Seasonal variations of aeromycoflora in the vegetable markets of Barpeta District of Assam, North East India

RAMESH DAS AND URMIMAYEE TALUKDAR

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Department of Botany,
University of Calcutta,
Kolkata 700 019, India

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RAMESH DAS* AND URMIMAYEE TALUKDAR
B.B.K.College, Nagaon 782011, Assam

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The seasonal variation of aeromycoflora in the air over the vegetable market is closely related with the climatic conditions like, temperature, rainfall, relative humidity and nature of the mycoflora. The aeromycological survey was conducted in the vegetable market at the different localities of Barpeta district, Assam. The field experiments were carried out to study the occurrence of indoor and outdoor aeromycoflora for one year from January to December 2015 comprising all the four seasons. The experiment results revealed that the highest number of aerospores were isolated in the month of May (708/14.34% and 401/14.27%) and followed by April (623/12.62% and 357/ 12.70%) and Jun (619/12.54% and 324/11.53%) in indoor and outdoor vegetable markets respectively. The species of *Aspergillus* was found the most dominant aeromycoflora in the air over both the vegetable and outdoor market followed by *Rhizopus, Penicillium* and *Alternaria*. The occurence of the airspores of vegetables market indicates the possible role in the damage of vegetables by the post harvest pathogens and other pathogenic mycoflora that cause health hazards to people those are working in the markets.

Key words: Airborne, environment, incidence, pathogenic, post-harvest

INTRODUCTION

A large number of mycoflora are always present in the air and also on the earth surfaces which are mainly attached to the leaf surfaces of plants, dust particles, on dead and decaying organic matters and also on the living organisms, being blown away by the air current**.** The aeromycoflora are known to have profound influence on the incidence of several pathogenic bacteria and fungi those are dispersed with the help of certain natural agencies such as air, soil, water and seed**.** Most of the fungal spores in the atmosphere have come from the soil, and hence, the fungal spores are generally more abundant in the air near the earth surface than at high altitude**.** Airborne fungi are the most common microorganisms which have adverse effect on human health causing various diseases like asthma, dermatitis, rhinitis and a wide range of cardio-respiratory diseases besides they are considered as a source of plant and animal pathogens (Tawfik and Munirah, 2012).There are several air mycoflora that produce mycotoxins and can cause health hazards in all segments of the population (Kakade *et al*, 2001). It has been reported that the higher concentration of airborne fungal

*Corresponding author : dasramesh82@gmail.com

spores along with the dust particles are considered to act as indicator of the level of atmospheric bio-pollution. There is a relationship between occurrence of air borne fungal spores and market diseases of vegetable and market environment. In the vegetable markets the rotten vegetables, fruits, seeds, different crraying bags, packing materials, straw, discarded leaves and stems are the main substrates for the growth of airborne pathogenic fungi. The air spores in the market area are affecting directly on the health of the people working in the market, customers and sellers because the fungal propagules in the ambient air are regularly and continuously inhaled by human beings regularly that may cause respiratory diseases in humans as well due to their higher concentration in the air creates environmental pollution.(Ahire and Sangale, 2012). However, atmospheric temperature, humidity and precipitation in the form of rain, fog, dew etc, determine the occurrence of the air mycoflora, disease incidence and the severity.Barpeta district is one of the largest producers of vegetables in Assam state. Barpeta Road vegetable market is the best market in entire Assam by volume of business, availability and variety of fresh vegetables, fruits and seeds. More than 20% of the total produce is lost due to post harvest diseases and decay caused by various fungi every year. However, no studies have been done on the incidence of airborne fungal pathogens in vegetable markets of Barpeta district. Therefore, the present study was aimed to investigate the qualitative and quantitative incidence of fungal spores in the extramural environment of various vegetable markets in Barpeta district of Assam.

