceding days. The moderately low temperature and high percentage of humidity also showed profound effect on growth and development of Mycosporophytes. Besides, a local source is very important factor for the prevalence of spores in the air.

Similar observation was also reported by Gregory (1961), Meredith (1962,1963) from abroad and Ramakrishnan and Soumini (1948), Ramakrishanan and Sundaram (1950), Mane (1978), Tilak and Mane (1981), Tilak and Babu (1981,1984), Tilak and Ramachander Rao (1987), Tilak (1984), Tilak and Pande (1989) etc, from India.

In general, the total airspora was rich during intermittent rainy and dry period. The spore load of total airspora obtained peak during the months of September and October in both Kharif seasons. High incidence of spores was recorded immediately one or two days after the rains, that resulted in inciting very mild disease incidence by pathogenic spore types, it may be due to the variety that was grown in the field found to be resistant.

Table No .1

Bajra crop seasons, sampling period, sowing and harvesting dates of bajra.

	Seasons.	Sowing Dates	Harvesting dates	Last Sampling Dates	Period of Sampling
Bajra B.K. 560	First Kharif	7th August, 2022	31st November, 2022	31st November, 2022	112 Days
	Second Kharif	17th July, 2023	31st October, 2023	31st October, 2023	113 Days

Table No. 2

The Total airspora and percentage contribution of each spore group type during First Kharif Season i.e. from 1st August 2022 to 30th November 2022 and Second Kharif Season i.e. from 10th July 2023 to 31st October 2023.

Sr. No. Spore Group	Total Spora		Percentage		Mean %
	Season - I	Season - II	Season - I	Season - II	
1. Zygomycotina	238	896	0.16	0.57	0.36
2. Ascomycotina	13678	14392	8.89	9.23	9.06
3.Basidiomycotina	15806	14840	10.27	9.51	9.89
4. Deuteromycotina	111582	111832	72.53	71.70	72.12
5.Other types	12544	40114	8.15	8.99	8.57

Total	**153848**	**182074**	**100.00**	**100.00**	**100.00**

Table No. 3

Variations in the seasonal concentration and the percentage contribution of the different spore types to the total airspora of two Kharif seasons.

(First Kharif season from 1st August 2022 to 31st November 2022 and Second Kharif season from 10th July 2023 to 31st October 2023).

Sr. No Spore type	Season's Total Spores/m^3 of air		% Contribution to the Season's Tota Airspora %		Mean %
	I 2022	II 2023	I 2022	II 2023	
1. Cladosporium	41510	43260	26.98	27.74	27.36
2. Curvularia	6678	6160	4.34	3.95	4.14
3. Helminthosporium	6174	65 80	4.01	4.22	4.11
4. Nigrospora	6062	6146	3.94	3.94	3.94
5. Alternaria	5712	6118	3.71	3.92	3.81
6. Periconia	4928	4494	3.2	2.88	3.04
7. Memnoniella	4816	2800	3.13	1.8	2.46
8. Hyphal fragments	4592	4844	2.98	3.11	3.04
9. Basidiospores (C)	4452	4634	2.89	2.97	2.93
10. Uredospores (Rust)	4452	3962	2.89	2.54	2.72
11. Smut spores	4102	2282	2.67	1.46	2.06
12. Pollen	3850	4704	2. o	3.02	2.76
13. Insect scales	2912	3108	1.89	1.99	1.94
14. Papularia	2828	1596	1.84	1.02	1.43
15. Penicillium	2590	1358	1.63	0.87	1.27
16. Basidiospores (H)	2436	1764	1.58	1.13	1.35
17. Bispora	2352	2128	1.53	1.36	1.44
18. Pithomyces	2310	2254	1.5	1.45	1.47
19. Didymosohaeria	2296	2548	1.49	1.63	1.56
20. Hypoxylon	2016	952	1.31	0.61	0.96
21. Cercospora	1960	1862	1.27	1.19	1.23
22. Sordaria	1778	714	1.16	0.46	0.81
23. Leptosphaeria	1764	2170	1.15	1.39	1.27
24. Zygosporium	1722	994	1.22	0.64	0.88
25. Pseudotorula	1498	1358	0.97	0.87	0.92
26. Sadasivania	1442	2562	0.94	1.64	1.29
27. Heterosporium	1358	756	0.88	0.48	0.68
28. Sporormia	1302	1456	0.85	0.93	0.89

29. Aspergillus	1274	1400	0.83	0.9	0.86
30. Bitrimonospora	1232	2576	0.8	1.65	1.22
31. Haplosporella	1204	1064	0.78	0.68	0.73
32. Torula	1204	1442	0.78	0.92	0.85
33. Stigmella	1134	882	0.74	0.57	0.65
34. Cordana	1092	616	0.71	0.39	0.55
35. Spegazzinia	1022	238	0.66	0.15	0.41
36. Diplodia	826	630	0.54	0.4	0.47

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