*I Research Journal of Environment Sciences*_____ *I Res. J. Environment Sci.*
Vol. **1(1),** 42-45, August **(2012)**

Short Communication

Rotifer Diversity in a Semiurban Shallow Perrenial Water Body: A Case Study of Jalaser Tank Mandalgarh, India

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Available online at: www.isca.in
Received 23rd July 2012, revised 31st July 2012, accepted 8th August 2012

Abstract

The species composition of plankton invertebrates was studied in Jalaser tank Mandalgarh in 2009–2010. A list of planktonic rotifers was made. The dominating complexes of zooplankton organisms were found. The quantitative characteristics of plankton communities in the pond were described and analysed on the basis of various diversity indices.

Key words: Zooplankton, dominating complexes, diversity indices.

Introduction

Rotifera is a group of primary freshwater invertebrates[1,2]. Rotifers play a pivotal role in many freshwater ecosystems they commonly occur in densities up to 1,000 individuals per litre, and are important filter-feeders on algae and bacteria. Their ubiquity and abundance explain their standing as one of the three main groups of freshwater zooplankton in limnological studies.They are permanently and obligatorily connected to aquatic habitats in all active stages, only their resting stages are drought-resistant. Classically, three groups are recognized within the Phylum Rotifera. Molecular studies have indicated that a fourth group, Acanthocephala, previously considered a separate Phylum of exclusively endoparasitic organisms, actually belongs to Rotifera[3,4] Rotifers are minute metazoans (50–2,000 lm), characterized by the presence of an anterior ciliated corona, a stiff body wall named lorica bearing variable appendages, and a specialized pharyngeal organ, the mastax, containing hard elements, termed trophy. Their propagules consist of single, hard-shelled, and durable encapsulated cysts (monogononts) or anhydrobiotic individuals (bdelloids). These propagules being small and drought-resistant, makes rotifers perfectly adapted to passive, aerial or phoretic dispersal. Monogononts and bdelloids reproduce parthenogenetically. In monogononts, periods of parthenogenetic reproduction are interspersed with sexual phases (heterogony), but bdelloids are unique in being the most diverse group of metazoans in which reproduction is by diploid, mitotic parthenogenesis only. The combination of their high dispersal capacity and their parthenogenetic reproduction, enabling them to establish or renew a population starting off from a single resting stage and to reach high effective population sizes relatively quickly[5].

Study area: Jalaser tank is a shallow artificial fresh water body of Mandalgarh, Bhilwara constructed by Jagirdar in mewar state time during 1649 as mentioned on the carvings of the pillar of Jalaser Mahadev temple, situated near this tank. The length of the earthen dam is half of the km.

The tank receives water mainly through its catchments area during rainy season. The catchments area which is 100 km^2 covers the western, southern and northern area. It has 500-meter long earthen embankment in western direction. Hill area of Laxmipura is situated on southern side and slope of Mandalgarh fort on northern and eastern side of the embankment. During summer season the water level reaches to its minimum level because of the evaporation and seepage through the earthen embankment. Earlier the water was used for irrigation purposes through its one km. long canal but at present it is abandoned. This tank is surrounded by human settlement except its embankment.

Material and Methods

The limnological studies on Jalaser Tank were carried out during 2009 – 2010. For the purpose of present investigation four different stations was selected. Water sampling was made on monthly basis from January to December i. e. for twelve months at four selected sites. During the collection of water samples from the surface and the desired depth of the pond precautions were taken to prevent any vertical disturbance. Narrow necked, ground glass, hard glass, stopper bottles were used. Standard methods were followed for physico-chemical analysis of the surface water [6,7,8]. While collected samples were brought to the laboratory and analysed for other parameters within 24 hours. In some cases where delay was unavoidable, chloroform was added in the samples to prevent the changes to be brought about by the bacterial activity.

For plankton studies standard method[9,10] with suitable modifications to suit local need and availability was used.

Plankton net: The mesh number 30 of size 60 mm was used for collecting samples. Sampling Procedure: The manner in which

sampling is done should conform to the objectives of the study. The "surface samples" (samples collected from the surface) are collected as close to the water surface as possible, mostly towards the centre of the lake at regular monthly intervals. A known volume of the sample, 5L to 50 L is filtered and planktons are filtered and preserved for further analysis

Preservation: The samples collected into the 100ml polyethylene vials were preserved by adding suitable amounts of 1ml chloroform to act as the narcotizing agent and 2ml of 2% formalin for preservation and analyses.

