



RESEARCH ARTICLE

DIVERSITY OF PLANKTON AND THEIR SEASONAL VARIATION OF DENSITY IN THE PARIYAT RIVER AT JABALPUR, (M.P.) INDIA

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ABSTRACT

Present paper deals with the analysis of diversity of Plankton (i.e., Phytoplankton and Zooplankton) and their seasonal variation of density in the Pariyat river, at Jabalpur district (M.P.). Four sampling stations were selected on the Pariyat river for sampling purpose. Samples were collected for a period of one year (October 2015 to September 2016) at each month of every season. Collected samples were evaluated for study of diversity of Plankton (i.e., Phytoplankton and Zooplankton) and their seasonal variation of density. Registered Phytoplankton were belong to 35 species of 25 genera of different groups like as Chlorophyceae (12 species of 11 genera), Euglenophyceae (3 species of 2 genera), Bacillario-phyceae (5 species of 5 genera) and Cyanophyceae (15 species of 7 genera). In the study period group Chlorophyceae was dominated over rest of the Phytoplankton population. Registered Zooplankton were belong to 22 species of 16 genera of different groups like as Protozoa (3 species of 3 genera), Rotifera (12 species of 6 genera), Cladocera (5 species of 5 genera) and Copepoda (2 species of 2 genera). Among recorded Zooplankton Rotifer's population was dominant during entire study span. It was noticed that density of Plankton was maximum in summer, minimum in rainy season and intermediate in winter season.

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INTRODUCTION

The term 'Plankton' is used for assemblage of microscopic, free floating organisms in water which wander at the mercy of winds and currents. Depends upon the nature plankton can be divided in two major groups, named phytoplankton and zooplankton. Phytoplankton are chlorophyll bearing suspended microscopic organisms consisting mainly of algae. The majority of the members of phytoplankton belongs to Chlorophyceae, Cyanophyceae and Bacillariophyceae group of algae. Phytoplankton are the basic members of aquatic ecosystems and hence change in phytoplankton population has a direct link with the change of water quality in any aquatic medium. The number and species of Phytoplankton serves to determine the quality of water body (Bahura, 1991). Phytoplankton, being the primary producer, forms the lowest trophic level in the food chain of fresh water ecosystem. In water bodies, seasonal qualitative and quantitative fluctuations occur in plankton communities. Their density varies according to the nature of water. Zooplankton are the microscopic animal components of aquatic system which move at the mercy of the water movements (current). Protozoans, Rotifers, Cladocerans and Copepods constitute the major groups of Zooplankton.

Zooplankton constitute an important link between primary producers (mostly phytoplankton) and higher consumers (mostly fishes) in aquatic food webs. They occupy in intermediate position in the food web and mediate the transfer of energy from lower to higher trophic level (Water, 1977). Zooplankton diversity is one of the most important ecological parameter in water quality assessment. Considering the importance of plankton diversity and variation in their density, several studies have been made in this field (Battish, 1992; Pandey *et al.*, 1993; Dhanapathi, 2000; Sampaio *et al.*, 2002; Rajshekhar, 2010; Khanna *et al.*, 2012; Shinde, 2012 and Kadam *et al.*, 2014).

Aims and Objectives

Objectives of the study was to analysis of diversity of Plankton (Phytoplankton and Zooplankton) and analysis of their seasonal variation of density in the Pariyat river at Jabalpur stretch.

MATERIALS AND METHODS

Study area

The study was carried out at Jabalpur stretch of the Pariyat river. Jabalpur is a historical city of Madhya Pradesh. Location of Jabalpur city in India is 23° 10'N 79° 56'E. 18 Km. Length

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of Pariyat at Jabalpur from Pariyat Lake to Sarsawa was under study programme (Fig. 1, 2 & 3). Sampling and Analysis Four sampling stations named as S1-Pariyat Lake, S2-Phagua Canal, S3- NH- 7 Pariyat Bridge, S4-Sarsawa were selected for the sampling purpose (Fig. 3). The samples were collected monthly till one year (October 2013 to September 2014) from selected sampling stations.

of 11 genera), *Euglenophyceae* (3 species of 2 genera), *Bacillariophyceae* (5 species of 5 genera) and *Cyanophyceae* (15 species of 7 genera). Alam, 2013 reported 30 species of different groups of Phytoplankton from the Pariyat river at Jabalpur stretch. In the study period group Chlorophyceae was dominated over rest of the Phytoplankton population. Data has given in Table 1.



