International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www. ijsrst. com)

Aeromycological Studies of Indoor Environment of Rural Healthcare Centre Sindewahi in Operation Theater by Volumetric Air Sampler Method

S. M. Waghare[1], V. R. Panse[2, 3]

[*1]Sesten Crop Science Private Limited, Nasik, India

[2]Radhakisan Foundation, Nagbhid, India

[3]Late B. S. Arts Prof. N. G. Science & A. G. Commerce College, Sakharkherda, India

[*1]*Corresponding author:- swtpanse@gmail. com*

Article Info

Volume 9, Issue 6

Page Number : 833-839

Publication Issue

November-December-2022

Article History

Accepted : 20 Nov 2022

Published : 15 Dec 2022

Introduction

Rural Healthcare Centre Sindewahi situates at latitude20. 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. [1] 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 samplingwas done in Operation Theater (O. T.). The air sampling was done regularity twice in the month for consecutive two years i. e. Aug. 2014-July2016. [2] Operation Theater of rural health care center is utilized only for family planning operations, particularly from the month of December to January. [3] Before the operation the O. T. was sterilized by fumigation process. Forthe sterilization formaldehyde fumigation method is used. The air samples were collected from O. T. of rural health carecenter Sindewahi regularly by volumetric air sampler method. [4]

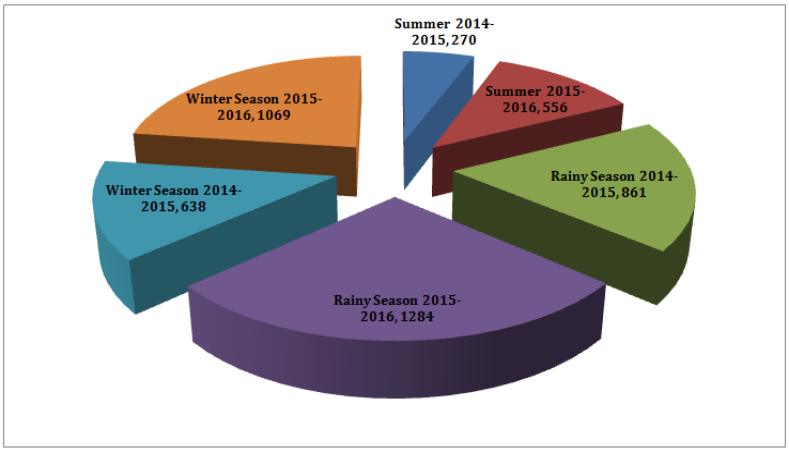
Fig. Latitude and Longitude Position of Rural Healthcare Centre Sindewahi

Volumetric Air Sampler Method

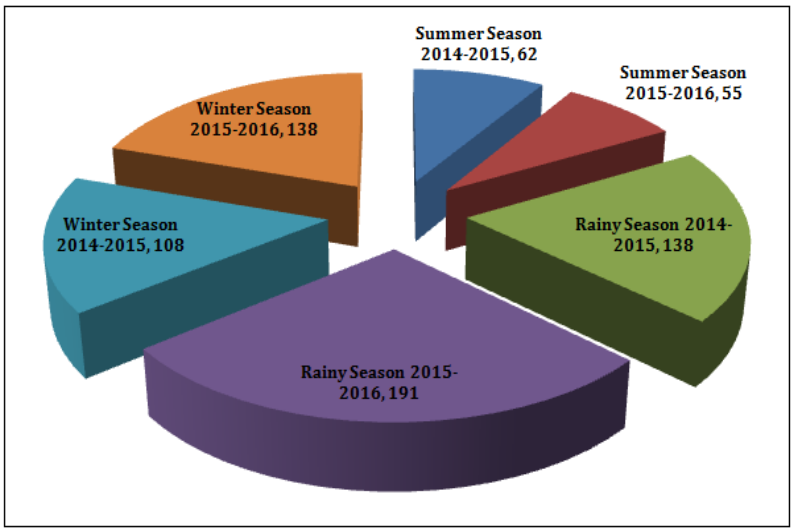
Indoor aeromycoflorain Rural Healthcare Centre Sindewahi

