ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 6, pp. 17737-17741, June, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

INTERACTIONS AMONG VARIOUS ZOOPLANKTONIC GROUPS IN A SUBTROPICAL POND OF JAMMU REGION, J&K, INDIA

Sharma, K. K., Kour, S and *Antal, N

Department of Zoology, University of Jammu, Jammu (J&K)

DOI: http://dx.doi.org/10.24327/ijrsr.2017.0806.0414

ARTICLE INFO

Article History:

Received 17th March, 2017
Received in revised form 21st April, 2017
Accepted 05th May, 2017
Published online 28th June, 2017

Key Words:

Interspecific, Interaspecific, diversity, abundance and correlation

ABSTRACT

Inter-specific and Intra-specific interactions are the well known phenomenon in various zooplanktonic communities of any aquatic ecosystem and these interactions are very essential for their survival and flourishment. To understand this interrelationship, investigation on zooplankton diversity and abundance was carried out for a period of one year in a perennial, shallow and highly polluted Dilli Pond located in Jammu district of J&K state. Twenty nine species of zooplankton were identified from Dilli pond belonging to 5 different groups viz. Protozoa, Rotifera, Copepoda, Cladocera and Ostracoda. Quantitative abundance showed the dominance of Copepoda because they have toughest exoskeleton and versatile feeding habits which ultimately assist them to hold up harsh environmental conditions as compared to other zooplanktonic groups. Correlation studies among various zooplankton groups showed both positive and negative correlation during the study period. Copepods showed positive correlation with Protozoa, Rotifera and Cladocera.

Copyright © Sharma, K. K., Kour, S and Antal, N, 2017, this is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Aquatic diversity of any pond ecosystem mainly encompasses of planktonic fauna (zooplankton and phytoplankton) and macrobenthic invertebrate fauna. Planktons are free floating organisms and play an integral role in the aquatic food chain (Rajagopal *et al.*, 2010). Apart from being a part of aquatic food web they act as barometer for measuring the overall biodiversity in any aquatic ecosystem. Fresh water zooplanktonic fauna basically consist of protozoa, rotifera, cladocera, copepoda and ostracoda. These different groups show several types of inter-specific and intra-specific interactions and their interactions are very essential for their survival and flourishment and also helpful in maintaining healthy aquatic ecosystem. Seasonal variations (both quantitative and qualitative) are shown by them depending upon various biotic (competition, predation, protocorporation, amenselism etc.) and abiotic factors (temperature, pressure, humidity, dissolved oxygen, free carbon dioxide etc.

Keeping in view the importance of interaction and correlation among various groups of zooplankton, the present research work has been designed to identify and study the interrelationship between different zooplankton inhabits the pond. This is an attempt to generate the basic information of ecology and behaviour of these aquatic organisms.

MATERIAL AND METHODS

Study area

Dilli pond is a natural pond and located at a distance of about 8 kms from University of Jammu. It is a perennial and shallow pond with area of about 300 square meters and depth ranging from 2.5 feet to 5 feet during the rainy season. Run-off containing fertilizers, agricultural waste, sewage and detergents, animal dung silt and decomposed organic matter enrich the pond with nutrients that supports the growth of aquatic macrophytes.

Methodology

Monthly samples for zooplankton study were collected by filtering 20 litres of water through plankton net (Nytex 70µm mesh size). The filtrate was transferred to glass vials and was preserved in 5% formalin. For the qualitative analysis, Edmondson & Winberg (1971), Pennak (1978) and Adoni (1985) were referred. For quantitative analysis, the drop count method was applied and the number of zooplankton per litre of the concentrate was calculated by using the formula:

Organism/litre = A x 1/L x n/V
Where
V =Volume of 1 drop (ml)
A= Number of organism per drop (ml)

Corresponding author:* **Antal, N
Department of Zoology, University of Jammu, Jammu (J&K)

n=Total volume of concentrated sample (ml)
L=Volume of original sample (l)

