Biosciences, Biotechnology Research Asia Vol. **3**(2), 317-324 (2005)

OCCURRENCE, FREQUENCY AND PERIODICITY OF WATERMOLDS IN THREE SELECTED WATER BODIES OF MADHYA PRADESH (INDIA) WITH SPECIAL REFERENCE TO SOME AMBIENT BIOTIC PARAMETERS

J. Krishna Prasad, T. A. Qureshi and S. A. Mastan

Department of Applied Aquaculture, Barkatullah University, Bhopal - 462 026 (India)

(Received: November 02, 2005; Accepted: December 07, 2005)

ABSTRACT

Investigations have been carried out on occurrence, frequency and periodicity of aquatic fungi in three selected water bodies namely Upper lake, Sarangpani lake and Chiklod reservoir of Bhopal region (Madhya Pradesh). The present study was conducted from August 2004 to July 2005. Water samples were collected every month from selected sites of three water bodies for the isolation of aquatic fungi. Similarly, physico---chemical parameters of water were also analyzed throughout study period. A total of twenty species of aquatic fungi belonging to eight genera were recorded from three selected water bodies. The isolated fungi are identified as *Achlya americana, A. flagellata, A. klebsiana, A. prolifera, Achlya* sp., *Aphanomyces* sp., *Allomyces anomalus, Aspergillus* sp., *Dictyuchus monosporus, D. achlyoids, Pythium aphanidermatum, P. undulatum, P. afertile, Saprolegnia diclina, S. ferax, S. hypogyana, S. parasitica, S. monoica, Saprolegnia* sp., and *Leptolegnia* sp. The occurrence, frequency and periodicity of fungi were also recorded.

The maximum number of fungi was recorded during winter months while the minimum in summer months. Seasonal variations , in the abundance of these fungi have been observed. Although, the variations in their abundance depend on several physio-chemical parameters of water but the temperature is found to be the governing factor.

Key words: Watermolds, occurrence, frequency and periodicity.

INTRODUCTION

Reservoirs constitute the prime inland fishery resources in the central and southeast India. Sufficient work has been done on the watermolds of lakes and ponds in India by Dayal and Tandon (1962), Khulbe and Bhargava(1977) and Manoharacharya (1991). The work on the watermolds of rivers and reservoirs is scanty. Notable work on this aspect is that of Barlocher (1992).

Ecological information on aquatic fungi is meager in India. Watermolds play an important role in the litter decomposition, simplification of organic matter and contribute to the energy flow and productivity of aquatic ecosystem. The importance of mycological studies of aquatic habitats has been emphasized abroad by Sparrow (1968), Alabi (1971), Dick (1976), Fox and Wolf (1977), Qureshi et al.(1995,1999,1999,1999,2001,2002) and Vikas et al (2004). There are quite a few reports on the ecology of aquatic fungi from various countries. However, Indian workers on this aspect have given very little attention.

Occurrence of watermolds in relation to seasons, temperature and hydrogen ion-concentration has been studied by a number of workers including Coker (1923), Lund (1934), Forbes (1935), Milovtsova (1935), Wolf and Wolf (1941), Waterhouse (1942), Naumov (1954), Rossy – Valdderrma (1956), Ziegler (1958), Perrott (1960), Sparrow (1960), Suzuki and Hatakeyama (1960), Dick & Newby (1961), Hughes (1962), Roberts (1963) and Alabi (1971). They observed that

watermolds showed seasonal periodicity and that their distribution got influenced by temperature and hydrogen ion concentration of the habitats.

Khulbe and Bhargava (1977) have made studies on the watermolds of temperate region while the distribution of watermolds in some tropical waters has been worked out by Dayal and Tandon (1962) and Srivastava (1967). Therefore, an attempt has been made in the present investigation on three selected water bodies of Madhya Pradesh, to study the occurrence, frequency and periodicity watermolds in relation to various physico-chemical factors.

