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Investigations of the Indoor Environment of the Rural Healthcare Center Sindewahi by Aeromycologists

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Abstract

The location of the Rural Healthcare Centre Sindewahi in India is latitude 20.283220 and longitude 79.6667600. This region experiences three distinct seasons: the summer, winter, and rainy season, which are determined by temperature, humidity, and rainfall. The warmer months of February through May saw highs of 45 to 47 degrees Celsius. Rainfall usually lasts from June to September, and minimum temperatures can drop as low as 8 or 9 degrees Celsius from October through January, when winter officially begins. Three distinct General Ward sections were used for air sampling in order to research the indoor aeromycoflora of the rural health care centre (G.W.). They sampled twice a month on a regular basis during the two years that followed, from August 2014 to July 2016.The Rural Healthcare Centre in Sewahi has the capacity to admit approximately seventy patients for medical care. O.P.D. began at 10:00 a.m. Physicians visit the general ward from 9:00 am to 10:00 am and from 4:00 pm to 5:00 pm. They give medication prescriptions and test recommendations to patients who have been admitted. The formaldehyde fumigation procedure is employed for sterilisation. By using the petriplate exposure method, air samples were routinely taken from G.W. of the rural health care centre Sindewahi.

Keywords : Formaldehyde Fumigation Procedure, Rural Healthcare, Rainfall, Aeromycoflora, O.P.D.

Fig. 4.1.:-Latitude and Longitude Position of Rural Healthcare Centre Sindewahi

Results and Discussion

Petriplate exposure method

Sindewahi's Rural Healthcare Center's indoor aeromycoflora

Three distinct sections of the rural healthcare institution Sindewahi were used to collect the fungus aeromycospora. The most traditional technique for gathering and identifying airborne fungal spores is the G.W. Petripalte exposure method.[1] The quantity of fungal spores that fall on the agar media-containing petriplate surface are cultured at room temperature at intervals of 4–7 days. Colonies are counted and recognised up to genera/species after 5-7 days.

A total of 71 fungal species from 20 distinct fungal genera were recovered using the petriplate exposure approach. In addition, sterile mycelia that were white, black, and orange were also identified during the course of two years of research (August 2014–July 2016).[2] Two of the twenty genera that have been identified are Phycomycotina: Rhizopus (4 species) and Mucor (7 species). The remaining 15 fungal genera, which include Aspergillus (12 fungal species), Penicillium (7 fungal species), Alternaria, Cladosporium, Curvularia, and Trichothecium (4 fungal species each), Fusarium, Candida, Phoma, and Trola (3 fungal species each), Cercospora, Drechlera, Helminthosporium, Nigrospora, and Trichoderma (1 fungal species each), represent Deuteromycotina.[3]

With 66.39 percent of the 52 fungal species studied over the course of two years, Deuteromycotina was the most prevalent group, followed by Phycomycotina with 15.28% and Ascomycotina with 7.23% (8 fungal species). During the research period, sterile mycelium was detected in 11.09 percent of cases at Sindewahi, a rural healthcare institution.[4]

Deuteromycotina were observed at 69.30%, Phycomycotina at 14.01%, and Ascomycotina at 7.12% in the first year of the study. Phycomycotina constituted 16.05%, Ascomycotina 7.29%, and Deuteromycotina 64.62% in the second year of the study. (Refer to Table 4.2). Between 2014 and 2016, a total of 4678 fungal colonies were identified at the rural health care centre in Sindewahid.[5] A total of 1769 fungal colonies were recovered in the 2014–2015 year, and 2909 fungal colonies were isolated in the 2015–2016 year. Aspergillus dominated the study throughout the course of the two years, accounting for 659 colonies (14.08%). Penicillium 570 colonies (12.18%), Mucor458 colonies (9.79%), Alteraria 432 colonies (9.23%), Rhizopus 257 colonies (5.49%), Curvularia179 colonies (3.82%), and Cercospora157 colonies (3.35%) were close behind. Homo sapiens 139 colonies (2.97%), Epicoccum 136 colonies (2.9%), and Fusarium 145 colonies (3.09%) 134 colonies of Geotrichum (2.86%) There were 125 colonies of Torula (2.62%), 123 colonies of Cladosporium (2.62%), 113 colonies of Helminthosporium (2.41%), 110 colonies of Trichoderma (2.35%), 105 colonies of Nigrospora (2.24%), and 89 colonies of Trichothecium (1.90%). Among the colonies, Drechslera accounted for 85 (1.81%), Candida 75 (1.6%), and Chaetomium 68 (1.47%). In a two-year examination, it was also discovered that there were 366 White sterile mycelia (7.82%), 145 Black sterile mycelia (3.09%), and 8 Orange sterile mycelia (0.17%). With 235 colonies(13.28%), Aspergillus dominated the first year of the study. It was followed by Penicillium with 223 colonies(12.6%), Mucor with 148 colonies(8.36%), Alteraria with 138 colonies(7.8%), Rhizopus with 100 colonies(5.08%), Curvularia with 93 colonies(5.25%), and Cercospora with 87 colonies (4.91%). During a two-year investigation, the following colonies were found: Helminthosporium 71 (4.01%), Geotrichum 62 (3.5%), Fusarium 57 (3.22%), Cladosporium 53

