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Aeromycological Studies of Indoor Environment of Rural Healthcare Centre Sindewahi in Outdoor patient department by Volumetric air sampler method

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Introduction

The Rural Healthcare Centre Sindewahi is located at a latitude of 20.283220 and a longitude of 79.6667600 in India. This region is categorized into three seasons—summer, winter, and rainy—based on temperature, humidity, and precipitation levels. The summer season occurs from February to May, with maximum temperatures reaching 45 to 47 degrees Celsius. Precipitation often transpires from June to September, but winter commences in October and extends through January, with minimum temperatures descending to 8 to 9°C. Air sampling was conducted in three distinct areas of the rural health care center to examine the indoor aeromycoflora, namely in the Outdoor Patient Department (O.P.D.).Air sampling was conducted bi-monthly during a straight two-year period, from August 2014 to July 2016. The Rural Healthcare Centre in Sindewahi has the capacity to admit around 70 patients for treatment. The Outpatient Department commenced at 10 AM, prescribing medication and recommending tests for hospitalized patients. The formaldehyde fumigation procedure is employed for sterilizing. Air samples were systematically collected from all three sections, namely the Outpatient Department of the rural health care center in Sindewahi, utilizing the volumetric air sampler method.

Fig. Latitude and Longitude Position of Rural Healthcare Centre Sindewahi

Results and Discussion

Volumetric Air Sampler Method

Indoor aeromycoflorainRural Healthcare Centre Sindewahi

The air sampler method is a simple and convenient technique for analyzing the concentration of indoor airborne fungal spores. This investigation utilized the Hi Media Air Sampler Mark II for the collection of aerospora. During a two-year research period, a Hi Media air sampler Mark II captured a total of 38,360 CFU's/M3 at the rural healthcare center in Sindewahi. During the first year (August 2014 - July 2015), a total of 16,470 CFUs/M3 were documented, of which 7,950 CFUs/M3 were captured in the O.P.D.

Seasonal change influenced the quantities of indoor fungal spores. The highest CFUs per cubic meter were seen during the wet season, followed by winter, with the lowest recorded in summer. From August 2014 to July 2015, a total of 7765 CFU's/M3 (41.74%) were observed during the rainy season, 5709 CFU's/M3 (34.60%) during the winter season, and 2960 CFU's/M3 (17.97%) during the summer season. A maximum of 2530 CFU's/M3 was recorded in July, followed by August, September, October, November, December, January, June, February, March, and April, while a minimum of 460 CFU's/M3 was captured in May.

During the second year of the research period (August 2015 - July 2016), a total of 21,890 CFUs/M3 were documented, of which 10,570 CFUs/M3 were isolated in the outpatient department (O.P.D.).Seasonal change influenced the concentration of fungus spores.

The highest CFUs per cubic meter were seen during the wet season, followed by winter, with the lowest recorded in summer. From August 2015 to July 2016, a total of 8,935 CFU's/M3 (40.81%) were observed during the rainy season, 7,790 CFU's/M3 (35.58%) during the winter season, and 5,215 CFU's/M3 (23.82%) during the summer season. In July, a maximum of 2585 CFU's/M3 was reported, followed by August, September, November, October, December, January, February, June, March, and April, while a minimum of 935 CFU's/M3 was observed in May.

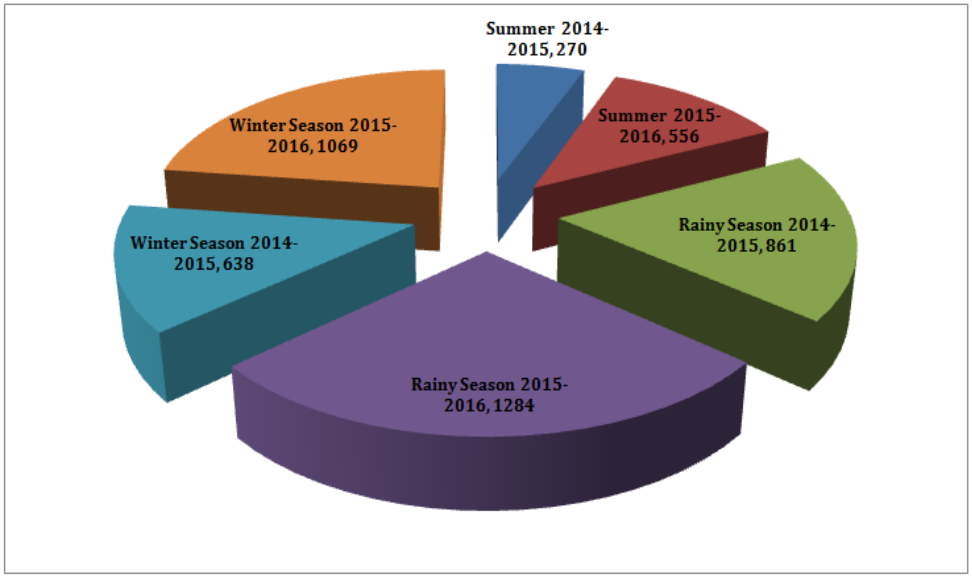
Indoor aeromycoflora in outdoor patient department (O.P.D.)