Fig. 1. Map of M. P. Express location of District Jabalpur

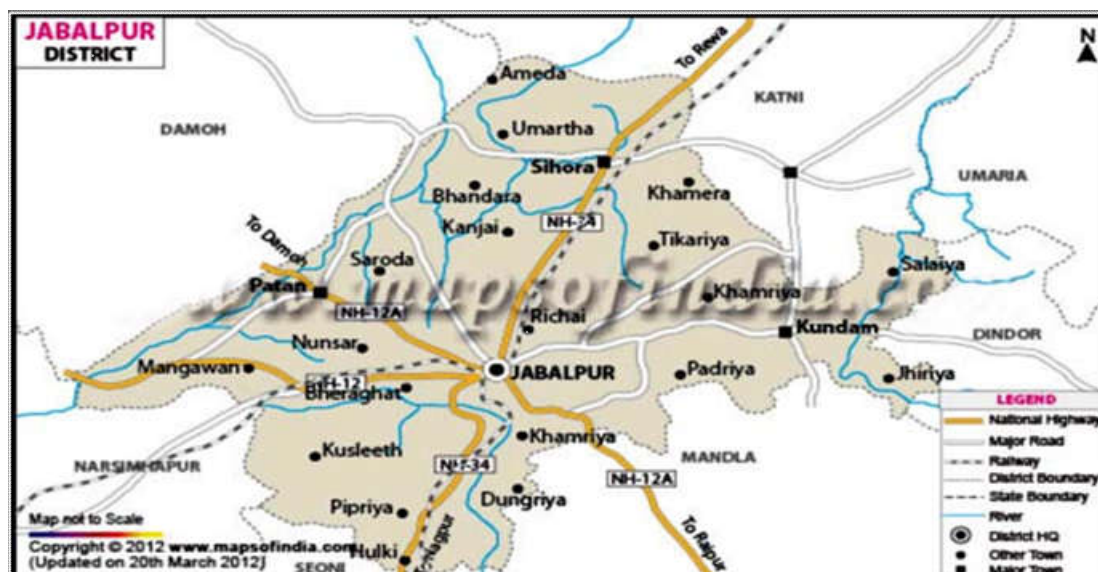


Fig. 2. Map of district jabalpur

Plankton samples were collected between 8.0 AM to 9.30 AM, at every selected sampling stations. Plankton net of bolting silk no. 25 was used for sampling purpose. Samples were taken at mid stream 0.5 to 1m below the surface of water. Collected concentrated plankton samples [10 ml] were fixed and preserved in 5% formalin. Plankton samples were examined under high power microscope and identified up to genus and species level with the help of standard books and monographs [Prescott, 1962; Adoni, 1985 for plankton and Battish, 1992 for Zooplankton].

RESULTS AND DISCUSSION PHYTOPLANKTON

Registered Phytoplankton were belong to 35 species of 25 genera of different groups like as *Chlorophyceae* (12 species

Mean value of density of recorded genera of *chlorophyceae* was varied from 9 org/L to 193 org./L during observation period. *Spirogyra* was most abundant genera among *chlorophyceae* group. Population of *Chlorophyceae* gradually risen from February on words and touched peak level im May and June. Shinde *et al.* (2012) have noticed maximum number of *Chlorophyceae* in summer and minimum during monsoon season. This finding is coinciding with the present work. Seasonal variation in density of *Chlorophyceae* genera is represented by diagram No.1. Mean value of density of recorded genera of *Euglenophyceae* was in range of org./L to 37 org./L Lowest density was observed in rainy season and highest density was noticed in summer season. Present work is in conformity with the observation made by other researchers. Shinde *et al.* (2012) recorded maximum genera of

Euglenophyceae in summer and minimum during monsoon. Seasonal fluctuation in density of recorded members of *Euglenophyceae* is expressed by Diagram 2. Mean value of density of members of *Bacillariophyceae* (diatoms) was in the range between 4 org./L 78 org./L *Navicula* was most dominant and *Synedra* was second dominant genera during study period. Minimum density was noticed in rainy season whereas maximum density of this group was recorded in summer season. The present observation is similar to those observation made by other workers. Shinde *et al.* (2012) recorded maximum genera of *Bacillariophyceae* during summer and minimum during monsoon. Seasonal fluctuation in density of this group is showed by Diagram No. 3.