Air sampler method is easy and convenient method to study the concentration of indoor airborne fungal spores. In this study Hi media air sampler Mark II was used for collecting aerospora.[5]By using Hi media air sampler mark II total 38360 CFU's/M³ were trapped in rural healthcare centre Sindewahi, during two years of research period.[6]In 1st year (Aug. 2014- July 2015) total 16470 CFU's/M³ were recorded, out of which 7950 CFU's/M³ were trapped in 1920 CFU's/M³ were trapped in O.T.

The concentrations of indoor fungal spores were affected by seasonal variation. Maximum CFU's/M³ were recorded in rainy season followed by winter and minimum in summer.[7] In Aug 2014-July 2015, total 7765 CFU's/M³ (41.74%) recorded in rainy season, 5709 CFU's/M³ (34.60%) recorded in winter season and 2960 CFU's/M³ (17.97%)recorded in summer season. Maximum 2530 CFU's/M³ were recorded in month of July followed by Aug., Sept., Oct., Nov., Dec., Jan., June, Feb., Mar., April., and minimum 460 CFU's/M³ were trapped in Month of May .



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



Seasonal Variations of C.F.U./M³ and Percentage Contribution in OT by Volumetric air sampler method in year 2014-2015 & 2015-2016

In 2nd year of research period (Aug. 2015- July 2016) , total 21890 CFU's/M³ were recorded, out of which 2960 CFU's/M³ were isolated in O.T.

The concentration of fungal spores was affected by seasonal variation.[8] Maximum CFU's/M³ were recorded in rainy season followed by winter and minimum in summer. In Aug 2015-July 2016, total 8935 CFU's/M³ (40.81%) recorded in rainy season, 7790 CFU's/M³ (35.58%) recorded in winter season and 5215 CFU's/M³ (23.82%)recorded in summer season.[9] Maximum 2585 CFU's/M³ were recorded in month Of July followed by Aug., Sept., Nov., Oct., Dec., Jan., Feb., June, Mar., April., and minimum 935 CFU's/M³ were recorded in Month of May.

Indoor aeromycoflora in Operation Theater (O.T.)

By using Hi media air sampler mark II, total 4880 CFU's/M³ were recorded in O.T. of Rural healthcare centre Sindewahi during two years of research period (Aug. 2014 – July 2016).

In 1st year of research (Aug.2014- July2015), total 1920 CFU's/M³were 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.[10] 1140 CFU's/M³ (59.37%) recorded in rainy season, 530 CFU's/M³ (27.60%) recorded in winter season and 250 CFU's/M³ (13.02%)recorded in summer season. Maximum 265 CFU's/M³were recorded in month of July followed by Aug., June, Sept., Oct., Nov., Dec., Jan., Mar., Feb., April respectively and minimum 30 CFU's/M³ were recorded in Month of May .

In 2nd year of research (Aug.2015-July2016), total 2960 CFU's/M³ were recorded, The concentration of fungal spores varies according to the seasonal variation. Maximum CFU's/M³ were recorded in rainy season followed by winter and minimum in summer.[11] 1445 CFU's/M³ (48.81%) recorded in rainy season, 1000 CFU's/M³ (33.78 %) recorded in winter season and 515 CFU's/M³ (17.39%) recorded in summer season. Maximum 445 CFU's/M³ were recorded in month of July followed by Aug., June, Sept., Jan., Feb., March, Sept., Oct., Nov., Dec., Jan., Feb., March, April, , and minimum 105 CFU's/M³ were recorded in Month of May.[12]

Discussion

Aeromycological survey from indoor environment of rural health care centreSindewahi, Chandrapur District was conducted fortnightly for two years (Aug2014-July 2016), by volumetric air sampling by Hi Media Air Sampler Mark II.[13] Tilak (1982) was suggested, the combination of two different air sampling methods for sampling aeromycoflora in indoor environment such as petriplate exposure method and volumetric air sampling by Hi Media Air Sampler Mark II .[14]

