The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(2): S.I (2): 165-170, 2025 www.thebioscan.com

INTRAMURAL AEROMYCOLOGICAL STUDY OF RURAL HOSPITAL OF DESAIGANJ WADSA, DISTRICT-GADCHIROLI MAHARASHTRA.

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DOI: 10.63001/tbs.2025.v20.i02.S.I(2).pp165-170

KEYWORDS
Indoor, Aeromycoflora, Rural Hospital, Hi Media Air Sampler, Desaiganj Wadsa, CFUs/m3.
Receivedon:

22-03-2025
Acceptedon:
25-04-2025
Published on
30-05-2025

ABSTRACT

The study was conducted on indoor environment of Rural hospital of Desaiganj Wadsa located in Gadchiroli district of Maharashtra state, in respect to aeromycoflora of Rural Hospital. In this study aeromycoflora were investigated from February, 2023 to January, 2024 for a year at an interval of 15 days. The sampling was conducted from the different section of hospital, such as OPD (Outpatient department), General ward and Dressing Ward. The indoor aeromycoflora was isolated by two methods with the help of Hi Air Sampler (Mark ll), Hi Media Laboratories, India and simultaneous Exposure Petri plate method. In exposure Petri plate method culture media Czapek's Dox Agar (CDA) was utilized and Rose Bengal Strips were used in Hi Air sampler. Total 1320 colonies were appeared by Exposure Petri plate method and total 6900 CFUs/m^3 were trapped by Hi-media air sampler method. The concentration of aeromycoflora in rainy season was high because of high humidity and low temperature. Fungal spores exhibit monthly and seasonal variation. Fungal spore concentration was maximum in humid months and decreases in dry and hot months. Growth of fungi is directly proportional to the Humidity and inversely proportional to temperature.

INTRODUCTION

Aerobiology is a branch of biology focused on the passive transport of organic particles, including bacteria, fungal spores, pollen grains and viruses. It examines the impact of these particles on organisms, such as causing infections and allergies in humans and animals, as well as infections in plants (Hicks, 1992; Kasprzyk, n. d.). Aeromycology is a subfield of aerobiology that investigates the dispersion of fungal spores and other fungal elements in both indoor and outdoor air. It studies the variations in their concentrations and the factors influencing these changes (Patil & Talhande, n. d.; Vaidya & Sahare, 2023). The study of airborne fungal spores, is crucial for understanding air quality, especially in indoor environments such as residential buildings, schools, hostels and many more places.

Airborne fungal propagules including spores remains throughout the year in a set of climatic conditions but their existence in environment varies with change in climate (Adhikari et al., 2004). Air borne fungal propagules occur throughout almost the whole year, but the seasonal rhythm in the occurrence of air borne spores and their spectrum depends on the type of climate (Agrawal and Tiwari, 2019). The fungal densities in the air also vary in accordance with geographical regions and seasons, besides the physical parameters such as wind direction, humidity, temperature precipitation and altitude (Harishankar et al., 2016).

The present study was conducted on intramural aeromycoflora in Rural hospital of Desaiganj Wadsa located in Gadchiroli District of Maharashtra State. Gadchiroli district experiences a tropical climate with high humidity, particularly during the rainy season. This condition favor the growth and spread of fungi. The location is ideal for studying airborne fungal concentration and growth.

The aim of present study is to determine the Intramural Aeromycoflora, their concentration and seasonal variation in indoor environment. Intramural aeromycoflora means the study of fungus present in indoor environment of the indoor places. There are many fungi which are responsible for bio deterioration of storage material, equipment and the health of people. Alsothe effect of meteorological parameters like rainfall, temperature and humidity on fungal spore concentration.

MATERIALS AND METHODS

I. Study area -Rural Hospital Desaiganj Wadsa (Lat 20.614476^0, Long 79.963506^0) was selected for the sampling site. Different sections of hospital such as OPD (Outpatient department), General ward and Dressing Ward were selected. The sample were collected from February 2023 to January 2024. For the present study following methodology were applied.

