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Aeromycological Studies of Indoor Environment of Rural Healthcare Centre Sindewahi

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ABSTRACT

Rural Healthcare Centre Sindewahi situates at latitude 20.283220 and longitude 79.6667600 of India. Depending upon the temperature, humidity and rainfall climate of this region divided into three seasons i.e. summer, winter and rainy season. The summer season starts from February to May and maximum temperature reaches up to 45 to 47c. The rainfall generally occurs from June to September while winter starts from October to month of January and minimum temperature reaches up to 8 to 9c. For studying the indoor aeromycoflora of rural health care centre the air sampling was done in three different sections General ward (G.W.). Their sampling was done regularity twice in the month for consecutive two years i.e. Aug.2014-July2016.In Rural Healthcare Centre sindewahi there is a facilityto admit about 70 patient for their treatment. O.P.D. was start from10 am. Doctors visit to the general ward in the morning 09:00 am to 10:00 am and evening 04:00pm to 05:00 pm, and prescribes the medicine and advice the test for admitted patients. For the sterilization formaldehyde fumigation method is used. The air samples were collected from G.W. of rural health care center Sindewahi regularly by petriplate exposure method.

Keywords : G.W, Rural Healthcare Centre, Temperature, Humidity, Rainfall Climate

I. INTRODUCTION

Fig. 1. :- Latitude and Longitude Position of Rural Healthcare Centre Sindewahi

II. RESULTS AND DISCUSSION

Petriplate exposure method

Indoor aeromycoflora in Rural Healthcare Centre Sindewahi

In Rural healthcare centre Sindewahi the fungal aeromycospora were collected from three different section G.W. Petripalte exposure method is the oldest method for collection and identification of air borne fungal spores.[1] The numbers of fungal spores which are settle on the surface of petriplate containing agar media are incubated for 4-7 days interval at room temperature. After 5-7 days colonies are counted and identified upto genera/species.[2]

By the petriplate exposure method total 71 fungal species belonging to 20 different fungal genera were recovered. Besides these white, black, and orange sterile mycelia were also isolated in two years (Aug 2014- July 2016) research work. Out of 20 identified genera, two genera *Mucor* (7species) and *Rhizopus* (4 species) belongs to Phycomycotina.[3] three fungal genera *Chaetomium (3fungal species), Epicoccum (2 fungal species), Geotrichum(3fungal species)*belongs toAscomycotina and remaining 15 fungal genera viz.*Aspergillus (12 fungal species), Penicillium(7 fungal species), ,Alternaria, Cladosporium, Curvularia, Trichothecium (each 4 fungal species), Fusarium, Candida , Phoma,Torula (each 03 fungal species), Cercospora , Drechlera, Helminthosporium,Nigrospora, Trichoderma (each 01 fungal species*) were representing Deuteromycotina.[4]

In two years study 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 % were recorded in rural healthcare centre Sindewahi during the research period.[5]

In 1st year study *Deuteromycotina* were recorded 69.30%, Phycomycotina were noted 14.01% and Ascomycotina wwere noted 7.12%.[6]

In 2nd year study *Deuteromycotina* were 64.62%, Phycomycotina were 16.05% and *Ascomycotina* were 7.29%. [7]

Total 4678 fungal colonies were recorded in rural health care centre Sindewahiduring the two year of research period i.e. 2014-2016. In year 2014-2015 total 1769 fungal colonies were recovered while in year 2015-2016 total 2909 fungal colonies were isolated. During the two years of study *Aspergillu*s were dominant having 659colonies (14.08%) followed by *Penicillium570 colonies (12.18%), Mucor*458 colonies (9.79 %),*Alternaria*432 colonies (9.23 %),*Rhizopus**257**colonies (*5.49%), *Curvularia*179 colonies (3.82 %),*Cercospora157colonies* (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%),Candida75 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.[8]

In 1st year study Aspergillus were dominant having 235 colonies (13.28%) followed by *Penicillium 223 colonies (12.6%), Mucor*148 colonies (8.36 %) ,*Alternaria* 138 colonies (7.8 %),*Rhizopus**100**colonies* (5.08 %), *Curvularia*93 colonies (5.25 %),*Cercospora 87 colonies* (4.91 %) *Helminthosporium*71 colonies (4.01%), Geotrichum 62 colonies (3.5%), *Fusarium 57 colonies* (3.22%),*Cladosporium 53 colonies*(2.99%),*Nigrospora*47 colonies (2.85 %), *Trichoderma 44 colonies* (2.48%), *Drechslera*42 colonies (2.37%),*Torula, Trichothecium36colonies (*2.03%), Chaetomium, Phoma 33 colonies (1.87%), Epicoccum, Candida 31 colonies (1.75%) , besides these *White sterile mycelia* 125 colonies (7%), *Black sterile mycelia*36 colonies (2.03%) and *Orange sterile mycelia 2 colonies* (0.247%) was noted in two years investigation.[9]