MATERIALS AND METHODS

Surface water samples from Upper lake, Sarangpani lake and Chiklod reservoir were collected once in a month from two sampling stations fixed on each water body for one year from August, 2004 to July, 2005 and brought to the laboratory for analysis. The samples were poured separately in sterilized petridishes and baited with sterilized hamp seeds, house flies and grass leaves etc. After 24 - 48 hrs, each bait was removed and washed with distilled water and placed in small petridishes containing distilled water. All the petri dishes, water and baits used were sterilized. After 48 hrs, growth of each isolate was observed. Pure culture of each species was made with the help of single hyphal culture method. To avoid the bacterial contamination , fungal colonies were treated with Potassium tellurite (0.01%) or Streptopenicillin (0.1%) All the cultures were maintained at room temperature (15 - 20°C). Species were identified with the help of monographs of Coker (1923), Coker and Matthews (1937), Johnson (1956), Sparrow (1960) and Scott (1961). Khulbe(1977) and Khulbe and Kaur (1998). The obtained data was analyzed statistically by using Karl Pearson's correlation coefficient and linear regression equation.

RESULTS

Twenty species of watermolds belonging to eight genera were isolated from the three lakes investigated. The list of fungi isolated is given in Table – 1.

In Upper lake, a total of 20 species of aquatic fungi viz. *Achlya americana, A. flagellata, A. klebsiana, A. prolifera, Achlya* sp., *Aphanomyces* sp., *Allomyces anomalus, Aspergillus* sp., *Dictyuchus monosporus, D. achlyoids, Pythium aphanidermatum, P. undulatum, P. afertile, Saprolegnia diclina, S. ferax, S. hypogyana, S. parasitica, S. monoica, Saprolegnia* sp. and *Leptolegnia* sp. were isolated. The maximum number of species was recorded during the month of December, 2004 while the minimum was recorded during the months of May and June, 2005, (Table-1 &Fig. 1).

In Sarangpani lake, a total of eighteen species of aquatic fungi viz. *Achlya americana, A. flagellata, A. klebsiana, A. prolifera, Achlya* sp., *Aphanomyces* sp., *Allomyces anomalus, Aspergillus* sp., *Dictyuchus monosporus, Pythium aphanidermatum, P. undulatum, P. afertile, Saprolegnia diclina, S. ferax, S. hypogyana, S. monoica, Saprolegnia* sp., and *Leptolegnia* sp. were isolated. The maximum number of species was recorded in the month of December, 2004, while the minimum was recorded in the months of May and June, 2005 (Table -1 & Fig. -1).

In Chiklod reservoir, a total of seventeen species of fungi viz. *Achlya americana, A. flagellata, A. klebsiana, A. prolifera, Achlya* sp., *Aphanomyces* sp., *Aspergillus* sp., *Dictyuchus monosporus, D. achlyoids, Pythium aphanidermatum, P. undulatum, Saprolegnia diclina, S. ferax, S. hypogyana, S. parasitica, S. monoica,* and *Leptolegnia* sp. were isolated. The maximum number of species was recorded in the months of December, 2004 and January, 2005 while the minimum was recorded in the months of May and June, 2005 (Table -1 & Fig. -1). The species isolated from Sarangpani lake are common in Upper lake except two, *Dictyuchus achlyoids* and *Saprolegnia parasitica.* The species isolated from Chiklod reservoir are common in Upper lake except three *Allomyces anomalus, Pythium afertile* and *Saprolegnia* sp.

Occurrence, Frequency and Periodicity of Watermolds

Occurrence of Watermolds are of ephemeral nature and consequently exhibits periodicity and frequency in aquatic ecosystem. The total fungal counts were higher during winter,

Table - 1 Occurrence and % of frequency of watermolds in three water bodies of Madhya Pradesh during study period (August 2004 to July 2005)