II. Exposure Petri plate method - Czapek's Dox Agar (CDA) was used in Petri plate method. This media prepared by using 12.24 gm of Czapek's Dox Agar (CDA) suspended in 250ml distilled water with streptomycin. Heat to boiling to dissolved media completely. Sterilized by autoclave for 15min. and cool down. Mix well and poured into Petri plates. Petri plates containing

sterilized CDA were exposed in the hospital in three different sections for 5 to 10 min. by keeping them at the height of five feet from the ground level. After that petri plates were sealed with cello tape and brought into laboratory. Petri plates incubated at room temperature for 3 to 8 days.

lll. Hi-media Air Sampler Method - In this method Rose Bengal strips were used in Hi Air Sampler (Mark ll), Hi Media Laboratories, India. Hi air sampler was moving in different sections of hospital for 5 to 10 min. After that Rose Bengal strips sealed, marked and brought into laboratory and incubated at room temperature.

After 6 to 8 days fungal colonies were appeared on petri plates and rose Bengal strips. Number of colonies were counted. Fungus from the colony was picked up with needle and slide was prepared by using cotton blue and observed under microscope. The identification of spores caught was based on i. microscopic character, ii. Morphological character, iii. Rate of growth, colony colour, size and shape of colony and other diagnostic feature of the spores.

In Hi air sampler method, the fungal colonies per unit volume of the air were then calculated as under,

$$CFUs/m3 = \frac{\text{colonies on agar strips } \times 25}{sampling\ time\ in\ minutes}$$

RESULTS AND DISCUSSION

In this study**by Exposure Petri plate Method** total 1320 colonies were recorded in one year.Out of three sections of Rural Hospital outpatient department (OPD) section recorded more concentration of fungal spores, total count 494 colonies (37.42%) followed by general ward total 431 colonies (32.65%) and minimum in dressing ward were 395 colonies (29.92%).
Fungal spores exhibited Monthly variation, concentration of fungal spores was maximum in month of August total count 175 colonies (13.25%)followed by month of July 162 colonies (12.27%), September 151 colonies (11.43%), December 141 colonies (10.68%), January-24 = 128 colonies (9.69%), October 121 colonies (9.16%), February 106 colonies (8.03%), June 99 colonies (7.5%), November 81 colonies (6.13%), March 72 colonies (4.45%), April 49 colonies (3.71%) and minimum in month of May total count 35 colonies (2.65%).

Fungal spores also showedSeasonal changes in the number of fungal spores were noticed, with highest count of587 colonies (44.46%)during rainy season, followed by winter season 471 colonies (35.68%) and minimum in summer season total 262 colonies (19.84%), Table-1.

