Journal of Phytology 2011, 3(4): 30-34
ISSN: 2075-6240
www.scholarjournals.org

www.journal-phytology.com

JP-Microbiology

Occurrence of Fungi in Pond Water (Dumaratarai Talab) of Raipur City, C.G., India

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Article Info

Article History

Received : 18-03-2011
Revised : 30-03-2011
Accepted : 05-04-2011

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Summary

Raipur is the capital town of the newly formed state of Chhattisgarh. Various types of spore producing fungi are present in pond water. During the period of present investigation overall total 91 fungal species (362 colonies) belonging to 45 fungal genera are isolated from Dumaratarai Talab ponds of Raipur city. Maximum numbers of fungal species are isolated during winter season, moderate in rainy season and minimum is summer season. Maximum (32 fungal species) numbers of fungal species are isolated in December month and minimum (05 fungal species) in March. All these fungi are highly adaptable to this pond water environment.

Introduction

Fungi have been recovered from diverse, remote and extreme aquatic habitats including lakes, ponds, rivers, streams, estuaries, marine environments, wastewaters, sludge, rural and urban storm water runoff, well waters, acid mine drainage and aquatic sediments (APHA, 1989; and Arvanbitidou *et.al.*, 1999). The fungi encountered in fresh water are divided into two principal groups. The Hydro fungi which require the presence of water to complete their life cycle and geo-fungi or typical soil fungi which were not specially adopted to aquatic existence, but they might be found in water because of adequate supply of nutrients, these were regarded as "Facultative aquatic fungi" (Cooke 1963). Pathogenic fungus predominantly exists in soil as moulds and generates spores. These spores dispersal may be achieved by the physical mechanisms of gravity, wind, water and animals. Spores present in air are settled down to soil with the help of rainwater. From soil they are carried off by rainwater to ponds and associated wetland where they contaminate water. Use of such contamination water may lead to outbreaks of serious health problem (diseases) to human, animal populations (Milan et al., 2005; Mirian Ueda et al., 2007 and Mohammad et al., 2007) and plants (Khulbe, 2001; Rangaswami et al., 2004). The aquatic fungi also play a key role in the decomposition of leaf litter and plant remains in aquatic environments (Barlocher, 1992; Gessner, Chauvet & Dobson, 1999). Majority of them play a vital role in degradation of complex organic matter in simple one and recycling of nutrients.

Knowledge of the total diversity of fresh waters is woefully incomplete – particularly among lower organism, and especially in tropical latitudes that support most of the world's species (Dudgeon *et al.,* 2005). Ever since fungi began to be studied nearly two centuries ago, new species have been described from the tropics, although the discovery rate has steadily declined. Today fewer scientists are engaged in exploration, differentiation, collection, identification, nomenclature, comparison and classification (Vane-Wright, 1992 and Hyde and Hawksworth, 1997) of fungi. The present paper deals with the study of distribution and seasonal variation of fungi in pond water.

Materials and Methods

Raipur is the capital town of the newly formed state of Chhattisgarh, the 26th state of Indian democracy. Raipur has a sub-tropical climate; temperatures remain moderate for most of the year. The seasonal climate of Raipur city is extremely hot and dry in summer season (March to June), hot and humid in rainy season (July to October) and cool and dry in winter season (November to February). In summer season temperature of city are ranged between 29^0C-45^0 C ($\pm 2^0$C), where as in winter between 08^0C-27^0C ($\pm 2^0$C). Raipur city receives about 1300 mm of rain, mostly in monsoon season from late June to early October.

There are lots of ponds present in Raipur city. Dumaratarai Talab is located in the suburbs in the south of Raipur city. During present study Petriplate method containing potato dextrose agar (PDA) media has been adopted for survey of pond water fungi. The survey is conducted for one year March 2007 to February 2008.

Results and Discussion

During the period of present investigation overall total 91 fungal species (362 colonies) belonging to 45 fungal genera are isolated from Dumaratarai Talab ponds of Raipur city. Out of 91 fungal species, 06 fungal species (11 colonies) belongs to 04 fungal genera of Zygomycotina, 06 fungal species (29 fungal colonies) belongs to 06 fungal genera of Ascomycotina, 76 species (315 fungal colonies) belongs to 34 fungal genera of Anamorphic fungi and 03 fungal species (07 fungal colonies) belongs to 01 fungal genera of Mycelia sterilia are observed (Table-1).

