International Journal of Advanced Research in Engineering Technology & Science
ISSN: 2349-2819
Impact Factor: 7.10
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Email: editor@ijarets.org Volume-11 Issue-11 November-2024 www.ijarets.org

AEROMYCOLOGICAL STUDY OF GROUNDNUT FIELDS IN KANDAHAR DISTRICT NANDED MAHARASHTRA

NAIK SHIVANI SHANKARRAO [1]
(Research scholar, Botany Shri JJT University, Jhunjhunu, Rajasthan)
Dr. DINESH KUMAR SINGH [2]
(Guide Department of Botany, Shri JJT University, Jhunjhunu, Rajasthan)
Dr. D.H. INGLE [3]
(Co-guide Department of Botany Shri Shivaji College of Arts, Commerce, and Science in Kandhar)

ABSTRACT

Groundnut crop (Arachis hypogea L.) is the most important oilseed crop in Maharashtra, India. It is cultivated in Kharif as well as Rabi season. Legumes with symbiotic bacteria on their roots are the most important plant nitrogen fixers for increasing soil fertility. Groundnut cultivar authenticity was selected for aerobiological study and Khandhar taluka of Nanded district of Maharashtra was selected. The present survey was conducted in groundnut fields to study pathogenic fungal airspores and disease occurrence. This crop was grown in an area of 1.73 hectares. The present aerobiological investigation was carried out using Tilak Air Sampler. A continuous air monitoring operation was conducted for 112 days in the months of June, July, August and September of the Kharif season of 2022. Air consists of various particles. Fungal spores, pollen, viruses, bacteria, dust mites, insect parts etc. Airborne catches of groundnut fields included 40 fungal spores, hyphal fragments, insect parts, pollen, etc. Certain interactions between air borne microorganisms, meteorological parameters, growth stage of crop plants and their influence on groundnut crop plant disease. A volumetric Tilak air sampler was used to trap biological constituents in the air, providing continuous quantitative and qualitative data incidentally.

Keywords: Groundnut Crop, Air-spora, Kharif Season, Tilak Air Sampler

INTRODUCTION:

A significant portion of our ecosystem is made up of the many types of particles that make up the atmosphere surrounding us. These particles may be biotic (e.g., bacteria, viruses, pollen grains, fungal spore, tiny plant fragments, insect fragments, mites etc.). Abiotic elements (such as sand, mineral pieces, and smoke from soot) The study of airborne creatures and their sources take off, dispersion, deposition, and their impact on other species—as well as the influence of environmental conditions on each of these phases is the main focus of aerobiology. This sequence is known as the aerobiological pathway. One category for aerobiology is

1) Indoor or Intramural Aerobiology, which addresses the issues of storing pathogens in a confined environment and infectious allergens.

2) The study of the dispersion, effects, and spread of microbiological components in outside air is known as

extramural or outdoor aerobiology. The Tilak air sampler was used in the Kandhar District Nanded to conduct the current aerobiological study. From June to September of 2023, 112 days were dedicated to continuous air monitoring. Groundnut (Arachis hypogea L.) field airborne captures captured comprise 45 fungus spores, hyphal fragments, insect parts, pollen grains, etc.