In 2nd year of study also *Aspergillus* were dominant having 424 colonies (15.19%) followed by *Penicillium 347 colonies (11.92%), Mucor*310 colonies (10.65 %) ,*Alternaria* 294 colonies (10.10 %),*Rhizopus**157**colonies* (5.39 %), %),Phoma 106 colonies (3.5%), Epicoccum 105 colonies (3.6%),*Torula 89 colonies(3.05%), Fusarium 88 colonies* (3.02%),*Curvularia*86 colonies (2.95 %),*Cladosporium 70 colonies*(2.4%)Geotrichum 72 colonies (2.47%), *Cercospora 70 colonies* (2.4 %), %), *Trichoderma 66 colonies* (2.26%), *Nigrospora*58 colonies (1.99 %), *Trichothecium53 colonies (*1.82%),Candida 44 colonies (1.51%),

*Drechslera*43colonies (1.47%), *Helminthosporium* 42 colonies (1.44%), Chaetomium 35 colonies (1.2%). Along with these *White sterile mycelia*241 colonies (8.28%),*Black sterile mycelia*109 colonies (3.7%) and orange sterile mycelia 3 colonies (0.20%) were noted in two years investigation.[10]

In 1st year investigation (Aug2014- July 2015) total 1769 fungal colonies were isolated, out of which 635 fungal colonies from General Ward (G.W.).[11]

In 1st year study shows that,seasonal variation also exhibited by indoor aeromycoflora. In rainy season (June to September) maximum 861(48.67%) fungal colonies were isolated followed by 638(36.06%) colonies in winter season (October to January) and minimum 270(15.26%) colonies in summer (February to May) were recorded. In whole study maximum 273 fungal colonies were recorded in month of July followed by Aug., Sept., Oct., Nov., Dec., Jan.,June, Feb., Mar., Apr. and minimum 44 fungal colonies were recorded in month of May.[12]

In 2nd year investigation (Aug2015- July 2016) total 2909 fungal colonies were isolated, out of which maximum 1036 fungal colonies from General Ward (G.W.) [13]

In 2nd year study shows that , seasonal variation changes the concentration of fungal spores in air, in rainy season (June to September) maximum 1284 (44.13%) fungal colonies were isolated after 1069 (36.74%) colonies in winter season (October to January) and minimum 556(19.11%) colonies in summer(February to May)were recorded. In whole study maximum 382 fungal colonies were recorded in month of July followed by Aug., Sept., Oct., Nov., Dec., Jan., June Feb., Mar., Apr. and minimum 77 fungal colonies were recorded in month of May. [14]

During 1st years (Aug. 2015- July 2016) of study , in month of April and May only a 5 genera viz. *Aspergillus* ,*Penicillium* ,*Alternaria*,*Mucor* and *Rhizopus* along with *White sterile mycelia* were recorded from indoor air atmosphere of G.W. of Rural healthcare centre Sindewahi. While in 2nd years of study along with these 5 genera *Curvularia* was also recorded.[15]

Indoor aeromycoflora in General Ward (G.W.)

In Rural healthcare centre Sindewahi air samples were collected from G.W. By using petriplate exposure method total 71 fungal species belonging to 20 different fungal genera were isolated. Besides these white sterile mycelia, black sterile myceliaand orange sterile mycelia were also isolated in two years (Aug2014- July 2016) of research work. Out of 20 fungal genera, 2 fungal genera i.e. *Mucor* (7 fungal species), and *Rhizopus* (4fungal species) represent Phycomycotina. 3 fungal genera *Chaetomium* (3fungal species), *Epicoccum* (2 fungal species), *Geotrichum* (3fungal species) represent the Ascomycotina and 15 fungal genera i.e. *Aspergillus* (12 fungal species), *Penicillium*(7 fungal species), ,*Alternaria, Cladosporium,Curvularia, Trichothecium* (each having 4 fungal species),*Fusarium,Candida , Phoma,Torula* (each 03 fungal species),*Cercospora*, *Drechslera, Helminthosporium*, *Nigrospora, Trichoderma* (each 01 fungal species) were represent the Deuteromycotina.[16]

1671 fungal colonies were recorded in G.W. of rural health centre Sindewahi during the two year of research period i.e. Aug. 2014- July 2016.

