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REGULAR ARTICLE

Biodeterioration of ancient monuments: Problems and prospects

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ABSTRACT

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. The air contains a large amount of biological and a biotic component such as, pollen grains, fungal spores, insects, mites, fibers and dust particles but their number and concentration depend upon the geographical location, types of vegetation and meteorological parameters. The problem of deterioration of ancient monuments caused by microbial agent, of which fungi play an important role in the deterioration. Present investigation focuses on mycobial survey of the Temple of Sirpur and study carried out March 2010 to February 2011. During the investigation period 18 fungal species were isolated from the surface of different ancient monuments of Sirpur which are *Aspergillus, Penicillium, Curvularia, Cladosporium, Fusarium* and *Rhizopus* reported as dominant fungal type in Laxman tample of Sirpur.

Introduction

Microorganisms always present in nature and affect our daily life directly or indirectly. The harmful effect by the colonisting of micro-organism on the monuments is scientifically known as biodeterioration. The monuments which are made of value ancient stones like marbles and granite which are affected by the harmful fungal activities fungal species are important agent responsible for damage of monuments. Colonization of microorganisms on monuments and biodeterioration are usually linked to environmental conditions. The most significant parameters affecting microbial growth are represented by physical factors, mainly moisture, temperature, and light, as well as by the chemical nature of the substratum. The aim of the present paper was to study the airborne mycoflora on monument surface and how can minimize the growth of fungi in the surface of precious collection.

Materials and Methods

During the investigation period PDA media was used for the isolation of microorganisms. Sample were collected from the surface of temple and artifacts 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 (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 center of fungal taxonomy Delhi for identification.

For the control of these fungi in vitro 1 antifungal compound sodium penta chloro phenate was used in various concentrations in 150 ml potato dextrose broth medium. Control flask without antifungal compound were also used simultaneously and incubated at 28±1°C for 7 days. All the experiments were performed in triplicates.

Results and Discussion

18 fungal floras were isolated from sampling site (Table 1). The fungal species like *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), *Cladosporium cladosporioides* (9.60) followed by *A. fumigatus* (9.04) and *Curvularia lunata* (8.47). On the contrary, minimum percentage contribution (0.56) is observed for *Aspergillus oryzae, Fusarium pallidoroseum* and *Aspergillus sp* (I). The results of present investigation revel with various work done by researchers. 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). 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 dematiaceous 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.

The effect of sodium penta chloro phenate on the growth of some selected fungi showed that 2% concentration leathal to most of the fungi, which showed enhanced growth as compared to

control. Probably this chemical acted as stimulant for the growth of fungi (Table 2).

Sodium penta chloro phenate was found to be effective in controlling the growth of all the test fungi at 2% concentration. It showed 100% inhibition of the fungal colonies. Similar result observed by (Barve and Thakre, 2003) in different antifungal compounds.however, besides the above treatments, environmental control is the basic area of prevention of biodeterioration which if worked out correctly and carefully may have little complications (Unial, 1991). Regular cleanliness and proper use of fumigants can control the biodeterioration of monuments with satisfactory results.

Table1. Isolation of fungal flora and their contribution

S. No.	Name of Fungi	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Total	Percentage Contribution
1	*Acremonium scatrotium*	0	0	0	2	0	0	1	0	0	0	0	0	3	1.69
2	*Aspergillus flavus*	-	3	-	1	-	9	-	3	-	1	7	2	26	14.69
3	*A. fumigatus*	1	2	0	0	5	4	3	0	0	0	0	1	16	9.04
4	*A. niger*	3	3	0	2	1	10	0	6	3	3	0	1	32	18.08
5	*A. oryzae*	0	0	0	0	0	0	1	0	0	0	0	0	1	0.56
6	*A. versicolor*	1	0	0	0	0	1	0	0	14	0	2	4	22	12.43
7	*A.* sp. (I)	0	0	0	0	0	0	0	0	0	1	0	0	1	0.56
8	*Cladosporium cladosporioides*	5	2	0	0	0	0	0	0	0	5	4	1	17	9.60
9	*C.* sp. (I)	0	0	0	0	0	0	0	0	0	0	2	3	5	2.82
10	*Curvularia lunata*	2	0	0	0	0	0	0	0	12	0	1	0	15	8.47
11	*Emericella nidulans*	1	2	1	0	0	3	0	0	0	0	0	0	7	3.95
12	*Fusarium pallidoroseum*	0	0	0	0	0	0	0	0	0	0	0	1	1	0.56
13	*Penicillium Chrysogenum*	0	0	0	0	1	0	0	0	0	1	2	1	5	2.82
14	*Rhizopus* sp.	1	2	0	0	0	1	0	2	3	1	1	3	14	7.91
15	*Trichoderma viride*	1	0	0	0	0	0	0	0	1	0	0	0	2	1.13
16	Dictyochlamydospora	0	0	2	0	0	0	0	0	0	0	0	0	2	1.13
17	Mycelia sterilia (White)	1	0	0	0	0	0	1	0	0	0	0	1	3	1.69
18	Mycelia sterilia (Pink)	1	0	0	0	0	0	0	0	0	2	0	2	5	2.82
	TOTAL	17	14	3	5	7	28	6	11	33	14	19	20	177	100.00

Table 2 .Effect of Antifungal compound on the growth of fungi

S. N.	Name of test fungi	Growth in Antifungal compound (2%)	Control
1	*Aspergillus flavus*	-	+
2	*A. fumigatus*	-	+
3	*A. niger*	-	+
4	*Cladosporium cladosporioides*	-	+

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References

Barve, Y.Y. and Thakre, R.P. (2003). A study of biodeterioration of paintings by fungi. J.. of Sci. and Tech. XIV and XV: 01-04.

Bungartz, F., Garvie, L. A. J. and Nash, T. H. (2004). Anatomy of the endolithic Sonoran Desert lichen Verrucaria rubrocincta Breuss: Implications for biodeterioration and biomineralization. Lichenologist. 36: 55–73.

Grover, R., Sharma, K.P., Kumar, P. and Kumar, S. (2007). Response of fungal community in the unpolluted and polluted habitats. J Environ Sci Eng. 49: 93-98.

Hoppert, M., Flies, C., Pohl, W.,Günzl, B. and Schneider, J.(2004). Colonization strategies of lithobiontic microorganisms on carbonate rocks. Environmental Geology. 46: 421-428.

Unial, C.P. (1991). Biodeterioration of Indian miniature paintings. Problems and prospects. Biodeterioration of cultural property. (Eds O.P. Agrawal and Shashi Dhawan) MeMillan India Ltd. pp 91-97.

W a r s c h e i d, Th.and B r a a m s, J. (2000). Biodeterioration of stone: a review. Int.Bio deterioration Biodegrad. 46: 343—368.