Environment Conservation Journal 4(1-3) 71-78, 2003
(ISSN 0972-3099)

Aeromycoflora of Gurukul Kangri and Yogi Pharmacy, Haridwar

Navneet ,V.K. Sharma, Rakhi Khanna and Prabhat

Department of Botany and Microbiology, Gurukul Kangri University, Haridwar

Abstract

The study of aeromycoflora of Gurukul Kangri and Yogi Pharmacy was carried out by gravity petri dish method in the year 1994 and 1998 respectively. A total of 12 fungal forms belonging to 8 genera were isolated from Gurukul Kangri and 17 fungal forms belonging to 11 genera were trapped from the air of Yogi Pharmacy. The dominant species were *Aspergillus niger, A. fumigatus, A. flavus, Cladosporium cladosporioides, Penicillium cyclopium, Epicoccum nigrum* rest of the fungi were of sporadic occurrence. In the diurnal cycle the fungi showed an evening tendency. The role of environmental factors i.e. relative humidity and temperature in affecting the densities of fungal population taken into consideration.

Key Words: ***Aeromycoflora, Cladosporium, Aspergillus***

Introduction

The air has the inherent property to sustain the life on earth besides majority of plant and human pathogens are air borne. The air is the basic amenity of our life and contain both viable and nonviable particulates. The microflora of air chiefly consists of fungi, yeast, bacteria, viruses etc. Aerobiological and indoor or intramural aerobiology. The study of airborne microbial contamination in a closed system like buildings hospitals, glass houses pharmaceutical industrial environment etc. is known as indoor aerobiology as against the outdoor aerobiology which is concerned with the survey of biological material in open space like fields and forests.

The presence of fungi in the air depend on the time of the day, season and geographical location. The number and type of fungi in the air is important for medical purposes because fungal spores provoke allergic response. The information regarding the changes in concentration and composition of allergens facilitate forecasting and treatment of allergic manifestations.

The Indian Acharyas and Rishis were well aware of different properties of herbs in curing various

diseases. Hardwar and Rishikesh are among the places where various sages and ayurvedic practioners have been formulating different ayurvedic preparations. Gurukul Kangri and Yogi Pharmacy are well known and reputed ayurvedic pharmacies of Hardwar. Both the pharmacies are important for the production of ayurvedic drugs which serve the mankind. The present study i.e. aeromycoflora of Gurukul Kangri and Yogi Pharmacy was under taken with a view to isolate and identify the fungi present in air which may affect the ayurvedic preparations of these pharmacies.

Materials and Methods

Aeromycoflora of Gurukul Kangri Pharmacy and Yogi Pharmacy were studied by using gravity petri dish method in February – March 1994 and September – December 1998. respectively. Four petridishes containing Martin's Rose Bengal Agar medium were exposed in Asav Department (Fermentation unit) of Gurukul Kangri Pharmacy in the morning and evening separately for five minutes at two feet height from the ground level both for intramural (inside) as well as extramural (outside) studies. In Yogi Pharmacy four samplings were conducted in four different sections i.e. raw material storage section, asav storage section, furnance section of asav preparation and packing section. The exposed plates were incubated at 25^0C and the number of fungal colonies appeared were counted and identified. Relative humidity and temperature were recorded by placing hygrometer and thermometer at sampling site.

Results

1 Gurukul Kangri Pharmacy:

A. Components:

The spore content of air was rich both qualitatively and quantitatively. A list of fungal spore types and the percentage contribution to total aeromycoflora is given in table 1. A total of 12 fungal forms belonging to 8 genera were trapped. *Cladosporium* formed the main bulk of the total aeromycoflora which was represented by its two species viz. *Cladosporium cladosporioides* and *C. herbarum*. *C. cladosporioides* were found to occur in maximum number. *Alternaria* was the next abundant genus followed by white sterile form. *Penicillium* was represented by two of its species viz. *P. cyclopium* and *P. chrysogenum* contributing 9.97% and 0.70% respectively of total aeromycoflora. *Curvularia species* contributed 3.92% of total aeromycoflora. *Epicoccum* was represented by one species i.e. *E. nigrum* which contributed 3.57% of total aeromycoflora. The fungal species having less than 2% contribution

comprises of *Rhizopus sp. P. chrysogenum, Aspergillus niger* and *Trichothecium sp*. The dominant species above 75% frequency of occurrence were *Cladosporium cladosporioides* and *Alternaria sp. Penicillium chrysogenum, Epicoccum nigrum* and white sterile form showed 50-75% frequency of occurrence (Table 2). Rest of fungi were of sporadic occurrence.