The study explains the precise relationship that exists between airborne microorganisms, weather conditions, crop plant growth phases, and their influence on the development of disease in ground nut crop plants. Airborne biological components were captured using a volumetric Tilak air sampler, which also produced continuous quantitative and qualitative data. The primary goal of the current research was to examine the population of fungal morphotypes that were prevalent in the surrounding air above the groundnut fields throughout a single Rabi Crop season. The fourth-largest edible oil and major source of vegetable protein in the world is the groundnut crop. Groundnut oil seeds make about one-ninth (1/9) of India's entire agricultural output. Groundnut oil is used as a lubricant, in shaving cream manufacturing, cooking, and vanaspati ghee manufacture. It may be roasted, eaten raw, or added to other dishes. Arachis hypogaea L. plants are harvested and fed to cattle. Rich in protein, oil cake is a by-product obtained from the extraction of oil from seeds and is used as fertiliser for several crops as well as animal feed. An annual member of the Fabaceae family, peanuts are scientifically known as Arachis hypogaea linn. Many parts of the world's tropical and subtropical zones rely on this crop for its oilseed production. Both in terms of land area and total output, India is unrivaled. The amount of oil in seeds may range from 44% to 55%, depending on the kind of seed and the farming circumstances. Many people use its oil as ghee for their vegetables. Cosmetics, lubricants, and soaps also contain it. Vitamins A and B, as well as proteins, are abundant in oils. Because of its nodule-shaped roots, this legume may improve soil fertility by reducing atmospheric nitrogen levels. Rajasthan has 2.09 lakh hectares of groundnuts, out of a total of 82.17 lakh hectares in India. In addition to Andhra Pradesh, Gujarat, Karnataka, and Tamil Nadu are other states that produce groundnuts, with respective areas of 22.39 lakh hectares, 17.52 lakh hectares, 12.29 lakh hectares, and 09.16 lakh hectares. Such research is relevant to farmers in developing epidemiological systems to avoid the start of epiphytotic, which is an essential practical use of aromatherapy. In order to avoid epidemics and the resulting agricultural loss, these kinds of meteorological studies are crucial to the disease prediction 4 system. The current study was conducted using the library's Tilak Continuous Air Sampler with a 75% efficiency rate. Throughout the duration of the examination, samples were consistently taken from every region on a weekly basis. Because weather conditions may impact air concentration everywhere, meteorological data were taken while the library's temperature and humidity were checked. Identifying fungal spores was a regular procedure that included scanning slides under a microscope. The observations are documented according to the relative dominance of the different groupings.

Material and Method:

Aerobiological investigation in the present study involves qualitative and quantitative analysis of soil aerosols in Kandhar, Nanded district of Maharashtra state. Air monitoring surveys were conducted using a volumetric Tilak air sampler. The Tilak air sampler was installed in the center of a 1.62 ha area of a groundnut field with its orifice facing west and placed on a stool 2 feet above the ground level. The Tilak air sampler is an electrically powered device with a rotating drum. A drum completes one rotation in eight days. One surface of the cellophane tape is adhesive, wrapped around the drum, while the other surface is coated with petroleum jelly to adhere the spores. Air was continuously sampled at the rate of five (5) liters per minute for one-year Kharif season every eight days after the drum completed one rotation; The previous cellophane tape was removed and replaced with new cellophane tape. A cellophane tape was brought to the laboratory and cut into 16 (sixteen) pieces of equal length. Each section provides qualitative and quantitative data on bio-constituents in day and night air. Slides were prepared and scanned. Air sampling was started eight days before sowing of groundnut seeds in the experimental fields and continued for eight days after harvest. A daily record of meteorological data was maintained regularly with the help of a digital thermometer and hygrometer and rainfall was recorded. Air monitoring surveys were conducted using a volumetric Tilak air sampler. The Tilak air sampler was installed in the center of a 1.74 ha area of a groundnut field with its orifice facing west and placed on a stool 2.5 feet above the ground level. The Tilak air sampler is an electrically powered device with a rotating drum. A drum completes one rotation in eight days. One surface of the cellophane tape is adhesive, wrapped around the drum, while the other surface is coated with petroleum jelly so that the spores adhere. Air was continuously sampled at a rate of five (5) liters per minute for the Rabi season of the year every eight days after the drum had completed one rotation; The previous cellophane tape was removed and replaced with new cellophane tape. A cellophane tape was brought to the laboratory and cut into 16 (sixteen) pieces of equal length. Each section provides qualitative and quantitative data on bio-constituents in day and night air. Slides were prepared and scanned. Air sampling was started eight days before sowing of groundnut seeds in the experimental fields and continued for eight days after harvest. A daily record of meteorological data was maintained regularly with the help of a digital thermometer and hygrometer and rainfall was recorded.

