International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Study of Seasonal Variations of Micro-Invertebrates in River Sikrahana near Chanpatia, West Champaran, Bihar

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Abstract

A study on the impact of sugar mills effluents discharge on the distribution and seasonal biodiversity of macro- invertebrates and water quality of river Sikrahana near Chanpatia, block of District West Champaran, Bihar.

About 5 sugar mills of District West Champaran release their effluents in directly in to river water through many tributaries of river Sikrahana. The study was done on this river during Jan 2024- Dec 2024 comprising the physico-chemical paramertes and macro-invertebrate. The benthic macro invertebrates showed a Unimodel pattern of variations during study. The total number of macro-invertebrates, the maximum number was recorded in January (7117 ind./m^2) and the minimum in August (1316ind./m^2). A total number, 13 species were recorded and most dominant group was insect followed by Oligochaetes and Gastropods. The number of macro-invertebrates at Chanpatia especially of Oligochaetes is high due to large inflow of effluents from sugar mills and domestic flow from surrounding areas brings disposal of decaying solid wastes.

Keywords: Sikrahana, Physico-chemical, Station-Chanpatia, Macro-invertebrate, Components, Oligocheates, Gastropods, Insects

INTRODUCTION

The extensive study of fresh water bodies in India is mostly due to people conscious of intense pollution of main river system of the country. The structural components ofour ecosystem consists of both biotic and abiotic components which interact each other. The water bodies of urban as well as rural areas are being polluted by extensive use of organic and inorganic chemicals and plant derivatives like nicotine, retonine, pyretherumetc. During study, it has been observed that due to discharge of domestic and industrial effluents which polluted river water to such extent they become health hazards if used for human consumption. A review of literatures shows that so far very few ecological studies of water bodies have been undertaken. Some recent work includes Singh et al. (1989) has made a comparative study of ecology of pond and a stretch of Ganga. Earlier Ramulu et al. (2011) studied the phytoplankton productivity in the lentic and lotic ecosystem.

MATERIALS AND METHODS

In the present study fresh water body River Sikrahana (Chanpatia) was selected which receives industrial effluents from sugar mills of West Champaran and domestic effluents from surrounding areas. For analysis of parameters, Water samples were collected in plastic Cans of two liters capacity on monthly basis from Jan 2024 to Dec 2024 and preserved by adding few drops of Chloroforms or H_2SO_4 as suggested by Goltermanet.al. (1978) and then brought to the laboratory for biological analysis. Aquatic insects were collected from station Chanpatia through the study period at monthly intervals.

RESULTS

A total number of 13 species were recorded and most dominant group was insect followed by Oligochaetes and Gastropods.

The benthic macro invertebrates showed a Unimodel pattern of variations during study.The total number of macro-invertebrates, the maximum number was recorded in January (7117 ind./m^2) and the minimum in August (1316ind./m^2).

A total number of 3species of Oligochaeta, T.tubifex, L.hoffmeisteri, B.semperi were observed during investigation. The highest number of Oligochaetes were observed in January (2451ind./m^2)and lowest in August (221ind./m^2). Of these, T. tubifex was dominant. The maximum number (2210 and 2254ind./m^2) was observed in January and December, while the lowest number (306and 393ind./m^2) in May and August during the study. The second dominant species was Limnodrillus hoffmeisteri, the highest number was noted in January, November and December (154 and 197ind./m^2) and lowest (24 and 45ind./m^2) in March and September. During study, Branchiodrillus semperi was thinly present throughout the year. The representation of Hirudinea hablobdella species was also observed.

In all 6 species of benthic insects Chironomousplumosus, Sticto-chironompussp, Culicoridessp, Ephemeropteran larvae, Gomphussp and Tachopteryx were recorded. Out of these, first 3 and last 2 species were found in river water. The population of benthic insects at Chanpatia was represented by Chironomous plumosus, Sticto-chironompus sp,Culicorides sp, and Tachopteryx sp. The total number of insects was maximum (3967ind./m^2) in January
and minimum (437ind./m^2) in March.

Chironomus plumosus was the most abundant species of insect. In the study, Chironomus plumosus reached its first peak (3661ind./m^2) in January and second peak (1366 ind./m^2) in June , while, the lowest number (306ind./m^2) was noted in March .

The Gastropods populations were represented by Bellamya bengalenris, B. crassa, Thiara tuberculata, T.scabra, Lymnaea acuminate, Gyralulus convexiusculus and Indoplanorbis sp. Of these 6 species were recorded at Chanpatia, The maximum number (1306ind./m^2) of total gastropods population was recorded in Marchand the minimum (178ind./m^2) in August during the investigation.

The Bellamya crassa was the most dominant gastropods at station. The highest number (716 ind./m^2) was observed in March and lowest (45 ind./m^2) in August. . Thiara granifera was the second abundant species of the gastropods, the highest and lowest (305 ind./m^2and45ind./m^2) were recorded in February and August. The maximum number of Thiara tuberculata (240 ind./m^2) was noted in May and the minimum (45 ind./m^2) in August.

DISCUSSION

Macro-invertebrates are important components in the food chain. Their dominance depends upon various factors like food quality, and abundant temperature, light, physic- chemical conditions of water, quality of bottom soil, fringing predation and oriposition habit, Haider et al (2017). Their chief source of energy is from the decaying organic detritus when settle in the bottom of water body. As a result they play an important role in the detritus food chain. In this study, a total of 20 species belonging to main classes were observed in the river water among these 4 species belonged to Oligochaeta, 1 species to Hirudinea, 6 Species to insect, 8 Species of gastropods, and a single species of Pelecypoda.