In 1st year of investigation (Aug2014- July 2015) total 635 fungal colonies were isolated. In rainy season (June to September) maximum 318(50.07%) fungal colonies were isolated followed by 234(36.85%) colonies in winter season (October to January) and minimum 83(13.07%) colonies in summer (February to May)were recorded. In whole study maximum 102 fungal colonies were recorded in month of July followed by Aug., Sept., Oct.,Nov., Dec.,Jan., June , Feb., Mar., Apr. and minimum 12 fungal colonies were recorded in month of May. [17]

In 2nd year investigation (Aug 2015- July 2016) total 1036 fungal colonies were isolated. In rainy season (June to September) maximum 460(44.40%) fungal colonies were isolated followed by 382 (36.87%)

colonies in winter season (October to January) and minimum 194(18.72%) colonies in summer(February to May)were recorded. In whole study maximum 138 fungal colonies were recorded in month of July followed by Aug., Sept., Oct., Nov., June, Dec., Jan., Feb., Mar.,Apr. and minimum 30 fungal colonies were recorded in month of May.

In two years of study Deuteromycotina (68.04 %) was dominant with 52 fungal species , followed by Phycomycotina with 15.67 % (11 fungal species) and *Ascomycotina* with 8.07% (8 fungal species).Besides these sterile mycelium was 8.19% were recorded in rural healthcare centre Sindewahi within a research period.[18]

In 1st year of study *Deuteromycotina*were recorded 68.97 %, Phycomycotina 14.64% and *Ascomycotina* 7.55% were recorded.

In 2nd year of study *Deuteromycotina* were 67.47%, Phycomycotina were 16.31% and *Ascomycotina* were 8.39 %.[17]

During the two years study *Aspergillus were* dominant having 218 colonies (13.04%) followed by *Penicillium 203 colonies (12.14%), Mucor* 176 colonies (10.53 %) ,*Alternaria* 147 colonies (8.79 %),*Rhizopus-**86** colonies* (5.14 %), *Curvularia*70 colonies (4.18%), Phoma 60 colonies (3.59%), *Fusarium 59 colonies* (3.53%),Geotrichum 55 colonies (3.29%), Epicoccum 54 colonies (3.23%), *Cladosporium, Cercospora 53 colonies* (3.17 %) *Torula 50 colonies (*2.99%), *Trichoderma 48 colonies* (2.87%), *Drechslera*39 colonies (2.33%),*Nigrospora*38 colonies (2.27 %),Trichothecium,*Helminthosporium* 34 colonies (2.03%),Candida30 colonies (1.79%), Chaetomium 26 colonies (1.55%) , Other than these *White sterile mycelia* 94 colonies (5.62%), *Black sterile mycelia*40 colonies (2.39%) and *Orange sterile mycelia 3 colonies* (0.17%) were recorded in two years of investigation.[18]

In 1st year of investigation, *Aspergillus* were dominant having 82 colonies (12.92%) followed by *Penicillium 76colonies 11.98%),Helminthosporium*18 colonies (2.67%),*Mucor*61 colonies (9.61 %) ,*Alternaria* 49colonies (7.71 %),*Rhizopus**32** colonies* (5.04 %), *Cercospora 21 colonies* (3.31%),*Curvularia* 30 colonies (4.73%),Geotrichum 25 colonies (3.94%), *Cladosporium, Fusarium 22 colonies* each (3.47%),*Drechslera,Nigrospora*19 colonies each(2.99 %),Chaetomium *11 colonies (*1.72%), , *Torula 14 colonies (*2.20%), *Trichoderma 23 colonies* (3.62%), , *Trichothecium 18 colonies* (2.82%), Phoma 13 colonies (2.05%), Candida, Epicoccum 12 colonies (1.89%). Besides these *White sterile mycelia* 43 colonies (6.78%), Black *sterile mycelia*10 colonies (1.57%) and *Orange sterile mycelia 3 colonies* (0.474%)were recorded in two years of investigation.[17]