B. Diurnal and seasonal periodicities:

The fungal content of the air at a particular sampling time varied between 7.0 and 66.0 propagules per 100 cm^3 (Table 3 A). Minimum number of propagules were trapped in first sampling at evening (inside) and maximum in second sampling at evening (outside) of room no. 2. In the diurnal cycle, fungi showed an evening tendency in all the samples except in the Ist sampling when it was obtained at morning (inside). In all the samplings morning gave minimum counts. On the basis of statistical analysis (Table-3B) aeromycoflora varied insignificantly.

2. Yogi Pharmacy:

A. Components:

The spore content of air Yogi Pharmacy was richer qualitatively than Gurukul Kangri Pharmacy. A total of 17 types of fungal species belonging to 11 genera were trapped from the air (Table-4). The most abundant fungus was *Asprigillus niger* which contributed 16.83% followed by *Aspergillus fumigatus* (14.71%) and *Aspergillus flavus* (13.89%). The fungal species having less than 2% contribution comparised of *Aspergillus sp*. (i), *Drechslera sp. Helminthosporium sp. Higrospora sp.* and *Penicillium sp*. (iii). Besides these white sterile forms and unidentified fungal spores were also trapped. The dominant fungal species above 60% frequency were *Aspergillus niger, A. flavus, A. fumigatus* and *Cladosporium sp*. (Table 5). Rest of fungi were of sporadic occurrence.

B. Diurnal and seasonal periodicities:

The fungal content of the air at particular sampling time varied between 4.19 and 32.50 propagules per 100 cm^3 (Table-6). Minimum number of propagules were trapped on 19.12.98 in the morning (inside) in IV sampling and the maximum number on 9.11.98 in evening (outside) in sampling III.

Discussion

The dominant fungal forms of air were *Cladosporium, Alternaria, Aspergilli* and *Penicillia. Cladosporium* is an ubiquitous fungus and its dominance in fungal aerospora has been reported from

different part of the country (Dixit and Gupta 1081, Yasmeen and Saxena 1992). During the course of present investigation, the total number of *Cladosporium* colonies were more in dry weather and decreased with the increase in humidity and decrease in temperature. *Alternaria* was isolated in abundance from air samplings of Gurukul Kangri Pharmacy. Pady (1957) and Rati and Ramallingam (1976) also found this fungus very close in percentage to *Cladosporium. Aspergillus species* were found to be present in the aeromycoflora throughout the period of investigation. Noble and Clayton (1963) investigated the fungal flora of air of hospital ward and found *A. fumigatus* was the dominant type of spore. Verma and Chile (1992) reported this fungus contributing 35.64% of the total fungal spores collected from the intramural environment in the allergy ward of medical college of Jabalpur city.

In the diurnal cycle highest quantities of fungi were trapped in the evening time and minimum during the morning. These findings are in confirmity with those of Mishra and Kamal (1971) and Sharma and Gupta (1978). The morning periods in winter months are commonly calm and the fungi most of which are wind dessiminated are not disturbed during this period. The undisturbed environmental conditions accounted for low fungal content of air in the morning. In the day time the fungal spores dry up and even gentle breeze disseminates the spores. The dissemination of spores results in the increased spore number in the evening time and this was the reason that the peak was observed in the evening.