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.[15] 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 .[16]*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).[17]

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* ***257****colonies (*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).[18]

In 2nd year of investigation (Aug2015- July 2016) total 2909 fungal colonies were isolated, out of whichminimum 384 fungal colonies were recorded from Operation Theater (O.T.) By volumetric air sampler method total 21890 CFU's/M³ were recorded, out of which 2960 CFU's/M³ were isolated in O.T.[19] 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)[20]

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 in table respectively.[21] 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).[22]

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.[23] 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%). 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%).

Rural Healthcare Center Sindewahi 2014-2016						
Volumetric Air Sampler Method						
Seasonal Variations of C.F.U./M³ and Percentage Contribution in Operation Theater (O.T.)						
Year August 2014- July 2016						
Sr. No	**Season**	**Year**	**Total No of Colonies**	**% Contributions**	**Total No of C.F.U./M³**	**% Contributions**
1	**Summer Season**	2014-2015	62	20.12	250	13.02
		2015-2016	55	14.32	515	17.39
2	**Rainy Season**	2014-2015	138	44.8	1140	59.37
		2015-2016	191	49.73	1445	48.81
3	**Winter**	2014-2015	108	35.06	530	27.6

	Season	2015-2016	138	35.93	1000	35.78
Total			**692**		**4880**	

When both the year of study was analyzed comparatively according to season wise 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.[24] 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.[25] 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%) .[26]

Volumetric air sampler methods when used to analyze the seasonal variation of fungal colonies. Rainy season was dominated over the other by contributing 41.74% with 7765CFUS/m^3 in the year 2014-2015 and 40.81% with8935 CFUS/m3 in second year of investigation.[27] Winter season showed approximately similar contribution 34.6% with 5705 CFUS/m3 and 35.58% with 7790 CFUS/m3 in first and second year of investigation respectively. The summer season contribute least 17.97% with 2960CFUS/m3 in year 2014-2015, while it was 23.82%with 5215 CFUS/m3 in year 2015-2016.[28]

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.[29] And high temperature with decreasing humidity (dry condition) arrests the growth and development of fungi.[30] The correlation between fungal spore concentration and metrological parameter was reported by Sudharsanam S. and Srikanth P. (2008), Pandey (1992), Tilak and Vishwe (1975).

Conclusions

The Rural Healthcare Centre Sindewahi in India, located in the Chandrapur District, conducted an aeromycological survey of its indoor environment from August 2014 to July 2016. The study involved air sampling twice a month, using the Hi Media Air Sampler Mark II to collect aerospora. The results showed that 71 fungal species were recovered, with *Deuteromycotina* being the dominant group. The most abundant aeroallergens were *Aspergillus, Penicillium, Mucor, Alternaria, Rhizopus, Curvularia, Cercospora, Fusarium, Phoma, Epicoccum, Geotrichum, Torula, Cladosporium, Helminthosporium, Trichoderma, Nigrospora, Trichothecium, Drechslera, Candida,* and *Chaetomium*. The highest fungal colonies were observed during the rainy season, with the highest recorded in 2014-2015 and the lowest in 2015-2016. The study also observed a correlation between fungal spore concentration and metrological parameters.