By using Hi media air sampler mark II, total 18520 CFU's/M3 were recorded in O.P.D. of Rural healthcare centre Sindewahi during two years of research period (Aug. 2014 – July 2016). In 1st year (2014-2015) of study, total 7950 CFU's/M3 were recorded. The concentration of fungal spores varies according to seasonal variation. Maximum CFU's/M3 were recorded in rainy season followed by winter and minimum in summer. 3525 CFU's/M3 (44.33%) were recorded in rainy season, 2915 CFU's/M3 (36.66%) recorded in winter season and 1510 CFU's/M3 (18.99%) recorded in summer season. Maximum 1140 CFU's/ were recorded in month Of July followed by Aug., Sept., Oct., Nov., Dec., Jan., Feb., Mar., June, April respectively and minimum 255 CFU's/M3 were recorded in Month of May. In 2ndyear of research period (Aug 2015-July 2016), total 10570 CFU's/M3 were recorded; the concentration of fungal spores was affected by seasonal variation. Maximum CFU's/M3 were recorded in rainy season followed by winter and minimum in summer. 4290 CFU's/M3 (40.58 %) recorded in rainy season, 3735 CFU's/M3 (35.33 %) recorded in winter season and 2545 CFU's/M3 (24.07%) recorded in summer season. Maximum 1260 CFU's/M3 were recorded in month Of July followed by Aug., Sept., Oct., Nov., Dec., Jan., Feb., June, Mar., April., and minimum 460 CFU's/M3 were recorded in Month of May . Discussion Aeromycological survey from indoor environment of rural health care center Sindewahi, Chandrapur District was conducted fortnightly for two years (Aug2014-July 2016), by volumetric air sampling by Hi Media Air Sampler Mark II. Tilak (1982) was suggested, the air sampling methods for sampling aeromycoflora in indoor environment such as volumetric air sampling by Hi Media Air Sampler Mark II .

Rural Healthcare Center Sindewahi 2014-2016						
Volumetric Air Sampler Method						
Seasonal Variations of C.F.U./M³ and no of colonies and their % Contribution of total aeromycoflora in Outdoor Patient department (O.P.D.)						
Year August 2014- July 2016						
Sr. No	**Season**	**Year**	**Total No of Colonies**	**% Contributions**	**Total No of C.F.U.s/M³**	**% Contributions**
1	**Summer**	2014-2015	125	15.13	1510	18.99
		2015-2016	307	20.61	2545	24.07
2	**Rainy Season**	2014-2015	405	49.03	3525	44.33
		2015-2016	627	42.1	4290	40.55
3	**Winter Season**	2014-2015	296	35.83	2915	36.66
		2015-2016	555	37.27	3735	35.33
Total			**2315**		18509	

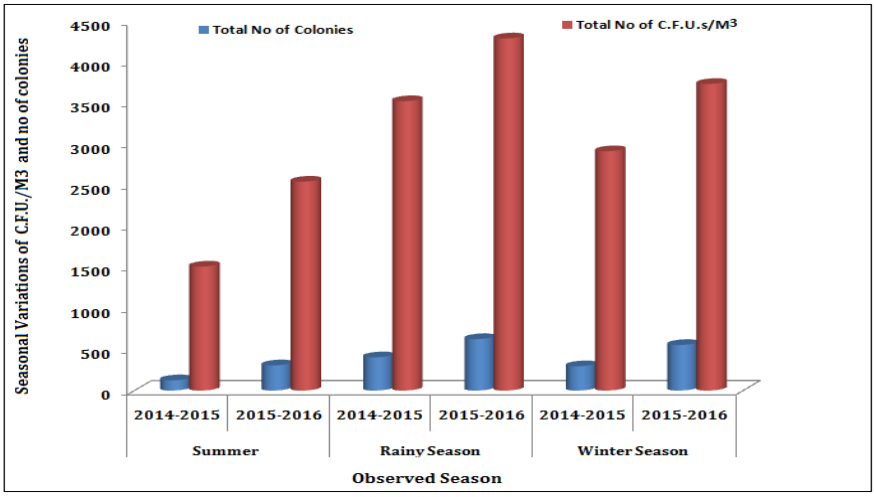
Two years (Aug., 2014-July 2016) study of rural health care center Sindewahi show that, 71 fungal species belonging to 20 different fungal genera were recovered. Besides these white, black, and orange sterile mycelia were also isolated. In which *Deuteromycotina* were dominant with 66.39 % (52 fungal species), followed by *Phycomycotina* with 15.28% (11 fungal species) and *Ascomycotina* with 7.23 % (8 fungal species). Sterile mycelium 11.09 % was recorded. *Deuteromycotina* were dominant in indoor environment of health care center followed by *Phycomycotina* and *Ascomycotina* , these results are in agreement with the finding of Kotwal S.G. and Gosavi S.V.(2010). *Aspergillus* were dominant having 659colonies (14.08%) followed by *Penicillium* 570 colonies (12.18%), *Mucor* 458 colonies (9.79 %), Alternaria 432 colonies (9.23 %), *Rhizopus* 257colonies (5.49 %), *Curvularia* 179 colonies (3.82 %),Cercospora 157colonies (3.35 %) *Fusarium* 145 colonies (3.09%), *Phoma* 139 colonies (2.97%), Epicoccum 136 colonies (2.9%) *Geotrichum* 134 colonies (2.86%) *Torula* 125colonies (2.62%), *Cladosporium* 123 colonies (2.62%),*Helminthosporium* 113 colonies (2.41%), *Trichoderma* 110 colonies (2.35%), *Nigrospora* 105 colonies (2.24 %), *Trichothecium* 89 colonies (1.90%) *Drechslera* 85colonies (1.81%),*Candida* 75 colonies (1.6 %), *Chaetomium* 68 colonies (1.47%). Along with these White sterile mycelia 366 colonies (7.82%), Black sterile mycelia 145 colonies (3.09%) and Orange sterile mycelia 8colonies (0.17%) was noted in two years investigation. *Aspergillus, Penicillium* spores represent most abundant aeroallergens in the indoor air. *Aspergillus* was the basic component of the atmospheric mycoflora. Majumdar and Harzara (2005). In 1st year investigation (Aug2014- July 2015) by volumetric air sampler method total 16470 CFU's/M3 were recorded, out of which 7950 CFU's/M3 were trapped in O.P.D. In 2nd year of investigation (Aug2015- July 2016) By volumetric air sampler method total 21890 CFU's/M3 were recorded, out of which 10570 CFU's/M3 were isolated in O.P.D.The present finding was correlated to the