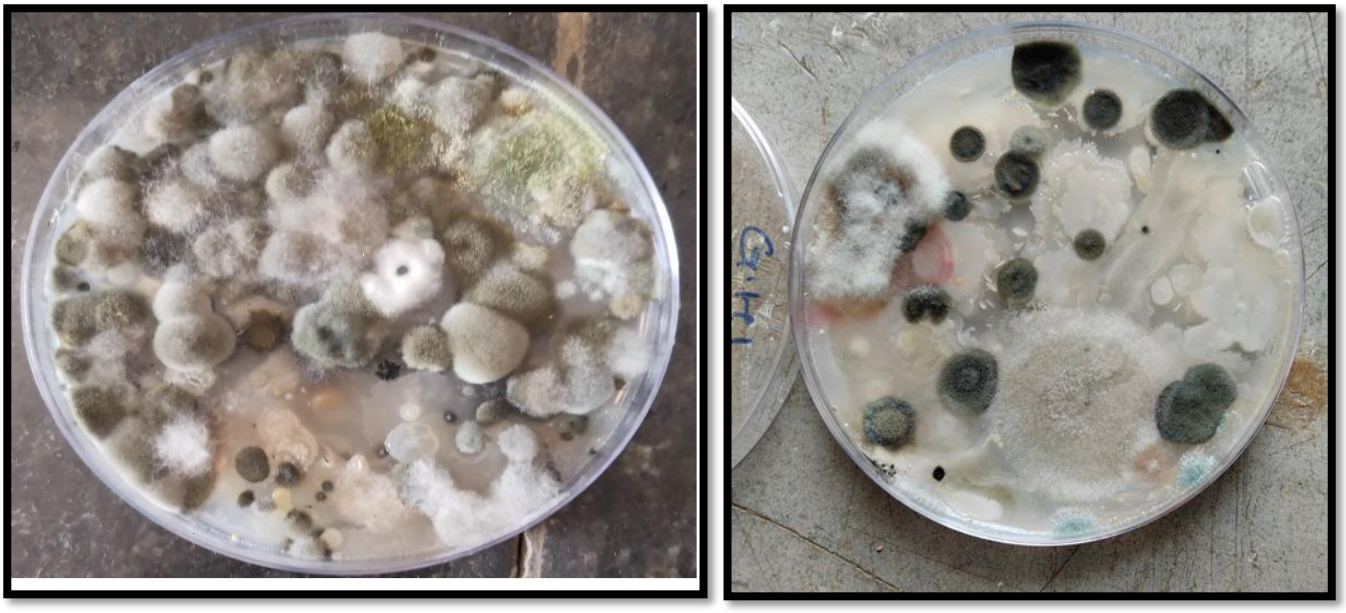
Hi-media Air Sampler method – By this method total 6700 CFUs/m^3 (colony forming units per cubic meter air) were recorded in one year of sampling from Feb-2023 to Jan-2024. O. P. D. section of hospital showed maximum concentration of fungal spore total 2455 CFU s/m^3 (35.57%) followed by general ward total 2250 CFUs/m^3 (32.60%) and minimum in Dressing ward section total 2195 CFU s/m^3 (31.81%).

Fungal spores revealed Monthly variation and maximum concentration was found in month of August total count 1000 CFU s/m^3 (14.49%) followed by month of July total 850 CFUs/m^3 (12.31), September 845 CFU s/m^3 (12.24), December 725 CFU s/m^3 (10.50%), January-24= 710 CFU s/m^3(10.28%), February 570 CFU s/m^3 (8.26%), June 460 CFU s/m^3 (6.66%), October 430 CFU s/m^3 (6.23%), November 420 CFU s/m^3 (6.08%), March 395 CFU s/m^3 (5.72%), April 250 CFU s/m^3 (3.62%) and minimum concentration in month of May total 245 CFUs/m^3 (3.55%).
Fungal spores showed Seasonal variation, higher fungal spore concentration in rainy season recorded total 3155 CFU s/m^3(45.72%) followed by winter season total 2285 CFU s/m^3 (33.11%) and lowest in summer season recorded total 1460 CFU s/m^3 (21.15%). Table-2.

During Feb-2023 to Jan-2024 in one year, humid months like August, July and Septemberthere was high humidity in this month so the concentration and growth of fungal spore was more by both methods.

In the study period, total rainfall was 1478.93mm. and there was high rainfall recorded in July month that is, 578.51mm., but there was no rainfall in month of February-2023. Also humidity was maximum in month of August and July and minimum in Month of May. Temperature was higher in month of May and average range in between 20^0c to 30^0c in humid months.(Table-3).

Some dominant genera identified by above study in Rural hospital of Desaiganj Wadsa were *Aspergillus, Alternaria, Cladosporium, Cercospora, Penicillium, Fusarium, Mucor,* and *Rhizopus*.



Fungal colony on CDA media in Petri plate.