RESULTS AND DISCUSSION

In an aquatic ecosystem zooplankton provide main food for fishes for all the stages of life and these plankton can also be used as indicators of the trophic status of water body (Verma and Munshi, 1987; Rao and Muley, 1981). They play a critical role by not only being primary consumers but also that they themselves show number of prey- predatory relationship within their own group. From the present study, a total of 29 species were enlisted from Dilli pond. Out of 29 species of zooplankton, 2 species belonged to group Protozoa, 14 species to Rotifera, 8 species to Cladocera, 4 species to Copepoda and only 1 species to Ostracoda. Phylum Protozoa was represented by *Centropyxis hemisphaerica* & *Centropyxis ecornis* and Rotifera was represented by *Brachinous calyciflorus*, *Brachinous rubens*, *Brachinous quadridentata*, *Brachinous angularis*, *Brachinous caudatus aculeatus*, *Brachinous caudatus personatus, Keratella tropica*, *Euclanis dilatata*, *Platyias quadricornis, Lecane inopinoata*, *Filinia opoliensis*, *Filinia longiseta*, *Testudinella* sp. and *Philodina* sp. the species belonging to Cladocera were *Chydorus sphaericus*, *Alona rectangula*, *Moina brachiata*, *Daphnia similis*, *Cerodaphnia cornuta* and *Cerodaphnia reticulata* and the species belonging to Copepoda were *Mesocyclops leuckarti*, *Tropocyclops* sp., *Diaptomus* sp. and nauplius larvae. While the group Ostracoda was represented by *Onchocypris pustulata*.

During the present investigation class Rotifera was found to be dominating among all the zooplanktonic groups. However the diversity of zooplankton varied from season to season. The sequence of qualitative dominance of zooplankton classes in Dilli pond was recorded in the hierarchy as: (Figure 1)

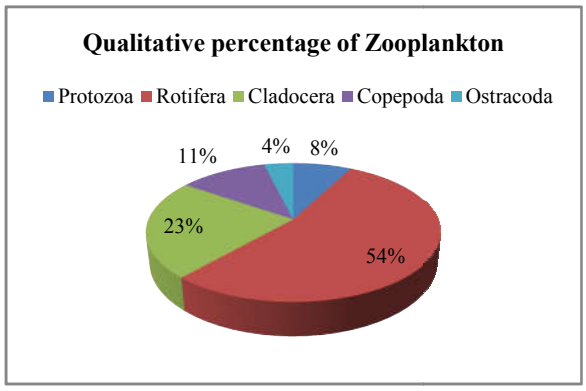

Figure 1 Qualitative percentage of zooplankton

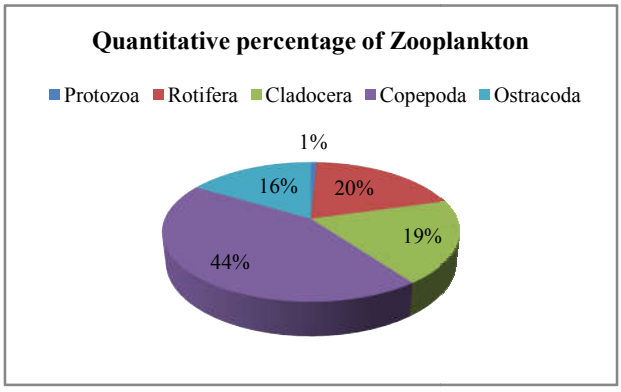

Figure 2 Qualitative percentage of Zooplankton

Rotifera > Cladocera > Copepoda > Protozoa > Ostracoda
The sequence of quantitative dominance of zooplankton classes in Dilli pond was recorded in the hierarchy as: (Figure 2)

Copepoda > Cladocera > Rotifera > Ostracoda > Protozoa
Protozoa

From the present investigative studies, it was observed that the protozoan contributed 1% to the total zooplankton count. Protozoan fauna of Dilli pond comprised of two species belonging to the family Difflugiidae. Quantitatively, protozoan density fluctuated from 0 to 0.6/litre. The total protozoan count acquired a peak in the month of May during both the years of present study followed by a fall or absence during winter. Protozoa were both qualitatively and quantitatively poor during the study period. Higher number of rotifers and other zooplanktons might be the reason for their low number as other zooplanktons feed on protozoans (Arndt, 1993).

Rotifera

Figure 2 reveals that the Rotifera contributed 20% to the total zooplankton count of presently studied water body. Rotifer fauna of Dilii pond comprised of fourteen species belonging to four families viz. Brachionidae (9 species), Lecanidae (1 species), Testudinelliidae (3 species), Philodinidae (1 species). Quantitatively, rotiferan density fluctuated from 0.25 to 18.75/litre during of study period (Table 1). Rotifers showed overall qualitative abundance among zooplankton during the study and this high species richness of rotifers in this pond may be attributed to plentiful organic matter and detritus available due to anthropogenic stress, rich macrophytic vegetation which provide both food and shelter for the planktons (Bonecker and Lensac-Taho, 1996; Sharma, 2002; Singh, 2004; Saini, 2009 and Jyoti *et al.*, 2009).

Presently enlisted rotifer population recorded a peak during winter and fall in monsoon season. This winter peak of rotifers may be due to low number of cladocerans as both rotifers and cladocerans show inverse relationship as they feed on same algal types and thus there exists natural competition between the two groups (Gilbert, 1988).