MATERIALS AND METHODS

The aeromycological survey was undertaken in the vegetable market at three different localities, Barpeta Road, Bahari and Howly of Barpeta district, Assam. The field survey was conducted in 2 sets of experiments; indoor and outdoor of the vegetable markets were carried out. Outdoor aeromycological survey was conducted around 100 meter away outside the market. Eight centres were selected for the present study. The experiment was carried out continuously for one year from January to December 2015 comprising all the four seasons- Winter (December-February), Spring (March-May), Summer (June-August), Autumn (September- November).The fungal spores were trapped by using Nutrient agar plate method containing PDA medium with Chloramphenicol (250 ug/L) to prevent bacterial growth. The sampler was operated in the morning, for 15 to 20 minutes at a height of 1-1.5m above the ground level for 15 minutes twice in a week. The Petri plates were recovered with the lids, brought to the laboratory and incubated at 27+ 1^0C. Fungal growth was examined at 5 days intervals. Pure culture was made for each of the isolated fungi and identified with the help of the literatures. The fungal colonies developed were counted and identified up to the generic level based on colony and reproductive characters and the average numbers were recorded in the Table 1 and 2. Rainfall, temperature and relative humidity in the areas were recorded with the help of maximum, minimum, and wet-dry bulb thermometer respectively.

RESULTS AND DISCUSSION

The results of aeromycological survey over vegetable market of Barpeta district revealed that the vegetable markets of the study areas harbors a cosmopolitan fungal species. The occurrence of indoor and outdoor aeromycoflora of vegetable market showed significant variations in the different months of the year. The experimental results (Table 1 and 2) showed that a total of 32 air spores (excluding pollen grains, hyphal fragments and unidentified spores) were found in the air over in both indoor and outdoor vegetable market. The results obtained in the experiment revealed that a total of 4938 airspores, including pollen grains, were isolated in the indoor vegetable market throughout the year where as, in case of outdoor market this number was 2811. The most dominant air spores isolated were the species of the genus *Aspergillus* (568), *Mucor* (299), *Penicillium* (295), *Altarnaria* (257), *Fusarium* 9235), *Trichoderma* (218), *Helminthosporium* (9215) and *Phytophthora* (206) in indoor vegetable market. The dominant air mycoflora isolated in the outdoor vegetable market were the species of the genus *Aspergillus* (257), *Mucor* (211), *Rhizopus* (211), *Curvularia* (176), *Alternaria* (172) and *Fusarium* (168). A similar result was obtained by Latha and Ramachandra Mohan (2013) who had studied dominant fungal flora (*Aspergillus*, *Fusarium*, *Alternaria* and *Curvularia*) from outdoor environments of four sites of Jnanabharathi campus of Bangalore. It was also reported by Pande *et al,* (2012) on incidence of pathogenic fungal types, like *Alternaria, Aspergillus, Cladosporium*,

Table 1 : Occurrence of some important types of aereomycoflora in the air over vegetable market in different months of the year 2015 (average of 3 replica plates) (Indoor market)

Air spore Isolated	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Indiviual Total
Alternaria sp.	12	16	21	30	36	30	28	22	20	19	14	9	257
Aspergillus sp.	35	44	49	65	70	67	53	46	42	37	33	27	558
Botrytis sp	-	3	6	9	13	9	2	3	1	1	-	-	47
Cercospora sp	2	1	1	11	13	9	8	7	4	1	1	-	59
Chaetomium sp.	--	1	2	2	3	6	3	3	1	1	-	-	22
Cladosporium sp.	3	7	7	12	13	14	8	7	7	8	5	2	93
Colletotrichum sp.	2	4	4	15	25	14	12	11	8	9	5	3	112
Cornyspora sp..	3	-	3	10	2	9	7	2	2	-	-	-	38
Curvularia sp	5	7	10	11	12	13	8	8	7	1	1	1	84
Drechslera sp.	4	4	6	16	12	10	10	9	9	10	9	7	106
Epicoccum sp.	2	5	8	8	6	9	5	3	2	2	1	1	52
Exosporium sp.	3	7	9	13	9	10	9	8	6	7	4	2	77
Fusarium sp.	13	16	18	26	36	32	22	17	16	15	15	9	235
Geotrichum sp.	2	1	1	16	17	15	10	10	8	5	5	3	93
Helminthosporium sp.	10	13	20	30	27	31	21	20	17	10	10	6	215
Mucor sp.	20	27	31	37	32	39	29	21	20	19	15	9	299
Nigrospora sp.	4	4	9	17	16	12	9	7	7	6	4	2	97
Penicillium sp.	11	15	20	40	43	40	33	31	19	18	15	9	298
Pestalotia sp.	3	2	6	10	13	8	4	5	3	2	2	1	59
Phoma sp.	7	8	11	18	14	17	11	10	7	8	3	3	117
Phytophthora sp.	13	15	17	30	22	22	20	19	19	13	8	8	206
Pythium sp	9	15	15	30	33	31	19	17	14	13	9	4	209
Rhizopus sp.	14	18	28	52	60	43	29	28	30	19	15	15	351
Rust spores	3	9	9	17	18	16	10	10	9	10	7	2	120
Smut spores	7	7	12	18	22	19	18	14	9	7	6	6	145
Trichoderma sp.	10	19	21	32	30	35	17	14	13	9	9	9	218
Trichothecium sp.	3	6	9	18	16	12	13	8	8	3	4	-	100
Torulopsis sp.	6	9	17	17	20	15	11	12	9	9	6	5	136
Verticillium sp.	2	7	9	15	17	13	12	11	10	10	8	7	113
Hyphal fragments	2	7	9	12	13	7	10	10	9	9	8	8	104
Pollen grains	9	9	17	33	30	27	28	30	27	23	17	17	267
Unidentified sp.	5	7	7	15	15	15	11	8	9	8	7	8	115
Total no of airspores	224	313	412	623	708	619	490	431	372	317	246	183	4938
% of air spores	4.54	6.34	8.34	12.62	14.34	12.54	9.92	8.73	7.53	6.42	4.98	3.71	