Table-1: - Exposure Petri plate Method

Total number of fungal colonies recorded in three different sections of Rural Hospital in different months of investigation. (Feb. 2023-Jan. 2024)

Season	Month	Number of Colonies					
		O. P. D.	**General Ward**	**Dressing Ward**	**Total fortnightly**	**Total Monthly**	**%**
Summer	**February 2023**	24	20	15	59	106	**8.03**
		22	15	10	47		
	March 2023	15	12	10	37	72	**4.45**
		13	12	10	35		
	April 2023	8	7	6	21	49	**3.71**
		10	9	9	28		
	May 2023	8	5	5	18	35	**2.65**
		7	5	5	17		
Total						**262 (19.84%)**	
Rainy	**June 2023**	18	15	13	46	99	**7.5**
		21	17	15	53		
	July 2023	30	25	24	79	162	**12.27**
		30	27	26	83		
	August 2023	30	28	27	85	175	**13.25**
		32	30	28	90		
	September 2023	24	22	22	68	151	**11.43**
		30	28	25	83		
Total						**587 (44.46%)**	
Winter	**October 2023**	25	21	20	66	121	**9.16**
		20	18	17	55		
	November 2023	15	14	13	42	81	**6.13**
		14	13	12	39		
	December 2023	28	24	23	75	141	**10.68**
		24	22	20	66		
	January 2024	26	24	24	74	128	**9.69**
		20	18	16	54		
Total						**471 (35.68%)**	
	Total	**494 (37.42%)**	**431 (32.65%)**	**395 (29.92%)**	**1320**	**1320**	

Hi Air Sampler Method

Total CFUs/m^3 trapped in three different sections of Rural Hospital of Desaiganj Wadsa(Feb. 2023-Jan. 2024)

Season	Month	Number of Colonies					
		CFUs/m^3in O. P. D.	**CFUs/m^3 in General Ward**	**CFUs/m^3 in Dressing Ward**	**Total fortnightly**	**Total Monthly**	**%**
Summer	**February 2023**	100	100	95	295	570	**8.26**
		100	90	85	275		
	March 2023	95	90	75	260	395	**5.72**
		65	35	35	135		
	April 2023	50	25	25	100	250	**3.62**
		55	50	45	150		
	May 2023	45	50	45	140	245	**3.55**
		40	25	40	105		
Total						**1460 (21.15 %)**	
	June	80	65	70	215	460	**6.66**

Rainy	2023	90	80	75	245		
	July 2023	150	150	145	445	850	12.31
		140	135	130	405		
	August 2023	170	160	160	490	1000	14.49
		180	170	160	510		
	September 2023	140	130	130	400	845	12.24
		150	150	145	445		
Total						3155 (45.72%)	
Winter	October 2023	80	70	70	220	430	6.23
		75	70	65	210		
	November 2023	70	65	60	195	420	6.08
		80	70	75	225		
	December 2023	110	105	110	325	725	10.50
		135	125	130	390		
	January 2024	145	140	135	420	710	10.28
		110	100	90	290		
						2285 (33.11%)	
Total		2455 (35.57%)	2250 (32.60%)	2195 (31.81%)	6900	6900	

