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Research Article

BOTTOM SEDIMENTS MYCOFLORA OF GANGA RIVER AT KANPUR (U.P.)

***Harshita Jaiswal and Vijay Tewari**
Department of Botany, D.G.P.G. College, Kanpur
**Author for correspondence*

ABSTRACT
The present study was carried out to study the mycoflora in sand. Sediment fungi in river environment need to improve knowledge of diversity of these microfungi in Bithoor, Ganga barrage and Jajmau sampling sites at Kanpur. The aim of this work was to isolate and identify the fungi from sand samples of these ecosystems. 36 samples of sand (surface of 20cm deep) were carried out during Jan-Dec 2009 in low to high tide. In all the 14 genera and 23 species were observed on these samples.

Key Words: *Sediment fungi, Ganga River*

INTRODUCTION
Kanpur is one of India's earliest industrial towns with varied industrial activities ranging from textile engineering and leather works. In the early times Ganga was the only source of transportation as well as the sewerage. Kanpur is the second largest city along the Ganga but the city and adjoining areas are partly sewered. Kanpur is the most polluted city in U.P. The main sources of pollution are industrial liquid-waste and effluents, domestic effluents and urban liquid waste carried through sewage and drains. Surface waste out of cultivated land contains chemical fertilizers, pesticides, manures and insecticides drained into water makes it unsafe for drinking and bathing. Festival bathing and consignment of half burnt bodies adds to pollution (Shukla and Asthana, 1995).
Biological analysis of the environment is immensely helpful in assessing the health of ecosystems. It is essentially based on the simple principal of sensitivity or tolerance of the organisms/communities to environmental changes. Due to various changes, the set pattern of specie dynamics in Ganga system gets disturbed vary greatly. The physico-chemical and biological quality of water differs in different eco-regions. Main cause of pollution of Ganga are the discharge of filth, garbage, untreated sewage, industrial effluents, residues of fertilizers, pesticides and immersion of human corpse, animal carcasses. Kanpur has a large cluster of big and small industries and Ganga is reduced to a mere trickle and is shifting its course towards Unnao. The city is facing acute problem of pollution due to a large number of tanneries, textile mills, woolen mills and jute mills. Wastes from these factories combined with domestic effluents have practically chocked Ganga at Kanpur. The water is very harmful for living beings and domestic use. The water has been found to be unfit even for bathing at Kanpur (Bilgrami, 1991). The ecology of rivers and pollution in India has been reviewed elsewhere (Bilgrami, 1986; Ajmal and Raziuddin, 1988; Sinha, 1988; Sharma *et al.,* 1993). Perhaps there exists a direct co-relation between chemical constituents of organic and inorganic nature coupled with physical attributes of the water body and microbe profile. The biology of riverine system is subject to changes in physico-chemical characteristics and complementary impacts of microbes. Involvement of microbes in self purification of water pollution and public health hazards is documented in the literature (Shukla 1989).

MATERIALS AND METHODS
Samples will be collected at locations where the river entered Kanpur and left Kanpur. Sampling sites will be carefully chosen on the basis of their significance in pollutional input and capacity of river for assimilation and self purification. Monthly sand sample carried out in Ganga water to observe fungal diversity at Kanpur stations (Bithoor, Ganga barrage and Jajmau Ghat), collected sand in sterilized polythene bags. The samples will be kept in laboratory at room temperature for isolation of sediment fungi.

Micro fungal analysis are using with slight modification dilution plate method (Waksman & Fred, 1922; Warcup, 1950; 1955 & Johnson *et al.,* 1960). Czapek's-Dox agar was used to medium for plating culture plates are incubated at 28 ± 1 ºC for 3-7 days. Colonies were counted from 3rd -7th days of plating and subculture was made in tubes having appropriate medium. The fungal forms were identified with the help of monograph and keys provided by Gillman (2008).

RESULTS AND DISCUSSION

During the present investigation, it was found that Czapek's Dox agar plate method for isolation and identification of sediment fungi. 36 samples of sand collected over one year from three different sites, have been found to contain fungi although these fungi are below the maximum values permitted at most river site. In all 14 genera have been recorded (Table 1-3). The three different sample collection stations (Bithoor, Ganga barrage & Jajmau) were selected in the river based on the extent of pollution and anthropogenic activities. From all the three sampling station, a total 23 species of fungi belonging to 14 genera were isolated from sand culture.