Total aerospora and its percentage contribution to the total aerospora during Kharif (2023-2024) season over Groundnut crop

Sr.No.	Spore Type	N	%
(A)	**PHYCOMYCETES**		
1	Circinella	3500	1.53

2	Cunninghamella	3864	1.69
3	Rhizopus	3640	1.59
4	Rhizopus zygospore	3416	1.49
	TOTAL	**14420**	**6.30**
(B)	**ASCOMYCETES**		
1	Ascospores	3710	1.62
2	Ascobol	4382	1.91
3	Bitrimonospora	4018	1.75
4	Bombardia	3878	1.69
5	Cheatomium	3682	1.6
6	Clasterosporium	4200	1.83
7	Claviceps	3416	1.49
8	Didymosphaeria	3766	1.64
9	Hypoxylon	4032	1.76
10	Hysterium	3486	1.52
11	Lacanidion	3178	1.39
12	Lasiodiplodia	4074	1.78
13	Leptosporium	2660	1.16
14	Lophiostoma	3780	1.65
15	Melanospora	3934	1.71
16	Otthia	4004	1.74
17	Pestalotiopsis	3486	1.52
18	Phaeosphaeria spartinicola	3346	1.46
19	Pleospora	3514	1.53
20	Sporidesmium	2758	1.2
21	Sordaria	2842	1.24
22	Sporothrix	3024	1.32
23	Teichospora	1148	0.5
	TOTAL	**80,318**	**35.10**
(C)	**BASIDIOMYCETES**		

1	Ganoderma	5796	2.53

2	Rhizoctonia	5600	2.45
3	Smut spores	6986	3.05
4	Uromyces	4746	2.07
	TOTAL	**23,128**	**10.11**
(D)	**DEUTEROMYCETES**		
1	Alternaria	6846	2.99
2	Beltraniella	4438	1.93
3	Bispora	4816	2.1
4	Cercospora	6356	2.78
5	Cladosporium	7392	3.23
6	Cordana	5264	2.3
7	Curvularia	5082	2.22
8	Diplodia	4676	2.04
9	Drechslera	4382	1.91
10	Epicoccum	4900	2.14
11	Fusarium	3626	1.58
12	Haplosporella	4256	1.85
13	Harkenssia	4592	2
14	Heterosporium	4326	1.89
15	Memnoniella	3388	1.48
16	Nigrospora	3836	1.68
17	Periconia	3136	1.37
18	Pestalotia	3570	1.56
19	Tetracoccosporium paxianum	2520	1.1
20	Torula	3542	1.55
21	Trichoconis	3878	1.65
	TOTAL	**94,822**	**41.44**
(E)	**OTHER TYPES**		
1	Pollen grains	3696	1.61
2	Algal filaments	2772	1.21
3	Insect parts	3738	1.63

Concentration and percentage contribution of each airborne bio-component during Kharif Season on Groundnut field

Sr.No.	Spore Type	Kharif Season	
(A)	**PHYCOMYCETES**	**N**	**%**
1	**Circinella**	**3500**	**1.53**
2	Cunninghamella	3864	1.69
3	Rhizopus	3640	1.59
4	Rhizopus zygospore	3416	1.49
	TOTAL	**14420**	**6.30**
(B)	**ASCOMYCETES**		
1	Ascospores	3710	1.62
2	Ascobol	4382	1.91
3	Bitrimonospora	4018	1.75
4	Bombardia	3878	1.69
5	Cheatomium	3682	1.60
6	Clasterosporium	4200	1.83
7	Claviceps	3416	1.49
8	Didymosphaeria	3766	1.64
9	Hypoxylon	4032	1.76
10	Hysterium	3486	1.52
11	Lacanidion	3178	1.39
12	Lasiodiplodia	4074	1.78
13	Leptosporium	2660	1.16
14	Lophiostoma	3780	1.65
15	Melanospora	3934	1.71
16	Otthia	4004	1.74
17	Pestalotiopsis	3486	1.52
18	Phaeosphaeria spartinicola	3346	1.46