Table 2 : Occurrence of some important types of aereomycoflora in the air over vegetable market in the different months of the year 2015 (average of 3 replica plates) (Outdoor market)

Air spore Isolated	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Individual Total
Alternaria sp.	7	10	11	26	27	19	20	15	11	10`	10	6	172
Aspergillus sp.	12	15	20	36	35	25	20	22	22	18	16	16	268
Botrytis sp.	6	8	8	15	16	17	10	14	14	13	11	9	145
Cercospora sp.	--	--	1	3	4	2	4	1	1	-	-	-	16
Chaetomium sp.	--	--	1	-	1	2	1	2	1	1	-	-	11
Cladosporium sp.	-	2	3	5	5	2	3	2	-	1	-	-	23
Colletotrichum sp.	6	10	15	21	20	20	19	21	15	10	7	5	179
Cornyspora sp..	3	4	6	9	7	9	4	7	5	4	3	3	64
Curvularia sp.	11	11	15	15	18	17	16	17	15	13	15	13	181
Cunninghamella sp.	6	8	9	10	10	11	11	11	3	4	2	2	90
Drechslera sp.	2	2	3	8	9	8	6	6	5	5	4	-	58
Epicoccum sp.	-	-	3	6	5	3	3	3	2	-	-	-	25
Fusarium sp.	5	6	10	14	25	21	18	18	16	16	12	7	170
Geotrichum sp.	--	--	1	4	5	5	3	3	1	1	-	-	23
Helminthosporium sp.	4	5	7	13	15	11	11	9	3	4	2	2	96
Mucor sp.	10	15	18	25	25	24	20	20	18	15	10	11	223
Nigrospora sp.	--	--	--	4	5	4	2	2	1	1	-	-	19
Penicillium sp.	4	4	5	15	18	13	11	10	9	9	7	3	108
Pestalotia sp.	1	1	3	8	10	4	7	4	3	3	-	-	44
Phoma sp.	--	--	5	6	7	4	7	3	3	-	1	-	36
Phytophthora sp.	3	8	10	16	17	15	12	13	9	9	3	-	118
Pythium sp.	2	5	5	8	11	9	7	7	1	1	3	1	68
Rhizopus sp.	10	14	18	28	30	20	18	18	19	14	12	10	217
Rust spores	5	5	9	8	17	11	10	10	9	4	3	8	133
Smut spores	5	6	7	11	11	9	8	8	8	6	7	7	92
Trichoderma sp.	--	--	--	3	6	3	2	2	3	2	1	1	23
Trichothecium sp.	--	--	--	3	4	3	2	3	1	-	-	-	16
Torulopsis sp.	1	1	3	6	7	6	4	5	3	2	3	2	43
Verticillium sp.	--	2	2	3	5	2	3	2	-	1	-	-	20
Hyphal fragments	4	5	7	11	10	12	7	6	9	7	7	4	99
Pollen grains	10	5	9	11	10	8	10	8	7	5	5	7	142
Unidentified sp.	4	5	2	6	6	5	8	3	5	3	4	4	91
Total no. of air spores	121	157	216	357	401	324	287	275	222	182	148	121	2811
% of air spores	4.30	5.59	7.68	12.70	14.27	11.53	10.21	9.78	7.90	6.47	5.27	4.30	