References :-

[1]. Vishal R. Panse, N.S. Kokode, S.J. Dhoble, Journal of advanced material letters, 5 (10),604-610,2014, https://aml.iaamonline.org/article_14457.html

[2]. V.R.Panse, N.S.Kokode, S. J. Dhoble, A.N.Yerpude, International Journal of researches in bioscience, agricultures and technology, 6,230-232,2015, https://www.researchgate.net/publication/307965396_Luminescence_study_of_SrAl2B2O7_Tb_3_Phosphor_for_white_LED#fullTextFileContent

[3]. V.R.Panse, N.S.Dhoble, S.J.Dhoble, N.S.Kokode, A.N.Yerpude, International Journal of researches in bioscience, agricultures and technology, 6,233-235,2015, https://www.researchgate.net/publication/307965398_Luminescence_investigation_of_K2Ca2SO43_Tb_3_Phosphor_for_Solid_State_Lighting_applications#fullTextFileContent

[4]. V R Panse, N S Kokode, S J Dhoble ,International Journal of recent trends in science and technology, 12,(2),273-275,2014, https://www.researchgate.net/publication/307965653_Preparation_characterization_and_luminescent_properties_of_LiBO_for_solid_state_lighting#fullTextFileContent

[5]. V. R. Panse, N. S. Kokode, S. J. Dhoble, International Journal of Chemical, Biological and Physical Sciences; Sec. C,4(4),3736-3744,2013, https://www.researchgate.net/publication/307965299_Study_of_Luminescence_properties_of_Tb_3_and_Mn_2_doped_BaAl_12_O_19_green_emitting_phosphor_for_solid_state_lighting#fullTextFileContent

[6]. N. S. Kokode, V. R. Panse, S. J. Dhoble, Journal of advanced material letter, 6(7),616- 619,2015, https://doi.org/10.5185/amlett.2015.SMS3

[7]. S.K.Vyawahare, D.B.Zade , V.R.Panse , N.S.Kokode, International Journal for Research in Engineering Application & Management , 4,56-60,2019, https://www.ijream.org/papers/NCRICE1938.pdf

[8]. A.N. Yerpude, V.V.Shinde, V.R.Panse, S. J. Dhoble, N.S.Kokode, International Journal of current engineering & scientific research, 5(1),28-30,2018, https://troindia.in/journal/ijcesr/vol5iss1part2/28-30.pdf

[9]. V. R. Panse, K. R. Nagde, D. B. Zade, N. S. Kokode, Global Journal Of Engineering Science And Researches,18,107-109,2018, https://www.gjesr.com/Issues%20PDF/NCRase%2018%20(Recent%20Advances%20in%20Science%20and%20Engineering)/Track-6/21.pdf

[10]. V.R. Panse , S.K. Vyawahare, S.J.Dhoble, N.S. Kokode ,Vijay Singh, International Journal of current engineering & scientific research,5(5)145-151,2018, https://troindia.in/journal/ijcesr/vol5iss5part2/145-151.pdf

[11]. V.R.Panse, S.K.Vyawahare, D.B.Zade, N.S.Kokode, Journal of Our Heritage,68(12),702-709,2019, https://archives.ourheritagejournal.com/index.php/oh/article/view/2914

[12]. G. R. Rahate, U. A. Thakare, A. B. Lad, V. R. Panse, K. V. Sharma, International Journal of Scientific Research in Science and Technology, 4(2),2222-2225,2018, https://res.ijsrst.com/PDF.php?pid=8396&v=4&i=2&y=2018&m=January-February

[13]. G. R. Rahate, U. A. Thakare, A. B. Lad, V. R. Panse, K. V. Sharma, International Journal of Scientific Research in Science and Technology,3(7)1542-1546,2017, https://res.ijsrst.com/PDF.php?pid=8393&v=3&i=7&y=2017&m=September-October

[14]. G. R. Rahate, U. A. Thakare, A. B. Lad, V. R. Panse, K.V. Sharma, International Journal of Scientific Research in Science and Technology, 3(8),2046-2050,2017, https://res.ijsrst.com/PDF.php?pid=8394&v=3&i=8&y=2017&m=November-December

[15]. D.B.Zade, N.S.Kokode , S.J.Dhoble,V.R.Panse, International Journal of Current Engineering And Scientific Research,5(11),5-7,2018, https://troindia.in/journal/ijcesr/vol5iss11/5-7.pdf

