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Aeromycological Investigation With Reference To Contribution Of Airborne Fungal Spores Over Cotton Field From Murali, Ghatanji Region Of Yeotmal District (M.S.), India

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Introduction:

Cotton is a very important crop for the sustainable economy of India and livelihood of the Indian cotton farming community. It is cultivated in about 312 lakh hectares across the world and in around 117 lakh hectares in the country. Thus, India accounts for around 37.5% of the global cotton area and contributes to 26% of the global cotton produce. Cotton continues to enjoy a pre-eminent and the most favored fibre status among the Indian textile mills, as the major raw material for the textile industry. Cotton is the second largest Kharif crop of the country, after Rice contributing 6-7% of the net sown area. Cotton in India provides direct livelihood to 6 million farmers and about 40 -50 million people are employed in cotton trade and its processing. Cotton is the backbone of textile industry, which consumes 59 % of the country's total fibre production. The cotton textile industry is the oldest and one of the largest single industries in the country. Cotton is cultivated in Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu, besides, in small areas in non- traditional states like Uttar Pradesh, Orissa, West Bengal, Assam and Tripura. The area under Maharashtra state during 2007-08 was 31.91 lakh ha with the production of 60.00 l bales and productivity of 320 kg lint /ha (Anonymous, 2008). Cotton plant subjects to infection by various fungi, bacteria and viruses which leads to reduction in gross yield and deterioration in quality causing depreciation of market value.

Aerobiology is a branch of biology that studies organic particles, such as bacteria, fungal spores, very small insects, pollen grains and viruses, which are passively transported by the air (Spieksma, 1991). In other words aerobiology is the scientific discipline focusing on the study of the passive transport of microorganisms and particles of biological origin in the atmosphere. Aeromycology is branch of Botany which deals with study of fungal flora in air. Aeromycology studies include not only fungal spore's liberation from the sources, transport and deposition, but also their effects on plants, animals, humans and even over food, building, work of art etc (Patil, *et al.,* 2016).

Keywords: *Cotton, Kharif, Aerobiology, Aeromycology*

Material and Methods

a) **Study sites -**For the aerobiological studies 3 different sites from study region were selected as follows-

- **Location – 1 :** Site – I : **Murali (North)**

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b) **Study of aerospora:** The present investigation was carried out by two methods viz., (i) sampler method.

Identification: Regular and standard mycological techniques were used for examining the material. A sterio-binocular microscope was used for studding morpho-microscopic characters by preparing slides. Extensive literature was consulted to determine the identity of fungi. On the basis of macro-morphological characteristics, the fungal colonies appeared on surface of agar jelly were recorded for number and their distribution on petri plates. Micro- and macro-morphology, reverse and surface coloration of colonies grown in Czapek's medium were considered for species identification. The isolates were identified and authenticated by authority. The per cent distribution of isolates and their incidence was recorded (Gregory *et al.,* 1959; Ellis, 1971;Barnet, H.L. and hunter, B.B. 1972; Tilak, 1989; Tiwari and Tiwari, 2007; Turkel and Bhajbhuje 2017).

Results and Discussion:

Location Murli Site I:

List of cotton field airborne fungal genera and other types were documented in the Murli site-I are listed as follows –

