Volume : 4 | Issue : 2 | February 2015 • ISSN No 2277 - 8179

Research Paper

Analysis of seasonal biodiversity of zooplanktons in Sahni tola talab(pond) of Sundarpur Bela, Darbhanga district, Bihar

Ecology

KEYWORDS : Sahni tola talab, zooplanktons, Protozoa, Rotifera, Cladocera, Copepoda

Uttam Kumar R. A., ICAR-RCER, Research Centre for Makhana, PO - Basudeopur Bira, Darbhanga

Shiv Shankar Kumar R. A., ICAR-RCER, Research Centre for Makhana, PO - Basudeopur Bira, Darbhanga

Prabhakar Kumar Singh Research Scholar, Deptt. of Biotechnology, L.N.M.U. Darbhanga

ABSTRACT

Sahni tola talab (pond) is located in the village Sundarpur Bela District-Darbhanga (Bihar). Zooplanktons are very sensitive to the change in the physical and chemical condition of water bodies. Any change in the aquatic environmental condition leads to the change in the zooplanktons communities in terms of tolerance, abundance, diversity and dominance in the habitat. Therefore, diversity of zooplanktons observation may be used as a reliable tool for bio-monitoring studies to access the pollution status of aquatic bodies. The zooplanktons diversity of the studied water body was fluctuating. There were 40 species of zooplanktons were recorded from Sahni tola talab. These zooplanktons species belonged to Protozoa, Rotifers, Cladocera, Copepoda and Ostracoda. Out of 40 species, 6 species belonged to Protozoa, 20 species to Rotifers, 7 species to Cladocera, 5 species to Copepoda and 2 species to Ostracoda. The pond receives domestic sewage water from nearby village and agriculture run off rain water. Maximum zooplankton diversity was recorded during winter season which was mainly dominated by Rotifers. These results indicate the eutrophic nature of pond. Minimum zooplankton diversity was recorded during monsoon season which may be due to high turbidity of water during monsoon.

INTRODUCTION

Zooplanktons are microscopic heterotrophic organisms that are very weak swimmers or are non motile which move at the mercy of the water movements. They serve as good indicator of changes in water quality, because it is strongly affected by the environmental conditions and it is quickly responded to changes in environmental quality, Gannon and Stemberger(1). They are not only useful as bioindicators, but also helpful in the improving of water quality of polluted waters. Zooplankton species are cosmopolitan in nature. Protozoans, Rotifers, Cladocerans, Copepods and Ostracods are common groups of the fresh water zooplankton. Planktonic protozoans are group of unicellular ciliated or flagellated organisms. Rotifers are considered nature's water purifier. They are prominent group among the zooplankton of a water body irrespective of its trophic status. This may be due to the less specialized feeding, parthenogenetic reproduction and high fecundity. Cladocerans are tiny aquatic crustaceans and are also known as water fleas. Copepods have been known to the most abundant zooplankton in the river systems. They dominate most aquatic ecosystems because of their resilience and adaptability to changing environmental conditions and ability to withstand varying environmental stresses, Barnes et al(2). Ostracods are mainly bottom dwellers of lakes. They live on detritus and dead phytoplanktons. Zooplankton communities respond to a wide variety of disturbances including nutrient loading, Dodson(3), acidification and sediment input. It has immense significance in fisheries, Jhingran(4). Zooplanktons also play an important role as indicators of trophic condition in both cold temperate and tropical waters, Sharma(5). The most common and severe problem of aquatic ecosystem is the enrichment of water by a nutrient that increases the biological growth and renders the water bodies unfit for diverse uses. The study of the fresh water fauna especially zooplankton, is complicated due to environmental variations. Seasonal fluctuation of zooplankton is greatly influenced by the variations in the temperature along with many other factors. Among various factors, temperature seems to exhibit the greatest influence on the periodicity of zooplankton, Prasad and Singh(6).

Several researchers have been worked on the seasonal variation of zooplanktons of fresh water bodies viz. Koushik and Sharma(7), Sunkad and Patil(8), Kumar et al(9), Shashikant and Vijayakumar(10). Investigations of freshwater zooplankton community structure have significant potential for assessing aquatic ecosystem health. Their dominance and seasonality are highly variable in different water bodies according to nutrient status, age and other factors. Therefore changes in aquatic environment accompanying anthropogenic pollution are a cause of growing concern and require monitoring of surface waters and organisms inhabiting them. So the present study was carried out to understand the seasonal diversity of zooplankton in Sahni tola talab(pond) of Sundarpur bela, Darbhanga district, Bihar.

