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Research Article

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# Indoor Aeromycological Studies in Primary Health Centers In Amravati District Maharashtra, India

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**Abstract**

*An aeromycological studies verifies the presence of air born fungi. It is very important to study fungal propagules in hospitals and health centres in context to Covid-19 pandemics. In the present research attempts were made to determine aeromycoflora of indoor environment of two Primary Health Centers (PHC1 and PHC2) in rural places of Amravati District in Maharashtra state in India. The samples were collected in the month of December 2022 and February 2023. The petriplate exposure method was used for the isolation of fungal mycoflora . In December 2022 Cladosporium cladosporioide and Aspergillus Niger shows the highest percent contribution while Mucor haemulids Fusarium spa and ,Uvularia lunate shows moderate percent of contribution in indoor environment of both PHCs .In month of February2023 Cladosporium cladosporioide shows dominance in both the PHCs and Aspergillus Niger, Mucor haemulids and Alternaria alternate were reported in moderate concentration. Some of these fungal species were reported as human pathogens.*

**Keywords:** Aero Mycology, Indoor , PHC, Amravati.

## 1. Introduction

Aerobiology is a scientific discipline focusing on the study of the passive transport of organisms but also with their products including viruses, cells and fungal spores or bacteria, pollen grains and impact of all these on organisms include infection, allergy, toxicosis in man, animals, infection of plants [1]. Aerobiology studies have received much attention recently because of application in the field of allergy, dispersal of pathogens and in allied aspect of microbiology.

Aero mycology is the branch of aerobiology that studies the dispersion of spores and other fungal elements in indoor and outdoor air, the changes in their concentrations, and the factors that affect those changes [2]. Fungi produce varied forms of spores which are differently, i.e. actively or passively released (blown away, rinsed-off or shaken out); however, their further fate usually depends on the wind [3-6]. Since fungal species constitute the major component of airborne flora, the study of aero mycology is highly significant.

Immuno-suppressed patients with severe neutropenia, chronic granulomatous disease, and acquired immunodeficiency syndrome (AIDS) have the highest risk of developing invasive fungal infection [5,7,8]. Mucor mycosis (earlier called Zygomycotic) is a rare but severe fungal infection caused by a group of Molds called mucoromycetes. Several hospitals across India have reported an increased incidence of Post Covid Mucor mycosis cases [9]. If fungal spores are inhaled from the atmosphere, lungs or sinuses of such individuals may get affected. Invasive aspergillosis (especially by A. fumigatus), candidemia, disseminated fusariosis, , and zygomycosis can reach mortality rate 100% [10] .

In the above context an aeromycological studies was performed in rural area in two primary health centres in Amravati district, Maharashtra , India during post covid period in the month of December 2022 and February 2023. Most of the fungi reported in indoor environment of these primary health centres are pathogenic.

## 2. Material and Method

### 2.1 Selection of Area

This work was carried out at primary health centers in Loni Takali and Teosa tahsil district Amravati , Maharashtra, India. Four wards of the PHC were selected for sample collection. These wards were the general ward, pathology laboratory, Doctor's cabin and medical store. The sample was collected on in December 2022 and February 2023. Room temperature and humidity of collection sites was recorded.

### 2.2 Plate Exposure or Settle Plate Method

Plate exposure or settle plate which involves the opening of plate

with specific culture media was used for this study [11,12]. This method allows fungi carrying particles to settle on the respective culture media. prepared plates are exposed for about 10-15 minutes in the different wards. The plates containing potato dextrose agar (PDA)was used for sample collection.The exposed petriplates were brought into the laboratory and incubated at 28 ± 1º C for 7 days. After 3rd, 5th and 7th days of incubation the fungal colonies were counted. At the end of 7th days of incubation the fungus was isolated and pure culture was maintained. For the purpose of identification and microphotography, slides were prepared with lacto-phenol cotton blue as the standard stain.

### 2.3 Identification of Collected Samples

Fungal colonies was initially characterized by cultural, morphological characteristics while the fungal isolates were identified on the basis of colony appearance and microscopic examination, morphology of the spore and hyphae as per Fungal Key of Barnett HL, Hunter BB (1972) [13].

Percentage contributions of individual species were calculated as per the standard formula:

$$\% \text{ of Contribution} = \frac{\text{Total No .of Colonies of One species}}{\text{Total No. of colonies of all species}} \times 100$$

## 3. Result and Discussion

Indoor aeromycological studies in two different primary health centres was conducted in rural areas of Amravati district of Maharashtra, India in December2022 and Febraury2023. The result of study shows that the indoor environment of both the PHC was full of aeromycoflora. In month of December 2022 from PHC-1 total 9 types of fungal colonies were identified from indoor environment. Out of these six were spore type and three were sterile hyphae. According to their appearance in the exposed petriplate samples, the highest percent contribution of *Cladosporium cladosporioide* was found (52.77 %) and the lowest percent contribution of *Mucor hiemalis* and *Fusarium sp.* was reported (2.77 % each) also *Penicillium sp. Alternaria alternata, Verticillium sp*. fungal colonies were found in moderate numbers. From PHC-2 total 11 types of fungal colonies were identified from indoor environment . Out of them seven spore types and 4four sterile hyphae type was reported . Among these highest percent of contribution was shown by Aspergillus niger (21.5%) and lowest number of *Curvularia lunata,Mucor* sp. ,Fusarium sp.(5.26 % each) and Aspergillus flavus, Alternaria alternata ,Bipolaris epifaunal spore were also reported in moderate counts. In the month of February 2023 in PHC 1 five types of colonies were reported , 4 spore type and 1 sterile hyphae. Cladosporium cladosporioide (86.48%) with highest and Aspergillus nine r (2.70%) with lowest percent contribution . In same month PHC 2 reported total 4 colonies out of which 3 are spore type and one sterile. Cladosporium cladosporioide with highest (90.90%) and Aspergillus Niger and Alternaria alternate (3.63% each) shows lowest percent contribution. Penicillium sp. was also reported.