The present work is the outcome of a series of intensive studies conducted over a period of five years (2015 to 2019) in study region. Compilation of such comprehensive data was a step to prepare Aeromycoflorla-monograph for study region. A total of 46 fungal isolates were isolated from the air of three different sites of cotton field. Fungi isolates were identified as *Albugo* sp.*;Mucor hiemalis; Rhizopus stolonifer; Sclerospora* sp.*; Alternaria macrospora; Aspergillus flavus; Aspergillus fumigates; Aspergillus niger; Candida* sp.*; Chaetomium* sp.*; Claviceps* sp.*; Cladosporium cladosporioides; Curvularia clavata; Curvularia lunata; Fusarium moniliforme; Fusarium oxysporum; Helminthosporium* sp*; Leveillula* sp.*; Mycosphaerella* sp.*; Nigrospora oryzae; Penicillium* sp.*; Nematospora* sp.*; Phakospora* sp.*; Scopulariopsis* sp.*; Sordaria fimicola; Sporomia* sp.*; Sclerotium* sp.*; Trichoderma viride*; *Valsaria* sp.*; Rhodotorula* sp.*;* Basidiospores; Rust spores; Smut spores; *Cercospora* sp.1*; Cercospora* sp.2*; Dreschlera* sp.*; Helminthosporium* sp.*; Pithomyces* sp.*; Stigmina* sp.*; Phomopsis micheliae; Tetraploa* sp.; *Torulla* sp.*; Trichothecium* sp.*; Physarum* sp.*; Stemonitis* sp. and unidentified fungal spores. Table 2, 13 and 24 indicates the mean percentage contribution, standard deviation and variance of various fungal spores over Cotton field of site-I (Murali Site).

Alternaria is common in outdoor environments in many countries (Awad and Farag, 1999; Bardana, 2003; Cooley, et al., 1998; de Ana et al., 2006; Jo and Seo, 2005; Lee and Jo, 2006; Li and Kendrick, 1995; Osborne, et al., 2006). The genera Cladosporium, Penicillium, and Aspergillus are common in the outdoor air all over the world in various climates (Cooley, et al.,1998; Gorny and Dutkiewicz, 2002; Gorny et al., 1999; Kuo and Li, 1994; Li and Kuo, 1994; Li and Kendrick, 1995).The predominant fungal spores are Aspergillus, Alternaria, Curvularia, Cladosporium and Helminthosporium. These are main aeroallergens from dust mycoflora.

According to Tilak and Pillai (1988) out of 15 types indentified, 9 types are reported to cause paper deterioration. These are *Aspergillus, Cladosporium, Curvularia, Alternaria,*

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Penicillium, Fusarium, Rhizopus, Epicoccum and *Trichothecium*, contributing 81.33% to the total fungal colonies. Aisners *et al.,* (1976) recommended that alteration be given to hospital construction materials to avoid using materials that might support the growth of sporulation of *Aspergillus* sp. *Aspergillus* (including A. *niger*, A. *flavus*, A. *fumigatus*, *Aspergillus* sp) was dominant followed by *Cladosporium (Cladosporium Cladosporides, Cladosporium* sp), *Alternaria* (*Alternaria alternata, Alternaria* sp) *Curvularia* (*Curvularia lunata, Curvularia* sp.) on both the sites of hospital.

Conclusion: Aerofungi cause an effect on the main production with economic losses of farming crop like cotton. It can be improved by identifying the leaf sicknesses inside the early-on leaf with disease identity. It can be capable of making easy the recognition of the diseases by a suitable fungal identification strategy. Fungal leaf diseases are responsible for major yield losses in commercially important crops worldwide. In addition to evaluating the agricultural significance of fungal leaf diseases, it is necessary to develop tools that enable the rapid recognition of these disease tools. One possible approach is the identification of environmental speciation in these pathogens.

Table 1: Total contribution of each airborne fungal spore over cotton field of Murali Site-I in 2015, 2016, 2017 and 2018.