Sps.	No. of occurrences			Winter (Dec., Jan., Feb.)			Spring (Mar., Apr.)			Summer (May, Jun.)			Rainy (Jul., Aug., Sep.)			Autumn (Oct., Nov.)		
	UL	SL	CR	UL	SL	CR	UL	SL	CR	UL	SL	CR	UL	SL	CR	UL	SL	CR
Achlya americana	5	5	3	66.6	66.6	33.3	-	50	-	-	-	-	66.6	33.3	33.3	50	50	50
A. flagellata	3	3	4	66.6	66.6	66.6	-	-	-	-	-	-	-	33.3	33.3	50	-	50
A. klebsiana	3	1	4	66.6	-	66.6	-	-	-	-	-	-	-	33.3	33.3	50	-	50
A. prolifera	6	5	4	66.6	33.3	66.6	50	-	50	-	-	-	33.3	100	33.3	100	50	50
Achlya sp.	1	1	3	-	33.3	33.3	50	-	50	-	-	-	33.3	-	-	-	-	50
Aphanomyces sp.	6	7	8	66.6	66.6	100	-	50	50	-	-	50	66.6	66.6	66.6	100	100	50
Allomyces anomalus	3	3	0	33.3	33.3	-	-	50	-	-	-	-	66.6	33.3	-	-	-	-
Aspergillus sp.	5	3	5	-	-	33.3	50	50	100	100	100	50	66.6	-	33.3	-	-	-
Dictyuchus monosporus	3	2	2	66.6	33.3	33.3	-	-	-	-	-	-	33.3	-	33.3	-	50	-
D. achlyoids	2	0	1	33.3	-	33.3	-	-	-	-	-	-	-	-	-	50	-	-
Pythium aphanidermatum	1	3	2	33.3	66.6	33.3	-	-	-	-	-	-	-	33.3	-	-	50	50
P. undulatum	5	3	2	66.6	33.3	-	-	-	-	-	-	-	66.6	33.3	66.6	50	-	-
P. afertile	5	1	0	66.6	33.3	-	-	50	-	-	-	-	33.3	-	-	100	-	-
Saprolegnia diclina	3	6	5	33.3	66.6	66.6	50	-	-	-	-	-	-	66.6	33.3	50	100	100
S. ferax	4	5	6	66.6	33.3	-	-	-	-	-	-	-	33.3	33.3	33.3	50	100	100
S. hypogyana	6	2	2	33.3	-	66.6	-	-	-	-	-	-	100	-	33.3	50	50	50
S. parasitica	1	0	3	66.6	-	-	-	-	-	-	-	-	-	-	33.3	-	-	-
S. monoica	4	1	4	33.3	-	-	100	-	-	-	-	-	-	-	33.3	-	50	50
Saprolegnia sp.	1	1	0	33.3	-	-	-	-	-	-	-	-	-	-	—	-	50	-
Leptolegnia sp.	1	3	2	33.3	33.3	33.3	-	-	-	-	-	-	-	66.6	33.3	-	-	-
No. of species **UL.**				**18**			**5**			**1**			**11**			**11**		
SL.				14			5			1			11			10		
CR.				14			5			2			14			10		