19	Pleospora	3514	1.53
20	Sporidesmium	2758	1.20
21	Sordaria	2842	1.24
22	Sporothrix	3024	1.32
23	Teichospora	1148	0.50
	TOTAL	**80,318**	**35.10**
(C)	**BASIDIOMYCETES**		
1	Ganoderma	5796	2.53
2	Rhizoctonia	5600	2.45
3	Smut spores	6986	3.05
4	Uromyces	4746	2.07
	TOTAL	**23,128**	**10.11**
(D)	**DEUTEROMYCETES**		
1	Alternaria	6846	2.99
2	Beltraniella	4438	1.93
3	Bispora	4816	2.10
4	Cercospora	6356	2.78
5	Cladosporium	7392	3.23
6	Cordana	5264	2.30
7	Curvularia	5082	2.22
8	Diplodia	4676	2.04
9	Drechslera	4382	1.91
10	Epicoccum	4900	2.14
11	Fusarium	3626	1.58
12	Haplosporella	4256	1.85
13	Harkenssia	4592	2.00
14	Heterosporium	4326	1.89
15	Memnoniella	3388	1.48
16	Nigrospora	3836	1.68
17	Periconia	3136	1.37
18	Pestalotia	3570	1.56

19	Tetracoccosporium paxianum	2520	1.10
20	Torula	3542	1.55
21	Trichoconis	3878	1.65
	TOTAL	**94,822**	**41.44**
(E)	**OTHER TYPES**		
1	Pollen grains	3696	1.61
2	Algal filaments	2772	1.21
3	Insect parts	3738	1.63
4	Hyphal fragments	3920	1.71
5	Unidentified	2016	0.88
	TOTAL	**16,142**	**7.05**
	Grand Total	**228,830**	**100**

Monthly average percentage contribution of each spore group and each spore type during 2023–24 Kharif season over Groundnut Crop

Sr No.	Spore Type	JUN	JUL	AUG	SEPT	OCT	TOTAL
A	**PHYCOMYCETES**						
1	Circinella	23.20	14.80	28.00	22.00	12.00	100
2	Cunninghamella	23.19	14.49	28.26	22.10	11.96	100
3	Rhizopus	21.54	18.46	25.00	21.15	13.85	100
4	Rhizopus zygospore	20.90	12.70	32.38	18.85	15.16	100
	TOTAL	**22.23**	**15.14**	**28.35**	**21.07**	**13.20**	**100**
B	**ASCOMYCETES**						
1	Ascospores	21.51	14.72	28.68	18.49	16.60	100
2	Ascobol	21.41	15.02	26.20	19.49	17.89	100
3	Bitrimonospora	21.60	12.54	31.01	19.51	15.33	100
4	Bombardia	23.10	14.44	26.71	19.13	16.61	100

5	Cheatomium	20.53	15.97	27.38	19.01	17.11	100
6	Clasterosporium	23.33	15.00	28.67	19.33	13.67	100
7	Claviceps	22.54	15.16	29.51	20.08	12.70	100
8	Didymosphaeria	22.30	15.61	24.91	21.19	15.99	100
9	Hypoxylon	24.65	13.89	28.13	23.61	9.72	100
10	Hysterium	23.69	17.27	27.31	18.07	13.65	100
11	Lacanidion	22.47	15.86	29.07	18.50	14.10	100
12	Lasiodiplodia	21.99	17.18	25.43	19.93	15..46	100
13	Leptosporium	22.63	15.79	30.53	20.53	10.53	100
14	Lophiostoma	22.59	14.44	28.89	20.37	13.70	100
15	Melanospora	25.98	11.74	30.25	22.78	9.25	100
16	Otthia	2.45	1.61	2.66	2.10	1.19	100
17	Pestalotiopsis	26.10	12.45	27.3	22.89	11.24	100
18	Phaeosphaeria spartinicola	23.85	17.15	25.9	21.76	11.30	100
19	Pleospora	25.10	11.55	27.49	23.9	11.95	100
20	Sporidesmium	23.86	15.23	27.9	17.26	15.74	100
21	Sordaria	23.65	14.29	26.1	21.18	14.78	100
22	Sporothrix	23.15	12.5	29.2	22.22	12.96	100
23	Teichospora	18.29	13.41	37.8	15.85	14.63	100
	TOTAL	**23.11**	**14.70**	**27.98**	**20.41**	**13.80**	**100**
C	**BASIDIOMYCETES**						
1	Ganoderma	20.53	17.15	25.36	18.84	18.12	100
2	Rhizoctonia	22.00	16.25	25.00	19.25	17.50	100
3	Smut spores	20.64	17.23	24.05	19.84	18.24	100
4	Uromyces	22.42	15.93	24.78	19.17	17.70	100
	TOTAL	**21.31**	**16.71**	**24.76**	**19.30**	**17.91**	**100**
D	**DEUTEROMYCETES**						
1	Alternaria	21.47	16.56	23.11	20.45	18.40	100
2	Beltraniella	20.50	17.35	24.92	21.14	16.09	100

