REVIEW OF RESEARCH
ISSN: 2249-894X
IMPACT FACTOR : 5.7631(UIF)
VOLUME - 10 | ISSUE - 10 | JULY - 2021

IMPACT OF TOXIC SUBSTANCE ON BIODIVERSITY OF ZOOPLANKTON IN A FRESHWATER BODY, BEEHAR AND BICHHIYA RIVER OF REWA (M.P.)

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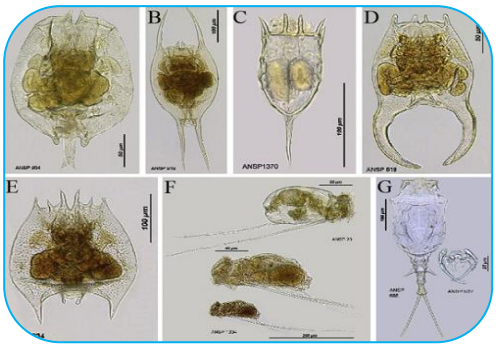
ABSTRACT:



This study assessed the seasonal variations of Zooplankton are cosmopolitan in nature and they are found to inhabit all freshwater body. The present study deals with the study of seasonal changes of diversity and density of Zooplankton in Beehar and Bichhiya River Rewa. The work was carried out for a period of one year from January 2020 to December 2020. During the present investigation a total of 33 species of zooplankton belonging to 6 major group viz. Protozoa, Rotifera, Copepoda, Cladocera, Ostracoda and Insecta have been reported from the four selected stations of Beeharriver, Rewa (M.P.) during the study period (Jan. 2020 to Dec. 2020). Among 33 species of zooplankton, 8 species belong to Protozoa 11 species to Rotifera, 4 species to Copepoda, 6 species to Cladocera, 1 species to Ostracoda and 3 species to Insecta. The Zooplankton sample consisted of 33.33% Rotifera, Cladocera, 18.18 % Protozoa 24.24%, Ostracoda 03.03%, Insecta 09.09% and Copepoda 12.12% respectively. Results revealed that maximum density of zooplankton was recorded at station B and minimum at station D during the years of study period. The maximum density of zooplankton was recorded during winter season (709 org/l sampling st. B) followed by summer season (741 org/l sampling st. B) and minimum during Rainy season (470 org/l sampling st. D) during the study years.The various kinds of diversity indices indicate the seasonal variation of zooplankton community and good quality of fresh water Ecosystem. They are also important as an index of productivity, eutrophication and pollution of the aquatic ecosystem.

KEYWORDS: *Beehar and Bichhiya River, Zooplankton diversity and density*

INTRODUCTION

Today, there are overarching concerns for surface water quality since being degraded by anthropogenic activities, such as urban, industrial, and agricultural developments accompanied by increasing water-resources exploitations and natural alterations caused by erosion, weathering, and precipitation processes of crustal materials (Alberto et al. 2001; Kazi et al. 2009; Strobl and Robillard 2008). Prevention and control of water pollution, as well as gaining reliable information about the water quality of rivers, reservoirs, and lakes as the main resources of inland water supply are necessary for irrigation, domestic, and industrial uses (Varol et al. 2012).

Surface water bodies are contaminated with many anthropogenic toxic chemicals that can affect their natural communities. It is necessary to assess the effects ofthese chemicals in order to conserve aquatic ecosystems.Among the anthropogenic chemicals, pesticides maycause the most serious problems because they are designed specially to kill organisms (both the noxioustarget organisms and other non-target ones) and they arereleased into the natural environment intentionally. Ithas been widely documented that pesticide concentrations in the natural environment are often high enoughto kill certain organisms (Hatakeyama et al., 1991, 1994)and affect the structure and function of natural communities (Helgen et al., 1988; Hatakeyama et al., 1990).

Zooplankton are microscopic animals that act as primary and secondary links in the food webs of all aquatic ecosystems. They feed on phytoplankton which directly provide food source for larval vertebrates and invertebrates as well as related to the growth of juvenile and larger fish. They are also important component in the transfer of energy from primary producers of phytoplankton to higher trophic levels such as fish.Regarding the habitat, zooplankton are cosmopolitan fauna and inhabit all freshwater bodies of the world. These communities are also sensitive to various substances in water such as nutrient enrichment and pollutants. Thus, they have often been used as indicators to assess the condition and change of the freshwater environment. They are endowed with many remarkable features and are often armored with pines, which hamper their predation by higher organisms.

Zooplankton are frequently used in Eco-toxicological tests because they are one of the groups most sensitive to toxic chemicals and they occupy a central position in the lentic (standing water) food chain. The responses of zooplankton to toxicity tests are considered to be informative of relative impacts on the ecosystem as a whole. In the present paper I review the results of pesticide toxicity tests conducted with zooplankton at different levels of organization, ranging from individuals to communities, and discuss the effects of chemicals from an ecological perspective.