During survey of aeromycoflora of Yogi Pharmacy, maximum aeromycoflora was recorded on 9.11.98 in furnance section and least on 19.12.98 in the packing section. At the time of sampling only one furnance was working, the environmental conditions i.e. temperature and humidity was found to be congenial for microbial growth. Moreover, in this section there is a wide open door and non-cemented floor, thus fungal spores are easily disseminated in the atmosphere from the soil. In the packing section, there is cemented floor and every possible effort is made to keep it clean and free from microbes by using ultraviolet light. The maximum number of colonies were recorded in the month of November due to moderate temperature and humidity as also reported by Verma and Srivastava (1966). Our data showed winter maxima and this trend is in confirmity with earlier reports from India (Sreeramulu and Ramalingam 1966, Ramalingam 1971).

Reference

Dixit R.B. and Gupta J.S. 1981. Seasonal and diurnal census of air-spora over al barely field. **J. Indian bot. Soc**. 60:348-351.

Mishra R.R. and Kamal 1971. Aeromycology of Gorakhpur. III. Seasonal variations in air fungal spora. **Mycopathol. Mycol. Appl**. 45:301-310.

Noble W.C. and Clayton, Y.M. 1963. Fungi in the air of hospital wards. **J.Gen. Microbiol**. 32:397-402.

Pady S.M. 1957. Quantitative studies of fungus spores in air. **Mycologia**. 49:339-353.
Ramalingam A. 1971. Air spora of Mysore. **Proc. Indian Acad. Sci**. B. 24:227-240.
Rati E. and Ramalingam A. 1976. Air borne Aspergilli at Mysore. Asp. **Allergy and Applied Immunol**. 9:139-149.
Sharma S.K. and Gupta J.S. 1978. Seasonal and diurnal fluctuations in the air spora over a brown sarson field. **Indian Phytopath**. 31:284-286.
Sreeramulu T. and Ramalingam A. 1966. A two year study of the air spora of paddy field near Viskhapatanam. **Indian J. agric. Sci**. 36:11-132.
Verma K.S. and Chile S. 1992. Fungi in the medical college of the Jabalpur city and the allergenic behaviour of some species**. J. Ind. bot. Soc.** 71:247-249.
Verma K.S. and Srivastava K. 1996. Incidence of viable and culturable aeromycoflora in Jabalpur. **Biodiversity and Environment** pp. 225-235.
Yasmeen and Saxena S.K. 1992. Survey of airborne allergenic fungal spores at Aligarh. **J. Ind. bot. Soc**. 71:195-196.

Table 1:- Percentage contribution of different fungi to total aeromycoflora of Gurukul Kangri Pharmacy, Hardwar (Feb. – Mar. 1994).

Fungal Species	**% Contribution**
Alternaria sp.	12.66
Aspergillus niger	1.05
Aspergillus sp.	2.05
Cladosporium cladosporioides	34.25
C.herbarum	15.13
Curvularia sp.	3.92
Epicoccum nigrum	3.57
Penicillium chrysogenum	0.70
P.cylopium	9.97
Rhizopus sp.	0.17
Trichothecium sp.	1.58
White sterile form	11.02
Unidentified	3.34

Aeromycoflora of Gurukul Kangri

Table 2:- Frequency (%) of different aeromycoflora of Gurukul Kangri Pharmacy, Hardwar (Feb.-Mar. 1994)

Fungal Species	**Frequency (%)**		
	I 9.2.94	**II 28.2.94**	**III 19.3.94**
Alternaria sp.	57.89	90.00	95.00
Aspergillus niger	26.31	20.00	45.00
Aspergillus sp.	31.57	10.00	05.00
Cladosporium cladosporioides	94.73	75.00	85.00
C. herbarum	05.26	55.00	45.00
Curvularia sp.	--	30.00	30.00
Epicoccum nigrum	15.78	75.00	50.00
Penicillium chrysogenum	5.26	20.00	25.00
P. cyclopium	84.21	55.00	70.00
Rhizopus sp.	15.8	--	--
Trichothecium sp.	10.52	40.00	20.00
White sterile form	36.84	45.00	95.00
Unidentified	26.31	40.00	--

Table 3A:- Diurnal Variation in the Density of total Aeromycoflora per 100 cm^3 of Gurukul Kangri Pharmacy, Hardwar (Feb.-Mar. 1994).