MATERIAL AND METHODS

Darbhanga is an important district of Bihar having longitude 85^0 45'E - 86^0 25'E and latitude 25^0 53'N - 26^0 27'N. Present work is based on the study of zooplanktons in respect with biodiversity from March 2013 to February 2014 in Sahni tola talab of Sundarpur Bela, Darbhanga district, Bihar. It is located about 10 km North-East from ICAR-RCER Research Centre for Makhana, Darbhanga. The Sahni tola makhana talab is a tropical perennial standing rectangular water body having area of 6 acres with an average depth of 2.8 meters. It receives water from nearby agricultural land during rainy season.

Monthly water samples were collected from different location of the pond and filtered through plankton net of mesh size 20µ. Now concentrated collected samples were preserved in freshly prepared 5% formalin in a number of 100ml vials. The samples were analysed under research light microscope and identification of zooplanktons was done by using relevant literatures namely Yule et al(11), Petersen(12). Zooplankton diversity was analysed on the basis of three seasons namely Summer, Monsoon and Winter.

Result and Discussion

Zooplanktons form a minute aquatic group and they occupy an intermediate position in both the food chain and food web. Most of the zooplanktons feed upon phytoplanktons and produces animal food for successive carnivore aquatic animals such as fishes and thus zooplanktons can be represented as secondary producer of any aquatic food chain (authors view, 2014). They mediate the transfer of energy from lower to higher trophic level, Waters(13).

The present study was undertaken to investigate the seasonal variations in zooplankton diversity of Sahni tola talab of Darbhanga district, Bihar. There were 40 zooplankton species observed during the present study (Table-1 & Figure2 & 3). Out of 40 zooplankton species, 6 species belonged to Protozoa, 20 spe-

cies to Rotifera, 7 species to Cladocera, 5 species to Copepoda and only 2 species to Ostracoda.

During the present investigation class Rotifera was dominated among all the zooplanktonic classes in all the seasons. However the diversity of zooplankton varied from season to season and the maximum diversity was recorded in winter season while minimum diversity was observed in monsoon season (Table 1 & Figure-1)

During summer season maximum species diversity was contributed by class Rotifera and minimum by Ostracoda. Class Protozoa was contributed by 5(20%) species and class Rotifera by 12(48%) species. Class Cladocera and Copepoda were represented by the same number of 3(12%) species and class Ostrcoda by only 2(8%) species during summer season (Table-2). The sequence of abundance of zooplankton classes during the summer season were as:

Rotifera > Protozoa > Cladocera = Copepoda > Ostracoda

The maximum species diversity was contributed by class Rotifera and minimum by copepod & Ostracoda during the monsoon season. Class Protozoa was contributed by 3(17.5%) species and class Rotifera by 8(47%) species. Class Cladocera was represented by 4(23.5%) species were as Copepoda and Ostracoda by the same number of species which was only 1(6%) during the monsoon season(Table-2). The sequence of dominance of zooplankton classes during the monsoon season were as:

Rotifera > Cladocera > Protozoa > Copepoda = Ostracoda

During winter season maximum species diversity was contributed by class Rotifera and minimum by Ostracoda. Class Protozoa was represented by 5(15.2%) species, Rotifera by 17(51.5%) species, Cladocera by 6(18.2%) species, Copepoda by 3(9.1%) species and Ostrcoda by only 2(6%) species during winter season (Table-2). The sequence of abundance of zooplankton classes during the winter season were as:

Rotifera > Cladocera > Protozoa > Copepoda > Ostracoda

The Rotifers and particle feeder Cladocerans were higher in winter can be linked to favourable temperature and availability of abundant food in the form of bacteria, nanopanktons and suspended detritus.

Table1: Seasonal variation in zooplankton diversity recorded in Sahni tola talab, Derbhanga

S. N.	Zooplankton species	Summer	Monsoon	Winter
	PROTOZOA			
1.	*Arcella discoides*	+		+
2.	*Arcella vulgaris*	+	+	+
3.	*Difflugia* ***sp.***	+	+	+
4.	*Euglypha* ***sp.***			+
5.	*Paramoecium caudatum*	+		
6.	Vorticella sp.,	+	+	+
	B. ROTIFERA			
7.	*Anuraeopsis fissa*	+	+	
8.	*Asplanchna brightwelli*	+		+
9.	*Brachionus angularis*		+	+
10.	*Brachionus bidentata*			+
11.	*Brachionus caudatus*			+
12.	*Brachionus falcatus*	+		+
13.	*Brachionus forticula*			+
14.	*Brachionus quadridentatus*			+
15.	*Brachionus terminalis*	+	+	+
16.	*Cephlodella catelina*			+
17.	*Cephlodella gibba*	+	+	+
18.	Conochilus sp.	+		
19.	*Keratella cochlearis*	+		+
20.	Keratella tropica	+	+	+
21.	*Lepadella* ***sp.***	+	+	+
22.	Monostyla quadridentatus		+	+
23.	*Notholca acuminata*		+	
24.	Polyartha vulgaris	+		+
25.	Pompholyx complanata	+		+
26.	*Trichocera rattus*			+
	C. CLADOCERA			
27.	*Alona* ***intermediate***	+		
28.	*Bosmina* ***sp.***	+	+	+
29.	Daphnia similes	+	+	+
30.	*Daphnia carinata*			+
31.	Diaphanosoma sp.		+	+
32.	*Leydigia* ***sp.***			+
33.	*Moina* ***sp***	+	+	+
	D. COPEPODA			
34.	Cyclops sp.			+
35.	*Thermocyclops crassus*	+	+	+
36.	*Heleodiaptomus viduus*	+		
37.	*Nauplius* ***larvae***	+		
38.	*Tropocyclops* ***sp.***			+
	E. OSTRACODA			
39.	*Cypris* ***sp.***	+		+
40.	*Stenocypris malcolmsoni*	+	+	+
Gross total of zooplanktons sp.		25	17	33

