Available online www.jocpr.com
Journal of Chemical and Pharmaceutical Research, 2019, 11(2): 127-131

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Deterioration of Safdarjung Tomb, New Delhi, India by Fungal Biodiversity

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ABSTRACT

Safdarjung Tomb (Safdarjung Ka Maqbara) mausoleum, built in 1754, by sandstone and marble. This monument has a spacious ambience, an imposing presence with its domed, arched red brown and white colored structures. It is situated at the intersection of Safdarjung and Aurobindo road, New Delhi, India. There is a serious threat of microbial deterioration being a very old tomb as well as exposer to various human pathogenic fungi on visitors of the tomb. Our investigation evaluated the status of mycobial decay of stone monument resulting of twenty nine fungal species belonging to eighteen genera (Deutermycetous groups) from the surfaces of tomb building structure and showed extensive biodeterioration as well to human pathogen.

Keywords: Mycobial Deteriotion; Safdarjung Tomb; India

INTRODUCTION

Fungi are responsible in deterioration of cultural heritage and stone monuments. Fungi play the most important role due to lack of knowledge and training for restorers and curators. There are various physical, chemical and biological factors damaging monuments. Biological factors are crucial in the decay of monuments such as bacteria, algae, mosses, fungi, insects, birds and human beings. Fungi play major devastating role in bio deterioration of monuments resulting through complex metabolic activities on stone surface. The growth of micro-organisms causes permanent loss to stone monuments resulting to discoloration, cracking, and distruction of building material. Thus, investigations of fungal diversity on monuments is necessary and important to preserve and enhance the longevity of historical monuments.

MATERIALS AND METHODS

Deteriorated stone samples were collected after careful observation from March 2015 to February 2017 of fungal degraded walled material of different structures of tomb by Swabbing, Scrapping and Cellophane taping , methods. Thereafter, Dilution (103 plate) with sampled material prepared and incubated at 250 C ± 30C for 4- 6 days .The colonies were counted for CFU (Colony Forming Unit) under Sterio- binocular on generic level and further by research compound microscope for different species identification . Thereafter, total number of colonies counted from each plate and their percentage diversity calculated for each fungal species for each year of 2015 -2017 and being tabulated as follows (Table 1):

Table1. Mycodiversity (2015-2017) recorded from Safdarjung Tomb

S. No.	Fungi Isolated /year	% Diversity 2015	% Diversity 2016	% Diversity 2017	Total % Diversity	Average % Diversity
1	Aspergillus fischeri	3.71%	1.51%	4.79%	10.01%	3.33%

2	Aspergillus oryzae	2.90%	3.64%	3.42%	9.56%	3.32%
3	Aspergillus terreus	3.87%	4.40%	5.47%	13.74%	4.58%
5	Bipolaris spicifera	2.58%	3.64%	1.36%	7.78%	2.59%
6	Chrysosporium indicum	3.39%	3.74%	5.47%	12.60%	4.20%
7	Chrysosporium tropicum	2.58%	2.43%	4.10%	9.11%	3.03%
8	Chaetomium glabosum	4.68%	3.49%	3.42%	11.59%	3.86%
9	Chaetomium indicum	3.23%	3.49%	2.73%	9.45%	3.15%
10	Curvularia lunata	6.13%	4.10%	4.10%	14.33%	4.77%
11	Drechslera spicifera	5.49%	2.43%	3.42%	9.70%	3.23%
12	Epidemophyton floccosum	3.55%	2.73%	3.42%	9.70%	3.23%
13	Exserohilum rostratum	3.06%	3.34%	2.05%	8.45%	2.81%
14	Epicoccum purpurascens	1.93%	4.40%	2.73%	9.04%	3.01%
15	Fusarium oxysporum	3.23%	5.16%	4.10%	12.44%	4.16%
16	Fusarium solani	2.90%	3.49%	3.42%	9.81%	3.27%
17	Glioclodium roseum	2.90%	4.10%	3.42%	10.42%	3.47%
18	Histoplasma capsulatum	3.55%	3.19%	2.73%	9.47%	3.15%
19	Neosartorya crassa	1.61%	4.10%	3.42%	9.13%	3.04%
20	Pestalotiopsis versicolor	3.39%	3.74%	4.79%	11.92%	3.97%
21	Penicillium citrinum	3.39%	3.74%	4.10%	9.13%	3.04%
23	Penicillium funiculosum	3.71%	3.64%	4.79%	12.14%	4.04%
24	Penicillium glabrum	3.23%	4.10%	4.10%	11.43%	3.81%
25	Penicillium purpurogenum	3.23%	2.43%	3.42%	9.08%	3.02%
26	Phoma glomerata	2.74%	3.49%	4.10%	10.06%	3.35%
27	Streptomyces albums	1.77%	3.03%	2.73%	7.53%	2.51%
28	Streptomyces griseus	3.39%	2.73%	2.05%	8.17%	2.72%
29	Trichophyton mentagraphytes	2.74%	2.88%	2.73%	8.35%	2.78%