The benthic-invertebrates distribution showed in river water, 18species of benthic macro- invertebrates were in defined among which the gastropods were the most abundant followed by insect and Oligochaeta. On other hand at the heavily polluted Chanpatia, only 13 species were observed in which most abundant species was insects followed by Oligochaeta and Gastropods.

The five major classes seem to constitute the benthic macro-invertebrate fauna of other confined water bodies also. Similar observations with variable number of species but belonging to same 5 classes have been observed by Ahmad and Singh (1989), Singh (1991, 1993). The role of river substratum in influencing the benthic fauna cannot be under estimated. Walmiki et al. (2016) suggested that in the absence of organic matter in the substratum as far that matter bottom fauna will not thrive for lack of nourishment. Keddy (2010) emphasized the role of depth of water bodies. Mophin et al (2014) stated that the other important factors influencing the benthic life are the pollutants discharge from various sources.

It is interesting to note that Carr and Hituman (1965) have classified water bodies into polluted, moderately polluted, and heavily polluted on the density of Oligochaetes population. On the above classification, Chanpatia with maximum Oligochaetes population density of 2560 ind./m^2 can strictly applied also be regarded though mean heaving polluted than river origin. So taking an over view it can be regarded as a rough index for population but it cannot be solely relied upon to determine the water quality, it may be noted that Shyam et al(2018) suggested that an Oligochaetes population of over 80% of macro benthic fauna indicates heavy deposits of organic matter in water body. The remaining 4 classes of benthic forms do not play any significant role as polluted indicator, their presence in the polluted water showed their ability to extract nourishment from decaying organic sources. It may be noted that in this study highest number Of macro-invertebrates at Chanpatia in January (7207 ind./m^2) and minimum in August (1316 ind./m^2).Secondly the conc. of macro- invertebrates was maximum during winter and less in monsoon. This could be attributed to enrichment river bottom by higher production and subsequent decaying of biomass during early winter and summer month when the sky is clear, sunlight plenty and wind action less resulting in higher photosynthesis, production of biomass, abundance of both of planktons and ultimate deposit of organic matter in bottom of river resulting in an increase in macro- invertebrate population.

During rainy season of due to dilution of river water, heavily flow of chemicals in the forms of insecticides, fertilizers and other organic substances from sugar mills and the catchment areas, the growth of macro-invertebrates is slow down. The number of macro- invertebrates at Chanpatia especially of Oligochaetes is high due to large inflow of effluents from sugar mills and domestic flow from surrounding areas brings disposal of decaying solid wastes. This provides procurable conditions for feeding and burrowing of Oligochaetes specially tubificid worms. This is in agreement with the findings of Mophin et al (2014). The general survey of the surrounding areas and edge of the river

showed that station Chanpatia has some of vegetation around it. According to Bhandarkar and Bhandarkar (2013), Haideret al (2013), Singh and Singh (2019), Yadav et al (1984) and Meshram et al (2014), vegetation plays an important role in aquatic ecosystem because they form the food materials for insects and decaying vegetations are eaten by bottom dwellers. A study of the number of macrozoo-bethoes showed that in the river water, the highest number occurs in winter i.e December and January, lowest number Was during monsoon i.e in August, other hand the highest and lowest count at Chanpatia (7207 and 1316 ind./m^2). This may be due to maximum water turbidity at Chanpatia in general and monsoon in particular.

CONFLICT OF INTEREST

Author declares that no conflict of interest.

ACKNOWLEDGEMENT

The author is thankful to Prof. (Dr.) Faiyaz Ahmad, Ex. Head, University Deptt. Of Zoology, B. R. A. Bihar University, Muzaffarpur, Prof. (Dr.) R. K. choudhary, Principal, M.J.K. College, Bettiah and Dr. Sanjiv Kumar Ram, Principal, Government Degree College, Badgaon, Bagaha, West Champaran Bihar for their valuable suggestions and support**.**

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Table:- Seasonal variations on monthly basis from January 2024 to December 2024

`Organisms/Months	Jan, 2024	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec, 2024
Oligochaetes												
T.tubifex	2210	1821	1605	933	306	522	609	393	501	629	1561	2254
L.hoffemeistri	154	68	24	X	X	X	X	68	45	88	154	197
B. semperi	87	X	X	23	66	44	X	X	23	X	66	109
Total no. of Oligochaetes	2451	1889	1629	956	372	566	609	461	569	717	1781	2560
Insecta												
C.plumosus	3661	1107	306	702	1215	1366	998	609	739	1041	1063	2297
Sticto-chironomus	66	66	44	X	X	44	X	X	X	87	152	261
Culicoides	152	44	87	X	X	66	X	X	X	44	87	87
Techopteryxsp.	88	X	x	88	110	X	X	68	153	197	218	110
Total no. of Insecta	3967	1217	437	870	1325	1476	998	677	892	1390	1520	2755

Gastropods												
B.crassa	197	305	716	391	110	67	67	45	132	175	262	326
S.bengalenris	X	23	109	44	X	X	X	X	X	23	44	87
T.granifera	240	305	153	110	88	67	67	45	110	153	15	262
T.tuberculata	175	110	88	132	240	197	68	45	68	110	153	197
Gynatus sp.	87	87	131	23	X	X	X	X	23	44	87	87
Incoplanoois sp.	X	X	109	X	X	X	X	X	23	X	66	44
Total	699	830	1306	700	438	331	202	178	356	505	627	1003
Total number of Benthos	**7207**	**3936**	**3372**	**2526**	**2135**	**2373**	**1809**	**1316**	**1817**	**2612**	**3928**	**6318**