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Taxonomic Identification of Micro-Organisms Growing on and Cause Biodeterioration of Cultural Heritage of Agra and Mathura Region

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ABSTRACT

Fungi and bacteria have been known to degrade dye particles and other coloring agents. However in the present investigation fungal enzymes deteriorate monument walls and make them ugly. The various historical monuments have been made cracked by fungal and bacterial enzymes like lipase, cellulose, ligninase, pectinase etc. These are secreted by their cell wall. Fungi and bacteria release these enzymes and in presence of moisture and suitable temperature and environmental conditions degrade and break the walls of monuments by deteriorating their rocks and calcium particles. Also various magnesium particles are broken by fungal and bacterial enzymes by growth of fungi in long period of time. The fungi and bacteria have the ability to grow fast also and they continue their growth in historical monuments.

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INTRODUCTION

We can see many fungi and bacteria of different colors growing in monumental walls. Hence our historical monuments get deteriorated. No care is taken by spraying antifungals or antibacterials. Hence the monuments have lost their beauty. Many fungi like *Aspergillus niger, Cladosporium spahaerospermum, Trichoderma harzianum, Albugo candida, Aspergillus flavus, Aspergillus fumigatus* etc. have their dominance on the walls of historical monuments. Bacteria like *Streptococcus, Streptobacillus, Vibrio, Clostridium* etc. also cut the beauty of monumental walls.[10]

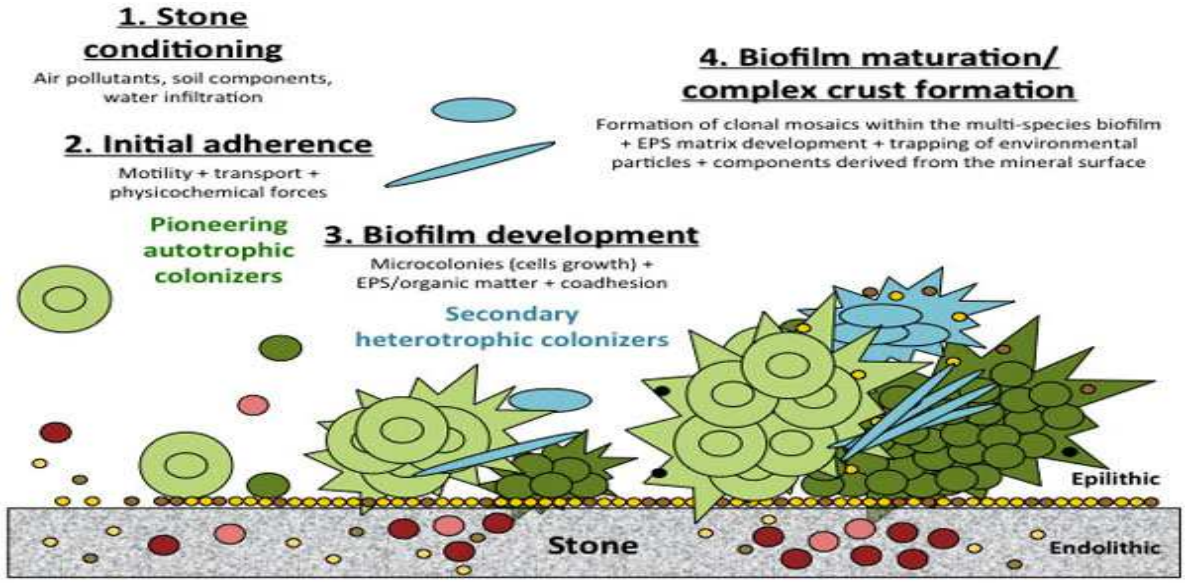

Fig-1: Fungi and bacteria degrading stone monuments (process)

We took the different colored fungi and bacteria by forceps in petriplates filled with Potato Dextrose Agar, Sabouraud's dextrose agar or blood agar medium and brought them to the laboratory for identification and dominance. [1]

OBSERVATION AND DISCUSSION

Table -1 fungal species identified from isolation from historical monuments in Agra

S. No.	Fungal species	Colony count
1.	Aspergillus niger	10
2.	Aspergillus flavus	8
3.	Aspergillus fumigatus	7
4.	Candida albicans	7
5.	Fusarium oxysporum	6
6.	Rhizopus nigricans	9
7.	Cladosporium sphaerospermum	6
8.	Alternaria Solani	5
9.	Geotrichum indicum	4
10.	Trichoderma harzianum	7

10 fungal species were obtained from Agra monuments on an average.[8,9] Out of these *Aspergillus niger* was the most dominant. This means the air borne spores of fungi were maximum of those of *Aspergillus niger* followed by *Rhizopus nigricans*.[2]

Table -2: Bacterial species identified from isolation from historical monuments in Agra

S. No.	Fungal species	Colony count
1.	Clostridium botulinum	5
2.	Bacillus spp.	8
3.	Streptococcus spp.	12
4.	Streptobacillus spp.	5
5.	Salmonella typhus	6

In case of bacteria *Streptococcus* spp had maximum colonies.

