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## Occurrence of Zoosporic fungi in some water bodies of Jabalpur, Madhya Pradesh

RP Mishra and AK Singh

### Abstract

The study on occurrence of zoosporic fungi in fresh water bodies of Jabalpur was conducted during January, 2010 to December, 2011. Monthly samples of water and decaying material were collected from Hanumantal pond, Supatal pond, Gour river and Narmada river. Baiting technique involving seeds of hemp, wheat, rice, oat, mustard; grass blades, apple fruits, nails, snake skin, pine pollen etc, revealed 23 species of zoosporic fungi. Maximum number of species were isolated on snake skin followed by hemp seeds and grass blades. Hanumantal pond revealed highest species richness (15 species) followed by Gour river (13 species), Supatal pond (12 species) and Narmada river (11 species). Seasonal analysis revealed maximum number of species during monsoon and minimum during summer. *Saprolegnia uliginosa* had highest frequency (53.1%) and *Balstocladella variabilis*, *Cladochytrium setigerum* and *Isoachlya* sp. each had lowest frequency (1%).

**Keywords:** Zoosporic fungi, baiting technique, water bodies

### 1. Introduction

Fungi are eukaryotic heterotrophic organisms, including both single-celled yeasts and multi-cellular filamentous fungi. Fungi producing zoospores are known as zoosporic fungi. Zoospore is a cytoplasmic mass surrounded by plasma membrane and bears flagella for floating and swimming. Their size ranges from 3 to 8  $\mu\text{m}$  in diameter. They are very sensitive to mechanical and osmotic shocks, as well as to temperature. By virtue of these characteristics, zoosporic fungi are not able to survive in extreme environmental condition<sup>[1]</sup>. The zoosporic fungi are commonly called as “water moulds” and belonged to class – Phycomycetes. They play a great role in decomposition and mineralization of organic matter, self-purification of water body, regulation of insect abundance and in causing the infectious disease in aquatic animals and plants<sup>[2, 3]</sup>. Zoosporic fungi are present worldwide in the soil, fresh water and marine ecosystems. There is scarcity of zoosporic fungi in sewage and heavily polluted water bodies. The purpose of the present investigation was to assess the species richness and occurrence of zoosporic fungi in pond and river ecosystems of Jabalpur, India.

### 2. Material and Methods

The monthly survey of the four water bodies i.e. Hanumantal pond, Supatal pond, Gour river and Narmada river of Jabalpur city were made during January, 2010 to December, 2011 to collect water samples, submerged decaying plants and animal remains. About 50 ml of water sample was collected in sterilized glass bottles. The decaying materials were collected in sterile polythene bags. The 5 gm of decaying material was put in the petriplates and put 10 ml of distilled water. The each sample (water as well as sediment suspension) was baited in petriplate with boiled seeds of hemp (*Cannabis sativa*), wheat (*Triticum aestivum*), rice (*Oryza sativa*), oats (*Avena sativa*), mustard (*Brassica campestris*), boiled grass blades (*Cynodon dactylon*), apple fruits (*Malus pumila*), snake skin & nails, (acetone treated) and ethylene oxide treated dusty pine pollens. The plates were incubated at 20°C for 10 days to support fungal growth. The baits showing fungal colonization were transferred to fresh petridishes and fresh baits were added. The water of the petriplate was replaced by fresh one periodically after an interval of 3 days. The baits along with mycelial growth were washed with sterile water several times in order to remove soil particles, protozoa, bacteria and other microbes.

The zoosporic fungi were identified under light microscope at 100X and 400X magnification by observing the fungal material kept in a drop of water under coverslip. The identification was done with the help of literature and relevant research papers<sup>[4, 5, 6]</sup>. The fungal frequency was calculated by the following formula.

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$$\text{Frequency (\%)} = \frac{\text{No. of samples showing presence of a fungus}}{\text{Total number of samples analyzed}} \times 100$$

Duncan's multiple range test using SPSS software (Statistical Package for Social Sciences) was worked out to assess the difference in the fungal occurrence in different sites as well as in different seasons.