Table 3 : The differences of aeromycoflora in indoor and outdoor vegetable market

Months	Indoor	Outdoor	Differences
Jan	224	121	103
Feb	313	157	156
Mar	412	216	196
Apr	623	357	266
May	708	401	307
Jun	619	324	295
Jul	490	287	203
Aug	431	275	156
Sep	372	222	150
Oct	317	182	135
Nov	246	148	98
Dec	183	121	62
Total air spore	4938	2811	2127

*Curvularia*etc. on vegetable and fruit market of Aurangabad. These results have similarity with the reports of Raveesha (2015) who reported the maximum incidence of the species of *Penicillium, Aspergillus, Alternaria, Cladosporium* and *Curvularia*. in the extramural environment of fruit and vegetable market at Kolar district of Karnataka.The species of *Cunninghamella* was found in outdoor market which was not found in indoor market, whereas, the species of *Cornyspora* was found in indoor market was absent in outdoor market.The experiment results revealed that the highest number of aerospores were isolated in the month of May (708/14.34% and 401/14.27%) and followed by April (623/ 12.62% and 357/12.70%) and Jun (619/12.54% and 324/11.53%) in indoor and outdoor market respectively. The lowest number of aeropores were found in the month of December (183/3.71%)) in case of indoor market, whereas, the lowest aerospores were found in the outdoor market in both the months of December and January (121/ 4.30%). The maximum number of fungal colonies was recovered during the month of May in air over both the indoor and outdoor vegetable market is probably may due to the optimum temperature range (20-35^{0}C) and high relative humidity (65-92%) along with mild rains during this period favoured the fungal growth. Whereas, the fungal growth was found minimum in the month of January and December of the year may due to the low temperature (10-18^{0}C) and rainfall of the area. During the investigation period, the species of *Aspergillus* was found the most dominant aeromycoflora in the air over both the vegetable and outdoor market**.** Similar results were reported by Talukdar and Bora (2007) who conducted the survey at banana market of Tihu of Nalbari district, Assam and reported the highest number of fungal colonies represented by *Aspergillus niger* and *Rhizophus stolonifer.* The experiment results (Table 3) were also revealed that the airspora of indoor and outdoor vegetable market show a close correlation qualitatively but there is a significant difference quantitatively. The airspora isolated in the indoor vegetable market (total 4938) were quantatively different with the airspora of outdoor (total 2811). The study showed that there are a close relationship between aeromycoflora of vegetable market and incidence of the post harvest diseases. The seasonal variation of aeromycoflora in the air over the vegetable market is closely related with climatic conditions like, temperature, rainfall, relative humidity and nature of the mycoflora. The occurence of the airspores of vegetables market indicates the possible role in the damage of vegetables by the post harvest pathogens. Therefore, the monitoring of the aeromycoflora on the vegetable market is important that will help to find out the nature of various types of pathogens and way out the control measures. It is also important to identify the various types of the non-pathogenic and pathogenic mycoflora that causes health hazards to people those are working in the market, customers and sellers.

REFERENCES

Ahire, Y.R. and Sangale M.K.2012. Survey of aeromycoflora present in vegetable and fruit market. *Elixir Appl. Botany,* **52:** 11381-11383

Kakade, U.B, Kakade H.U. and Saoji, A.A. 2001. Seasonal variation of fungal propagules in a fruit market environment, Nagpur (India), Aerobiologia, **17:** 177-182.

Latha, N. and Ramachandra Mohan, M. 2013. Aeromycological study of Jnanabharathi Campus, Bangalore University, Bangalore, Karnataka, *Current Biotica*, **7** 83-87.

Pande, B.N, Dere, P.K. and Arsule CS. 2012. Atmospheric fungal diversity over the vegetable market at Aurangabad (M.S.), *Eco. Revolution,* P.145-150.

Raveesha, 2015; Aeromycological study of fruit and vegetable market of Kolar District,Karnataka. *Indian Journal of Applied Research,* **5** :63-66

Talukdar, K.K. and Bora, K.N. 2007. Air mycoflora of banana markets at Nalbari District, Assam, *Journal of Mycopathological Research,* **45 :** 31-34.

Tawfik M, Muhsin and Munirah M, Adlam. 2012. Seasonal distribution pattern of outdoor airborn fungi in Basrah city,Southern Iraq. *Journal of Basrah Researches (Science)*, **38**: 92-98.