- = Absent, UL = Upper lake, SL=Sarangpani lake, CR=Chiklod reservoir

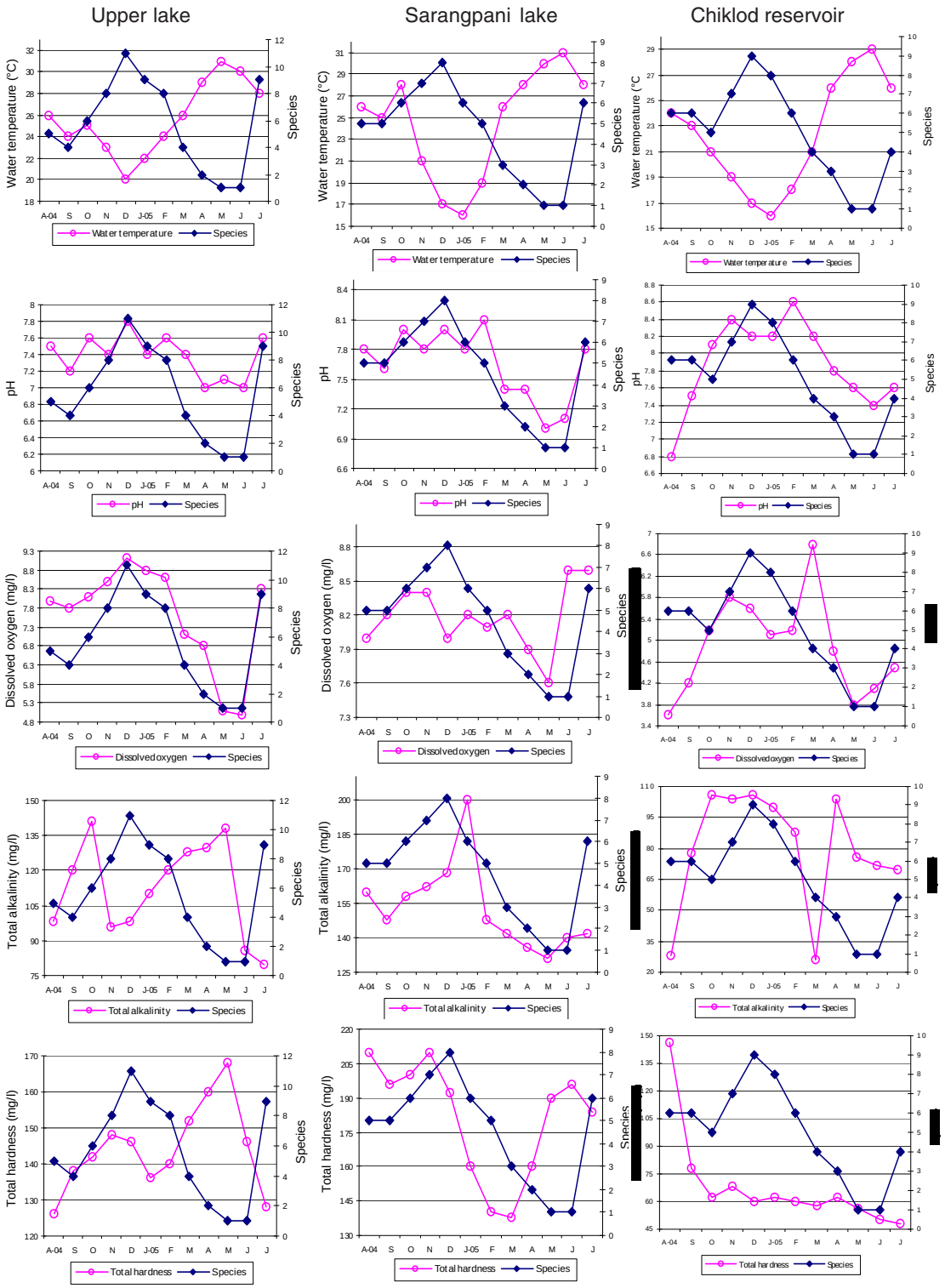

Fig. - 1: Relationship between the number of fungal species and physico-chemical parametes of water during study period

early spring and rainy season. Thereafter, with the commencement of dry hot period, a sharp decline in the fungal population was recorded from May to June. In September, the number increased again with the decrease in water temperature. Total fungal counts were higher from September to February. Consequently, the fungal population tended to decrease from March to June. Eccentric species exhibited their dominance from spring to the rainy season and centric and sub centric from autumn to the early spring.

Most of the species were found to be temperature dependent and fluctuated with the change in temperature (Fig.1). As a consequence, the fungal population of three water bodies, the Upper lake, Sarangpani lake and Chiklod reservoir, showed a significant negative correlation with temperature whereas the pH and dissolved oxygen exhibited positive correlation with the occurrence of fungal population.

The 't'- test for difference of mean applied between the physico-chemical parameters of three water bodies, indicated that there was no significant difference in pH, DO, total alkalinity and total hardness of these water bodies.

