28th WEDC Conference Kolkata (Calcutta), India, 2002
SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

Fungi : An Indoor Air Contaminant

Yasmeen, Amiya Akram, M. M. Ashhar, India

Abstract :

A survey of airborne fungal spores of indoor environment was made from September 2001 to March 2002. In all 20 species of fungi were recorded. *Aspergillus* was the most predominant genus detected followed by *Cladosporium, Alternaria and Penicillium* spores.

Introduction :

When excessive moisture accumulates in buildings or in building materials, fungal growth occurs which may result in adverse health problems in occupants like allergies or respiratory problems[1]. Fungi reproduce by giving off huge number of spores into the air. When these spores are inhaled, they may trigger an allergic reaction[2]. Allergies can lead to asthma, especially in children, causing permanent lung damage. Although studies on aerial biopollution of Aligarh have been carried out[3], very less emphasis has been given on the study of airspora as indoor air contaminant. In view of this fact, the study of airspora of the indoor environment of selected locations of Aligarh city was carried out and the presence of fungal species was correlated with the health problems that they may cause.

Materials and Method :

Samples were collected from 30 households, which were categorized into three socioeconomic groups that are high, middle and low-income groups according to their financial status and standard of living. The health status of residents was analaysed based on a questionnaire and the health problems associated to various fungal species were reported. The study was carried out from the month of September to March. The fungal spores were trapped from the sampling stations by exposing petriplates containing Potato Dextrose Agar (PDA) medium to the indoor environment for a period of 5 minutes and at a height of 1.5 m above the ground level[4]. The plates were then incubated at a temperature of 30°C for 7 days. After this period fungal colonies were observed and identified[5].

Results and Discussion :

Variation of fungal species and health problems were reported earlier[6]. In the present study sampling stations were selected and categorized as Low Income Group (LIG), Middle Income Group (MIG) and High Income Group (HIG). The various fungal species were identified and health problems attributed to these species are reported in Table – 1. In all, 20 species of fungi were obtained from the indoor environment. Apart from this *white* and *yellow sterile mycelium* were also observed.

Low Income Group (LIG) : A total number of 14 species of fungi were recorded in the indoor environment of this socio-economic group. The frequency of many allergy-causing fungi was very high. Along with other species, *A fumigatus* was a species that was isolated only from this income group. *A fumigatus* acts as a potent allergen and can cause localized infection of lungs[7]. The health problems in this income group were found to be highest.

Middle Income Group (MIG) : A total number of 12 species of fungi were isolated from the indoor environment of this income group with 100% frequency of fungi like *Aspergillus niger* and *Cladosporium cladosporioides*. About 50% and above residents of this income group suffered from health problems like no perception of smell, sneezing, sore throat and cough which are fungal allergy symptoms.

High Income Group (HIG) : A total number of 17 species of fungi were found in this income group, which is maximum among all the three groups. This may be due to conducive environment for the proliferation of fungi found to be present in this income group. Large number of fungal species may be attributed to the presence of materials like carpet, air-conditioner, refrigerator, washing machine etc. Although the number of fungi found was more, but the % frequency of many allergy-causing fungi was below 50%, which explains that the residents of this income group suffered less from fungal allergic symptoms.

TABLE – 1 : Health problems associated with various fungal species found in various income groups.

Fungal Species	Health Problems	LIG	MIG	HIG
Aspergillus flavus	Allergies, aspergillosis of the lungs, corneal, otomycotic, and nasoorbital infections.	+	+	+
Aspergillus fumigatus	Invasive and allergic aspergillosis	+	-	-
Aspergillus tucuensis	-	+	+	+
Aspergillus ochraceus	Produces kindney and liver toxins	+	+	+
Aspergillus sydowi	This species is only occasionally pathogenic	+	+	+
Aspergillus niger	Skin, pulmonary infections and ear infections	+	+	+
Aspergillus terreus	Associated with aspergillosis of the lungs. Also causes ear infection and infection of finger or toenails and produce toxins.	+	-	-
Alternaria alternata	Alternaria species is associated with hypersensitivity pneumonitis, extrinsic asthma, produces toxic metabolites	+	+	+
Alternaria longipes		-	-	+
Cladosporium cladosporioides	Cladosporium sp. is a common allergen, it can cause mycosis, extrinsic asthma.	+	+	+
Curvularia lunata	Curvularia sp. is allergenic, may also cause corneal infections, mycetoma, and infection	+	+	+
Dreschlera sp.	Occasionally causes corneal infection of the eye	-	-	+
Fusarium sp.	Can produce hemorrhagic syndrome in humans. Frequently involved in eye, skin, and nail infections.	+	+	+
Monilia sp.	Infrequently involved in corneal eye infections. Reported to be allergenic.	-	+	+
Mucor sp.	May cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus passasges, brain, eyes, and skin.	-	-	+
Nigrospora sp.	Reported to be allergenic.	-	-	+
Pullvularia pullulans	-	-	+	+
Penicillium notatum	Penicillium sp. may cause hypersensitivity pneumonitis, allergic alveolitis in susceptible individuals and extrinsic asthma.	+	+	+
Rhizopus negricans.	Rhizopus sp. may cause mucorosis in immune compromised individuals. The sites of infection are the lung, nasal sinus passages, brain, eyes, and skin.	+	-	+
Trichothecium roseum.	Produces trichothecence toxin.	+	-	-

"+" Indicates presence of a particular species in a particular income group.
"_" Indicates absence of a particular species in a particular income group.

Conclusion

The presence of these fungal species in indoor environment may be attributed to water vapour produced during combustion resulting in moist and damp conditions favourable for fungal growth. Seven species of Aspergillus were found in the indoor environment, which is of concern as some of them may cause infections, allergies as well as mycotoxicity.

Although the number of species found in LIG was less than in HIG, but % frequency of allergy causing fungi was very high. Moreover, the symptoms of mould allergies – sneezing, cough, nasal congestion, itchy and watery eyes, skin rashes and rhinitis – were found to be maximum among the LIG residents. Presence of such a large number of fungal species can pose serious threat to the health of building occupants apart from damaging the building materials. Therefore these should be regarded as Indoor Air Contaminant and seriously dealt with.

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Yasmeen, Scientist, Department of Botany, A.M.U., Aligarh - 202002.

Amiya Akram, Graduate Student, Department of Civil Engineering, A.M.U., Aligarh-202002.

M. M. Ashhar, Professor, Environmental Engineering, Department of Civil Engineering, A.M.U., Aligarh-202002