Table -2: Class wise species diversity & percentage contribution of zooplankton in Sahni tola talab in different seasons

Class	Summer	%	Monsoon	%	Winter	%
Protozoa	05	20	3	17.5	05	15.2
Rotifera	12	48	8	47.0	17	51.5
Cladocera	03	12	4	23.5	06	18.2
Copepoda	03	12	1	06.0	03	09.1
Ostracoda	02	08	1	06.0	02	06.0

Figure-1: Class wise variation of zooplankton in different seasons of Sahni tola talab

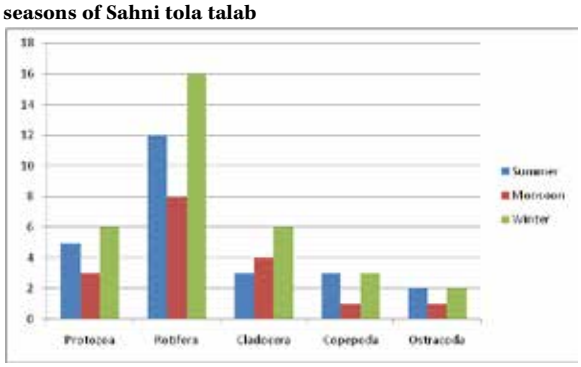


Table-3: Overall qualitative & percentage contribution of different classes of zooplankton

Class	No. of Species	% contribution
Protozoa	06	15.0
Rotifera	20	50.0
Cladocera	07	17.5
Copepoda	05	12.5
Ostracoda	02	05.0

Figure-2 Overall class wise percentage diversity composition of zooplankton

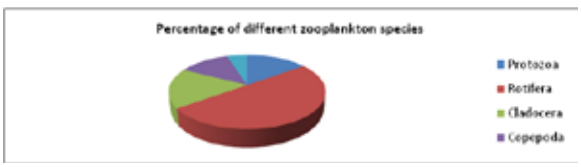
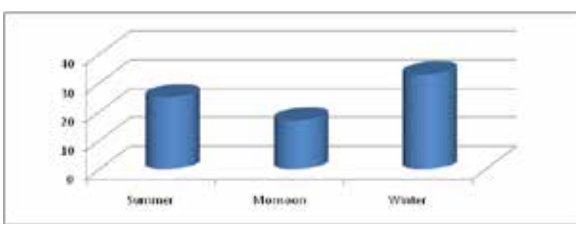


Figure-3 Diversity variation of zooplankton species in different season



The maximum diversity of zooplanktons was contributed by class Rotifera in throughout study period. Class Rotifer contributed 20(50%) species of the total zooplankton population recorded during the present study. Cladocera contributed by 7(17.5%) species followed by class Protozoa contributed by 6(15%) species, copepods by 5(12.5%) species and Ostracoda by 2(5%) species only (Table-1 & 2 & Figure-2 & 3). The dominance of Rotifers is characteristics of tropical water bodies as it has been reported by various authours such as Egborge(14) and MwebazaNadwula(15).

On the basis of qualitative study, *Arcella vulgaris, Difflugia* ***sp. and*** *Vorticella sp.* were the most common Prozoan species whereas *Brachionus terminalis, Cephlodella gibba, Keratella tropica and Lepadella* ***sp.*** were the most common Rotiferan species which occurred throughout the study period. *Bosmina sp., Daphnia* ***similes*** and *Moina sp.* were the most common Cladoceran species recorded in all three seasons. Copepodan and Ostracodan classes were represented by only one species namely *Thermocyclops crassus and Stenocypris malcolmsoni* respectively in whole study period.