In 2nd year of investigation (Aug2015- July 2016), Aspergillus were dominant having 136 colonies (13.12%) followed by *Penicillium 127 colonies (12.25%),Mucor*115 colonies 11.10%) ,*Alternaria* 98 colonies (9.45 %),*Rhizopus**54**colonies* (5.21 %),Phoma 47colonies (4.53%) ,Epicoccum ***42** colonies* (4.05 %),*Curvularia*40 colonies (3.86%), *Fusarium 37 colonies* (3.57%),*Torula 36 colonies (*3.47%), *Cercospora 32colonies* (3.01%),Geotrichum 30 colonies (2.89%), *Trichoderma 25 colonies (2.41%) , Drechslera*20 colonies (1.93%),*Cladosporium, Nigrospora 19 colonies each* (1.83%),Candida 18 colonies (1.79%), *Helminthosporium*17 colonies (1.64%),*Trichothecium 16colonies* (1.54%), Chaetomium 15 colonies (1.44%). Other than these *White sterile mycelia*51 colonies (4.92%) and *Black sterile mycelia*30 colonies (2.89%) werenoted in two years investigation.

III. Seasonal Variation

The monthly contribution of total colonies enumerated in three different sections of rural health care center Sindewahi, during 2014-2015 and 2015-2016 were illustrated respectively. 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 inMay (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%) .

When both the year of study was analyzed comparatively according to season wise by exposure petriplate method i.e. summer, rainy and winter, the maximum colony count were observed in rainy season compared with that of winter and summer in both the year of investigation. In the 2014-2015, rainy season dominated with the colony counts of 861 which contribute (48.67%) where as in 2015-2016 it was (44.13%) with colony count 1284. Dominance of rainy season was followed by the winter (Oct. -Jan). The colony count 638 was observed in 2014-2015 with the frequency (36.05%). While that was 36.74% with the colony count 1069 in the second year of investigation i.e. 2015-2016. Summer season contribute less. In 2014-2015 it was 270 (15.26%) while in 2015-2016 it was 556 (19.11%) .

Maximum fungal colonies were recorded during rainy season because of favorable climate such as high rain fall with increasing humidity and moderate temperature which is good for growth and development of fungi. And high temperature with decreasing humidity (dry condition) arrests the growth and development of fungi. The correlation between fungal spore concentration and metrological parameter was reported by Sudharsanam S. and Srikanth P. (2008), Pandey (1992), Tilak and Vishwe (1975).

IV. Conclusion

1) Aaeromycological survey of rural health care centers of sindewahi reveal that altogether 71 species belonging to 20 genera were identified by exposure petriplate method and Hi Media Air Sampling. The dominant genera occurring in these healthcare centers *were Aspergillus, Penicillium, Alternaria , Mucor, Rhizopus, Chaetomium, Cladosporium., Curvularia, Tricothecium, Candida, Fusarium, Phoma and Torula.*

2) Quantitatively and qualitatively, deuteromycotina were predominant in indoor air to the total aerospora followed by phycomycotina and ascomycotina on an average of two years.

3) Fungal spores exhibited seasonal variation. Maximum concentration of fungal spores were observed in rainy season (June-Sept.) followed by winter (Octomber-January) and then summer (Feb.- May).

4) Fungal spores also exhibited annual variation, maximum concentration were recorded in month of July and August and minimum in month of May.

5) In rainy season temperature around to 25c and humidity more than 80% is often available. This type of climate condition supports the healthy growth to most of fungi. While the hot and dry climatic condition in summer generally restricts the growth of fungi.

6) Higher relative humidity (more than 80%) and moderate temperature (25 c to 30c) provide most congenial environment for the maximum

contribution of fungal spores in the intramural environment of healthcare centers.

7) The mean temperature and relative humidity differs in all the months in outdoor and indoor healthcare centers of Chandrapur districts, during the survey period. The amount of rainfall was higher from June to September and concentrations of fungal spores were high in that period. In July and August when there was maximum rainfall, an appreciable qualitatively and quantitatively increase in indoor airospora of healthcare centers was observed.
8) Concentration of fungal spores different from month to month. The highest incidences were recorded from July to December and lowest from March to May. The incidence of CFU's/M^3 in the indoor air was not homogeneous. The different may be due to prevail climate during each month and intramural sources that supports the growth and proliferation of fungi.
9) All the sections of healthcare centers of Chandrapur District show the presences of micro fungi in the indoor environment in all the month of the year. Even the operation theatres are not the fungal free. Only when there fumigation is done before and after using the operation theatre fungal free environment prevails for some period in operation theatres.
10) It is clear from this study of various sections of healthcare centers that patients and workers are the high risk of being exposed to very high concentration of allergic fungal spores. Fungi and their toxins cause illness in human beings.
11) The investigation obtained from this study enable to state that a constant skilled estimation of mycological status is very necessary in majority of work places especially healthcare centers admitted to General wards for their treatment of various diseases operated operation theatres. The main criteria of such estimation should be the distribution of fungal prorogues and the concentration of species.
12) It is proved that health care centers cannot be totally free of microfungi particularly in general wards, but some corrective measures can reduce their frequency and concentration of occurrence such as