Cladocera

An inquisite look at the table 1 revealed that the cladocera contributed 19% to the total zooplankton population of this pond. Cladoceran fauna of Dilli pond comprised of six species belonging to three families viz. Chydoridae (7 species), Moinidae (1 species), Daphnidae (3 species). Quantitatively, cladoceran density fluctuated from 0.0 to 16.55/litre during the study period (Table 1).

Cladoceran population showed maxima in the post monsoon month (September) and absence or decline in cladoceran population during winter and summer months, this minima might be due to presence of large number of rotifer and copepods as these organisms showed their maxima in winters. Similar summer absence or decline was also reported by Chandrakiran (2008) and Saini (2009).

Copepoda

From the present investigative studies, extending from August, 2013 to July, 2015, it was revealed that the Copepoda contributed 44% to the total zooplankton count.

Table 1 Qualitative and Quantitative distribution (Number/litre) of Zooplankton of Dilli Pond

Zooplankton	Months (Aug, 2013 – July, 2014)												
	Aug.	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May.**	**Jun.**	**Jul.**	**Total**
Protozoa													
Class: Rhizopoda													
Order: Testacea													
Family: Difflugiidae													
Centropyxis hemisphaerica	0.1	0.2	0.1	0.0	0.0	0.1	0.05	0.1	0.3	0.55	0.2	0.05	1.75
Centropyxis ecornis	0.0	0.0	0.05	0.05	0.0	0.0	0.0	0.0	0.05	0.05	0.1	0.0	0.3
Total Protozoa	0.1	0.2	0.15	0.05	0.0	0.1	0.05	0.1	0.35	0.6	0.3	0.05	2.05
Rotifera													
Class: Monogonota													
Order: Ploima													
Family: Brachionidae													
Brachionus calyciflorus	1.1	0.0	0.0	0.2	0.65	12.2	8.35	0.15	0.1	0.1	1.35	0.35	24.55
Brachionus angularis	0.0	0.0	0.0	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.25
Brachionus caudatus personatus	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3
Brachionus caudatus aculeatus	0.0	0.0	1.75	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.95
Brachionus quadridentata	0.0	0.0	0.0	0.0	0.0	0.15	0.1	0.25	0.3	0.0	0.0	0.0	0.8
Brachionus rubens	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Keratella tropica	0.0	0.0	0.0	0.9	0.95	6.1	4.05	2.45	0.0	0.0	0.0	0.0	14.45
Euchlanis dilatata	0.0	0.0	0.1	0.0	0.0	0.0	0.05	0.1	0.0	0.0	0.0	0.0	0.25
Platyias quadricornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.05
Family: Lecanidae													
Lecane inopinata	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.5
Order: Floscullariacea													
Family: Testudinelliidae													
Testudinella sp.	0.0	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05
Filinia longiseta	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	1.15	0.35	0.0	0.0	2.0
Filinia opoliensis	0.1	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.05	0.25
Order: Bdelloidea													
Family: Philodinidae													
Philodina sp.	0.0	0.0	0.0	0.0	0.0	0.3	0.15	0.1	0.0	0.0	0.0	0.0	0.55
Total Rotifera	1.4	0.25	1.95	10.85	1.75	18.75	12.8	3.4	1.55	0.55	1.4	0.4	55.05
Cladocera													
Family: Chydoridae													
Chydorus sphaericus	0.05	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05	0.2
Alona rectangula	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.05	0.85
Family: Moinidae													
Moina brachiata	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.05
Family: Daphnidae													
Cerodaphnia reticulata	7.5	16.15	0.15	0.2	0.0	2.6	1.6	3.45	0.2	0.0	0.0	0.0	31.85
Cerodaphnia cornuta	0.0	0.0	0.7	0.6	0.0	4.05	1.75	8.0	0.0	0.0	0.0	0.0	15.1
Daphnia similis	0.0	0.0	0.0	0.0	0.0	0.0	0.85	4.25	0.25	0.0	0.0	0.0	5.35
Total Cladocera	7.75	16.55	0.9	0.8	0.0	6.65	4.3	15.9	0.45	0.0	0.0	0.1	53.4
Copepoda													
Order: Cyclopoida													
Family: Cyclopidae													
Mesocyclops leuckarti	12.2	14.5	8.35	4.45	1.35	4.9	2.4	2.75	1.9	1.1	0.65	0.3	54.85
Tropocyclops sp.	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.9	0.0	0.0	0.0	1.1
Nauplius larvae	0.35	4.9	6.5	2.0	0.2	17.05	10.5	8.35	0.0	0.15	0.15	0.0	50.15
Order: Calanoida													
Family: Diaptomidae													
Heliodiaptomus sp.	0.0	0.0	2.7	0.75	0.0	2.3	0.6	6.5	0.85	0.2	0.1	0.45	14.45
Total Copepoda	12.55	19.4	17.55	7.2	1.55	24.45	13.5	17.6	3.65	1.45	0.9	0.75	120.55
Ostracoda													
Order: Podocopa													
Family: Cypridae													
Onchocypris pustulata	14.5	12.10	0.25	0.55	0.95	0.4	0.1	0.0	0.5	0.3	1.1	14.85	45.6
Total Ostracoda	14.5	12.10	0.25	0.55	0.95	0.4	0.1	0.0	0.5	0.3	1.1	14.85	45.6