(2.99%), Nigrospora 47 (2.85 %), Trichoderma 44 (2.48%), Drechslera 42 (2.37%), Troluma, Trichothecium 36 colonies (2.03%), Chaetomium, Phoma 33 (1.87%), Epicoccum, Candida 31 colonies (1.75%), and White sterile mycelia 125 colonies (7%), Black sterile mycelia 36 colonies (2.03%), and Orange sterile mycelia 2 colonies (0.247%). Aspergillus dominated the study in the second year as well, with 424 colonies (15.19%), followed by Penicillium 347 colonies (11.92%), Mucor310 colonies (10.65%), Alteraria 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 %), Trichothecium 53 colonies (1.82%), Candida 44 colonies (1.51%), Drechslera 43 colonies (1.47%), Helminthosporium 42 colonies (1.44%), Chaetomium 35 colonies (1.2%). In the course of a two-year examination, in addition to this White sterile mycelia 241 colonies (8.28%), Black sterile mycelia 109 colonies (3.7%), and orange sterile mycelia 3 colonies (0.20%) were identified. [6]A total of 1769 fungal colonies were isolated during the first year of the inquiry (August 2014–July 2015), 635 of which came from General Ward (G.W.). [7]

The first year of the study demonstrates that indoor aeromycoflora also exhibits seasonal fluctuation. greatest fungal colonies (48.67%) were isolated during the rainy season (June to September), followed by minimum fungal colonies (15.26%) in the summer (February to May) and greatest fungal colonies (638, 36.06%) in the winter (October to January). Over the duration of the study, the month of July yielded the highest number of fungal colonies (273), with August, September, October, November, December, January, June, February, Mar, and April recording the lowest number of fungal colonies [8].

A total of 2909 fungal colonies were identified throughout the second year of the inquiry (August 2015–July 2016), with a high of 1036 of those colonies coming from the General Ward.[9]

The results of the second year's study demonstrate how seasonal variation affects the concentration of fungal spores in the air. During the rainy season (June to September), the highest number of fungal colonies (24.13%) were isolated, following 1069 (36.74%) in the winter (October to January) and the lowest number (19.11%) in the summer (February to May). Over the course of the study, the month of July yielded the highest number of fungal colonies with 382, followed by August, September, October, Nov., Dec., Jan., June, Feb., Mar., and Apr., with the lowest number of fungal colonies reported in May. Only five genera—Aspergillus, Penicillium, Alteraria, Rhizopus, and Mucor—as well as white sterile mycelia were identified in the indoor air atmosphere of the G.W. of the Rural Healthcare Centre Sindewahi during the first years of the study (August 2015–July 2016). In the second year of research, Curvularia was noted in addition to these five genera.[10]

Aeromycoflora inside in the General Ward (G.W.)

Air samples from G.W. were taken in the Sindewahi rural healthcare clinic. A total of 71 fungal species from 20 distinct fungal genera were isolated utilising the petriplate exposure method. In addition to these white sterile mycelia, two years of research (August 2014–July 2016) resulted in the isolation of black and orange sterile mycelia.[11] Two fungal genera, Mucor (7 fungal species) and Rhizopus (4 fungal species), out of 20 fungal genera, are representative of the Phycomycotina order. The Ascomycotina is represented by the three fungal genera Chaetomium (three fungal species), Epicoccum (two fungal species), and Geotrichum (three fungal species). The Deuteromycotina is represented by the fifteen fungal genera, which

include Aspergillus (12 fungal species), Penicillium (7 fungal species), Alternaria, Cladosporium, Curvularia, and Trichothecium (each with four fungal species), Fusarium, Candida, Phoma, and Trola (each with three fungal species), Cercospora, Drechslera, Helminthosporium, Nigrospora, and Trichoderma (each with one fungal species).