Dissolved Oxygen plays an important role in the growth and development of fungal population. In the present study, fungal species of three water bodies showed a positive relationship with dissolved oxygen and pH. Correlation coefficient between physico-chemical parameters and fungal flora is calculated for the three water bodies. The fungal population has not shown any relationship with total alkalinity and total hardness. The obtained data is analyzed statistically by using Karl Pearson's correlation coefficient. The Linear regression equation is also obtained by taking fungal flora as dependent variable and different physico-chemical parameters as independent variable (Table-2).

In Upper lake, the maximum value of temperature (31°C) in the month of May 2005, pH (7.8) in the month of December 2004, dissolved oxygen (9.1 mg/l) in the month of December 2004, total alkalinity (141 mg/l) in the month of October 2004, and total hardness (126 mg/l) in the month of

Table - 2: Correlation Coefficient (r) & Regression equation between fungal population of water & various physico chemical parameters

Physico-chemical Parameters	Upper Lake			Sarangpani Lake			Chiklod Reservoir		
	Mean & Standard Deviation	Correlation coefficient (r)	Regression eq. Y = a + bx	Mean & Standard Deviation	Correlation coefficient (r)	Regression eq. Y = a + bx	Mean & Standard Deviation	Correlation coefficient (r)	Regression eq. Y = a + bx
Water temperature (°C)	25.67 3.1972	-0.8113*	Y=26.66-0.8179 x	24.75 4.951	-0.693*	Y=12.258-0.3101 x	22.33 4.17	-0.89*	Y=16.559-0.5176 x
pH	7.38 0.2478	0.8695*	Y=-77.855+11.312 x	7.65 0.3403	0.8895*	Y=-39.7206+5.7914 x	7.87 0.487	0.4037	Y=-10.751+2.0023 x
Dissolved oxygen (mg/l)	7.60 1.3019	0.9115*	Y=-11.4837+2.2566 x	8.18 0.2794	0.2714	Y=13.0355+2.153 x	4.89 0.881	0.383	Y=-0.1385+1.0505 x
Total alkalinity (mg/l)	112.08 19.5297	-0.3887	Y=12.85-0.0642 x	152.92 17.8487	0.667*	Y=-8.08+0.0828 x	79.83 27.036	0.293	Y=2.9067+0.0262 x
Total hardness (mg/l)	144.17 11.6178	-0.5370	Y=27.14-0.149 x	181.33 24.3493	0.2265	Y=0.8452+0.0206 x	67.50 24.807	0.267	Y=3.245+0.026 x

*P < 0.05

August 2004, whereas the minimum value of temperature (20°C) in the month of December 2004, pH (7.0) in the months of April and June 2005, dissolved oxygen (5.0 mg/l) in the month of June 2005, total alkalinity (80 mg/l) in the month of July 2005, and total hardness (126 mg/l) in the month of August 2004, was recorded.

While during the study period the maximum temperature (31°C) in the month of June 2005, pH (8.1) in the month of February 2005, dissolved oxygen (8.6 mg/l) in the months of June and July 2005, total alkalinity (200 mg/l) in the month of January 2005, total hardness (210 mg/l) in the months of August and November 2004, were recorded in Sarangpani lake and minimum temperature (16°C) in the month of January 2005, pH (7.0) in the month of May 2005, dissolved oxygen (7.6 mg/l) in the month of May 2005, total alkalinity (131 mg/l) in the month of May 2005, total hardness (138 mg/l) in the month of March 2005 were recorded in Sarangpani lake.

In Chiklod reservoir, the maximum temperature (29°C) was recorded in the month of June 2005, pH (8.6) in the month of February 2005, dissolved oxygen (6.8 mg/l) in the month of March 2005, total alkalinity (106 mg/l) in the month of October 2004 and total hardness (146 mg/l) in the month of August 2004. while the minimum temperature (16°C) in the month of January 2005, pH (6.8) in the month of August 2004, dissolved oxygen (3.6 mg/l) in the month of August 2004, total alkalinity (28 mg/l) in the month of August 2004, total hardness (48 mg/l) in the month of July 2005 in Chiklod reservoir.

The pH and dissolved oxygen exhibited a positive correlation with the occurrence of fungal population in the three water bodies.

