

DIURNAL PERIODICITY IN THE FUNGAL AIRSPORA OF GUWAHATI

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An analysis of the diurnal periodicity of the fungal airspora has been carried out employing culture plate method in November 1980. The daily periodicity of occurrence of fungal types was noted. Analysis showed that the fungal spores are abundant in the afternoon and least in the morning. The maximum number of fungal colonies (59 colonies per plate) was recorded at 12.00 hrs. (noon) and minimum (14 colonies per plate) at midnight (24.00 hrs.). Of the types recorded, *Cladosporium* (18.46%) constituted the highest number followed by *Curvularia* (13.59%) *Aspergillus* (11.84%) and *Penicillium* (10.81%). Similar experiments were also carried out indoor air of the rooms occupied by asthmatic patients and healthy persons. The atmosphere of rooms occupied by asthmatic patients contains a high density of fungal spores in all the times of the day than in the rooms of healthy persons. The types predominantly occurring in the air of rooms occupied by asthmatic patients are *Cladosporium*, *Penicillium*, *Aspergillus* and *Alternaria*.

INTRODUCTION

Fungal spores form an important constituent of the atmospheric air. The composition and concentration of the air spora depends mainly upon the source of organisms, weather, altitude, presence of mountain, season, air currents and the time of day.

Apart from the specific function of the pollen grains concerned with pollination and fertilization in higher plants and propagation in the case of fungal spores there may be involvements of some of the types of fungal spores and pollen grains in certain forms of human allergy such as asthma, hayfever and rarely eczema. Feinburg (1944) considered certain moulds to be significant allergens amongst patients sensitive to inhalant allergens. The occurrence

and distribution of air borne fungal spores in relation to human allergic diseases and as plant pathogens have been studied in detail (Baruah and Chetia, 1966 ; Bora and Baruah 1977 ; Gregory 1961 ; Hirst 1953 ; Bora 1969).

Air sampling in 1966-67 and 1967-68 showed maximum dispersal of spores in October-November and in April. *Cladosporium* constituted the major part of the airspora observed (Bora 1969).

Investigations are therefore carried out to study the diurnal periodicity of fungal airspora of Guwahati and also to determine the extent of distribution of fungal spores in the atmosphere of rooms occupied by asthmatic patients and healthy persons at the different times of the day.

MATERIALS AND METHODS

The diurnal periodicity of fungal airspora was studied by culture plate method. Experiments were carried out in the month of November 1980.

Petridishes (9 cm dia) containing Czapeks-Dox agar medium were exposed to outdoor atmosphere for 10 min. at 03.00 hrs, 06.00 hrs, 09.00 hrs, 12.00 hrs, (noon), 15.00 hrs, 18.00 hrs, 21.00 hrs, and 24.00 hrs. (midnight). Thereafter petridishes were removed and incubated. The fungal colonies were counted and identified upto the generic level.

An analysis of fungal air spora in the atmosphere of the rooms occupied by asthmatic patients as well as healthy persons was also carried out at the different times of the day by culture plate method. The nutrient plates were exposed at 06.00 hrs, 08.00 hrs, 11.00 hrs, 12.00 hrs (noon), 14.00 hrs, 16.00 hrs and 18.00 hrs.

RESULTS

The results (Table 1) show that the fungal colonies were recorded in large numbers in the afternoon and the lowest recorded in the morning. The maximum number of fungal colonies (59 colonies per plate) at 24.00 hrs. (midnight). *Cladosporium* formed the largest number in the outdoor air followed by *Curvularia*, *Aspergillus*, and *Penicillium*.

Table 1. Number of total colonies per petriplate and the percentage contribution of each type to total isolates

Types of fungi	03.00 hrs.	06.00 hrs.	09.00 hrs.	12.00 hrs. (noon)	15.00 hrs.	18.00 hrs.	21.00 hrs.	24.00 hrs. (midnight)
Alternaria	0.35	0.35	0.35	0.7	1.04	1.39	0.39	—
Aspergillus	0.7	1.04	1.04	2.09	2.09	2.44	1.74	0.7
Cladosporium	1.04	1.39	1.39	3.84	3.48	3.14	3.14	1.04
Curvularia	0.7	0.7	1.39	2.78	3.14	2.44	1.74	0.7
Fusarium	0.35	0.35	0.35	0.7	1.04	1.04	0.7	—
Gliocladium	0.35	0.35	0.7	1.04	0.7	0.7	0.35	0.35
Helminthosporium	0.35	0.7	0.7	1.04	1.39	1.04	1.04	0.7
Mucor	—	—	0.35	0.7	0.35	0.35	0.35	0.35
Nigrospora	0.35	0.35	0.35	0.35	0.35	0.35	0.35	—
Penicillium	0.35	0.7	0.7	2.44	2.09	2.09	2.09	0.35
Rhizopus	0.35	0.35	0.35	1.04	1.04	1.04	0.7	—
Trichoconis	—	—	—	0.7	0.35	0.35	0.35	—
Trichoderma	0.35	0.35	0.7	2.09	1.39	1.39	0.35	—
Unclassified	0.35	1.39	0.7	1.04	1.04	0.7	0.7	0.7
Total Colonies	16	23	26	59	59	53	40	14

Table 2. Number and types of fungal colonies trapped in the atmosphere of rooms occupied by asthmatic patients at the different times of the day

(Results represent the number of colonies caught in five culture plates)