result of study conducted at university hospital in Rotterdam, Netherlands. Where the concentration of fungal spores was higher in indoor open area sections as compared to wards and operation theaters .by A.C Leenders et al. (1999) Seasonal Variation The monthly contribution of total colonies enumerated in OPD sections of rural health care center Sindewahi, during 2014-2015 and 2015-2016 were illustrated . The colony counts in different months varied from 44-273 in first year of study, while it was from 77 to 382 in the second year of study period. The higher colony counts were observed in the month of July (273) followed by August (242) in 2014-2015. Also in the next year of investigation the maximum colony count were observed in month of July (382) followed by August (350). On the average percentage contribution of monthly colony counts to the total colony counts varied from 2.48% to 15.43% and 2.64%to 13.13% in both years respectively. In the first year the highest colony counts was recorded in month of July (15.43%) followed by August (13.68%), September (12.88%), October (11.02%), November (99.83%), December (8.3%), January (6.89%), June (6.67%), February (5.25%), March (4.4%), April (3.1%) and least was reported in May (2.48%) (Table No.4.4). In second year of investigation (2015-2016), the highest colony counts were recorded in month of July (13.13%) followed by August (12.03%), September (11.44%) October (10.69%), November (9.62%), December (8.62%), January (7.8%) June (7.52%), February (6.66%), March (5.77) April (4.02%) and least in May (2.64%).



Seasonal Variations of C.F.U./M³ and no of colonies and their % Contribution of Total Aeromycoflora by Volumentric air sampler method for the year 2014-2015 & 2015-2016

When the academic year was assessed comparatively by season.Volumetric air sampler methods employed to examine the seasonal variation of fungal colonies revealed that the rainy season predominated, accounting for 41.74% with 7765 CFU/m³ in 2014-2015 and 40.81% with 8935 CFU/m³ in the subsequent year of inquiry. The winter season shown a comparable contribution of 34.6% with 5705 CFUs/m3 in the first year and 35.58% with 7790 CFUs/m3 in the second year of the experiment. The summer season contributed 17.97% with 2960 CFU/m³ in 2014-2015, but it accounted for 23.82% with 5215 CFU/m³ in 2015-2016.



Seasonal Variations of C.F.U./M³ and no of colonies and their % Contribution of total aeromycoflora in OPD by Volumetric Air Sampler Method in year 2014-2016

The highest number of fungal colonies was seen during the rainy season due to the conducive atmosphere characterized by substantial rainfall, elevated humidity, and moderate temperatures, which are optimal for fungal growth and development. Elevated temperatures coupled with reduced humidity (arid conditions) inhibit the growth and development of fungus. Sudharsanam S. and Srikanth P. (2008), Pandey (1992), and Tilak and Vishwe (1975) revealed the link between fungal spore concentration and meteorological parameters.

Conclusion

The study examines the aeromycological conditions in the indoor environment of Rural Healthcare Centre Sindewahi in India, focusing on the Outdoor patient department. The center, which admits around 70 patients, uses a formaldehyde fumigation method for sterilization. Over two years, 38360 CFU's/M3 were collected using the Hi media air sampler Mark II. The study found that seasonal variation affected the concentration of indoor fungal spores, with maximum CFU's in the rainy season, minimum in the summer, and maximum in the winter. The study also found a correlation between fungal spore concentration and metrological parameters, emphasizing the importance of understanding seasonal variations in indoor air quality.

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