al. (2012) have recorded maximum member of *Cyanophyceae* in summer and minimum during monsoon season. Seasonal fluctuation in density of this group is showed by diagram No.4. It was noticed that density of phytoplankton was maximum in summer, minimum in rainy season and intermediate in winter season. Data of average value of seasonal density of recorded Phytoplankton in the Pariyat river at study area (Jabalpur) has given in the table No. -2 .Present findings are in accordance with the finding of pther workers. Singh, (1990) reported that plankton population showed bimodal, pattern of fluctuation with one peak in pre winter and other in summer. Hassan *et al.* (2010) observed minimum density of phytoplankton during monsoon and maximum during summer.



Map of pariyat River Jabalpur (Satellite Picuture from Google Earth)

Table 1. List of recorded Phytoplankton in Pariyat River at study area (Jabalpur)

Chlorophyceae			Bacillariophyceae		
Genera		Species	Genera		Species
1.	<i>Ankistrodesmus</i>	<i>falcatus</i>	1.	<i>Cyclotella</i>	<i>Meneghiniana</i>
2.	<i>Chlorella</i>	<i>vulgaris</i>	2.	<i>Melosira</i>	<i>sp.</i>
3.	<i>Chlorococcum</i>	<i>infusionum</i>	3.	<i>Navicula</i>	<i>viridula</i>
4.	<i>Cladophora</i>	<i>fracta</i>	4.	<i>Nitzschia</i>	<i>angustata</i>
5.	<i>Cosmarium</i>	<i>tenue</i>	5.	<i>Synedra</i>	<i>ulna</i>
6.	<i>Closterium</i>	<i>sp.</i>	Cyanophyceae		
7.	<i>Hydrodictyon</i>	<i>reticulatum</i>		Genera	Species
8.	<i>Pediastrum</i>	<i>simplex</i>	1.	<i>Anabaena</i>	<i>fertilissima</i>
	<i>Pediastrum</i>	<i>tetras</i>	2.	<i>Lyngbya</i>	<i>gracilis, magnifica, spirulinoidus</i>
9.	<i>Scenedesmus</i>	<i>quadricauda</i>	3.	<i>Merismopedia</i>	<i>elegans, punctata, glauca</i>
10.	<i>Spirogyra</i>	<i>condensate</i>	4.	<i>Microcystis</i>	<i>aeruginosa</i>
11.	<i>Stigeoclonium</i>	<i>tenue</i>	5.	<i>Nostoc</i>	<i>sp.</i>
Euglenophyceae			6.	<i>Oscillatoria</i>	<i>clorina, limosa, subbrevis, tenuis</i>
Genera		Species	7.	<i>Phormidium</i>	<i>calciola, uncinatum</i>
1.	<i>Eugelna</i>	<i>acus</i>			
	<i>Euglena viridis</i>				
2.	<i>Phacus</i>	<i>caudatus</i>			

Mean value of density of recorded genera of *Cynophyceae* (Blue Green Algae) was noticed in the range between 9 org./L to 123 org./L *Microcystis* was the most dominant genus. Highest density of this group was observed during summer (May and June) while lowest density was noticed in rainy season (August). The present work is in conformity with the work of other researchers. Thirugnanmoorthy and Selvaraju, (2009) has reported that maximum density of *Cyanophyceae* members occurred from April to June and density was gradually decreased during winter and rainy season. Shinde *et*

Zooplankton: Registered zooplankton were belong to 22 species of 16 genera of different groups like as Protozoa (3 species of 3 genera), Rotifera (12 species of 6 genera), Cladocera (5 species of 5 genera) and Copepoda (2 species of 2 genera). Alam, 2013 reported 15 species of different group of Zooplankton from the Pariyat river at Jabalpur stretch. Among recorded Zooplankton Rotifer's population was dominant during entire study span. Data has given in table No. -3 Mean value of density of recorded Protozoans was varied from 3 org./L to 31 org./L at different sampling stations.

