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Prevalence of airborne *Aspergillus* in the air of monuments: Impact on biodeterioration and human health

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ABSTRACT

Aspergillus infections have grown in importance in the last years. The *Aspergilli* have always been a factor in the human environment. Biodeterioration processes result from complex interactions of surface-invading microbes with each other as well as with the surface material. Fungal ability in production of pigments and organic acids have crucial role in discoloration and degradation of monuments. Air acts as a vehicle for the dispersion of microorganisms. *Aspergillus* species can cause various forms of disease. This investigation focuses on mycological survey of the Sita Devi Temple of Devarbija, Bhandedwal Temple of Arang Laxman temple of Sirpur and Pateleswar Mahadev Temple of Bilaspur (C.G.), India. Species of *Aspergillus* reported as a dominant fungal flora followed by *Alternaria*, *Penicillium, Curvularia, Cladosporium, Fusarium, Mucor* and *Rhizopus* from all the sample sites. The purpose of this investigation is to summarize the current knowledge about this important group of fungi.

Introduction

Chhattisgarh is the land of ancient culture which has lots of ancient monuments, temples and fort. Stone surfaces are continuously exposed to physical, chemical and biological degradation. Among biological agents microorganisms have critical importance, in stone deterioration. Fungi has greater role in the biodeterioration of monuments (Burford et al., 2003). Biodeterioration of ancient buildings and monuments depend upon environmental factors i.e. light, moistures, weather and temperature, type of vegetation and source of contamination. It is important to understand these activity of micro- organisms in order to select appropriate treatment strategies for the repair and restoration of buildings and monuments. (Gaylarde et al., 2006). The monuments which are made of value ancient stones like marbles, granite and other have greater get more damaged from fungal colonizing.

Spores of fungi are almost always present in air but their numbers and types differ with time of day, weather, season and location (especially if this is dominated by large nearby spore sources). Without a source of spores in a building, numbers indoors are usually smaller than outdoors but the types found are similar. Heaviest exposure to airborne spores is often found in the workplace. Many of the organisms found are well-known allergens and have been implicated in occupational asthma or extrinsic allergic alveolitis. Some may also cause infection, e.g. *Aspergillus fumigatus,* or carry mycotoxins, e.g. *Aspergillus flavus,* while very intense exposure may cause 'organic dust toxic syndrome'(Latge, 1999). *Aspergillus* species are widely distributed fungi whose conidia are present in the outside air in a year-round fashion. After inhalation of airborne conidia, *Aspergillus* species can cause various forms of disease, (Hospenthal et al., 1998, Hedayati et al., 2007). *Aspergillus fumigatus* is by far the most prevalent species in cases of invasive disease. *Aspergillus* species are saprophytic, thermotolerant fungi that survive and grow on organic debris and that aerosolize conidia, which humans inhale at the rate of hundreds per day without experiencing complications (Anderson et al., 1989). This investigation summarizes the biodeterioration and health aspects of the medically important fungal genus *Aspergillus*.

Material and Method

Sample were collected from all sampling sites in every month and prepaired solution in sterile distilled water and few drops of this sample poured in petridishes containing Potato dextrose agar (PDA) media, in this nutrient media potato and dextrose are the source of carbohydrates. Agar is used as solidifying agent. Then petriplates incubated at 26±1^{0}C for seven days (Grover et al., 2007). Fungi were identified from National center of fungal taxonomy Delhi, India.

Result and Discussion

During investigation period from Deverbija temple 15 fungal flora was identified, in which 5 species of *Aspergillus* were isolated (Fig.1). It is found that maximum percentage contribution is observed for *A. fumigatus* (11.36) followed by *Aspergillus niger* (10.22), *Mucor* sp. (9.09), *A. flavus* (7.95).

In Aarang, 7 species of *Aspergillus* from 19 fungal flora were identified from samples (Fig. 2). It is found that maximum percentage contribution among *Aspergillus* species was observed for *Aspergillus niger* (8.48) followed by *A fumigates* (7.87), *A flavus* (6.66), *A. Scalrotium* (4.84) *A. nidulans and A. temari* (4.25).

In Bilaspur, 6 species of *Aspergillus* from 17 fungal flora were identified from the samples (Fig. 1). It is found that maximum percentage contribution among Aspergillus species was observed for *Aspergillus niger and A flavus* (9.25) followed by *A fumigates* (8.18), *A. Scalrotium* (4.84) *A. nidulans and A. temari* (0.37) (Fig. 3).