Table 1: Sand Culture Fungi at Bithoor

	Month											
Name of Fungus	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec.
Aspergillus flavus	+	+	-	-	+	+	+	+	+	+	+	+
A.niger	-	+	+	-	+	-	-	+	+	-	+	-
A. terreus	+	+	+	+	+	-	+	+	-	+	-	+
A. ustus	-	+	+	-	-	-	-	+	+	-	-	+
A. versicolor	+	-	+	-	-	+	-	+	+	-	+	+
A. fumigates	+	+	-	+	+	-	+	+	-	+	-	+
A. nidulans	-	+	-	-	-	-	-	-	-	+	+	+
A. candidus	-	+	+	-	-	-	-	+	+	-	-	+
Memnoniella echineta	-	+	-	-	+	+	-	-	+	-	-	-
Fusarium semitectum	-	+	+	-	+	-	+	-	+	+	-	+
F. oxysporium	-	-	-	-	+	-	+	+	-	+	+	-
Trichothesium roseum	-	+	-	-	-	-	-	-	-	-	-	-
Bipolaris sp.	+	+	-	-	+	-	-	+	-	+	-	+
Drechslera hawaiiensis	-	+	-	+	-	+	-	+	-	-	+	-
Pennicillium funiculosum	+	+	-	-	+	-	+	-	-	-	-	+
P. pinophillum	-	+	-	-	-	+	-	-	-	-	-	-
Scopulariopsis brevicaulis	-	+	-	-	-	-	-	-	-	-	-	-
Oospora sulphurea	-	+	-	-	-	-	-	-	-	-	-	-
Pullularia pullulans	-	-	-	-	-	-	-	-	-	-	-	-
Curvularia geniculata	-	-	+	+	-	-	+	-	+	-	-	+
Rhizopus sp.	-	+	-	+	-	+	-	+	-	+	-	+
Chaetomium globosum	-	+	-	-	-	-	-	-	-	-	+	-
Alternaria alternata	-	+	-	-	-	-	-	-	-	-	+	-

Ganga is known for its variance in biological fabric within short distances, and totality of fungal infestation in Entire River is unknown. Results of present investigation emphasize importance of

fungi of Ganga waters in self purification and public health hazards. Fourteen genera spread over twenty three species were isolated from the river water. The occurrence of fungal spores and hyphae in Ganga waters indicate that they are capable of utilizing the nutrients from the polluted waters. In water ecosystem fungi occupy the same functional status as bacteria, bringing about effective degradation. Bacteria induce B.O.D. reduction alone while fungi also set in degradation of phosphate and ammonia-N spilled through domestic waste. Fungi posses capability of reducing B.O.D. as well as phosphate and ammonia- N (Patil, 1979; Heremith, 1984). Therefore fungi are better degraders as compared to bacteria. Presence of fungi and yeast in the water receiving organic enrichment is of pivotal importance in self purification of water and cannot be simply ignored as contaminants (Cooke, 1977).

January: During January six species of three genera were isolated in Bithoor, nine species of six genera in Ganga barrage and nine species of five genera in Jajmau.

February: Ninteen species and twelve genera were isolated in Bithoor, thirteen species of seven genera in Ganga barrage and fourteen species of nine genera in Jajmau.

March: Three genera comprising seven species were isolated in Bithoor, four genera and four species in Ganga barrage and four species and three genera in Jajmau.

April: Five species of four genera isolated in Bithoor, three species of two genera in Ganga barrage and six species and five genera in Jajmau.

May: Nine species of five genera were isolated in Bithoor, six species of five genera in Ganga barrage and seven species of four genera in Jajmau.

Table 2: (Sand Culture Fungi at Ganga barrage)

Name of Fungus	Month											
	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec.
Aspergillus flavus	-	+	-	-	-	-	-	+	+	-	+	+
A.niger	+	-	-	-	-	-	-	+	-	-	-	-
A. terreus	+	+	-	-	-	-	+	+	-	+	-	-
A. ustus	-	+	-	+	+	+	-	-	+	+	-	-
A. versicolor	-	-	-	-	-	+	-	+	+	-	-	+
A. fumigates	+	+	-	+	+	-	+	+	-	+	+	+
A. nidulans	-	+	-	-	-	-	-	-	-	+	+	+
A. candidus	-	+	+	-	-	-	-	+	+	-	-	+
Memnoniella echineta	-	-	-	-	-	-	-	-	-	-	-	-
Fusarium semitectum	-	+	+	-	+	-	+	-	+	+	-	-
F. oxysporium	+	-	-	-	-	-	-		-	+	+	-
Trichothesium roseum	-	-	-	-	-	-	-	-	-	-	-	-
Bipolaris spc.	+	-	-	-	+	-	-	+	-	+	-	-
Drechslera hawaiiensis	-	-	-	-	-	-	-	-	-	-	+	-
Pennicillium funiculosum	+	+	-	-	+	-	+	-	-	-	+	+
P. pinophillum	+	+	-	-	-	+	-	-	-	-	+	-
Scopulariopsis brevicaulis	-	+	+	-	-	-	-	-	-	-	-	+
Oospora sulphurea	-	-	-	-	-	-	-	-	-	-	-	-
Pullularia pullulans	-	-	-	-	-	-	-	-	-	-	-	+
Curvularia geniculata	+	-	+	-	+	-	+	-	+	-	+	+
Rhizopus sp.	+	+	-	+	-	-	-	+	-	+	-	+
Chaetomium globosum	-	+	-	-	-	-	+	-	-	-	+	-
Alternaria alternata	-	+	-	-	-	-	-	-	-	-	+	+