Table No. Average value of seasonal density of recorded *Phytoplankton* in Pariyat river at study area (Jabalpur)

Period Oct. 2015 to Sept. 2016 Months		Chlorophyceae(org./l)	Euglenophyceae(org./l)	Bacillariophyceae	Cyanophyceae(org./l)
Winter Season	Oct.	83	17	43	64
	Nov.	99	26	62	72
	Dec.	74	14	53	46
	Jan.	65	6	49	36
Total		321	63	207	218
Summer Season	Feb.	82	12	48	58
	Mar.	129	15	56	78
	Apr.	147	24	64	90
	May	183	31	70	115
Total		541	82	238	341
Rainy Season	Jun.	193	37	78	123
	Jul.	32	5	14	29
	Aug.	9	3	4	9
	SSep.	25	5	14	19
Total		257	50	110	180
Grand Total		1119	195	555	739
Percentage (%) Contribution		42.91%	7.48%	21.28%	28.34%

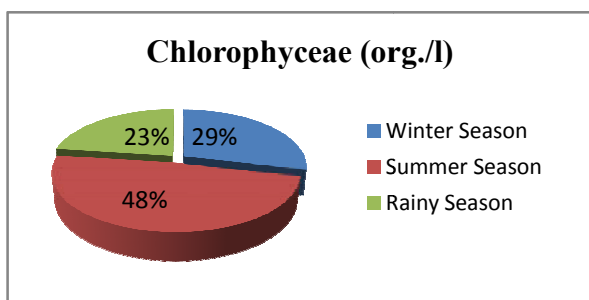


Diagram-1 Express Seasonal Fluctuation in density of *Phytoplankton* (Chlorophyceae)

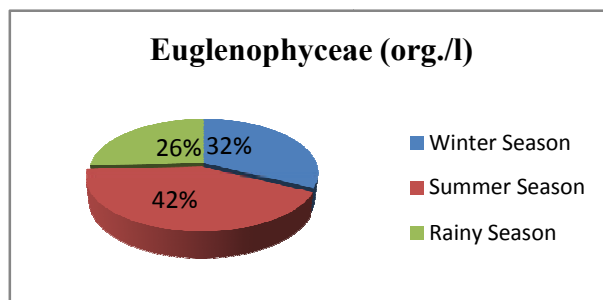


Diagram-2 Express Seasonal fluctuation in density of *Phytoplankton* (Euglenophyceae)

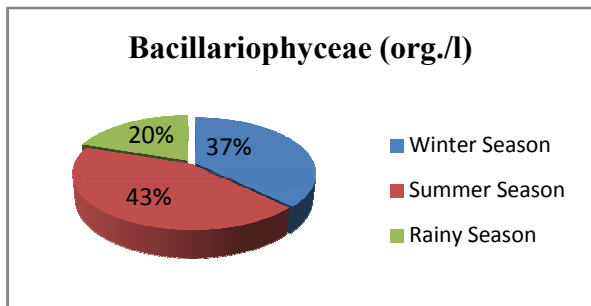


Diagram-3 Express Seasonal Fluctuation in density of *Phytoplankton* (Bacillariophyceae)

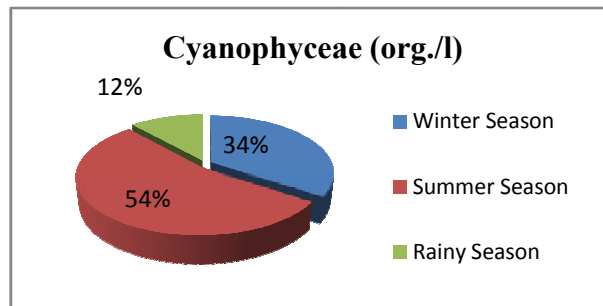


Diagram-4 Express Seasonal fluctuation in density of *Phytoplankton* (Cyanophyceae)