AIMS AND OBJECTIVE OF STUDY:-

The objective of the present study is based to investigate on “Impact of Toxic substances on Biodiversity of Zooplanktons in water of Beehar and Bichhiyariver Rewa (M.P.)”. The study has been conducted to fulfil the following aspects.

1. The general survey of the Beehar and Bichhiyariver and its climatic conditions.
2. Qualitative and quantitative study of Zooplankton will be recorded.

REVIEW OF LITERTURE:-

Quantitative study of zooplankton was carried out by many researchers worldwide. Bhat et al (2014), Chatterjee et al (2014), Koli and Muley (2012), Kulkarni and Surwase (2013), Patole (2015), Pradhan (2014), Sehgal et al (2013), Watkar and Barbate (2013) studied zooplanktons quantitatively to a large extent from Indian continent. The importance of the Zooplankton is well recognized as these have vital part in food chain and play a key role in cycling of organic matter in an aquatic ecosystem Sharma et al (2010). Though numerous works on Zooplankton diversity are being reported from different parts of India but there is scarcity of report from freshwater bodies of different parts of Northeast India except some worth mentioning of Sharma and Sharma (2008); Kar and Barbhuiya (2004); Kar (2013).

MATERIAL AND METHODS:-

Samples were collected regularly at monthly intervals by using plankton net and preserved in 5% formalin during Jan.2020 to Dec.2020 for zooplankton following the standard method (APHA,1999). The planktonic counting was done by using a Sedgwick rafter counting cell. The average number of plankton in per liter of water was calculated. Planktonic samples were collected separately from fixed from five sampling sites (A, B, C, D and E) of the river to study the seasonal variations. Identification and analysis of zooplankton were made following the methods recommended by Ward and Whipple (1959), Needham and Needham (1962), Holome and McIntyre (1971) and Pennak (1978).

STUDY AREA

The study area is situated between 81⁰-18, east longitude and 28⁰-32, north latitude and is situated on Vindhya plateau at the height of 318 meter above m. s. l. The climate is mainly sub-tropical and sub humid. The average annual rainfall of the region is 82.953 mm and relative humidity is 79.36 %. Two water bodies namely Bichhiya andBeehar River were selected for study, because of their contribution to the development of fresh water culture fishery of Rewa district.

Sampling Station

Five sampling station were selected for physical analysis of river. They are-

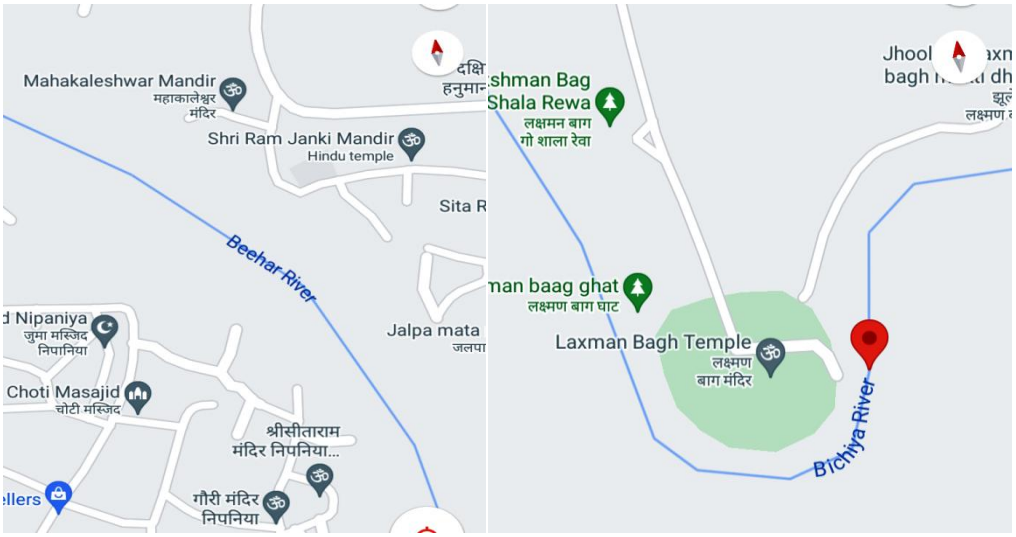


Fig. 1.Location map of Beehar and Bichhiya River Rewa M.P.

Station A- The I[st]station was Gurh where the river Bichhiya originated. It is about 27k.m. away From Rewa town.
Station B- The 2[nd] station was established at Laxman Bag Mandir 6 km away from Rewa District.
Station C- The 3[rd] station was established before Rajghat the characteristics of the station is PHE Deptt. Pumping.
Station D- The 4[th] station was marked on Chhotipul which is half km from Old Rewa Bus Stand.
Station E–The 5[th] Station was marked on Jayanti Kung Forest area.