Table-1: Showing number of fungal colonies of water mycoflora of Dumaratarai Talab ponds water

No	NAME OF FUNGI	SUMMER					RAINY					WINTER					G. Tot.
		Mar	April	May	June	Tot.	July	Aug	Sep	Oct.	Tot.	Nov	Dec	Jan	Feb	Tot.	
A	*Zygomycotina*																
1	*Absidia corymbifera*	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
2	*Absidia* sp.	0	0	0	0	0	0	0	0	1	1	0	1	0	1	2	3
3	*Mucor racemosus*	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
4	*Rhizopus nigricans*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
5	*R. oryzae*	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
6	*Syncephalastrum racemosum*	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	3
Total number of collonies		0	0	1	1	2	0	2	1	2	5	0	1	1	2	4	11
Total number of species		0	0	1	1	2	0	1	1	2	4	0	1	1	2	3	6
Total number of genera		0	0	1	1	2	0	1	1	2	3	0	1	1	2	3	4
B	Ascomycotina																
1	*Chaetomium* sp. I	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	2
2	*Emericella nidulans*	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3
3	*Neoarachnotheca keratinophila*	1	0	3	6	10	0	2	4	1	7	0	0	0	0	0	17
4	*Neosartoria fischeri*	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	2
5	*Thielavia appendiculata*	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	4
6	*Wolkia decolorans*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
Total number of colonies		2	0	4	9	15	0	2	4	1	7	2	4	0	1	7	29
Total number of species		2	0	2	2	4	0	1	1	1	1	2	2	0	1	4	6
Total number of genera		2	0	2	2	4	0	1	1	1	1	2	2	0	1	4	6
C	Anamorphic																
1	*Acremonium persicinum*	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
2	*A. recefi*	0	0	0	0	0	2	0	0	0	2	0	3	0	0	3	5
3	*A. strictum*	0	0	0	1	1	0	0	0	0	0	1	2	0	0	3	4
4	*A. terricola*	0	0	0	0	0	1	0	1	0	2	0	1	0	0	1	3
5	*Aspergillus candidus*	0	0	0	0	0	0	0	0	5	5	1	1	0	0	2	7
6	*A. carneus*	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	2
7	*A. flavus*	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2
8	*A. fumigatus*	9	7	0	8	24	0	0	0	0	0	0	0	0	1	1	25
9	*A. Japonicus*	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	4
10	*A. luchuensis*	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
11	*A. niger*	0	1	0	4	5	3	1	0	0	4	0	0	1	2	3	12
12	*A. niveus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
13	*A. ochraceus*	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
14	*A. oryzae*	0	0	0	2	2	0	1	0	0	1	0	0	0	0	0	3
15	*A. speluneus*	0	0	0	2	2	1	0	0	0	1	0	2	0	0	2	5
16	*A. sydowi*	0	0	0	0	0	1	0	2	1	4	2	7	2	0	11	15
17	*A. terreus*	0	1	0	1	2	0	1	0	1	2	1	2	1	0	4	8

18	*A. versicolor*	0	0	0	0	0	0	10	0	1	11	4	0	0	0	4	15
19	*Aspergillus* sp. I	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1
20	*Aspergillus* sp. II	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
21	*Aspergillus* sp. III	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
22	*Aureobasidium pullulans*	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	2
23	*Candida* sp.I	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
24	*Candida* sp.II	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	3
25	*Chaetophoma quercilifolia*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
26	*Chalaropsis thielavioides*	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
27	*Chrysosporium tropicum*	0	2	0	1	3	0	0	0	0	0	1	0	0	0	1	4
28	*Cladosporium cladosporoides*	0	0	0	0	0	0	0	0	3	3	11	3	3	0	17	20
29	*C. herbarum*	0	0	0	0	0	0	0	0	0	0	0	6	1	0	7	7
30	*C. sphaerospermum*	0	0	0	0	0	0	1	0	0	1	5	12	1	10	28	29
31	*Colletotrichum gloeosporioides*	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2
32	*Corynespora* sp.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
33	*Cylindrocarpon* sp.	0	0	0	0	0	0	0	0	0	0	0	3	1	0	4	4
34	*Endobotryella oblong*	0	0	0	0	0	0	1	0	0	1	0	10	0	0	10	11
35	*Fusarium moniliforme*	0	0	0	0	0	1	1	3	0	5	0	0	0	0	0	5
36	*F. oxysporum*	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2
37	*F. solani*	0	0	0	0	0	2	2	0	0	4	2	4	0	0	6	10
38	*Fusarium* sp. I	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2
39	*Geotrichum* sp.	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	3
40	*Gliocladium* sp.	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
41	*Graphium* sp.	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
42	*Helicocephalum sareophilium*	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
43	*Helicoma* sp.	0	0	0	0	0	0	0	3	0	3	1	0	0	0	1	4
44	*Macrophomina phaseolina*	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	2
45	*Memnoniella echinata*	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
46	*Moniliella* sp.	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
47	*Myridontium kerotinaphilum*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
48	*Nigrospora oxyzae*	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
49	*N. sphaerica*	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
50	*Penicillium digitatum*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
51	*Penicillium frequentans*	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
52	*P. multicolor*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
53	*P. notatum*	0	0	1	2	3	0	0	0	0	0	0	0	0	1	1	4
54	*P. oxalicum*	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
55	*P. purpurascens*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
56	*P. purpurogenum*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
57	*P. rubrum*	0	0	0	0	0	0	0	0	0	0	2	2	0	0	4	4
58	*Penicillium* sp. I	0	0	0	0	0	0	1	0	4	5	0	6	0	1	7	12
59	*Penicillium* sp. II	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	2