RESULTS AND DISCUSSION

During investigation total 29 fungal species belonging to 18 genera were isolated from Safdarjung tomb, during March 2015 to February 2017. The maximum fungal diversity (4.04-4.77%) was recorded against Aspergillus terreus, Chrysosporium indicum, Curvularia lunata, Fusarium oxysporum, Penicillium funiculosum. While, optimum diversity (3.02-3.97%) were Aspergillus fischeri, Aspergillus oryzae, Chrysosporium tropicum, Chaetomium glabosum, Chaetomium indicum, Drechslera spicifera, Epidemophyton floccosum, Epicoccum purpurascens, Neosartoria crassa, Pestalotiopsis versicolor, Penicillium citrinum. Penicillium glabrum, Penicillium purpurogenum, Phoma glomerata and minimum diversity (2.51-2.78%) were Bipolaris spicifera, Exserohilum rostratum Fusarium solani, Glioclodium roseum, Histoplasma capsulatum, Streptomyces albums, Streptomyces griseus, and Trichophyton mentagraphytes (Figures 1 and 2).

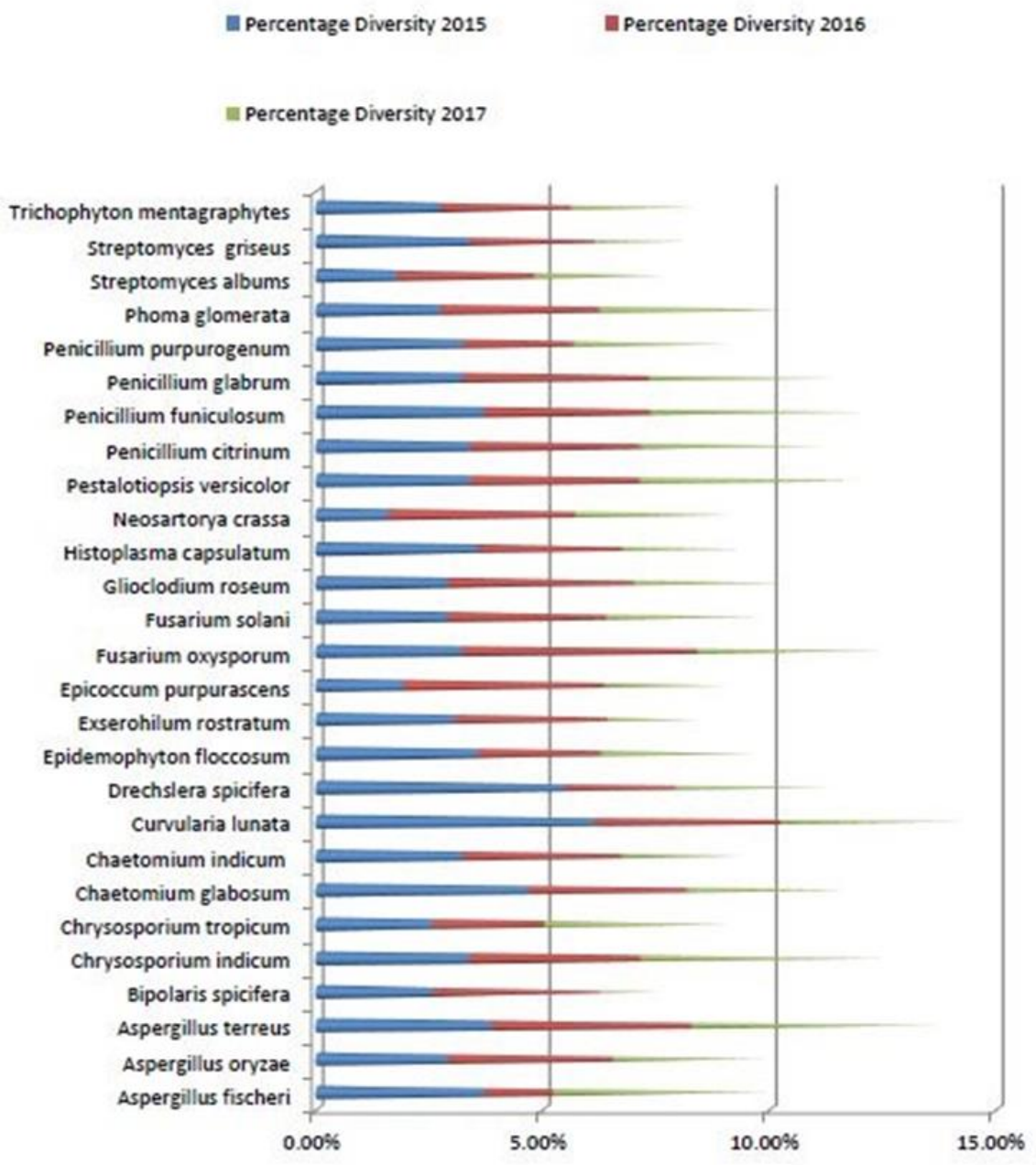

Figure 1. Percentage Diversity of Safdarjung Tomb, Delhi, (2015, 2016, 2017)