Types of fungi	06.00 hrs.	08.00 hrs.	10.00 hrs.	12.00 hrs. (noon)	14.00 hrs.	16.00 hrs.	18.00 hrs.	Total
Absidia	3	5	7	10	18	19	16	70
Alternaria	30	36	39	45	43	45	42	280
Aspergillus	29	33	38	48	52	47	43	290
Cladosporium	44	49	57	74	76	78	77	455
Curvularia	6	9	5	12	13	13	12	70
Fusarium	11	14	15	14	16	20	15	105
Gliocladium	—	—	—	—	—	—	—	—
Helminthosporium	14	18	18	22	23	24	21	140
Mucor	4	5	6	4	6	9	6	40
Nigrospora	—	—	—	—	—	—	—	—
Penicillium	40	43	52	61	64	64	61	385
Rhizopus	—	—	—	—	—	—	—	—
Trichoderma	—	—	—	—	—	—	—	—
Unclassified	19	21	25	26	29	27	28	175
Bacteria	6	6	8	10	10	14	16	70
Total Colonies	206	239	270	326	344	358	337	2080
Percentage (%)	9.9	11.5	13.0	15.7	16.5	17.2	16.2	

Table 3. Number and types of fungal colonies trapped in the atmosphere of rooms occupied by healthy persons at the different times of the day
(Results represent the number of colonies caught in five culture plates)

Types of fungi	06.00 hrs.	08.00 hrs.	10.00 hrs.	12.00 hrs. (noon)	14.00 hrs.	16.00 hrs.	18.00 hrs.	Total
Absidia	—	—	—	4	5	—	—	9
Alternaria	5	5	4	6	9	10	5	44
Aspergillus	9	11	18	29	26	19	26	138
Cladosporium	14	26	37	46	56	55	48	382
Curvularia	4	6	6	12	8	4	3	43
Fusarium	7	11	10	14	17	16	9	84
Gliocladium	—	—	—	1	1	—	—	2
Helminthosporium	6	9	12	20	13	18	17	95
Mucor	5	6	5	10	10	9	8	53
Nigrospora	—	—	—	—	—	1	1	2
Penicillium	12	23	32	41	44	45	43	240
Rhizopus	—	—	—	—	—	1	1	2
Trichoderma	—	—	—	—	1	—	—	2
Unclassified	10	16	18	26	26	18	24	140
Bacteria	4	6	4	11	14	12	8	59
Total Colonies	76	119	146	220	232	208	193	1194
Percentage (%)	6.4	10.00	12.2	18.4	19.4	17.4	16.2	

The analysis of fungal airspora in the atmosphere of the rooms occupied by asthmatic patients and healthy persons (Tables 2 and 3) shows that a total number of 2080 fungal colonies were trapped in the atmosphere of room of asthmatics whereas 1194 colonies were recorded in the atmosphere of healthy persons. Of the types isolated, *Cladosporium* is the major component of the air of asthmatic's room. The maximum number of fungal colonies (358 colonies) was recorded in the atmosphere of asthmatic's room at 16.00 hrs. whereas it was recorded (232 colonies) in healthy persons at 14.00 hrs.

DISCUSSION

The results on the whole indicate that the concentration of fungal airspora varies with time of day. The distribution of airspora is governed by the complex physical and biological factors that depend on the locality. The diurnal and seasonal variations of weather in a particular locality may affect the composition and concentration of the airspora. The prevalence of fungal airspora varies hour to hour. Airspora analysis in the outdoor air shows that the fungal types like *Cladosporium*, *Curvularia*, *Aspergillus*, *Penicillium* and *Helminthosporium* are

most abundant in the afternoon and least in the morning. Of the types isolated, *Cladosporium* is the major component of the air. Air sampling showed maximum number of fungal colonies (20.55% of the total isolates) at 12.00 hrs. (noon) and a minimum (4.89% of total isolates) at 24.00 hrs. (midnight). Heise and Heise (1950) found the concentration of pollen grains and *Alternaria* varied with time of day, locality and altitude. It has been also reported that the species of *Cladosporium* dominate the day time spora in temperate regions and in the most tropics (Gregory & Hirst 1957 ; Pady, 1957 ; Halmilton, 1959).

The air of room occupied by asthmatic patient contains a high density of fungal spores (2080 colonies) in all the times of day than in the room, of healthy persons (1194 colonies). There is no qualitative difference in the fungal spores trapped in the air of patient's room and those of healthy persons. Tomsikova *et al* (1965) noted that the molds and yeast are significantly higher in the patient's air passages than in the healthy persons.

Cladosporium (455 colonies) formed the largest numbers in the air of asthmatic room followed by *Penicillium* (385 colonies), *Aspergillus* (290 colonies), *Alternaria* (280 colonies) and *Helminthosporium* (140 colonies). Hansen (1928) isolated *Aspergillus* and *Penicillium* spp. from the environment of the patient. He was also able to reproduce the asthmatic symptoms in several patients by giving the inhalation of mold spores. Stark (1967) isolated *A. fumigatus* from plugs of matter in the sputum of a 46 yr. old Indian asthmatic patient. The maximum number of fungal colonies was recorded at 16.00 hrs. in the room occupied by asthmatic patients.

Horesji *et al* (1960) found that the continuous inhalation of spores of moulds results in their setting down and growing on the mucous membrane of the respiratory tract. It may be assumed that the appearance of certain fungal spores in large numbers in the air at a particular time have some significance on the causes of allergic symptoms in human.

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