60	*Penicillium* sp. III	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2
61	*Phoma eupyrena*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
62	*P. exigua*	0	0	0	0	0	0	2	1	1	4	0	0	0	0	0	4
63	*P. medicaganis*	0	0	0	0	0	4	0	2	0	6	0	2	0	2	4	10
64	*P. sorghina*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
65	*Phoma* sp.	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	5
66	*Phomopsis* sp. I	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2
67	*Sclerococcum sphaerale*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2
68	*Scopulariopsis cinereus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
69	*Scytalidium* sp.	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	2
70	*Trichoderma atroviride*	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
71	*T. viride*	0	0	1	0	1	0	1	4	1	6	0	0	0	0	0	7
72	*Trichoderma* sp.	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	2
73	*Trichothecium roseum*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
74	Unknown - I	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
75	*Verticillium lamellicola*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
76	Yeast	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	2
Total number of collonies		11	13	3	24	51	20	31	28	27	106	43	83	12	20	158	315
Total number of species		2	6	3	11	16	13	19	13	15	44	19	29	9	9	46	76
Total number of genera		2	3	3	4	8	9	13	7	9	21	14	14	5	6	23	34
D	Mycelia sterilia																
1	Mycelia sterilia	0	0	0	0	0	2	1	0	0	3	2	0	0	0	2	5
2	Mycelia sterilia	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
3	Mycelia sterilia	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total number of colonies		1	0	0	0	1	2	1	0	0	3	2	1	0	0	3	7
Total number of species		1	0	0	0	1	1	1	0	0	1	1	1	0	0	2	3
Total number of genera		1	0	0	0	1	1	1	0	0	1	1	1	0	0	1	1
GRAND TOTAL	Number of colonies	14	13	8	34	69	22	36	33	30	121	47	89	13	23	172	362
	Number of species	5	6	6	14	23	14	22	15	18	50	22	33	10	12	55	91
	Number of genera	5	3	6	7	15	10	16	9	12	26	17	18	6	9	31	45

The fungal population was not homogenous throughout the year and show seasonal variation. Effect of season on occurrence and distribution of pond water fungi are also observed. Meteorological conditions play a very important role in the occurrence of water fungi in ponds. Maximum numbers of fungal species 55 fungi species (172 colonies) belonging to 31 fungal genera are recorded during winter season (Table-1). Their occurrence is attributed to the suitable low temperature and stagnancy of the water, which provides better chances to harbour fungal spores, enhancing their chances of germination, growth and survival on dead and decaying organic matter lying at the bottom (Singh and Wadhwani, 1989). Optimum temperature from 20^0C to 30^0C is most suitable for the growth of higher fungal species (Khulbe *et al.*, 2000). Highest counts of filamentous fungi were also found by Goncalves *et al.* (2006) in winter months.

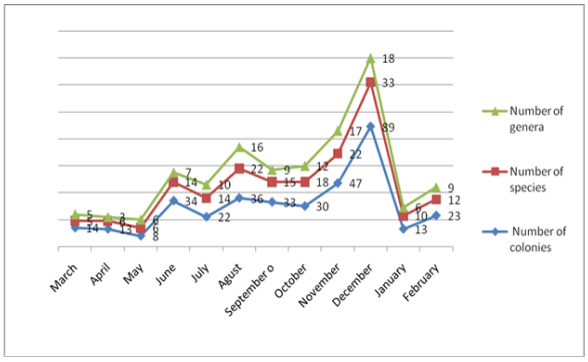
Moderate numbers of fungal species, 50 fungal species (121 colonies) belonging to 26 genera are found in rainy season (Table-1). This can be explained as during rainy season, there is continuous inflow or outflow of water in the ponds that dilutes the organic matter and mobilizes the nutrients haphazardly. Due to this the proper nidation of fungus doesn't occur, leading to their decreased number.

While minimum number of fungal species 23 fungi species (69 colonies) belonging to 15 fungal genera is recorded during summer season in ponds (Table-1). The strong summer insolation together with low water was the most important factor responsible for the summer reduction of fungi (El-Hissy, 1982). Higher temperature show lethal effect on the growth of fungi.

Maximum number 33 fungal species (89 colonies) of 18 fungal genera are recorded in the month of December. Which is followed by 22 fungal species (47colonies) of 17 fungal genera, 22 fungal species (36 colonies) of 16 fungal genera, 18 fungal species (30 colonies) of 12 fungal genera, 15 fungal species (33 colonies) of 09 fungal genera, 14 fungal species

(34 colonies) of 07 fungal genera, 14 fungal species (22 colonies) of 10 fungal genera, 12 fungal species (23 colonies) of 09 fungal genera, 10 fungal species (13 colonies) of 06 fungal genera, 06 fungal species (13 colonies) of 03 fungal genera and 06 fungal species (08 colonies) of 06 fungal genera in the month of November, August, October, September, June, July, February, January, April and May respectively (Figure- 1). Minimum number 05 fungal species (14 colonies) of 05 fungal genera are found in the month of March.

Figure- 1 showing monthly distribution of number of genera, species and colonies



The occurrence of large variety of fungal species in the pond water system indicates a dynamic and diverse fungal community. The majority of species identified from the water seems well adapted for survival in this environment and highly effluence by external atmospheric condition (Srivastava, 1967 and Khulbe *et al.* 2000).

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