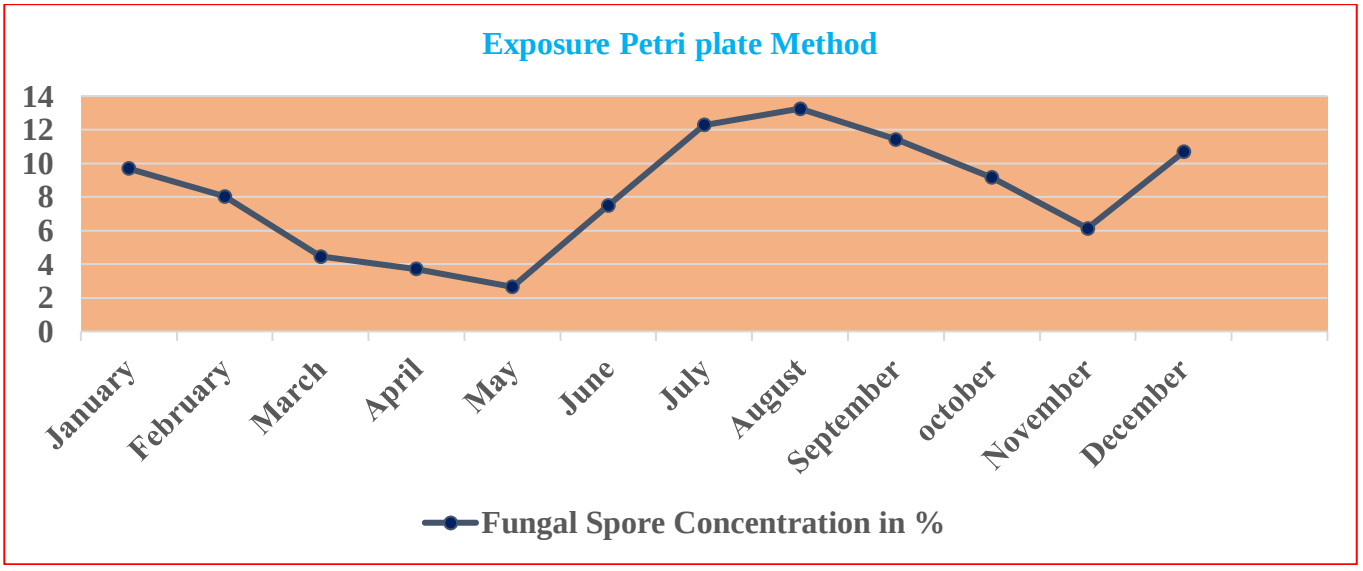


Fig. 2: -Monthly variation of fungal spore concentration by Exposure Petri plate Method