Copepod fauna of Dilli pond comprised of three species belonging to two families viz. Cyclopidae (2 species), Diaptomidae (1 species) and also were recorded number of nauplius larvae. Quantitatively, copepod density fluctuated from 0.75 to 24.45/litre during the study period (Table 1). Quantitative richness of Copepoda as compared to other zooplanktonic groups may be attributed to their toughest exoskeleton, long and strong appendages which help in fast swimming of these organisms, versatile feeding habits which assist them to hold up harsh environmental conditions. Also was prevalent the fact that different species of copepod occupied different niches within same habitat, so there wass no competition among each other (Jyoti and Sehgal, 1979) and expanded reproductive phase (Sharma and Sharma, 2011 & Bhat *et al.*, 2014) which kept their number high.

A look at the table 1 indicated that the copepods registered population maxima during present study in the winter months this may be because of their ability to adapt to low temperature, high DO, total alkalinity and presence of phytoplankton (Rajashekhar *et al*., 2010).

Ostracoda

Presently recorded Ostracoda contributed 16% to the total zooplankton count. Ostracod fauna of Dilli pond comprised of only one species belonging to family Cyprididae. Quantitatively, ostracod density fluctuated from 0 to 14.85/ litre (Table 1). Maximum number of ostracods was recorded in monsoon and low or absence in winter months. Being benthic in nature, plenty of dead organic matter brought to the water body with rain runoff may help in the growth of ostracods and hence increase their density. The dependency of ostracods on organic matter is reflected by their low density in summer and winter when water level is stable and no mixing of water was noted (Chaitram, 2014).

Correlation studies

Correlation studies conducted on the present data of this pond showed positive correlation among Rotifera-Cladocera (0.037), Rotifera-Copepoda (0.50), Cladocera-Copepoda (0.71) and Cladocera-Ostracoda (0.28). Negative correlation was observed between Rotifera-Ostracoda and Copepoda-Ostracoda. Protozoa showed negative correlation with all other groups because qualitative and quantitative abundance of protozoans were very low throughout the year as compared to other zooplanktonic groups. Rotifers and copepods showed positive correlation as they both showed maxima in winters and minima in monsoons. They both coexist but copepods showed numerical dominance over rotifers as they feed on some small sized rotifers. Cladoceran showed positive correlation with rotifer because they also showed coexistence but they numerically showed inverse relationship that might be due to existence of natural competition among these two groups. Cladocera and copepod also recorded positive correlation because they both showed their presence throughout the year. Cladocera also showed positive correlation with ostracoda due to their synchronized presence or absence. They were high during monsoon and post-monsoon months and showed absence or less abundance in winter and summer months.

CONCLUSION

To understand these interactions among various zooplanktonic groups, investigation on diversity and abundance was carried out in a perennial, shallow and highly polluted Dilli Pond located in Jammu district of J&K state. Among the recorded groups the qualitative abundance was shown by Rotifera and quantitative abundance was shown by Copepoda. These different groups show several types of interactions which are very essential for their survival and flourishment and also helpful in maintaining healthy aquatic ecosystem. The presumed presence of *Brachionus* sp., *Keratella* sp., *Lecane* sp., *Chydorus sphaericus* and *Mesocyclops leuckarti* in the pond indicates the higher trophic status of the pond as these species are indicator of eutrophication (Wanganeo and Wanganeo and Wanganeo, 2006; Kumar *et al.*, 2010). Thus, can be concluded that this water body is eutrophic and the anthropogenic load needs to be checked to save it.

Acknowledgements

The authors are grateful to UGC for help and encouragement and providing financial assistance under UGC-SAP. We also sincerely thank Department of Zoology, University of Jammu for providing lab facilities to conduct the work successfully.