In G.W. of the rural health clinic Sindewahi, 1671 fungal colonies were documented during the course of the two-year research period, which ran from August 2014 to July 2016. During the first year of the study, which ran from August 2014 to July 2015, 635 fungal colonies were isolated. Maximum 318 (50.07%) fungal colonies were isolated during the rainy season (June to September). These were followed by 234 (36.85%) colonies in the winter (October to January) and minimum 83 (13.07%) colonies in the summer (February to May). Over the course of the study, the month of July yielded the highest number of fungal colonies—102—followed by August, September, October, November, December, January, June, February, March, and April, and the month of May yielded the fewest—12—fungal colonies. [12] In the second year of the study, which ran from August 2015 to July 2016, 1036 fungal colonies in total were isolated. The highest number of fungal colonies isolated during the rainy season (June to September) was 460 (44.40%), followed by 382 (36.87%) during the winter season (October to January) and a minimum of 194 (18.72%) during the summer (February to May). Over the course of the study, the month of July yielded the highest number of fungal colonies—138—followed by August, September, October, November, June, December, January, February, March, and April, while the month of May yielded the fewest—30. Over the course of the two-year investigation, 52 fungal species belonging to Deuteromycotina (68.04%), Phycomycotina (15.67%), and Ascomycotina (8.07%) were the most prevalent.During the research period, 8.19% of sterile mycelium were observed in Sindewahi, a rural healthcare institution. Deuteromycotina were observed at 68.97%, Phycomycotina at 14.64%, and Ascomycotina at 7.55% in the first year of the study. Deuteromycotina accounted for 67.47% of the study in the second year, followed by Phycomycotina (16.31%) and Ascomycotina (7.39%). Over the course of the two-year study, Aspergillus dominated with 218 colonies (13.04%), followed by Penicillium 203 colonies (12.14%), Mucor 176 colonies (10.53%), Alteraria 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 %) 50 colonies of Torula (2.99%), 48 colonies of Trichoderma (2.87%), 39 colonies of Drechslera (2.33%), 38 colonies of Nigrospora (2.27 %), 34 colonies of Trichothecium, Helminthosporium (2.03%), 30 colonies of Candida (1.79%), 26 colonies of Chaetomium (1.55%), In addition, during the course of the two-year examination, 94 colonies of White sterile mycelia (5.62%), 40 colonies of Black sterile mycelia (2.39%), and 3 colonies of Orange sterile mycelia (0.17%) were noted. Aspergillus dominated the first year of the investigation with 82 colonies (12.92%), followed by Penicillium 76 colonies (11.98%), Helminthosporium 18 colonies (2.67%), Microcor 61 colonies (9.61%), Alteraria 49 colonies (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%). During

the course of the two-year examination, in addition to this White sterile mycelia 43 colonies (6.78%), Black sterile mycelia 10 colonies (1.57%), and Orange sterile mycelia 3 colonies (0.474%) were noted. During the second year of the study (August 2015 to July 2016), Aspergillus accounted for 136 colonies (13.12%), with Penicillium coming in second with 127 colonies (12.25%), Alteraria with 98 colonies (9.54%), Rhizopus with 54 colonies (5.21%), Epicoccum with 42 colonies (4.05%), Curvularia with 40 colonies (3.86%), Fusarium with 37 colonies (3.57%), Trolum with 36 colonies (3.47%), Cercospora with 32 colonies (3.01%), Geotrichum with 30 colonies (2.89%), Trichoderma 25 colonies (2.41%), Drechslera with 20 colonies (1.93%), Cladosporium and Nigrospora with 19 colonies each (1.83%), Candidate with 18 colonies (1.79%), Helminthosporium with 17 colonies (1.64%), Trichothecium with 16 colonies (1.54%), and Chaetomium with 15 colonies (1.44%). Apart from this, during the course of a two-year examination, 51 White sterile mycelia colonies (4.92%) and 30 Black sterile mycelia colonies (2.89%) were noted.[13]