Concentration technique: The plankton nets are used to collect samples for the qualitative and quantitative estimation of the plankton, by filtering a known volume of water (5-50 litters) through the net depending on the plankton density of the tanks.

Qualitative and quantitative evaluation of plankton: Detailed analyses of planktonic populations are done by estimating the numbers in each species.

Sedimentation and enumeration by microscope: Preserved samples in bottles are mixed uniformly by gentle inversion and then exactly 1ml of the sample is pipette out into the S-C cell for analysis.

Counting: Counting cell- Sedgwick-Rafter (S-R) cell, Strip counting, Lackey's drop method. The plankton counts per strip are then determined by multiplying the actual count by the factor representing the counted portion of the whole S-R cell volume.

Zooplankton Analysis: Standardization of filtering volume: The volume of water to be filtered for zooplankton analysis was standardized by repeated trials at a particular spot in Jalaser tank and filtering different volumes of water through the plankton net i.e., 25L, 50L, 75L, 100L, 125L and 150L. The experiment was carried out twice in order to determine the precision of the results.

Zooplankton collection: Water was collected from the surface with minimal disturbance and filtered in a No. 25 bolting silk cloth net of mesh size 63 µm and 30 cm diameter. The final volume of the filtered sample was 125ml, which was transferred to another 125ml plastic bottle and labelled mentioning the time, date and place of sampling.

Preservation: The samples collected in 125ml plastic bottles were preserved by adding 2ml of 4% formalin.

Concentration: The preserved samples were kept for 24 hours undisturbed to allow the sedimentation of plankton suspended in the water. After 24 hours, the supernatant was discarded carefully without disturbing the sediments and the final volume of concentrated sample was 50ml.

Qualitative and quantitative analysis of zooplankton: The qualitative and quantitative analysis of zooplankton was done by using Sedgwick-Rafter cell (for standardization) and by Lackey's drops method. Six strips were counted in Sedgwick-Rafter cell with dimensions of 50mm x 20mm x 1mm. In Lackey's drop method, the cover slip was placed over a drop of water in the slide and whole of the cover slip was examined by parallel overlapping strips to count all the organisms in the drop. About 20 strips were examined in each drop. Number of sub samples to be taken was dependent on the examining 2 to 3 successive sub samples without any addition of unencountered species when compared to the already examined sub samples in the same sample. The zooplankton were identified up to a taxonomic precision of species level in Rotifera, genus level in both Cladocera and Copepoda using self made keys and standard identification keys[11,12,13,14,15]. The species belonging to each group were noted down and number of individuals in each species was counted. The number of organisms was expressed in Total organisms per litter.

Biodiversity: -Biodiversity of phytoplankton and zooplankton was studied using Shannon Weaver index [16], Lloyd, Zar and Karr index[17] and Menhinick's index[18], which was calculated as follows.

Shannon Weaver index

I	=	$- \Sigma$ ni / N log ni / N
I	=	Shannon Weaver index
ni	=	Number of individuals in the species.
N	=	Total number of organisms (density).
ni	=	Proportion on i^{th} species in the sample.

Lloyd, Zar and Karr index

d^-	=	C/N (N log10 N – ni log10 ni) Where
d^-	=	Mean diversity
C	=	3.321928
N	=	total number of individuals in the i^{th} species

Menhinick's index: -

d1	=	S / √N Where
d1	=	Menhinick's index
S	=	total number of species.
√N	=	total number of organism (density).

Results and Discussion

During present study rotifers were observed to be present in considerably higher number than the organisms of other groups. Excessive dominance of rotifers is an indication of eutrophic nature of water body. Regardless of zooplanktonic species, cladocerans and copepods occur in lower number than rotifers[19].

The results of the present study indicate that the maximum number of genera occurred during winter season than summer and monsoon season as also reported by[20]. The lesser number of genera might be attributed to the lesser nutrients in the tank which consequently result in less productivity or might be due

to the depletion of important factors such as dissolved oxygen and pH. The reduction in the number of genera/species may be due to predation, variation in the pH of water which is always associated with the genera/species composition of Zooplankton inhibiting among them [21]. In winter, it is biotic interaction operating through feeding pressure rather than water quality, it seems to affect the zooplankton diversity and density particularly the stocked fish species play an important role in harvesting species of copepoda and Cladocera, thereby reducing their predatory pressure on other groups. The rotifers and particle feeder Cladocera were higher in winter due to favourable temperature and availability of abundant food in the form of bacteria, nanoplankton and suspended detritus. Further availability of species, water parameters and food sources for rotifer in reservoir is important for the occurrence, abundance, tolerance and adaptations[22].