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Sr. No	Spore Group	Spore Concentration/m³ of Air				% Contribution to the total airspora				Mean % contribution	Std deviation (Population)	Variance (Population Std dev.)
		2015	2016	2017	2018	2015	2016	2017	2018			
	Zygomycotina											
1	*Albugo* sp.	7831	7784	18090	17890	2.65	2.57	5.90	5.70	4.205	1.59	2.54
2	*Mucor hiemalis*	2425	3420	2960	1970	0.821	1.15	1.002	0.667	0.91	0.18	0.03
3	*Rhizopus stolonifer*	7120	6780	7890	6754	2.411	2.296	2.672	2.281	2.415	0.15	0.024
4	*Sclerospora* sp.	1160	1090	1210	954	0.392	0.369	0.409	0.323	0.373	.03	.001
	Ascomycotina											
5	*Alternaria macrospora*	4520	4120	4260	4135	1.530	1.395	1.442	1.400	1.441	0.05	.0029
6	*Aspergillus flavus*	18650	21200	19450	20650	6.316	7.179	6.586	6.993	6.768	0.33	0.11
7	*Aspergillus fumigatus*	20150	19845	18940	19650	6.824	6.720	6.414	6.654	6.653	0.15	0.022
8	*Aspergillus niger*	17890	21030	18645	19710	6.058	7.122	6.314	6.675	6.542	0.40	0.16
9	*Candida* sp.	1250	1085	1130	1065	0.423	0.367	0.382	0.360	0.383	0.024	.006
10	*Chaetomium* sp.	3020	3890	3180	4122	1.022	1.317	1.076	1.4	1.203	0.15	0.025
11	*Claviceps* sp.	1380	1190	1250	1570	0.47	0.403	0.423	0.531	0.456	0.049	.002
12	*Cladosporium cladosporioides*	2340	2250	2510	2610	0.82	0.76	0.850	0.89	0.83	0.047	.0022
13	*Curvularia clavata*	2970	2840	2755	2685	1.005	0.96	0.933	0.909	0.951	0.035	.0012
14	*Curvularia lunata*	2350	2210	2480	2390	0.795	0.748	0.839	0.809	0.797	0.032	.0010
15	*Fusarium moniliforme*	4360	4190	4230	4080	1.476	1.418	1.381	1.38	1.413	0.039	.001
16	*Fusarium oxysporum*	4520	4210	4420	4380	1.530	1.425	1.496	1.480	1.482	0.037	.0014
17	*Helminthosporium* sp.	2420	2338	2310	2345	0.819	0.792	0.783	0.74	0.783	0.028	.0081
18	*Leveillula* sp.	2460	2120	2330	2280	0.834	0.718	0.791	0.78	0.780	0.041	.0017
19	*Mycosphaerella* sp.	3510	2870	2980	2940	1.188	0.97	1.00	0.995	1.038	0.087	.0076
20	*Nigrospora oryzae*	1840	1790	1750	1910	0.623	0.606	0.592	0.651	0.618	.0219	.0004
21	*Penicillium* sp.	2260	2420	2130	2345	0.765	0.819	0.721	0.794	0.774	0.036	.0013
22	*Nematospora* sp.	3840	3655	3780	3670	1.300	1.237	1.281	0.242	1.015	0.446	0.199
23	*Phakospora* sp.	1420	1370	1480	1360	0.480	0.463	0.501	0.460	0.476	.0163	.0027