Seasonal Variation

The figures depicted below represent the monthly contribution of all colonies counted in three distinct areas of the Rural Health Care Centre Sindewahi in the years 2014–2015 and 2015–2016, respectively. In the first year of the study, the colony counts varied from 44 to 273, while in the second year, the counts ranged from 77 to 382. In 2014–2015, the months of July (273) and August (242) had the highest colony counts. The highest colony count was recorded in the following year of research in the months of July (382) and August (350). In both years, the average monthly colony count percentage contribution to the overall colony count ranged from 2.48% to 15.43% and 2.64% to 13.13%, respectively. As per Table No. 4.4, the month of July (15.43%) had the highest colony counts in the first year, 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 May (2.48%). During the second year of the study (2015–2016), July (13.13%) had the greatest colony counts, followed by August (12.03%) and September (11.44%). The lowest percentage was in May (2.64%), followed by 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 November (9.62%). The largest colony count was found in the rainy season compared to that of the winter and summer in both study years when the seasons were analysed comparing using the exposure petriplate method, i.e., summer, rainy, and winter. The rainy season predominated in 2014–2015 with 861 colonies, contributing 48.67%, but in 2015–2016, it contributed 44.13% with 1284 colonies. The winter (October to January) followed the rainy season's dominance. In 2014–2015, a colony count of 638 was recorded with a frequency of 36.05%. In contrast, it amounted to 36.74% in the second year of the inquiry, or 2015–2016, with a colony count of 1069. Summertime makes less of an impact. It was 270 (15.26%) in 2014–2015 and 556 (19.11%) in 2015–2016.[14]The rainy season saw the highest number of fungal colonies recorded due to the ideal weather conditions—high rainfall, rising humidity, and moderate temperatures—which promote the growth and development of fungus.[15] Furthermore, a dry environment with high temperatures and low humidity limits the growth and development of fungus.[16] Pandey (1992), Tilak and Vishwe (1975), and Sudharsanam S. and Srikanth P. (2008) showed a link between fungal spore concentration and metrological parameter.[17-18]

Conclusions

1) An aaeromycological survey conducted in rural Sindewahi health care centres revealed that 71 species, representing 20 taxa, were found by the use of the exposure petriplate method and high media air sampling. Aspergillus, Penicillium, Alternaria, Mucor, Rhizopus, Chaetomium, Cladosporium, Curvularia, Tricothecium, Candida, Fusarium, Phoma, and Torula were the most common genera found in these healthcare facilities.
2) For an average of two years, deuteromycotina dominated indoor air in terms of both quantity and quality, followed by phycomycotina and ascomycotina.
3) There was seasonal change in fungal spores. The wet season (June to September) had the highest concentration of fungal spores, which were then followed by winter (October to January) and summer (February to May).
4) Fungal spores also showed yearly change; the months of July and August showed the highest concentrations, while May showed the lowest.
5) During the rainy season, temperatures can reach up to 25 °C and humidity levels can frequently reach over 80%. The majority of fungus can grow healthily in this type of climate. However, the summer's hot, dry weather typically inhibits the growth of fungi.
6) In the intramural environment of healthcare facilities, higher relative humidity (over 80%) and moderate temperatures (between 25 and 30 degrees Celsius) offer the most hospitable conditions for the maximal contribution of fungal spores.
7) Throughout the study period, the mean temperature and relative humidity varied throughout the year in Chandrapur districts' outdoor and indoor healthcare facilities. June through September saw more rainfall, and during that time, fungal spore densities were also higher. When the amount of rainfall was at its highest, in July and August, there was a noticeable qualitative and quantitative rise in the indoor airospora of healthcare facilities.
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) Every month of the year, microfungi are found in the indoor environments of all the Chandrapur District's healthcare facilities. Not even the operating rooms are free of fungi. Fungal-free environments in operating rooms are only temporary when fumigation is performed both before and after using the space.
10) This investigation of different areas of hospitals makes it abundantly evident that there is a significant risk of exposure to extremely high concentrations of allergic fungus spores for both patients and staff. Human disease is caused by fungi and their poisons.
11) The research from this study allows us to conclude that, in the majority of workplaces, particularly in healthcare facilities that admit general wards for the treatment of various diseases and operate operating rooms, a continuous and skilled evaluation of the mycological status is extremely required. The distribution of fungal prorogues and the concentration of species should be the primary determinants of this kind of estimation.
12) It has been demonstrated that healthcare facilities cannot completely eradicate the presence of microfungi, especially in general wards. However, several corrective actions can lessen the frequency and concentration of these occurrences, such as

Carefully organising the routine and appropriate cleaning of every area of medical facilities. To keep dust free, hoover cleaners and manual cleaning should be employed.

Plenty of lists and good ventilation can be found in the general ward and other sections of hospitals.

Installation of air conditioners or air exhaust fans to eliminate spores from indoor air • Special attention should be paid to operating rooms; frequent and adequate fumigation should be required before to and during use. • Appropriate protocols for disposing of biological waste products that are taken from patients following surgery. Healthcare facilities should have any damaged or undesired material that microfungi use as substrates removed. Patients and visitors in general wards should wear masks to prevent indoor contamination.

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