- Well planning for regular and proper cleaning of all section of healthcare centers. Vacuum cleaners along with manual cleaning should used to remain dust.
- Well ventilation and plenty of lists in general ward section and other section of healthcare centers.
- Installation of air conditioners or air exhaust fan to remove spores from indoor air
- Especially attention in operation theatre, proper and regular fumigation should be necessary before and often the use of operation theatre.
- Proper arrangements for destroying biological waste materials removed from patients after operations.
- Removing any damage or unwanted material which is used by micro fungi as substrates, from healthcare centers.
- Use to mask by visitors and patient in general ward to prevent inhalation of contaminated indoor.

V. REFERENCES

[1]. Sudharsanam S, Steinberg R. Srikanth P. Bio-aerosols in indoor environment: Composition, health effects and analysis. Indian J Med Microbiol. 2008;26:302-12

[2]. Pace NR, Angenent LT, St Amand A, Kelley ST, Hernandez MT. Molecular identification of potential pathogens in water and air of a hospital therapy pool. Proc Natl Acad Sci USA. 2005; 102:4860-5.

[3]. Kasprzyk I. Aeromycology - main research fields of interest during the last 25 years. Ann Agric Environ Med. 2008; 15:1-7.

[4]. Brilhante RS, Pantoja LD, Cordeiro RA, et al. Isolation of pathogenic yeasts in the air from hospital environments in the city of Fortaleza, northeast Brazil. Braz J Infect Dis. 2010; 14:30-4.

[5]. Miranda ET, da Silva RA, Martins- Giannini MJ, Diniz JN, Monitoring of airborne fungus and yeast species in a hospital unit. Rev Saude Publica. 2005; 39:398-405.

[6]. Munoz Rodríguez AF, Tormo Molina R, Gonzalo Garijo MA, Silva Palacios I. Pollen and spores in the air of a hospital out-patient ward. Allergol Immunopathol (Madr). 2002;30:232-8.

[7]. Kim D, Kim YS, Kim KY. Distribution characteristics of airborne bacteria and fungi in the general hospitals of Korea. Ind Health. 2010; 48:236- 43.

[8]. Wilson P, Li Y, Eames I, Tang JW. Airborne transmission of disease in hospitals. J R Soc Interface. 2009;6 Suppl 6:S697-702.

[9]. Humphreys . Microbes in the air -when to count! (The role of air sampling in hospitals). J Med Microbiol. 1992;37:81-2.

[10]. Pauw BE. What are fungal infections? Mediterr J Hematol Infect Dis. 2011;3:e2011001.

[11]. Debeaupuis JP, Sarfati J, Chazalet V, et al. Molecular typing of environmental and patient isolates of Aspergillus fumigatus from various hospital settings. J Clin Microbiol. 1998;36:1494-500.

[12]. Stchigel AM, Gazzoni A, Mayayo E, Landeyro J, Capilla J. Infiltración perineural por células fúngicas. Presentación de un caso y revisión de la literatura. Rev Iberoam Micol. 2010;27:94-7.

[13]. Heins-Vaccari EM, Távora LG, Gambale W, et al. Comparative performance of two air samplers for monitoring airborne fungal propagules. Braz J Med Biol Res. 2003;36:613-6

[14]. Martins AS, Nunes ZG, Altoe AL, et al. Indoor air microbiological evaluation of offices, hospitals, industries, and shopping centers. Mem Inst Oswaldo Cruz. 2005;100:351-7.

[15]. Nielsen PV. Control of airborne infectious diseases in ventilated spaces. J R Soc Interface. 2009;6 Suppl 6:S747-55.

[16]. Fritz L, Maschmeyer G, Neuburger S, et al. A prospective, randomized study on the use of well-fitting masks for prevention of invasive aspergillosis in high-risk patients. Ann Oncol. 2009;20:1560-4.

[17]. Luijendijk A, Van Belkum A, Behrendt M, Leenders AC, Verbrugh HA. Density and molecular epidemiology of Aspergillus in air and relationship to outbreaks of Aspergillus infection. J Clin Microbiol. 1999;37:1752-7.

[18]. Do Amparo Salmito M, Mobin M. Fungus microbiota in air conditioners in intensive care units in Teresina, Piauí. Rev Soc Bras Med Trop. 2006; 39:556-9.

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