Table 3: Sand Culture Fungi at Jajmau

Name of Fungus	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aspergillus flavus	+	+	-	-	-	-	+	+	-	+	-	-
A.niger	-	+	-	-	+	-	-	-	+	-	-	-
A. terreus	+	-	+	-	+	-	-	-	-	+	-	+
A. ustus	+	-	-	+	-	-	+	+	-	-	+	-
A. versicolor	+	-	-	-	-	+	-	+	+	-	-	-
A. fumigates	-	+	-	+	+	-	-	+	-	+	-	+
A. nidulans	-	+	-	-	-	-	-	-	-	+	+	+
A. candidus	-	+	+	-	-	-	-	+	-	-	-	+
Memnoniella echineta	-	-	-	-	-	-	-	-	+	-	-	-
Fusarium semitectum	-	+	+	-	+	-	+	-	+	+	-	-
F. oxysporium	-	-	-	-	+	-	+	+	-	+	+	-
Trichothesium roseum	+	+	-	-	-	-	-	-	-	-	-	-
Bipolaris spc.	+	+	-	-	+	-	-	+	-	+	+	+
Drechslera hawaiiensis	-	+	-	+	-	+	-	+	-	-	+	+
Pennicillium funiculosum	+	+	-	-	+	-	+	-	-	-	-	+
P. pinophillum	+	+	-	+	-	+	-	-	-	-	+	-
Scopulariopsis brevicaulis	-	-	-	-	-	-	-	-	-	-	-	-
Oospora sulphurea	-	-	-	-	-	-	-	-	-	-	-	-
Pullularia pullulans	-	-	-	-	-	-	-	-	-	-	-	-
Curvularia geniculata	-	-	+	+	-	-	+	-	+	-	-	-
Rhizopus sp.	-	+	-	+	-	+	-	+	-	+	-	-
Chaetomium globosum	+	+	-	-	-	-	+	-	-	-	+	-
Alternaria alternata	-	+	-	-	-	-	-	-	-	-	+	-

June: Six species of five genera were isolate in Bithoor, three species of two genera in Ganga barrage and four species of four genera in Jajmau.
July: Seven species of four genera were isolated in Bithoor, six species of five genera in Ganga barrage and seven species of five genera in Jajmau.
August: Eleven species of five genera were isolated in Bithoor, eight species of three genera in Ganga barrage and nine species five genera in Jajmau.
September: Eight species four genera were isolated in Bithoor, six species three genera in Ganga barrage and five species four genera in Jajmau.
October: Eight species of four genera were isolated in Bithoor, eight species four genera in Ganga barrage and eight species of five genera in Jajmau.
November: Eight species of five genera were isolated in Bithoor, ten species of seven genera in Ganga barrage and eight species of seven genera in Jajmau.
December: Twelve species of six genera were isolated in Bithoor, eleven species of seven genera in Ganga barrage and seven species of four genera in Jajmau.