3	Bispora	20.93	17.44	24.71	19.19	17.73	100
4	Cercospora	19.38	18.50	22.25	21.81	18.06	100
5	Cladosporium	21.02	17.23	24.05	20.08	17.61	100
6	Cordana	20.48	17.55	24.47	19.41	18.09	100
7	Curvularia	22.04	17.63	23.97	19.56	16.80	100
8	Diplodia	20.66	15.57	24.85	17.96	20.96	100
9	Drechslera	22.68	14.06	26.84	21.09	15.34	100
10	Epicoccum	21.14	17.43	22.29	20.57	18.57	100
11	Fusarium	23.55	11.97	29.34	21.62	13.51	100
12	Haplosporella	21.05	15.13	29.93	19.74	14.14	100
13	Harkenssia	21.95	18.29	22.87	21.04	15.85	100
14	Heterosporium	21.36	20.06	22.65	19.74	16.18	100

15	Memnoniella	20.25	17.36	30.58	19.01	12.81	100
16	Nigrospora	19.34	14.6	32.21	18.61	14.23	100
17	Periconia	20.09	17.41	25.00	19.64	17.86	100
18	Pestalotia	21.18	18.04	22.35	20.78	17.65	100
19	Tetracoccosporium paxianum	18.89	18.33	27.22	16.67	18.89	100
20	Torula	19.76	17.00	26.09	20.55	16.60	100
21	Trichoconis	20.94	17.33	24.55	20.22	16.97	100
	TOTAL	**20.94**	**16.95**	**25.13**	**20.05**	**16.93**	**100**
E	**OTHER TYPES**						100
1	Pollen grains	25.38	14.77	27.65	17.42	14.77	100
2	Algal filaments	21.72	14.14	32.32	16.67	15.15	100
3	Insect parts	23.97	14.23	28.84	17.98	14.98	100
4	Hyphal fragments	25.00	14.64	27.50	17.86	15.00	100
5	Unidentified	20.14	15.97	25.00	21.53	17.36	100
	TOTAL	**23.67**	**14.66**	**28.36**	**18.04**	**15.26**	**100**

Conclusion:

The present aeromycological survey conducted on groundnut crop serves as a vital and effective tool for forecasting fungal diseases. Aeromycology, the study of airborne fungal spores and their dynamics, plays a crucial role in understanding the interaction between environmental elements and the occurrence of plant pathogens. This survey has successfully revealed the diversity, abundance, and seasonal variation of fungal spores present in the air over groundnut cultivation fields. By analyzing the presence and density of pathogenic spores such as *Aspergillus*, *Alternaria*, *Fusarium*, *Colletotrichum*, and *Rhizopus*, it becomes possible to predict the potential outbreaks of fungal infections at different stages of crop development.