### 3. Results and Discussion

Baiting technique of the 96 water samples and decaying material collected from four different water bodies resulted 23 species of zoosporic fungi as presented in Table 1-4. The order Peronosporales made highest contribution (30.4%) to species richness followed by Chytridiales (26.1%), Saprolegniales (26.1%), Blastocladiiales (13%) and Monoblepharidiales (4.4%). The maximum number of species were isolated on snake skin followed by hemp seeds and grass blades. Species richness also varied in different sites and seasons. Hanumantal pond revealed highest richness (15 species) followed by Gour river (13 species), Supatal pond (12) species and Narmada river (11 species). Duncan's multiple range test (DMRT) for the assessment of difference in the fungal occurrence in different sites revealed two homogenous groups i.e. (i) Narmada river, Gour river and Supatal pond as  $P = 0.698 > 0.05$ , and (ii) Gour river, Supatal pond and Hanumantal pond as  $P = 0.057 > 0.05$ .

The seasonal analysis (envolving two month in each season) of species richness revealed highest value (17 species) during monsoon (July - August) followed by winter (December -

January) (14 species), post-monsoon (October – November) (12 species), spring (February – March) (12 species) and summer (April – May) (7 species). The DMRT test for seasonal analysis revealed three homogenous groups i.e. (i) summer (ii) spring, winter and post-monsoon and (iii) monsoon at  $\alpha = 0.05$ .

The highest species richness in monsoon may be attributed to influx of rain water which brings soil borne zoosporic fungi into the water body. The majority of the physico-chemical parameters of water also become favorable during this season. The lowest species richness during summer might be due to the high temperature and other unfavorable physico-chemical conditions.

The frequency of occurrence of zoosporic fungi varied in different water bodies. *Phytophthora erythroseptica* was most frequent fungus in Hanumantal (79.2%) and Supatal pond (83.3%). *Pythium debaryanum* had highest frequency in Gour river (83.3%) whereas *Pythium tenue* had 100% frequency in Narmada river. The consolidated mean frequency of four water bodies shows different picture. *Saprolegnia uliginosa* rank first in terms of highest frequency (53.1%). *Phytophthora erythroseptica* (40.6%) and *Saprolegnia anisospora* (37.5%) ranked second and third respectively. *Blastocladiella variabilis*, *Cladochytrium setigerum* and *Isoachlya* sp. each had lowest frequency (1%). Seasonal analysis indicates maximum frequency during monsoon followed by post-monsoon, winter, spring and summer. The similar conclusions have also been drawn by other scientist [7, 8, 9].

**Table 1:** Occurrence of zoosporic fungi in Hanumantal pond during January, 2010 to December, 2011.

S. No.	Fungi	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Baits
		2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	
(A)	Blastocladiiales																									
1	<i>Blastocladia pringsheimii</i>	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	Snake skin
2	<i>Blastocladiella simplex</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	<i>Blastocladiella variabilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(B)	Chytridiales																									
4	<i>Cladochytrium setigerum</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Grass blade
5	<i>Nowakowskiella elegans</i>	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Apple fruit
6	<i>Olpidium pendulum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	<i>Rhizophydium coronum</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	Snake skin
8	<i>Rhizophlyctis chitinophila</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	<i>Rhizophlyctis rosea</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	Snake skin
(C)	Monoblepharidiales																									
10	<i>Gonapodya prolifera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	+	+	+	-	-	Apple fruit
(D)	Peronosporales																									
11	<i>Phytophthora cryptogea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	<i>Phytophthora erythroseptica</i>	+	+	+	+	+	+	-	+	-	+	+	+	-	+	-	-	+	+	+	+	+	+	+	+	Grass blades
13	<i>Phytophthora parasitica</i>	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	Apple fruit