DISCUSSION

Under present study, fungal flora of three water bodies of Bhopal region, viz. Upper lake, Sarangpani lake and Chiklod reservoir was studied in relation to temperature, pH and dissolved oxygen etc. Coker (1923) pointed out for the first time that for the majority of members of *Saprolegniaceae,* spring was the most favorable season for growth and abundance. Later, Forbes (1935), Waterhouse (1942), Dayal & Tandon (1962, 1963), Srivastava (1967), Khulbe & Bhargava (1977), Manoharachary & Ramarao (1981) and Misra (1982, 1983), Qureshi et al., (1995,1999,1999,1999,1999,2001,2002), and Vikas et al.,(2004) working in widely different locations, reported that winter was the most suitable period for growth of aquatic fungi. However, Chaudhuri *et al.,* (1947), Naumov (1954), Perrott (1960) and Dick & Newby (1961) observed two maximum, one in early spring and the other in autumn. Roberts (1963), likewise, recorded low numbers during warm season while in autumn, he observed that the species began to build up and reached a maximum in spring. The present paper reports the fungal flora of three water bodies of Bhopal region (Table -1).

Although, the temperature is considered to be an important factor for determining the occurrence, distribution and seasonality of watermolds (Hughes 1962; Roberts 1963; Khulbe and Bhargava, 1977 and Manoharachary 1981) but it is also influenced by hydrogen ion concentration (Hughes 1962; Dayal and Tandon 1963; Roberts 1963; Srivastava 1967; Khulbe 1991 and Manoharachary 1991) and also dissolved oxygen content of water (Sparrow 1960 and Gupta and Mehrotra, 1987). Watermolds are of ephemeral nature and consequently exhibit seasonality in aquatic ecosystem. In winter months, maximum was recorded for these fungi. The maximum number of fungal species recorded in December and January of winter months, while the minimum number in May and June of summer months respectively.

It is observed that the watermolds showed marked seasonal fluctuation in their occurrence and distribution. Occurrence of maximum species during winter and spring seasons might be due to moderate values of temperature and slightly higher values of pH. Maximum number of watermolds were recorded by Perrott (1960), Dick and Newby (1961), Roberts (1963) in spring and autumn. Dayal and Tandon (1962), Manoharachary (1991) and Khulbe *et al.* (1995) also recorded maximum fungal counts in the winter and spring reasons. In the present study, the maximum number of watermold was recorded in winter and minimum in summer months. This observation gets support from the work of Fox and

Wolf (1977), Manoharachary *et al.* (1984) and Khulbe *et al.* (1995). Higher temperature during summer and high turbidity and dilution of nutrients during rainy season has also been found to be unfavorable for most of the aquatic fungi by Dayal and Tandon (1962) and Khulbe (1991). Higher temperature is thought to suppress the growth and asexual reproduction in watermold.

It has been noticed that eccentric species of *Saprolegniaceae* were maximum in number during summer months (April to July), while centric and sub centric species were found to be dominating during a period of low temperature months. These findings conform with the observations of Hughes (1962), Srivastava (1967), Manoharachary (1981), Mer (1992), Kaur and Khulbe (1998). All of them noted the occurrence of large number of eccentric species during the warmer months.