24	*Scopulariopsis* sp.	1255	1140	1300	1270	0.425	0.386	0.440	0.430	0.420	.0205	.00042
25	*Sordaria fimicola*	260	245	265	270	0.088	0.082	0.089	0.091	0.087	.0033	.0001
26	*Sporomia* sp.	420	740	580	645	0.142	0.250	0.196	0.218	0.201	.0393	.0015
27	*Sclerotium* sp.	1240	1370	1160	1325	0.419	0.463	0.392	0.448	0.430	.0272	.0007
28	*Trichoderma viride*	1560	1450	1680	1390	0.528	0.491	0.568	0.470	0.514	0.037	.0013
29	*Valsaria* sp.	1255	1340	1260	1125	0.425	0.453	0.426	0.380	0.421	.0262	.00069
	Basidiomycotina											
30	*Rhodotorula* sp.	1680	1460	1540	1520	0.568	0.494	0.521	0.520	0.525	0.026	.0007
31	Basidiospores	14720	16840	15790	17110	4.98	5.70	5.347	5.79	5.454	0.319	0.102
32	Rust spores	16170	16840	17420	14640	5.47	5.70	5.79	4.95	5.477	0.326	0.106
33	Smut spores	6580	7410	5955	6430	2.22	2.50	2.01	2.17	2.225	0.176	0.031
	Deuteromycotina											
34	*Cercospora* sp.1	6420	5470	6080	5860	2.17	1.85	2.05	1.98	2.012	0.115	0.0134
35	*Cercospora* sp.2	40200	39840	41730	45890	13.61	13.49	14.13	15.54	14.19	0.81	0.663
36	*Dreschlera* sp.	5800	4860	6680	5410	1.96	1.64	2.26	1.83	1.922	0.225	0.050
37	*Arthrinium saccharicola*	19850	17680	18950	18460	6.72	5.85	6.18	5.88	6.157	0.349	0.122
38	*Pithomyces* sp.	4135	3465	2845	4110	1.40	1.14	0.93	0.131	0.900	0.474	0.224
39	*Stigmina* sp.	1325	985	1025	1100	0.448	0.32	0.33	0.35	0.362	0.05	.0025
40	*Phomopsis micheliae*	1640	1760	1370	1280	0.55	0.58	0.44	0.40	0.492	0.074	.0055
41	*Tetraploa* sp.	60	480	250	330	0.002	0.015	0.08	0.01	0.026	0.031	.0009
42	*Torulla* sp.	11520	14240	13420	12040	3.90	4.71	4.38	3.83	4.205	0.360	0.129
43	*Trichothecium* sp.	840	1040	650	780	0.28	0.34	0.21	0.24	0.267	0.04	.0023
	Myxomycotina											
44	*Physarum* sp.	1360	1480	1220	1445	0.46	0.49	0.39	0.46	0.45	0.036	.0013
45	*Stemonitis* sp.	1990	2040	1870	1955	0.69	0.67	0.61	0.62	0.64	0.033	.0011
	Other Types											
46	Hypal fragments	12400	11840	9870	13580	4.199	3.92	3.22	4.33	3.92	0.428	0.183
47	Insect parts	3980	2760	4320	3800	1.34	0.91	1.41	1.21	1.218	0.191	.036
48	Plant parts	5860	7650	6240	6130	1.98	2.53	2.03	1.95	2.122	0.237	0.056
49	Pollen grains	5460	5780	5210	4885	1.84	1.91	1.70	1.55	1.75	0.138	.019