[16]. V. R. Panse, Alok Shukla, S. J. Dhoble, International Journal of Photonics and Optical Technology,2(3),42-44,2016, https://www.researchgate.net/publication/309410060_Development_and_Characterization_of_Sr_2_B_2_O_5_Tb_3_Phosphor_for_Assessment_of_Trap_Parameter

[17]. V. R. Panse, N. S. Kokode, A. N. Yerpude, S. J. Dhoble, International Journal of Photonics and Optical Technology, 2(4),21-25,2016 , https://www.researchgate.net/publication/388634450_Luminescence_Investigation_of_Trivalent_Dy_and_Tb_doped_KAlPO_4_Cl_Phosphor_for_Solid_State_Lighting

[18]. Vishal R Panse, Ardian Asyhari, Arti Saxena, Rofiqul Umam, Marta Michalska-Domańska, Aparna Dixit , International Journal of Electronics and Communications Systems,4(2),113-125,2024 , https://ejournal.radenintan.ac.id/index.php/IJECS/article/view/25071

[19]. Andi Fadlan, Hartono Hartono, Antomi Saregar, Vishal R Panse, Gaurav Rahate, Anita Shukla, International Journal of Hydrological and Environmental for Sustainability,3(2), 65-73,2024, https://journal.foundae.com/index.php/ijhes/article/view/442/227

[20]. VR Panse, SP Hargunani, Antomi Saregar, SM Waghare, Arti Hadap, SV Dewalkar, Yuberti Yuberti, Journal of Optics, https://link.springer.com/article/10.1007/s12596-024-02077-5

[21]. Aziza Anggi Maiyanti, Muhammad Iffat Imtiyaza, Ummiy Fauziyah Laili, Vishal R Panse, Islamic Journal of Integrated Science Education (IJISE) 3(2), 105-118,2024, https://doi.org/10.30762/ijise.v3i2.3397

[22]. Antomi Saregar, Fredi Ganda Putra, Vishal R Panse, Yuberti Yuberti, Swati M Waghare, Arti Hadap, Journal of Optics, https://link.springer.com/article/10.1007/s12596-024-02125-0

[23]. Antomi Saregar, SP Hargunani, A Hadap, VR Panse, SV Dewalkar, Journal of Optics, https://link.springer.com/article/10.1007/s12596-024-01835-9

[24]. Ardimas, Puripat Wattana, Chatchai Putson, Vishal R Panse, Endah Kinarya Palupi, Ganesha Antarnusa, Abd Basith, Ulfa Mahfudli Fadli,Journal of Integrated Ferroelectrics,225(1), 368-375,2022, https://doi.org/10.1080/10584587.2022.2054074

[25]. Agus Mulyono, Md Monirul Islam, Vishal R Panse, Jurnal ilmiah pendidikan fisika Al-Biruni,11(1), 69 75,2022 https://www.researchgate.net/publication/362545326_Patella_radiograph_image_texture_The_correlation_with_lumbar_spine_bone_mineral_density_values#fullTextFileContent

[26]. Manmeet Kaur, Prashant K Sahu, DP Bisen, VR Panse, Prabhjot Singh,Journal of Macromolecular Symposia,100(1), 2100068,2021 https://onlinelibrary.wiley.com/doi/10.1002/masy.202100068

[27]. V.R. Panse, N.S. Kokode, S.J. Dhoble, national Journal for Light and Electron Optics, 126,4782–4787,2015

[28]. V.R. Panse, S.J. Dhoble, International Journal for Light and Electron Optics 219 165107,2020

[29]. S. V. Panse, S. R. Choubey, Antomi Saregar, V. R. Panse,9(5),711-721,2022, https://doi.org/10.32628/IJSRST

[30]. Ardimas, Puripat Wattana, Chatchai Putson, Vishal R Panse, Endah Kinarya Palupi, Ganesha Antarnusa, Abd Basith & Ulfa Mahfudli Fadli, INTEGRATED FERROELECTRICS, 225, 368–375,2022,https://doi.org/10.1080/10584587.2022.2054074