In Sirpur, total 18 fungal flora were isolated from sampling site. The fungal species were *Cladosporium oxysporum, Fusarium* Mycelia sterilia *Aspergillus, Penicillium, Curvularia, Cladosporium, Mucor, Rhizopus, Trichoderma* species were observed. It is found that maximum percentage contribution is observed for *Aspergillus niger* (18.09), *A flavus* (14.69), A.

versicolor (12.43), followed by *A fumigatus* (9.04). On the contrary, minimum percentage contribution (0.56) is observed for *Aspergillus oryzae, and Aspergillus* sp. (I). (Fig. 4).

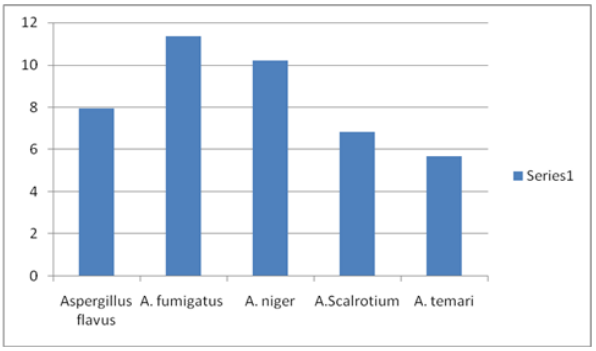

Fig. 1 *Aspergillus* species in Sita Devi Temple of Devarbija

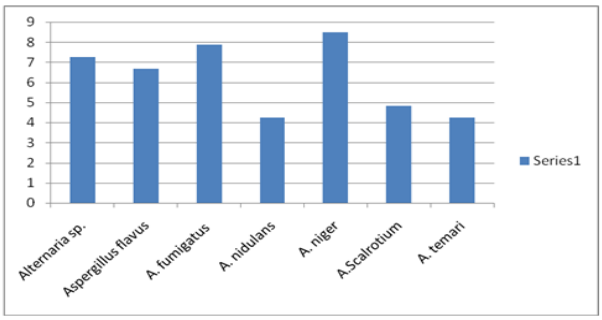

Fig. 2 *Aspergillus* species in Bhandedwal Temple of Arang

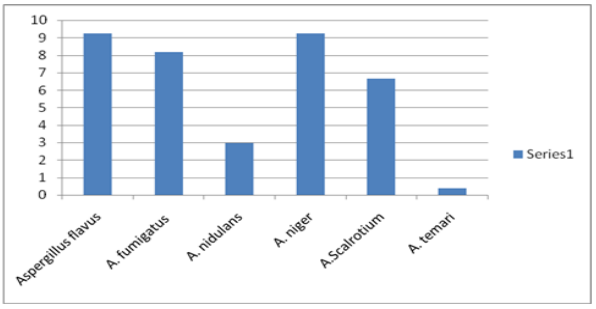

Fig. 3 *Aspergillus* species in Laxman temple of Sirpur

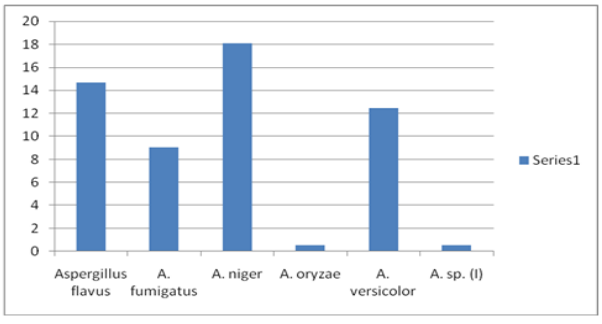

Fig. 4 *Aspergillus* species in Pateleswar Mahadev Temple of Bilaspur

The results of present investigation revel with various work done by researchers. It was studied by (Arzu Cicek et al., 2007) that Excessive moisture in building materials supports microbial growth. The organisms construct a system of ducts and cavities by active dissolution of the substratum (Hoppert et al., 2004). A. fumigatus is one of the few fungi that is capable of producing pulmonary infections in humans. *A. fumigatus* is associated with several human health issues. It is the most common air borne fungal pathogen of humans (Denning, 1998). The results of the mycological assessment showed that the majority of *Aspergillus* species isolated from investigated sites are aeroallergen (Bush, 2001).

Conclusion

This study suggests an important role of fungi as allergens. Further studies are necessary to elucidate the importance of particular fungal species in the development of occupational allergy.

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