Fig.2: Mixed fungal colonies in petriplate

Among all these species, *Aspergillus niger* was the most dominant, followed by *Rhizopus nigricans*. The fungi were taken from different areas and by forceps put in petriplates. Then the number of colonies was counted. This shows that these fungi degrade the wall of historical monuments. The wall of monuments is made of calcium, magnesium basically cement. Fungal enzymes are so strong that they dissolve the wall in years. As care is not taken fungal enzymes keep deteriorating walls of monuments. [3]

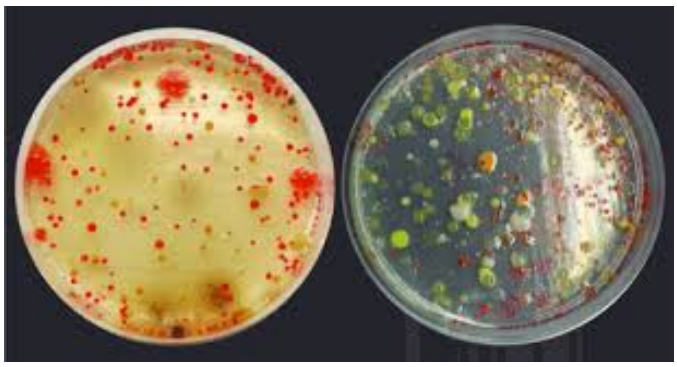

Fig.3: Mixed bacterial colonies in petriplates

Fig.4: the Taj Mahal losing its sheen in Agra

Fig.5: Krishna Janmabhoomi in Mathura

Table-2: Fungal species isolated from historical monuments in Mathura

S. No.	Fungal species	Colony count
1.	Aspergillus niger	10
2.	Aspergillus flavus	6
3.	Aspergillus fumigatus	8
4.	Candida albicans	6
5.	Fusarium oxysporum	7
6.	Rhizopus nigricans	8
7.	Cladosporium sphaerospermum	5
8.	Alternaria Solani	3
9.	Geotrichum indicum	6
10.	Trichoderma harzianum	9
11.	Colletotrichum albicans	7
12.	Trichothecium roseum	8

In case of monuments in Mathura on an average the colony count of *Aspergillus niger* was again the highest. This was followed by *Trichoderma harzianum*. Hence we can say that *Aspergillus niger* spores were again widespread in the air of Mathura.[4]

Table-3: bacterial species obtained from monuments of Mathura

S. No.	Bacteria	Colony count
1.	Streptococcus spp.	9
2.	Streptobacillus spp.	6
3.	Salmonella typhus	7

Here again *Streptococcus* spp. had maximum colony count.

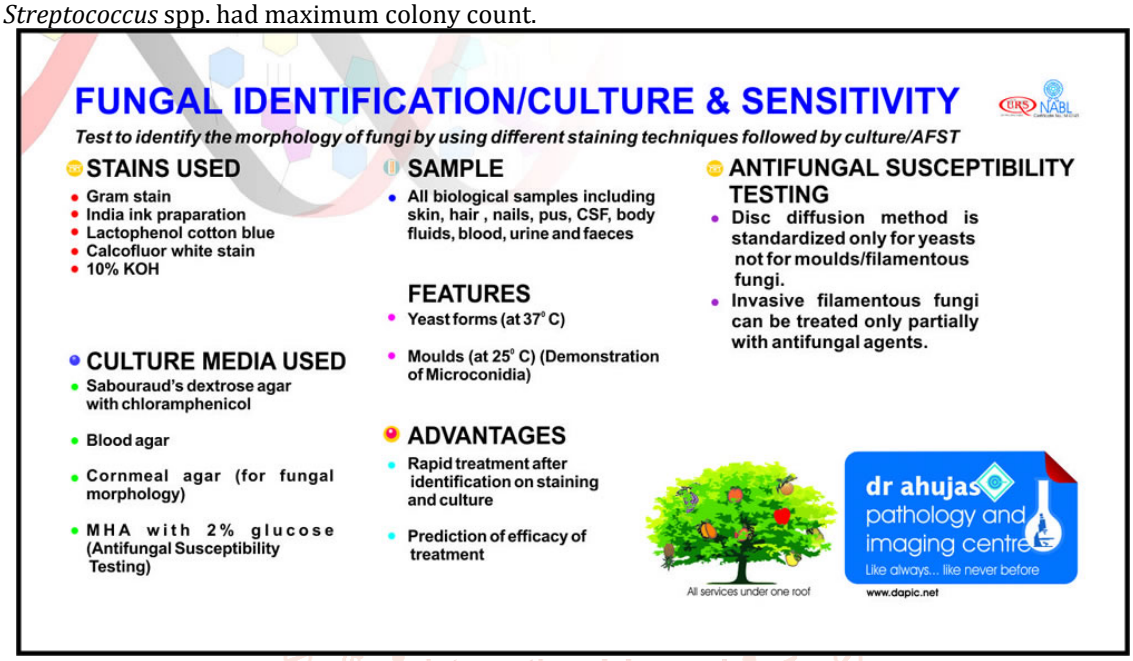

Fig.6: fungal identification and sensitivity

CONCLUSION

Strict measures should be taken to prevent fungi from degrading historical monumental walls:

1. Regular antifungal sprays like Bordeaux mixture and antibacterial sprays
2. Washing and cleaning of monumental walls
3. Strict checking of monuments regularly
4. Painting and cementing wherever degradation has occurred[5]

The precious historical walls are fun for tourists and economy for India. They require to be preserved. There are fungal and bacterial airborne spores which attach themselves to the walls of historical monuments and degrade them. Regular checking and preservation of monuments is necessary as they are economically useful tourist spots.[6,7]

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