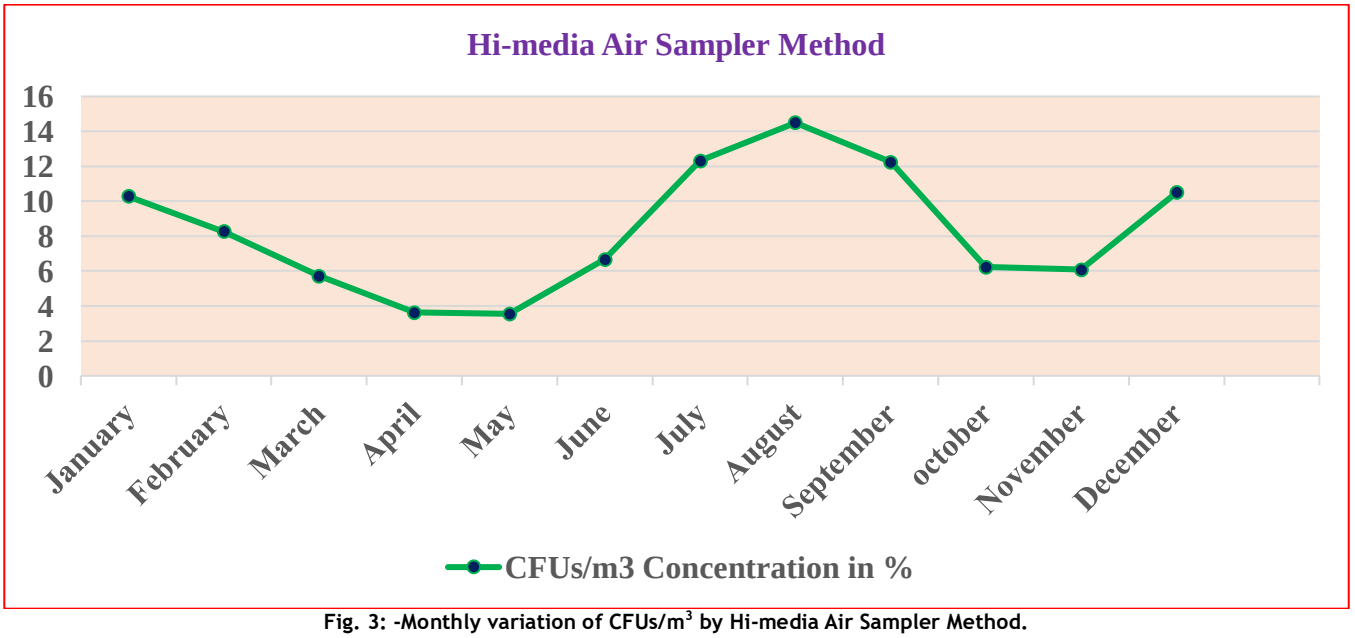


Fig. 3: -Monthly variation of CFUs/m^3 by Hi-media Air Sampler Method.

Table- 3: -The table shows the minimum, maximum and average temperature, Humidity and Rainfall from Feb-2023 to Jan-2024 in Gadchiroli district.

Month	Temperature, °C			Relative Humidity, %			Rainfall, mm
	Minimum	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Actual Rainfall**
February 2023	15.6	36.3	25.6	17.4	95.1	45.9	0
March 2023	21.8	40.6	30.5	14.0	88.3	36.3	34.24
April 2023	26.7	43.6	33.2	16.8	69.7	40.1	47.69
May 2023	28.5	44.9	35.9	15.8	64.9	38.8	36.93
June 2023	23.8	40.6	31.1	28.5	97.7	63.0	127.23
July 2023	23.5	32.9	27.0	54.4	99.8	83.9	587.51
August 2023	23.4	33.6	26.5	51.5	100.0	86.1	273.11
September 2023	23.6	33.7	27.5	47.0	98.4	79.0	352.37
October 2023	20.4	33.1	27.4	33.9	92.7	67.3	6.53
November 2023	17.5	32.7	25.2	29.2	84.6	56.5	2.12
December 2023	11.5	29.1	21.2	30.2	96.5	63.9	9.18
January 2024	14.3	31.3	21.6	24.2	78.5	48.6	2.02
Total							**1478.93**

Source- Indian climate department and Indian Wris department of India.

CONCLUSION

The study revealed significant monthly variation and seasonal variation in fungal spores concentration within Rural hospital. Maximum concentration was recorded in month of August and July and minimum in month of May because of, significant effect of meteorological parameter on proliferation of fungi.
In rainy season temperature range available between 25^0C to 30^0 C and humidity more than 80%. That type of climate condition supports the growth and proliferation of fungal spore. And fungal spores concentration were high during that period. That shows increase in indoor aeromycospora in Rural hospital in month of August and July. Growth of fungi is directly proportional to the Humidity and inversely proportional to temperature. Outpatient department (OPD) shows more concentration of fungal spores and minimum concentration in dressing ward. Dominant genera found in Rural hospital are *Aspergillus, Alternaria, Cladosporium, Cercospora, Penicillium, Fusarium, Mucor,* and *Rhizopus*. It is concluded that, Rural hospital of Desaiganj Wadsa was not free from fungal spores throughout study period but regular monitoring and proper cleaning of all sections of hospital can reduces the fungal growth concentration. Also removed of damage and unwanted material from hospital can help in reducing concentration of fungal spores. Installation of air quality management and use of mask by patient and doctors is recommended for safety particularly for susceptible persons.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my research center Director/Principal Dr. D. H. Gahane sir for supporting my research and creating supportive environment for my research work. Also my research center Department of Botany Nevjabai Hitkarini College Bramhapuri to providing necessary equipments for my research.

I wish to acknowledge the generous financial support of 'MAHAJYOTI' Institute of the other backward class Bahujan welfare department, Government of Maharashtra, without their funding this research work not possible.

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