In the context of climate change, this kind of survey gains even more importance. Fluctuations in temperature, humidity, rainfall, and wind patterns directly influence the sporulation, dispersal, and infection capacity of fungal pathogens. Warmer and more humid conditions, for instance, provide a favorable environment for the proliferation of airborne spores, increasing the risk of early and severe disease onset. The aeromycological data collected thus enables early warning systems that are crucial for initiating timely disease control measures, ultimately protecting yield and quality.

The data obtained from this survey also helps in correlating the critical growth phases of the groundnut crop—such as germination, flowering, and pod formation—with the peak period of pathogenic spore concentration in the atmosphere. This information empowers farmers and cultivators to adopt proactive strategies, including the application of fungicides, biological control agents, or resistant crop varieties. Furthermore, it assists in planning irrigation and field management practices that can reduce disease incidence.

Importantly, the survey sheds light on the alarming increase in the concentration of certain pathogenic spores, suggesting the need for immediate and informed actions. With rising global temperatures and changing precipitation patterns, such conditions are likely to become more frequent, intensifying the challenge of fungal diseases in groundnut and other crops. Aeromycological monitoring, therefore, not only supports immediate agricultural decision-making but also contributes to long-term planning and sustainable farming.

In conclusion, the present aeromycological survey provides a comprehensive understanding of the fungal flora affecting groundnut crops and establishes a strong foundation for the development of an early disease warning system. It emphasizes the critical role of spore monitoring in safeguarding crop health under the increasingly unpredictable conditions brought on by climate change. By utilizing this data, farmers and agricultural stakeholders can adopt effective, timely, and environmentally sound measures to mitigate the impact of fungal diseases, ensuring better yield, food security, and economic stability for cultivators.

References:

1.Arsule C.S. and Pande B.N. (2012) Aeromycology of Cercospora on groundnut at Newasa(M.S.) Internat. J. Plt.Protection 5(1): 8-11. 2.

Aher Malati H. (2021). Aeromycological Studies over Some Groundnut Fields in Nashik District of Maharashtra, India. Journal of Emerging Technologies and Innovative Research (JETIR), Vol-8, Issue-3, pp. 2943-2950.

3. Kalkar, S.A. and Patil, G.V. (1997). Fungal airspora of a groundnut field at Nagpur. Aerobiology. Proceedings of the 5th Internat. Conf. Bangalore 1994. (Ed. S.N. Agashe). Oxford & IBH Publishing Co. Pvt.Ltd., pp.249-254.

4. Kadam, R.M., Reddy, N.J.M., Banswadekar, V.R and Jhadav, B.S. (2008a). Atmospheric concentration of Cercospora sp. (Leaf spot pathogen) over groundnut (Arachis hypogea L.) Bioinfolet,

5(1):51-53. 5. Mullaiah, K.V. 1989. Aeromycology of Cercospora sp. pathogenic to crop plants. In: Environment Ecology and Aerobiology (Ed., S.T. Tilak). Today and Tomorrow Printers and Publishers, New Delhi pp. 67-78.

6. Patil, B.N., Bhonde, S.R. and Khandikar, D.N. (2009). Trends in Area, Production and Productivity of

Groundnut in Maharashtra. Financing Agriculture-A National Journal of Agriculture and Rural Development, 41(2):35-39.

7. Rajalakshmi M.C. and Shakila P. (2008). An Aeromycological Survey Over Groundnut Field. Nature Environment and Pollution Technology. Vol-7, Issue-1, pp. 145-146.

8. Sonawane B. N and Arsule C. S and Pande B. N. A Survey of Bioaersoles over Groundnut Fields at Newasa Dist. Ahmednagar (M.S.). International Journal of Recent Scientific Research Vol. 8, Issue, 8, pp. 18954-18958,

9. Sreeramulu, T. and Ramalingam, A. (1966). A two-year study of the airspora of a Paddy field near Visakhapatnam. Indian J. Agri. Sci., 36:111-132.

10. Tilak, S.T. 1988. Aerobiology and Epidemiology of groundnut disease In: Perspective in Mycology and Plant Pathology, Prof. R. S. Mehrotra Comm. Volume