**Table 4:** Occurrence of zoosporic fungi in Narmada river during January, 2010 to December, 2011.

S. No.	Fungi	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Baits
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	
(A)	Blastocladales																									
1	<i>Blastocladia pringsheimii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	<i>Blastocладиella simplex</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	<i>Blastocладиella variabilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	Snake skin
(B)	Chytridiales																									
4	<i>Cladochytrium setigerum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	<i>Nowakowskiella elegans</i>	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Apple fruit
6	<i>Olpidium pendulum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	Pine pollen grain
7	<i>Rhizophyidium coronum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	<i>Rhizophlyctis chitinophila</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	<i>Rhizophlyctis rosea</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	+	-	-	-	-	-	-	Snake skin
(C)	Monoblepharidiales																									
10	<i>Gonapodya prolifera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(D)	Peronosporales																									
11	<i>Phytophthora cryptogea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	Mustered seed
12	<i>Phytophthora erythroseptica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	<i>Phytophthora parasitica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	<i>Pythium debaryanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	<i>Pythium mammillatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	<i>Pythium proliferum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	<i>Pythium tenue</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Black ant
(E)	Saprolegniales																									
18	<i>Achlya klebsiana</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	-	+	-	+	+	Wheat
19	<i>Isoachlya sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	<i>Saprolegnia anisospora</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	-	+	+	+	-	+	-	-	Grass blade
21	<i>Saprolegnia declina</i>	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-	Grass blade
22	<i>Saprolegnia parasitica</i>	+	-	+	-	+	+	-	-	-	-	-	-	+	+	-	+	+	+	-	-	-	-	-	-	Hemp seed
23	<i>Saprolegnia uliginosa</i>	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-	+	-	Mustered seed
	Total occurrence	6	5	4	3	3	4	1	1	1	1	1	1	5	5	6	8	6	7	6	4	4	3	3	3	

+ = present, - = absent

**Table 5:** Frequency (%) of zoosporic fungi in four water bodies during January, 2010 to December, 2011.

S. No	Species	Hanumantal pond	Supatal pond	Gour River	Narmada river	Mean frequency
(A)	Blastocladales					
1	<i>Blastocladia pringsheimii</i>	33.3	0.0	33.3	0.0	16.7
2	<i>Blastocладиella simplex</i>	0.0	8.3	8.3	0.0	4.2
3	<i>Blastocладиella variabilis</i>	0.0	0.0	0.0	4.2	1.0
(B)	Chytridiales					
4	<i>Cladochytrium setigerum</i>	4.2	0.0	0.0	0.0	1.0
5	<i>Nowakowskiella elegans</i>	25.0	0.0	0.0	25.0	12.5
6	<i>Olpidium pendulum</i>	0.0	0.0	33.3	50.0	20.8
7	<i>Rhizophyidium coronum</i>	12.5	16.7	16.7	0.0	11.5
8	<i>Rhizophlyctis chitinophila</i>	0.0	16.7	12.5	0.0	7.3
9	<i>Rhizophlyctis rosea</i>	25.0	25.0	0.0	20.8	17.7
(C)	Monoblepharidiales					
10	<i>Gonapodya prolifera</i>	25	25.0	0.0	0.0	12.5

(D)	Peronosporales					
11	<i>Phytophthora cryptogea</i>	0.0	0.0	0.0	8.3	2.0
12	<i>Phytophthora erythroseptica</i>	79.2	83.3	0.0	0.0	40.6
13	<i>Phytophthora parasitica</i>	62.5	0.0	41.7	0.0	26.0
14	<i>Pythium debaryanum</i>	0.0	0.0	83.3	0.0	20.8
15	<i>Pythium mammillatum</i>	8.3	0.0	8.3	0.0	4.2
16	<i>Pythium proliferum</i>	58.3	37.5	0.0	0.0	24.0
17	<i>Pythium tenue</i>	0.0	0.0	0.0	100.0	25.0
(E)	Saprolegniales					
18	<i>Achlya klebsiana</i>	50.0	41.7	0.0	37.5	32.3
19	<i>Isoachlya</i> sp.	0.0	0.0	4.2	0.0	1.0
20	<i>Saprolegnia anisospora</i>	41.7	41.7	41.7	25.0	37.5
21	<i>Saprolegnia declina</i>	20.8	29.2	33.3	33.3	29.2
22	<i>Saprolegnia parasitica</i>	33.3	25.0	25.0	37.5	30.2
23	<i>Saprolegnia uliginosa</i>	58.3	58.3	58.3	37.5	53.1
	Total no. of species	15	12	13	11	

Frequency= No. of species positive sample ÷ total no. of sample i.e. 24 (2 sample / month) × 100

#### 4. Conclusion

The isolation and identification of only 23 zoosporic fungi indicate either poor species richness or use of inappropriate baits/isolation technique. Peronosporales made highest contribution (30.4%) and Monoblepharidales the least (4.4%). Hanumantal pond located within the city showed highest species richness and the river Narmada the least. Monsoon season revealed maximum number of species and summer the minimum. *Saprolegnia uliginosa* was most frequent fungus.

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