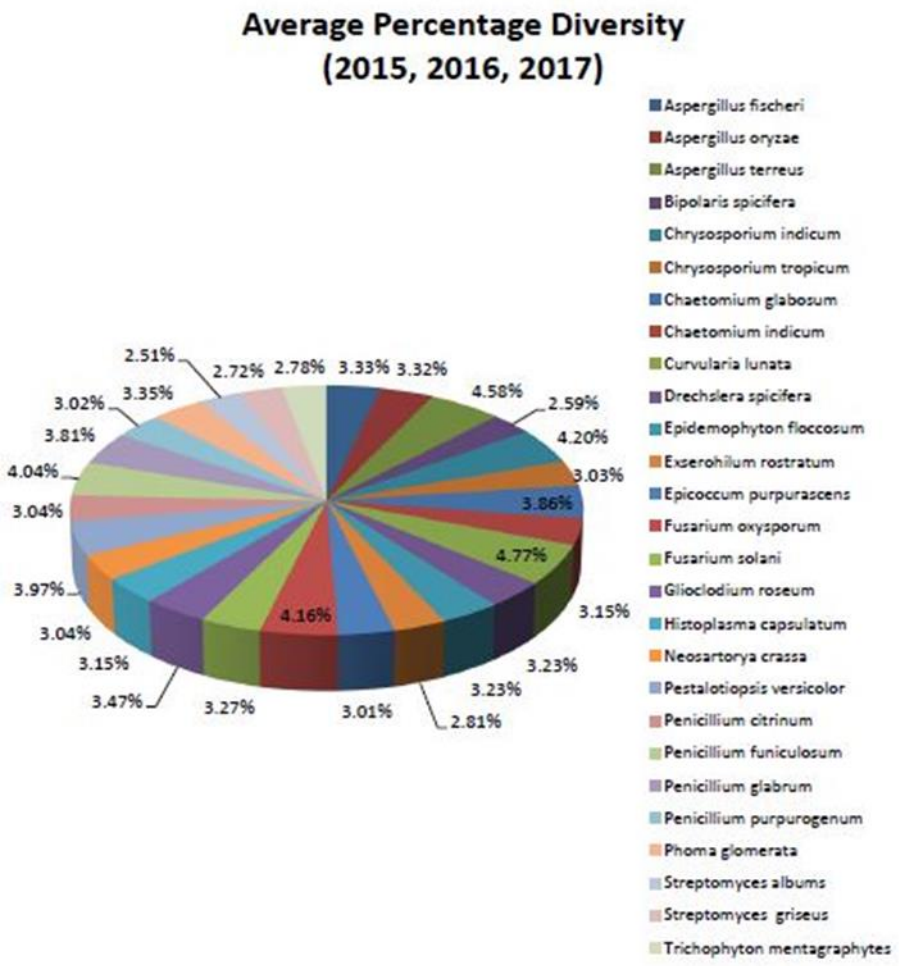

Figure 2. Average Percentage Diversity of Safdarjung Tomb, Delhi, (2015, 2016, 2017)

The fungal diversity recorded during March 2015 to February 2017 is in agreement swith the earlier findings [1,2,4,5,7,8].

CONCLUSION

The identified micro fungi cause discoloration (change in the visual appearance due to an internal reaction. It also cause mechanical exfoliation of stone material by hyphae penetration and production of different pigments[6,3] and some species produce organic acids such as *Aspergillus* sp and *Penicillium* sp. There are huge numbers of fungi which have large biochemical decay potential. In recent times, it is evident that the fungal ability to interact with minerals, metals and organic compounds by different process such as biomechanical and biochemical, makes them suited as biological weathering agents of rock and building stone. Biological and mycological investigations plays crucial role in conservation of monuments. These investigations may not be overlooked in modern conservation concept, as there is a close collaboration between art and Science. This collaboration is the comparative study of the role of microbial colonization on the degradation of historic monuments [9].

ACKNOWLEDGMENTS

We are highly thankful to Dr. P.N.Chowdhry, Director cum Principal Mycologist, National Center of Fungal Taxonomy, New Delhi (www.ncft,in) for confirming and identitifying large number of fungal cultures isolated and related scientific help during above investigations.

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