Zooplankton population shows a marked seasonal variation during the present investigation (Table-2 & Figure- 2 & 3). The maximum zooplankton diversity (33 species) was observed in winter season and the minimum (17 species) in monsoon season. Intermediate number of zooplankton diversity (25 species) was observed in summer season. The winter season is the most favourable period for the growth and multiplication of zooplankton species which may be due to abundance of food availability in water. The same finding has been also reported by Kumar (16) and Kumar et al(17). Monsoon season was represented by least number of zooplankton which may be due to high turbidity which restricts the growth of planktons.

The presence of *Arcella vulgaris, Difflugia* ***sp.****, Brachionus terminalis, Cephlodella gibba, Keratella tropica, Bosmina sp. and Thermocyclops crassus* in all the seasons indicates the eutrophication of the studied pond which is supported by the view of Chaurasia et al(18) and Kumar et al(19).

CONCLUSION

Zooplankton population in Sahni tola talab reveals the eutrophic condition of the pond which is due to anthropogenic activities such as domestic waste disposal in the form of sewage, human excreta as well as animal and human bathing and agricultural runoff water during rainy season.

ACKNOWLEDGEMENT

The authors express their sincere thanks to the head and centre co-ordinating supervisor of ICAR-RCER, RCM Darbhanga for providing necessary facilities for this purpose.

REFERENCE

(1)Gannon, J.E., and Stemberger, R.S.(1978) Zooplankton especially crustaceans and rotifers as indicators of water quality. Trans. Am. Micros. Soc, [97 16-35]. | (2)Barnes, R.S.K., Calow, P. and. Olive, P.J.W.(1988) The Invertebrates: a new synthesis. Blackwell Scientific Publications, London. | (3) Dodson, S.(1992) Predicting crustacean zooplankton species richness. Limnology and Oceanography, 37: 312-324. | (4)Jhingran, V.G.(1991) Fish and Fisheries of India. Hindustan Publishing Corporation, Delhi, 954 pp: 848-856. | (5)Sharma, B.K.(1998) Faunal Diversity in India: Rotifera. Eds. J.R.B. Alferd, A.K. Das and A.K. Sanyal, Zoological Survey of India, Envis Centre, 57-70. | (6)Prasad and Singh(2003) Composition, abundance and distribution of phytoplankton and zoobenthos in a tropical water body, Nat.Environ& Poll.Tech., 2(3), 255-258. | (7)Koushik and Sharma(1994) Physico-chemical characteristics and zooplankton population of a perennial tank, Matsya Sarowar, Gwalior, Enviro& Ecol , 13(3), 523-528. | (8)Sunkad and Patil (2004) Water quality assessment of Fort Lake of Belgaum (Karnataka) with special reference to zooplankton, J.Envi.Biol ., 25(1), 99-102. | (9)Kumar, U., Garg, S. and Choudhary, S.(2010). Status of zooplanktons in the chaurs of Begusarai District (Bihar). Proc. Zool. Soc. India. 9 (2) : 51 – 59. | (10)Shashikant, M. and Vijayakumar, K.(2010), Ecology and abundance of zooplankton in Karanja reservoir, Res. Jl of Biol Sciences , 5(2), 187-198. | (11) Yule, C. M. and Sen, Y. H.(2004) Freshwater invertebrates of the Malaysian Region. Academy of Sciences, Malaysia, pp. 379-851. | (12)Petersen, F.(2010) An illustrated key to the Philippine Freshwater Zooplankton. | (13)Waters, T. F.(1977) Secondary production in inland waters. Advances in Ecological Research, 10: 11-164. | (14)Eborge, B. M.(1981) The composition, seasonal variation and distribution of zooplankton in lake Asejire, Nigeria. Rev. Zoo.. Afr., 95, pp 136-180. | (15)Mwebaza-Nadwulu, L., Sekiranda, S.B.K. and V.,Kiggundu((2005) Variability in zooplankton community along a section of the upper Victoria Nile, Uganda, Afr. J.Ecol., 43, pp 251-257. | (16)Kumar, K. S.(2001) The fresh water zooplankton of some lakes in Dharamapuri district Tamilnadu. J. Aqua. Biol.,16, pp 5-10. | (17) Kumar, P., Wanganeo, A., Wanganeo, R., Sonaullah, F.(2011) Seasonal variations in zooplankton diversity of railway pond, Sasaram, Bihar. International journal of Environmental Sciences Volume 2 No.2 pp. 1007-1016. | (18)Chaurasia, S. K. and Adoni, A. D.(1985)Zooplankton dynamics in a shallow eutrophic lake. Proc. Nat. Symp. Pure and Appl. Limnology(ed) Adoni, A. D. Bull. Bot. Soc. Sagar,32 pp 30-39. | (19)Kumar, P., Sonaullah, F. Wanganeo, A.(2010) A preliminary limnological study on Shersha Suri pond, Sasaram, Bihar. Asian J. Exp. Sci. 24(2) pp. 219-226.