As compare to December 2022 the presence of aero mycoflora was lowered in February 2023 which may be due to increase in temperature and humidity. Highest number of colonies were reported from pathology area in PHC-1 in both december2022 and February 2023. Total count of colonies were more in general ward of PHC2 in both December 2022 and February 2023. Presence of Aspergillus spp. Fusarium spp. and Mucor spp. are worrisome because this is the group at the highest risk of suffering from potentially fatal invasive fungal diseases like aspergillosis filariasis, and zygomycotic [8,14,15]. A study performed in the waiting room of the allergy service of the Infanta Cristina Hospital in Spain showed that most of the fungal spores belonged to the genus Cladosporium (C. cladosporioides and C. herbarum). A research project performed in the ICUs, operating rooms, biomedical laboratories, and lobbies of five general hospitals in Seoul, South Korea, found that the most frequently isolated fungal genera in the air were: Cladosporium spp. (30%), Penicillium spp.(20%-25%) and Aspergillus spp. (15%-20%) [16,17].

## 4. Conclusion

Exposure to airborne pathogens is a common denominator of all human life. These factors have some useful and harmful effects on humans and on environment. The present research reveals that diverse aeromycoflora are present in indoor environment of both the PHCs. The effect of airborne fungal spores on human health is also important point of concern which could be studied by using of these finding provided in this research work . Exposure to such indoor airborne fungal spores develops various respiratory diseases, airborne disorders and allergies. It may also show the direct impact on patients, medical staff and other humans which are present in that indoor environment.

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| Sr. no. | Spore types | Cabin | Medical | General Ward | Pathology | Total | Percent count of fungal colonies |
|---|---|---|---|---|---|---|---|
| 1 | *Cladosporiumcladosporioide* | - | - | 9 | 10 | 19 | 52.77 |
| 2 | *Mucor hiemalis* | 1 | - | - | - | 1 | 2.77 |
| 3 | *Fusarium sp.* | - | 1 | - | - | 1 | 2.77 |
| 4 | *Penicilliumsp.* | 4 | 1 | - | - | 5 | 13.88 |
| 5 | *Alternaria alternata* | 2 | - | 2 | - | 4 | 11.11 |
| 6 | *Verticillium sp.* | - | - | - | 3 | 3 | 8.33 |
| 7 | Sterile hyphae | - | 1 | 1 | 1 | 3 | 8.33 |
| | Total | 7 | 3 | 12 | 14 | 36 | 99.96 |

**Table 1: The total count and percentage contribution of fungal colonies from indoor environment of PHC-1 in December 2022 at temperature 27 ° C**

| Sr no. | Spore types | Cabin | Medical | General Ward | Pathology | Total | Percent count of fungal colonies |
|---|---|---|---|---|---|---|---|
| 1 | *Aspergillus niger* | | | 1 | | 1 | 2.70 |
| 2 | *Cladosporiumcladosporioide* | | | | 32 | 32 | 86.48 |
| 3 | *Mucor hiemalis* | 1 | | | | 1 | 2.70 |
| 4 | *Penicillium sp.* | | 2 | | | 2 | 5.40 |
| 5 | Sterile hyphae | | 1 | | | 1 | 2.70 |
| | Total | 1 | 3 | 1 | 32 | 37 | 99.98 |

**Table 2: The total count and percentage contribution of fungal colonies from indoor environment of PHC-1 in February 2023 at temperature 34 ° C**

| Sr. no. | Spore types | Cabin | Medical | General Ward | Pathology | Total | Percent count of fungal colonies |
|---|---|---|---|---|---|---|---|
| 1 | *Aspergillus flavus* | - | 1 | 2 | - | 3 | 15.78 |
| 2 | *Aspergillus niger* | - | 2 | - | 2 | 4 | 21.05 |
| 3 | *Alternaria alternata* | 2 | - | - | - | 2 | 10.52 |
| 4 | *Curvularia lunata* | - | - | 1 | - | 1 | 5.26 |
| 5 | *Bipolaris sp.* | - | - | - | 3 | 3 | 15.78 |
| 6 | *Mucor sp.* | 1 | - | - | - | 1 | 5.26 |
| 7 | *Fusarium sp.* | 1 | - | - | - | 1 | 5.26 |
| 8 | Sterile hyphae | - | 1 | 3 | - | 4 | 21.05 |
| | Total | 4 | 4 | 6 | 5 | 19 | 99.96 |

**Table 3: The total count and percentage contribution of fungal colony from indoor environment of PHC-2 in December 2022 at temperature 30 ° C**

| Sr. No. | Spore types | Cabin | Medical | General Ward | Pathology | Total | Percent count of fungal colonies |
|---|---|---|---|---|---|---|---|
| 1 | *Aspergillus niger* | 1 | 1 | | | 2 | 3.63 |
| 2 | *Alternaria alternata* | | | 2 | | 2 | 3.63 |
| 3 | *Cladosporium cladosporioide* | | 16 | 19 | 15 | 50 | 90.90 |
| 4 | Sterile hyphae | | | | 1 | 1 | 1.81 |
| | Total | 1 | 17 | 21 | 16 | 55 | 99.97 |

**Table 4: The total count and percentage contribution of fungal colony from indoor environment of PHC-2 in February 2023 temperature 32 ° C**