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# Seasonal variation and ecological study of fungi in relation to biodeterioration

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**Abstract**
Present investigation focuses on mycobial survey of ancient temple of Chhattisgarh and study carried out March 2010 to February 2011. During the present investigation period it was observed that fungal population was varying from season to season and month to month. Environmental factor play an important role for the distribution of the fungal spores. The Fungal population is not homogenous throughout the year and shows seasonal variation. It was observed that maximum fungal population was observed in winter season, due to favourable temperature and relative humidity, moderate in rainy season and minimum number of fungal population was recorded in summer season, possibly due to unfavourable temperature and relative humidity for mycoflora. It was also observed that Aspergillus niger showed maximum percentage frequency and maximum percentage contribution both.

**Keywords:** Chhattisgarh, *Aspergillus,* Biodeterioration,Seasonal variation.

## INTRODUCTION

The biodeterioration of ancient buildings and monuments depend upon many factors which includes environmental factors like light, moistures, weather, temperature etc type of micro – organism that is its potential towards the colonization in the surrounding environments, materials of the monuments. Microbial activity can have an important impact on the durability of building materials.Fungal ability in production of pigments and organic acids have crucial role in discoloration and degradation of different types of stone in cultural heritage objects. Additionally, stone objects may support novel communities of microorganisms that are active in biodeterioration process. Ancients monuments are regularly affected by the continuous colonization of micro-organisms especially bacteria, cyanobacteria, yeast, some algae species and various fungal species. (Gorbushina et al., 2004). Fungal organisms cause diseases in plants, animals, and human beings. They are responsible for deterioration of organic objects. Fungi has greater role in the biodeterioration of monuments (Burford et al., 2003). The present paper deals with the mycological survey of ancient temple with environmental factors.

## MATERIALS AND METHODS

The fungi were collected from the Siddheshwar Temple Palari (Dist – Raipur). This monument is situated at *70 kms distance from Raipur* at Palari village on Raipur-Baloda Bazar road. The date of the construction of the temple is circa *7th–8th cent. A.D.* This is a fine specimen of existing brick temples in Chhattisgarh region.

### For Isolation of Surface Mycoflora

During the investigation period PDA media was used for the isolation of microorganisms. Sample were collected from the surface of temple and artefacts of all the months in the sterile polythene bags and prepared the solution in sterilized distilled water. Few drops of sample pour in the petridishes and kept this petridishes at 28±1◦C for 7 days for incubation as discussed by Grover et.al. (2007). at the end of incubation period fungal colonies were counted, isolated and identified with the help of available literature and finally send this culture to authentic authority: National centre of fungal taxonomy Delhi for identification.

### For the Ecological study

For ecological studies, at the end of the incubation period percentage frequency and percentage contribution of fungal flora is also calculated (Sharma 2001).

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## RESULT AND DISCUSSION

### Seasonal variation

Seasonal variation affects aeromycoflora of the area. Fungal spores are not equally distributed in the environment their distribution varies according to geographical location and meteorological conditions. The climate of Raipur city divided by three seasons; Rainy season (July–October), winter season (November– February) and summer season (March–June).

During investigation period, it is also observed that the maximum fungal species are recorded in winter season, moderate fungal species in rainy season and minimum fungal species are recorded in summer season. (Table 1).

Table 1. Seasonal variation

| S. No. | Name of Fungi | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Aspergillus scalrotium* | + | - | - | - | + | - | + | + | + | + | + | - |
| 2 | *A. fumigatus* | + | + | + | + | - | + | - | - | - | - | - | - |
| 3 | *A. niger* | + | + | + | + | + | + | + | + | + | - | + | + |
| 4 | *A. oryzae* | - | - | + | + | - | - | - | - | - | - | - | - |
| 5 | *A. versicolor* | - | - | - | - | - | - | - | - | + | + | + | + |
| 6 | *Acremonium scatrotium* | - | - | + | - | - | - | - | - | - | - | - | - |
| 7 | *Cladosporium* sp.I | + | - | - | - | - | - | - | - | + | + | + | + |
| 8 | *Cladosporium* sp. II | - | - | - | - | - | - | - | - | - | + | - | - |
| 9 | *Curvularia lunata* | - | - | - | - | - | - | - | + | - | - | - | - |
| 10 | *Curvularia lunata* var. *aeria* | - | - | - | - | - | - | - | - | - | + | - | - |
| 11 | *Emericella nidulans* | + | + | + | + | - | + | - | + | - | - | - | + |
| 12 | *Fusarium pallidoroseum* | - | - | - | - | - | - | - | - | - | - | + | + |
| 13 | *Penicillium Chrysogenum* | - | - | - | + | - | - | - | - | - | + | + | - |
| 14 | *Rhizopus* sp. | + | - | - | - | + | + | + | + | + | + | + | + |
| 15 | *Trichoderma viride* | - | - | - | - | - | - | - | - | - | - | - | + |
| 16 | *Alternaria* sp. | - | - | - | - | - | - | - | - | + | + | + | - |
| 17 | Mycelia sterilia (White) | - | + | - | - | - | - | + | - | - | + | - | - |

### Ecological studies

In the present study, percentage frequency and percentage contribution was also observed.