RESULT AND DISCUSSION :-

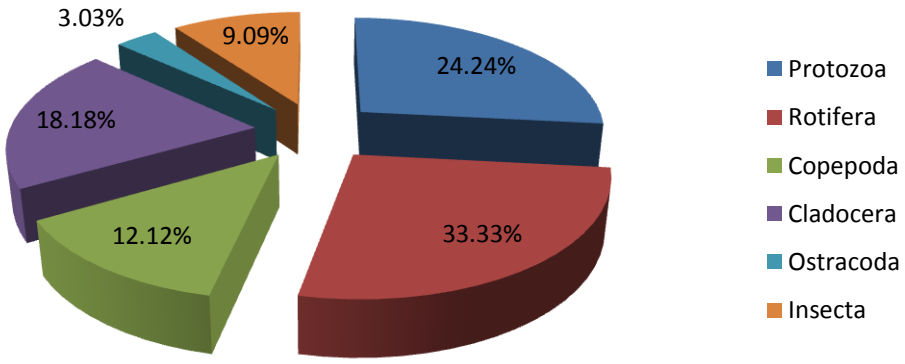
Zooplankton plays an important role in the study of faunal bio-diversity of a water body. Zooplankton feed on phytoplankton and facilitate the conversion of plant material into animal tissue which are the basic food for higher animals including fishes. In an aquatic ecosystem, zooplankton play an important role in and aquatic food chain as they are largely consumed by fishes. Zooplankton density varies depending on the availability of nutrients in aquatic ecosystem. The physical and chemical characteristics of a water body also determine the occurrence, diversity and density of both flora and fauna in any given habitat. Zooplankton are important biological indicator of water quality as they respond quickly to the environmental changes.

During the present investigation a total of 33 species of zooplankton belonging to 6 major group viz. Protozoa, Rotifera, Copepoda, Cladocera, Ostracoda and Insecta have been reported from the four selected stations of Beeharriver, Rewa (M.P.) during the study period (Jan. 2020 to Dec. 2020).

Among 33 species of zooplankton, 8 species belong to Protozoa 11 species to Rotifera, 4 species to Copepoda, 6 species to Cladocera, 1 species to Ostracoda and 3 species to Insecta. The species composition of different groups of zooplankton and their percentage contribution are given below:

S.No.	Group	Genera	Species	Percentage
1.	Protozoa	08	08	24.24
2.	Rotifera	08	11	33.33
3.	Copepoda	04	04	12.12
4.	Cladocera	06	06	18.18
5.	Ostracoda	01	01	03.03
6.	Insecta	03	03	09.09
	Total	**30**	**33**	**100.00**

Graph.1. Composition of different groups of Zooplankton and their percentage contribution



The identified zooplankton of Beeharriver are listed below:

Group 1.Protozoa :

Amoeba sp, Euglepha sp., Euglena sp., Paramecium sp., Epistylis sp., Vorticella sp., Diffusia sp., Arcella sp.

Group 2.Rotifera:

Asplanchnabrightwelli, Brachionuscaudatus, B. Calfertus, B. angularis, B. aculiatus, Epiphanesclavulata, Filinialongiseta, Keratellacochlearis, Monostyla sp., Monogonont rotifer, Polyarthra sp.

Group 3.Copepoda:

Cyclops sp., Diaptomus sp., Mesocyclops sp., Nauplii

Group 4.Cladocera:

Alonaaffinis, Bosmina sp.,Ceriodaphnia sp., Daphnia sp., Moina sp., Monodaphnia sp.

Group .5 Ostracoda:

Cypis sp.

Group 6.Insecta:

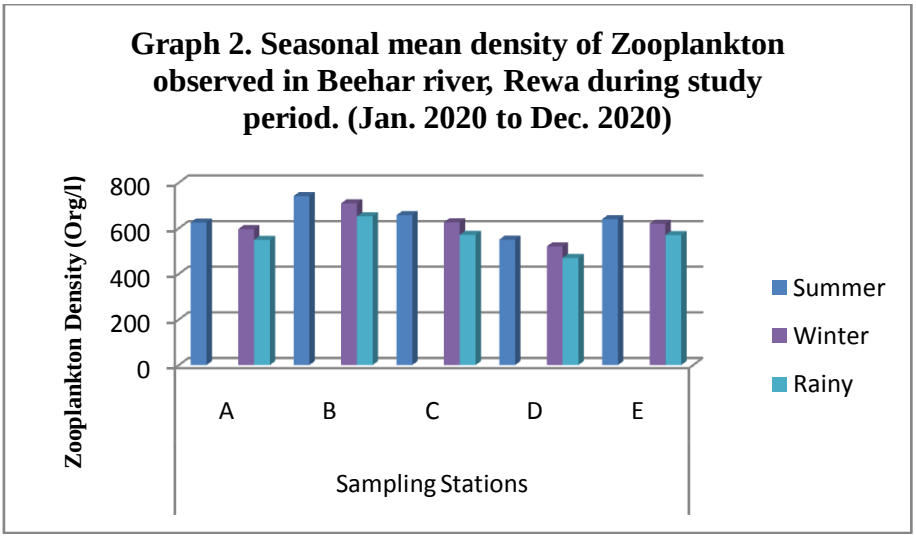
Aedes larva, Ephemeropteran larva, Trichopteran larva.