Conclusion

Different levels of disturbance and factors have different effects on diversity. To preserve biodiversity in a given area, we need to be able to understand how diversity is affected by different factors. Because diversity indices provide more information than simply the number of species present (i.e., they account for some species being rare and others being common), they serve as valuable tools that enable biologists to quantify diversity in a community and describe its numerical structure.

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Table-1
Monthly variation in rotifer

Months	Site 1		Site 2		Site 3		Site 4	
	No. of species	No. of Ind./Lit.	No. of Species	No. of Ind./Lit	No. of Species	No. of Ind./Lit	No. of Species	No. of Ind./Lit
JAN	18	85	17	82	17	74	20	76
FEB	17	88	17	80	17	73	19	72
MAR	18	86	18	80	16	76	18	73
APR	18	79	17	77	16	72	18	75
MAY	16	73	16	70	16	68	17	65
JUN	17	78	15	71	15	70	18	67
JUL	17	49	17	41	15	38	15	34
AUG	14	34	13	49	12	34	14	34
SEP	13	33	14	38	11	36	14	35
OCT	11	34	16	42	16	48	20	45
NOV	14	47	17	51	17	51	20	60
DEC	15	58	17	58	17	57	20	68
TOTAL	188	744	194	739	185	697	213	704

Table-2
Diversity indices of the Rotifers under investigation

Index	Site 1	Site 2	Site3	Site 4
Menhinick's				
Summer	1.0126	1.0427	1.0052	1.1952
Monsoon	1.388	1.3805	1.3611	1.644
Shannon Weaver				
Summer	1.1072	1.0102	1.0311	0.8914
Monsoon	1.1233	1.1628	1.1358	0.8747
Winter	1.069	1.2223	1.2104	1.2696
Lyod and zar				
Summer	4.0252	3.8717	3.7954	4.0751
Monsoon	1.388	1.3805	1.3611	1.644
Winter	1.0796	1.0934	1.0646	1.2039

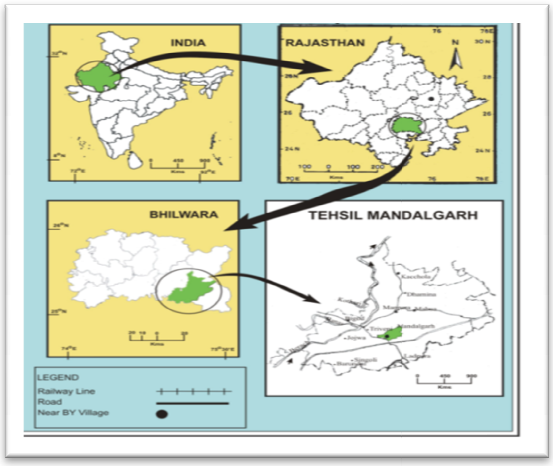

Figure-1
Location Map-1 of study area Tehsil Mandalgarh Jalaser Tank

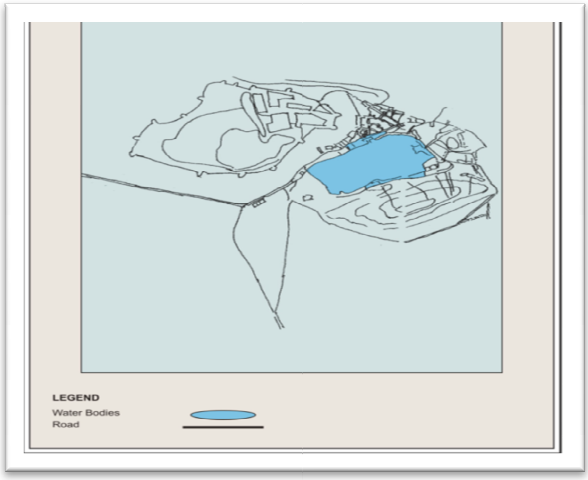

Figure-2
Location Map-2 study area Jalaser Tank Tehsil Mandalgarh Dist Bhilwara Rajasthan.