REFERENCES

1. Alabi, R. O. Seasonal periodicity of *Saprolegniaceae* at Ibadan, Nigeria. *Trans. Brit. mycol. Soc.* **56:** 337-341 (1971)
2. Barlocher F. Seasonal occurrences and movements of fungi in streams. *In microbial Activity in the Himalaya* (ed RD Khulbe) Shree Almora Book Depot, Almora India 3-29 (1992)
3. Chaudhuri, H., P. L. Kochhar, S. S. Lotus, M. L. Banerjee & A. H. Khan. A handbook of Indian watermolds. Part I. *Punjab Univ. Bot. Publ.* Lahore. 70 (1947)
4. Coker, W. C. The *Saprolegniaceae* with Notes on Other Watermolds. New York. & Matthews, V. D., (1937). *Saprolegniales. N. Amer. Flora* **2:** 15-16 (1923)
5. Dayal, R. D and Tandon, R. N. Ecological studies of some aquatic phycomycetes. *Hydrobio*l **20:** 121-127 (1962)
6. Dayal, R. D and Tandon, R. N. Ecological studies of some aquatic Phycomycetes II. Fungi in relation to chemical factors of the water. *Hydrobiol* **22:** 324-330 (1963)
7. Dick, M. W. & H. V. Newby, The occurrence and distribution of *Saprolegniaceae* in certain soils of South-East England I. Occurrence. *J. Ecol*. **49:** 403-419 (1961)
8. Dick, M. W. & Newby, A. V. The occurrence and distribution of *Saprolegniaceae* in certain soils of Sout-east England. I. Occurrence. *J. Ecol.* **49:** 403-419 (1961)
9. Forbes, E. J. Watermolds of the Manchester District. Mem. *Manchr. lit. Phil. Soc.* **79:** 1-11 (1935)
10. Fox N. C. and Wolf, F. T. Aquatic *phycomycets* of Randnor lake Nashbille Tennessee. *J. Tennessee Acad. Sci.* **52:** 100-104 (1977)
11. Gupta, A. K. and R. S., Mehrotra. *Seasonal periodicity aquatic fungi in tanks at Kurukshetra,* India. Kluwer Academic Publishers printed in Belgium (1987)
12. Hughes, G. C. Seasonal periodicity of the *Saprolegniaceae* in the South-eastern United States. *Trans. Brit. mycol. Soc.* **45:** 519-531 (1962)
13. Johnson, T. W. Jr. The genus *Achlya: Morphology and Taxonomy.* Ann. Arbor (1956)
14. Khulbe, R. D. & Bhargava, K. S. Distribution and seasonal periodicity of watermolds in some lakes in Naini Tal Hills, *India. Hydrobio.* **54:** 67-72 (1977)
15. Khulbe, R. D. An ecological study of watermolds of forest soils of Kumaun Himalaya, India. *Trop. Ecol.* **32**(1): 127-135 (1991)
16. Khulbe, R. D., G. S. Bist and C. Joshi. An ecological study of watermolds of some revires of Kumaun Himalays. *J. Indian Bot. Soc*. **74:** 61-64 (1995)
17. Lund, A. Studies on Danish freshwater Phycomycetes and notes on their occurrence. *K. danske Vidensk. Selsk* **9:** 1-98 (1934)
18. Manoharachary, C and P. Ramarao. Seasonal variation and distribution of fungi in two freshwater ponds of Andhra Pradesh, India. *Indian Acad. Sci. (Plant Sci.).* **90**(3): 237-243 (1980)