Seasonal density of Zooplankton (org/l):

The mean seasonal density of different stations of Beeharriver, Rewa recorded during the study years of study period are represented in Table 2. Results revealed that maximum density of zooplankton was recorded at station B and minimum at station D during the years of study period. The maximum density of zooplankton was recorded during winter season (709 org/l samplingst. B) followed by summer season (741 org/l sampling st. B) and minimum during Rainy season (470 org/lsampling st.D) during the study years.

Table 2. Seasonal mean density of Zooplankton observed in Beeharriver, Rewa during study period. (Jan. 2020 to Dec. 2020).

Years	Seasons	Sampling Stations					Mean
		A	B	C	D	E	
Jan 2020 to Dec. 2020	Summer	625	741	657	550	640	642.60
	Winter	596	709	626	520	620	614.20
	Rainy	549	652	571	470	570	562.40



The values of total number of zooplankton have been noted to varied with an increasing trend from January up to August and becoming maximum in the month of August due to rain brings more zooplankton from the water bodies of upper reaches to the sites under investigation.

Zooplanktons are the integral part of lotic community and contribute significantly to biological productivity of ecosystems. The abundance of some zooplanktons as intermediate in aquatic food web is supposed to be an inductor of gradual eutrophication of the system. These organisms are good experimental tool for eco-toxicological studies to determine the ecological health of the system. Seasonal variations profoundly affected zooplanktons population in Beehar water, which is very high during the summer and low in the monsoon.

Zooplanktons are considered to be the ecological indicators of water bodies (Gajbhiye and Desai 1981). Factors such as light intensity, food availability, dissolved oxygen and predation effect the population dynamics of zooplankton. Low pH or higher salinity can reduce their diversity and density (Horn and Goldman, 1994). The samples from five sampling sites have been analyzed for spatial and temporal distribution.

Similar observation was made by many researchers throughout the country Kar and Kar (2013) reported 26 species of Zooplankton from an oxbow lake of Cachar, Assam; Tyor et al. (2014) studied Zooplankton diversity in a shallow lake of Gurgaon, Haryana revealing Rotifera with highest diversity followed by Cladocera and then Copepoda showing least diversity; Pawar (2014) reported 66 species of Zooplankton in some freshwater bodies around Satara district of Maharashtra, India.

Pahwa and Mehrotra (1966) reported rotifer population from Ganga river, where they constituted 61.5 to 94.4% of population. Govind (1969) reported a rotifer peak in February (24.7%) out of the total zooplankton from shallow zone of Tungbhadra reservoir. Gupta (1989) reported a major rotifer peak in August and in February from two ponds near Jodhpur. Sheebaet. al. (2004) Qualitative and quantitative study of zooplankton in Ithikkara river, Kerala. These exhibited a bimodal pattern with

a major peak in December and a minor peak in August. The second group of zooplankton, Copepoda, also exhibited two maxima (April & August) and two minima (February, March and September).

CONCLUSION:-

Aquatic organisms in the natural environment often are exposed to multiple toxic chemicals simultaneously. The chemicals have complex effects on the organisms, sometimes being antagonistic or additive, and at other times synergistic. Analysis of toxicant effects on other life history characteristics such as off-spring size, morphology and behavior is necessary to evaluate the effects on populations, communities and ecosystems. The dominance of zooplankton species is highly variable in different types of water body according to nutrient levels, predator and other environmental factors which then affects the other biotic components of the ecosystems. The rapid increase of human activities and assemblage of livestock are creating pollution in the dam water and needs immediate measure. At this critical juncture the local representatives, Government and Non-Government bodies, the educated bodies, the village heads and the reputed figures of the society should come forward and formulate conservational model for the sustainability of this beautiful water body. There are many common patterns in the structural and functional responses of ecosystems to toxic chemical and other anthropogenic stressors such as acidification, heavy metal pollution and climatic warming, as originally hypothesized by Odum (1985). Identification of these common patterns is helpful for predicting the ecological risks of environmental problems created by human activities, and is thus an important research topic in both ecotoxicology and fundamental ecology. Accordingly, more emphasis needs to be placed on ecological analysis in future ecotoxicology research.

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