References

Adoni, A.D. (1985). Workbook on limnology. Pratibha Publishers C-10 Gour Nagar Sagar, India.

Arndt, H. (1993). Rotifers as predators on components of the microbial web (bacteria, heterotrophic flagellates, ciliates)-a review. *Hydrobiologia*, 255/256, 231-24.

Bhat, N. A., Wanganeo, A. and Raina, R. (2014). The composition and diversity of net zooplankton species in a tropical water body (Bhoj Wetland) of Bhopal, India. *International Journal of Biodiversity and Conservation*, 6(5): 373-38.

Bonecker, C.C. and Lansac-Toha, F.A. (1996). Community structure of rotifers in two environments of the upper river Parana floodplain (MS)-Brazil. *Hydrobiologia*, 325:137-150.

Chaitram, A. M. (2014). Study on seasonal variations in physico-chemical parameters and planktonic diversity of Budki Medium Irrigation tank, Shirpur dist.-Dhule (M.S.), India. Ph. D. Thesis, North Maharashtra University, Jalgaon, Maharashtra.

Chanderakiran (2008). Diversity, Dynamics and Cyclomo-rphosis in Cladoceran inhabiting fresh water ponds of Jammu. Ph.D. Thesis, University of Jammu, Jammu.

Edmondson, W.T. and Winberg, G.G. (1971). A manual on the productivity in Freshwaters. Blackwell Scientific Publications, Oxford: 358p.

Gilbert, J. J. (1988). Suppression of rotifer populations by Daphnia: A review of the evidence, the mechanisms, and the effects on zooplankton community structure. *Limnol. Oceanogr*., 33: 1286-1303.

Jyoti, M. K. and Sehgal, H. (1979). Ecology of rotifers of Surinsar, a subtropical, fresh water Lake in Jammu (J&K), India. *Hydrobiologia*, 65: 23-32.

Jyoti, M. K., Sharma, K. K. and Sharma, J. (2009). Population dynamics and community structure of zooplankton inhabiting in fish pond Jammu, India. *Current World Environment*, 4(1): 165-169.

Kumar, P., Sonaullah, F. and Wanganeo, A (2010). A preliminary limnological study on Shershah Suri Pond, Sasaram, Bihar. *Asian J. Exp. Sci*., 24(2): 219-226.

Pennak, R.W. (1978). Fresh water invertebrates of United States. 2nd edition. A Wiley- Interscience Publication.

Rajagopal, T., Thangamani, A., Sevarkodiyone, S.P., Sekar, M. and Archunan, G. (2010). Zooplankton diversity and physico-chemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu, *Journal of Environm-ental Biol*ogy, 31: 265-272.

Rajashekhar, M., Vijaykumar, K. and Zeba, P. (2010). Seaso -nal variations of zooplankton community in freshwater reservoir Gulbarga District, Karnataka, South India. International *Journal of Systems Biology*, 2(1): 6-11.

Rao, M. B. and Muley, E. V. (1981). Seasonal and species of Zooplankton organisms and their succession in two freshwater ponds at Waghuli, Poona. proc. Symp. Ecol. Anim. Pool. Zool. Surv. India, 2, 63-64 pp.

Saini, M. (2009). Limnological characterization of Gharana wetland (Reserve), Jammu. M. Phil dissertation, University of Jammu, Jammu.

Saini, M. (2009). Limnological characterization of Gharana Wetland (Reserve), Jammu. M.Phil. Dissertation, Univer -sity of Jammu, Jammu.

Sharma, S. P. (2002). Studies on the impact of anthropogenic influence on the ecology of Gharana wetland of Jammu. Ph.D. Thesis, University of Jammu, Jammu.

Sharma, B.K. and Sharma, S. (2011). Zooplankton diversity of Loktak Lake, Manipur, India. Journal of Threatened Taxa, 3(5): 1745-1755.

Singh, P. (2004). Faunal diversity and ecology of wetlands of Jammu. Ph.D. Thesis, University of Jammu, Jammu.

Verma, P. K. and Munshi, D. (1987). Plankton community structure of Badua reservoir, Bhagalpur (India). *Tropical Ecology*, 28: p200-207.

Wanganeo, A. and Wanganeo, R. (2006). Variation in zooplankton population in two morphologically dissimilar rural lakes of Kashmir Himalayas. Proc. Nat. Acad. Sci. India. 76 (B) III.

How to cite this article:

Sharma, K. K., Kour, S and Antal, N.2017, Interactions among Various Zooplanktonic Groups in A Subtropical Pond of Jammu Region, J&K, India. *Int J Recent Sci Res.* 8(6), pp. 17737-17741. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0806.0414

****