### Percentage frequency

Frequency is the main parameter which we help to known the distribution of individual species in that particular area. During investigation period maximum percentage frequency reported for *Aspergillus niger* (91.66%), *Rhizopus sp. (75%) A. scalrotium, Emericella nidulans* (58.33%), *Aspergillus fumigates, Cladosporium sp I* (41.66%), were recorded. While minimum frequent fungal species (8.33%) are *Cladosporium sp II*, *Curvularia lunata*, and *Trichobotrys viride*. (Table 2).

Table 2. Ecological studies

| S. No. | Name of Fungi | Total | Percentage Contribution | Percentage Frequency |
|---|---|---|---|---|
| 1 | *Aspergillus scalrotium* | **32** | 16.00 | 58.33 |
| 2 | *A. fumigatus* | **19** | 9.5 | 41.66 |
| 3 | *A. niger* | **50** | 25.00 | 91.66 |
| 4 | *A. oryzae* | **7** | 3.5 | 16.66 |
| 5 | *A. versicolor* | **9** | 4.5 | 33.33 |
| 6 | *Acremonium scatrotium* | **1** | 0.5 | 8.33 |
| 7 | *Cladosporium* sp.I | **27** | 13.5 | 41.66 |
| 8 | *Cladosporium* sp. II | **1** | 0.5 | 8.33 |
| 9 | *Curvularia lunata* | **4** | 2.00 | 8.33 |
| 10 | *Curvularia lunata* var. *aeria* | **1** | 0.5 | 8.33 |
| 11 | *Emericella nidulans* | **15** | 7.5 | 58.33 |
| 12 | *Fusarium pallidoroseum* | **3** | 1.5 | 16.66 |
| 13 | *Penicillium Chrysogenum* | **3** | 1.5 | 25.00 |
| 14 | *Rhizopus* sp. | **19** | 9.5 | 75.00 |
| 15 | *Trichoderma viride* | **1** | 0.5 | 8.33 |
| 16 | *Alternaria* sp. | **3** | 1.5 | 25.00 |
| 17 | Mycelia sterilia (White) | **5** | 2.5 | 25.00 |
| | **TOTAL** | **200** | **100.00** | |

**Percentage contribution**

The seasonal percentage contributions of the mycoflora were observed during the investigation period. Maximum percentage contributions of fungal species were observed in winter season, moderate percentage contribution in rainy season, while minimum percentage contributions were reported in summer season. The members of Anamorphic fungi has shown maximum contribution throughout the year.

During the investigation period maximum percentage contribution showed by *Aspergillus niger* (25.00%), *Cladosporium sp I* (13.5%), and *Aspergillus Scalrotium* (16.00%) and *Aspergillus fumigates* (09.50). Moderate percentage contribution showed by *Aspergillus versicolor* (04.50%)*, A. oryzae* (03.50%). While minimum percentage contribution (0.50%) were observed for *Arcemonium,Cladosporium sp. II and* for *Trichoderma viride.* (Table 2).

Similar results are also made by many researchers. Urzi *et al*. (2001) recorded that *Aspergillus*, *Penicillium*, *Fusarium*, *Alternaria*, *Cladosporium*, *Ulocladium*, *aureobasidium* and *Poma* are most common isolates of terrace of Missina Museum at Sicily, Italy. Similar results reported at Raipur(C.G.) by Agrawal (2010). Gorney *et al*. (2002) reported that *Aspergillus versicolor*, *Cladosporium cladosporioides* and *Penicillium* are most dominant in indoor environments of Poland. Shelton *et al*. (2002) reported that *Cladosporium*, *Penicillium*, *Aspergillus* and nonsporulating fungi are most frequent fungal species in the indoor and outdoor environments of United States. Singh (2006) reported that *Aspergillus niger* are found to be most frequent fungal species of the aeromycoflora. The results of present investigation revel with various work done by some more researchers. It was studied by Gaylarde et al., (2006) that Excessive moisture in building materials supports microbial growth. Endolithic lichen and fungal growth can be used to describe the ecophysiological adaptations of them to the environmental extremes of the rock as studied by Bungartz et al. (*2004*). The biodiversity of soil crust biota from different geographical regions is rather dissimilar and their determination is only rarely based on cultured material in the case of Cyanobacteria, algae and fungi. (Ajit Varma and Francois Buscot 2007). It is also seen the Biogenic weathering is caused by the action of lithobiontic organisms. Homogeneous carbonates are predominantly colonized by endolithic species that actively penetrate the rock substratum independent of already existing pores or fissures. The organisms construct a system of ducts and cavities by active dissolution of the substratum. (Hoppert et al.,2004). Fungi are especially concentrated in stone crusts. They are able to penetrate into the rock material by hyphal growth and biocorrosive activity, due to excretion of organic acids or by oxidation of mi-neral-forming cations, preferably iron and manganese. Their deterioration acti- vities also include discoloration of stone surface, due to the excretion of mela- nin by dematiaceus fungi (W a r s c h e i d and B r a a m s, 2000). Biological and mycological investigations are very important part of good conservation and cannot be ignored in modern conservation concept which includes close collaboration between art and science.

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