19. Manoharachary, C. & P. Ramarao, Seasonal variation and distribution of fungi in two freshwater ponds of Andhra Pradesh, *India. Proc. Ind. Acad. Sci.* **90:** 237-243 (1981)
20. Manoharachary, C. The taxonomy and ecology of freshwater *Phycomy cetes* from Indian. *Indian Rev. Life Sci.* **1:** 3-21 (1991)
21. Mer, G. S. Species composition and habitat preference of watermolds in the nainital District of Kumaun Himalaya, India. *Hydrobiol* **77**(2): 315-324 (1992)
22. Milovtsova, M. O. Vadsahgribi Kharkova Taiogo okolits Kharkivs kii derzhavnii Universitet Trudi N. – *D. Institutu Botaniki* **1:** 28-37 (1935)
23. Misra, J. K. Occurrence, distribution and seasonality periodicity of aquatic fungi as affected by water temperature in certain alkaline ponds of India*. J.Plant Pathol*. **1:** 133-140 (1983)
24. Misra, J. K., Occurrence, distribution and seasonality of aquatic fungi as affected by chemical factors in six alkaline ponds of India. *Hydrobiol.,* **97:** 185-191 (1982)
25. Naumov, N. A. Flora gribov Leningradskoi oblasti, vypusk 1. Arkhimitsety. Fikomitsety. Moscow and Leningrad: *Academy of Sciences U. S. S. R.* (1954)
26. Perrott. P. E. The ecology of some aquatic phycomycetes. *Trans. Brit. mycol. Soc.* **43:** 19-30 (1960)
27. Qureshi, T. A., R. Chauhan, Y. Prasad and S. A. Mastan Fungi isolated from EUS affected fishes of Hataikheda reservoir, Bhopal. *Indian J. Applied and Pure Biol.,* **10**(2): 153-157 (1995)
28. Qureshi, T. A., R. Chauhan and S. A. Mastan. Mycotic flora of different EUS prone water bodies of Bhopal. *Indian J. Applied and Pure Biol.* **14**(2): 168-173 (1999)
29. Qureshi, T. A., R. Chauhan , Y. Prasad and S. A. Mastan. Association of fungi with Epizootic Ulcerative Syndrome of fishes. *Indian J. Applied and Pure Biol.* **14**(1): 45-49 (1999)
30. Qureshi, T. A., R. Chauhan, Y. Prasad and S. A. Mastan: Inhibitory effects of certain chemicals on pathogenic Fungi isolated from EUS affected fishes. *J. Ecotoxical. Environ. Mont.,* **11**(2): 133-142 (1999)
31. Qureshi, T. A., R. Chauhan, and S. A. Mastan: Histopathology of mycoses in certain fishes of Bhopal. *Indian J. Anim. Hlth.* **40**(1): 93-96 (2001)
32. Qureshi, T. A., R. Chauhan, and S. A. Mastan: Experimental infection of *Saprolegnia sp*. on different species of fish. *J.Nat.Con.* **14**(2): 385-388 (2002)
33. Rajendra Kaur and R. D. Khulbe. Occurrence, distribution and ecology of watermolds in Nanaksagar reservoir, Kumaun Himalays Nainital, Uttar Pradesh, India. *J. Indian Bot. Soc.* **77,** 111-116 (1998)
34. Roberts, R. E. A study of the distribution of certain members of the *Saprolegniales. Trans. Brit. mycol. Soc.* **46:** 213-224 (1963)
35. Rossy-Valdderrama, C. Some watermolds from Puerto Rico. *Jour. Elisha. Mitch. Sci. Soc.* **72:** 129-137 (1956)
36. Scott, W. W. A monograph of the genus *Aphanomyces* Virginia *Agril. Exp. Sta. Tech. Bull.* **151** (1961)
37. Sparrow, F. K. *Ecology of the freshwater fungi in the Fungi*, **3** (GCA insworth and AS Sussman eds.) Academic Press, New York, 41-93 (1968)
38. Sparrow, F. K. Jr. Aquatic Phycomycetes. *Ann. Arbor.* (1960)
39. Srivastava, G. C. Ecological studies on some aquatic fungi of Gorakhpur, India. *Hydrobiol* **30:** 385-404 (1967)
40. Suzuki, S. Microbiological studies on the lakes of Volcano Bandai. I. Ecological studies on aquatic Phycomycetes in the Goshikinuma lake group. *Japan. J. Ecol.* **10 :** 172-176. & Hatakeyama, T. (1960). Ecological studies on the aquatic fungi in the Shiga Lake group. *Japan. J. Limnol*. **21:** 64-72 (1960)
41. Vikas Salgotra**,** S.A. Mastan &T.A. Qureshi: Incidences of *Saprolegniasis* in fishes of Hataikheda reservoir, Bhopal (M.P.). *Ind. J. Fish* (in press) (2004)
42. Waterhouse, G. N. Some watermolds of the Hogsmill River collected from 1937-1939. *Trans. Brit. mycol. Soc.* **25:** 315-324 (1942)
43. Wolf, F. r. & Wolf, F. A., Aquatic Phycomycetes from the Everglades region of Florida. *Lloydia* **4:** 270-275 (1941)
44. Ziegler, A. W. The *Saprolegniaceae* of Florida. *Mycologia* **50:** 693-696 (1958)