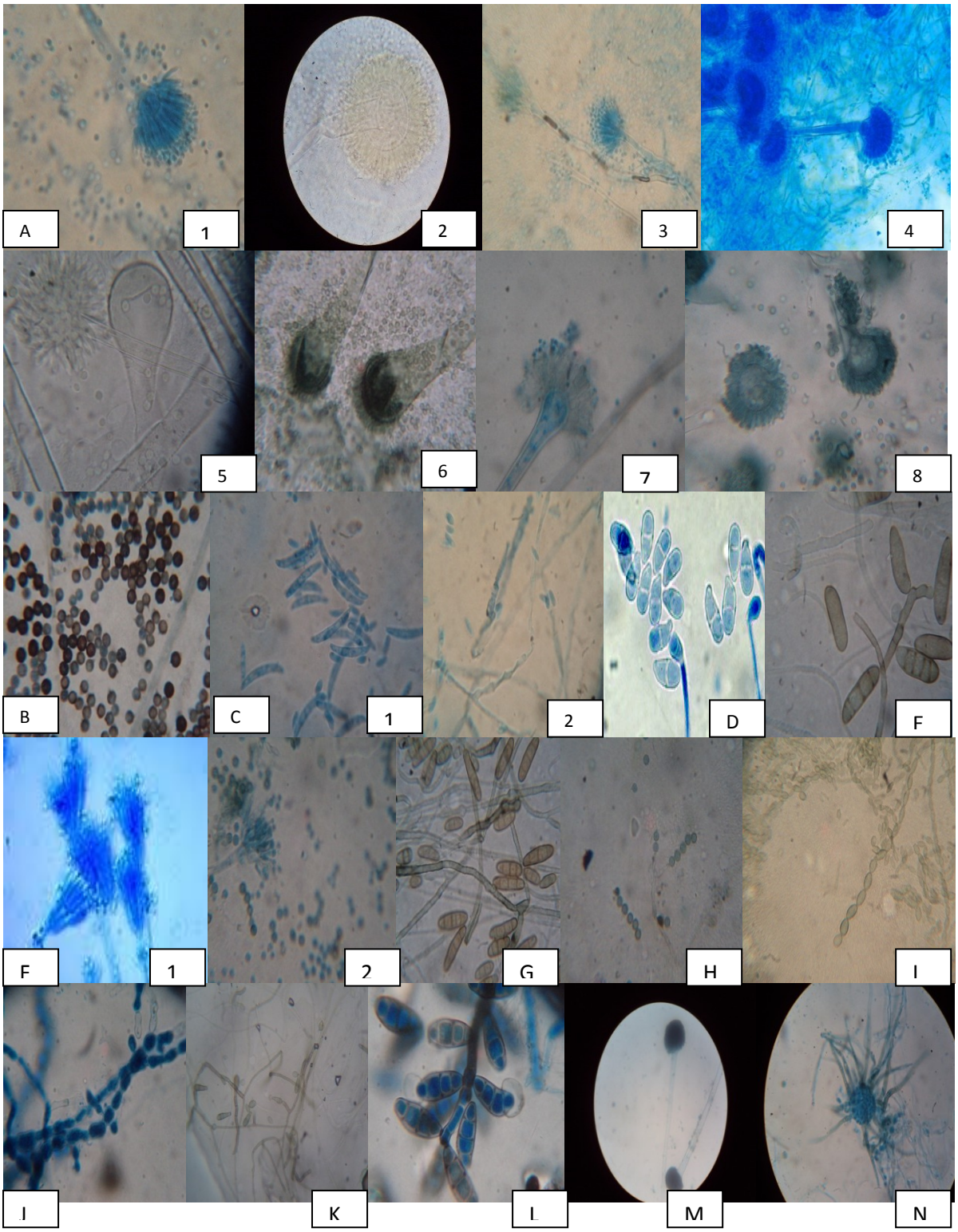

Figure A: 1. Aspergillus flavus, 2. A. niger, 3. A. terreus, 4. A. ustus, 5. A. versicolor, 6. A. fumigates, 7. A. nidulans, 8. A. candidus, **Figure B:** Memnoniella echineta, **Figure C:** 1. Fusarium semitechtum, 2. F. oxysporium, **Figure D:** Trichothecium roseum, **Figure E:** Bipolaris sp, Fig.-F: 1. Penicillium feniculosum, 2. P. pinophilum, **Figure G:** Drechslera hawiiensis, **Figure H:** Scopulariopsis brevicaulis, **Figure I:** Oospora sulphurea, **Figure J:** Pullularia pullulans, **Figure K:** Alternaria alternate, **Figure L:** Curvularia geniculata, **Figure M:** Rhizopus sp., **Figure N:** Chaetomium globosum.

The sand of river Ganga supports 14 genera spread over 23 species. Species of genera *Aspergillus, Fusarium, Pennicillium, Curvularia, Rhizopus, Chaetomium and Alternaria* comprise a group of allergenic fungi isolated during present investigation. *Aspergillus sp. and Penicillium sp*. cause athlete's foot. *Aspergillus sp. Penicillum sp. and Rhizopus sp.* cause otomycosis. *Aspergillus fumigates, A. flavus and A. terreus* cause aspergillosis. Certain allergenic disease like allergenic rhinitis, bronchial asthma, hypersensitivity and pneumonitis are caused by fungal organisms like *Curvularia sp., Aspergillus sp. and Fusarium sp*. Presence of such fungi in Gnaga is of pivotal significance from view point of infections in both animals and human beings, thereby posing public health problems. The fungi are also involved in self-purification of water. During investigations two fungal genera including *Bipolaris sp.and Drechslera sp.* were recorded and involved in self purification of water (Shukla and Asthana, 1995).

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