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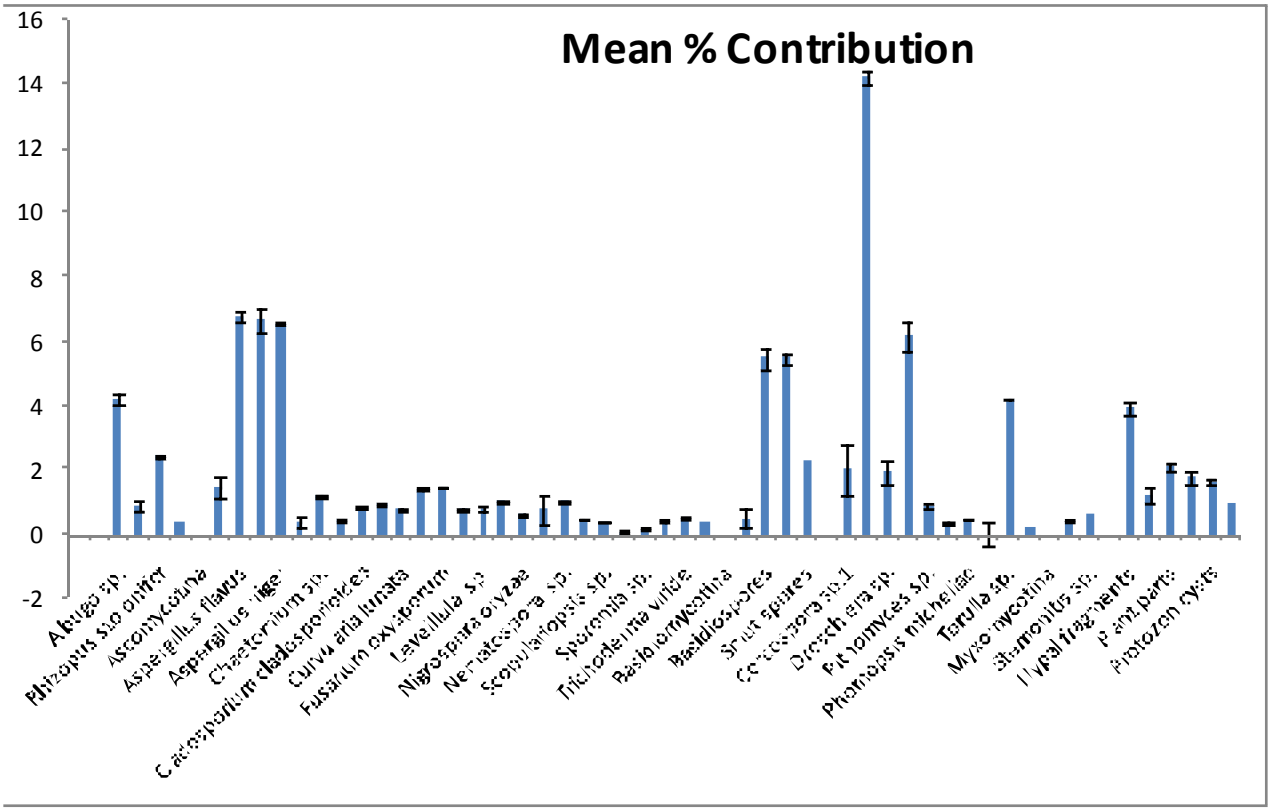
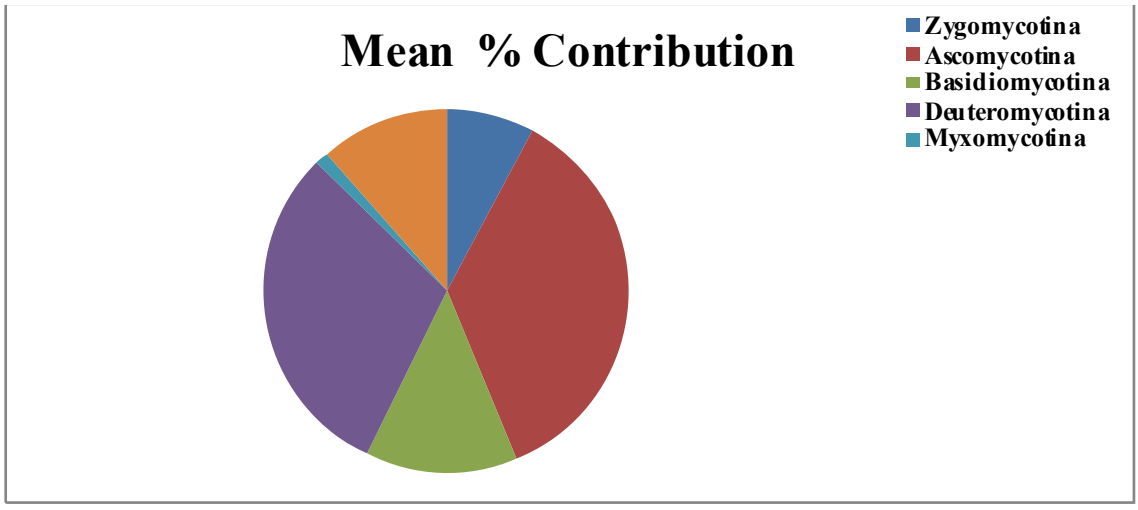
50	Protozon cysts	4185	5348	4625	5870	1.41	1.77	1.51	1.87	1.64	0.186	0.034
51	Unidentified fungal spores.	3429	2774	2694	3441	1.161	0.91	0.87	1.09	1.0078	0.121	0.014
	Total	**295280**	**302024**	**306159**	**313556**	**99.93**	**99.47**	**99.30**	**99.86**	**99.831**	8.8677	4.952

Graph1: Showing Mean %Contribution, Standard deviation and Variance of Various Fungal Spores Over Cotton Field of Murali Site-I from 2015 to 2018.



Graph 2: Showing Mean Contribution of Various Fungal Spores Over Cotton Field during study period from 2015 to 2018.



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