Sampling Time	Sampling number		
	I 9.2.94	II 28.2.94	III 19.3.94
Morning (Outside)	11.10	21.93	15.59
Morning (Inside)	19.80	13.09	20.16
Morning (Onside)	10.20	65.99	63.69
Morning (Inside)	6.72	29.90	23.25

Table 3B:- Two Analysis of Variance Table

Source of Variation	DF	Sum of Squares	Mean Square	F
Among means of treatment A	3	1049.19	349.73	1.58
Among means of treatment B	2	1870.81	935.40	4.25
Residual	6	1320.33	220.05	

A = Time Interval
B = Diurnal Cycle
DF = Degree of Freedom
Insignificant at 0.05 level

Table No 4:- Percentage Contribution of different Fungi to total aeromycoflora of Yogi Pharmacy, Hardwar (Sep. to Dec. 1998).

Sl. No.	**Name of Fungi**	**% Contribution**
1.	*Alternaria sp.*	2.57
2.	*Aspergillus flavus*	13.89
3.	*Aspergillus fumigatus*	14.71
4.	*Aspergillus niger*	16.83
5.	*Aspergillus sp. (i)*	0.55
6.	*Cladosporium sp.*	6.53
7.	*Curvularia lunata*	6.34
8.	*Drechslera sp.*	1.28
9.	*Fusarium sp.*	3.67
10.	*Helminthosporium sp.*	1.10
11.	*Mucor sp.*	6.25
12.	*Nigrospora sp.*	1.01
13.	*Penicillium sp. (i)*	12.60
14.	*Penicillium sp. (ii)*	3.49
15.	*Penicillium sp. (iii)*	0.36
16.	*Rhizopus sp.*	2.48
17.	White sterile form	2.20
18.	Unidentified	4.04

Table No. 5:- Frequency % of Different Aeromycoflora of Yogi Pharmacy, Hardwar (Sep.-Dec. 1998).

Sl. No.	Name of Fungus	Frequency (%)			
		Sep.	Oct.	Nov.	Dec.
		16.9.98	4.10.98	9.11.98	19.12.98
1.	*Alternaria sp.*	--	40	55	15
2.	*Aspergillus flavus*	60	30	85	35
3.	*Aspergillus fumigatus*	90	45	90	35
4.	*Aspergillus niger*	95	45	95	10
5.	*Aspergillus sp. (i)*	10	15	--	--
6.	*Cladosporium sp.*	35	25	55	70
7.	*Curvularia lunata*	--	45	80	25
8.	*Drechslera sp.*	--	40	20	--
9.	*Fusarium sp.*	25	40	55	10
10.	*Helminthosporium sp.*	--	35	--	30
11.	*Mucor sp.*	75	55	10	--
12.	*Nigrospora sp.*	--	20	30	--
13.	*Penicillium sp. (i)*	90	55	35	20
14.	*Penicillium sp. (i)*	15	35	40	10
15.	*Penicillium sp. (iii)*	--	25	5	--
16.	*Rhizopus sp.*	65	--	30	--
17.	White sterile form	10	35	25	15
18.	Unidentified	55	45	25	30

--: Absent

Table No. 6:- Diurnal Varitation in the Density of total Aeromycoflora Per 100 cm^3 of Yogi Pharmacy, Hardwar (Sep.-Dec. 1998).

Sl. No.	Sampling Time	Sampling Numbers, Months and Date			
		I	II	III	IV
		Sep.	Oct.	Nov.	Dec.
		16.9.98	4.10.98	9.11.98	19.12.98
1.	Morning (Inside)	14.26	11.74	24.32	4.19
2.	Morning (Onside)	11.32	11.11	28.73	5.45
3.	Morning (Inside)	13.84	13.42	19.50	4.82
4.	Morning (Onside)	15.72	10.69	32.50	6.29

Environment Conservation Journal 4(1-3) 79-82, 2003