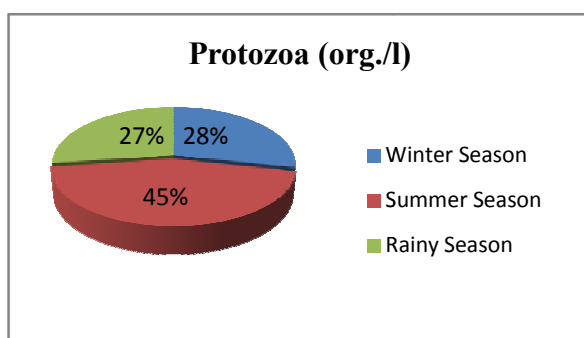
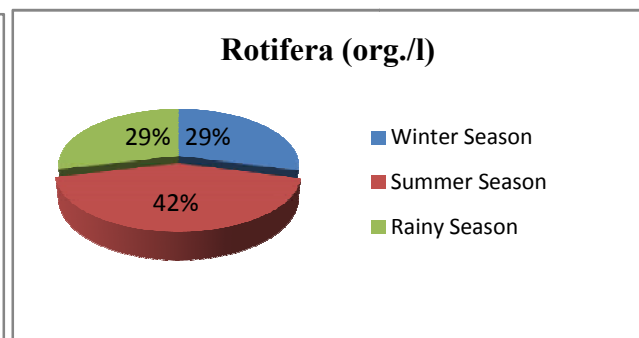
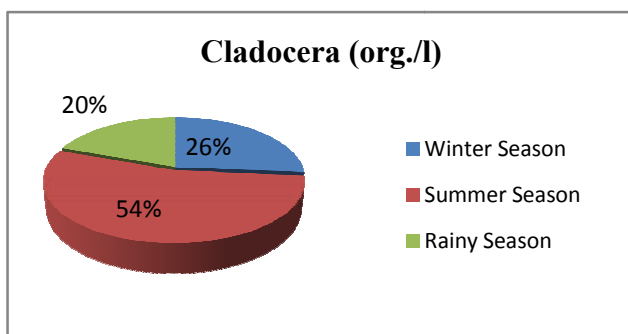
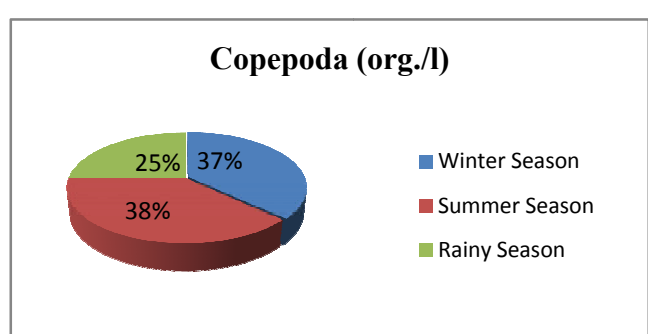
Table 3. List of recorded *Zooplankton* in the Pariyat River at study area (Jabalpur).

Protozoa		
Genera	Species	
1. <i>Arcella</i>	<i>Dentata</i>	
2. <i>Paramecium</i>	<i>caudatum</i>	
3. <i>Vorticella</i>	<i>Campanula</i>	
Cladocera		
Genera	Species	
4. <i>Alona</i>	<i>rectangular</i>	
5. <i>Bosmina</i>	<i>longirostris</i>	
6. <i>Ceriodaphnia</i>	<i>reticulate</i>	
7. <i>Daphnia</i>	<i>carinata</i>	
8. <i>Moina</i>	<i>brachiata</i>	
Copepoda		
Genera	Species	
9. <i>Cyclops</i>	<i>bicuspidatus</i>	
10. <i>Macrocylops</i>	<i>albidus</i>	

Protozoa		
Genera	Species	
1. <i>Asplanchna</i>	<i>intermedia</i>	
2. <i>Brachionus</i>	<i>Calyciflorus</i>	
<i>Brachionus</i>	<i>Caudatus</i>	
<i>Brachionus</i>	<i>falcatus</i>	
<i>Brachionus</i>	<i>plicatilis</i>	
<i>Brachionus</i>	<i>quadridentatus</i>	
<i>Brachionus</i>	<i>rubens</i>	
3. <i>Filinia</i>	<i>longiseta</i>	
4. <i>Keratella</i>	<i>cochlearis</i>	
<i>Keratella tropica</i>		
5. <i>Philodina</i>	<i>citrine</i>	
6. <i>Polyarthra</i>	<i>sp.</i>	

Table 4. Average value of seasonal density of recorded Zooplankton in the Pariyat River at study area (Jabalpur)

Period	Oct. 2015 to Sept. 2016 Months	Protozoa (org./l)	Rotifera(org./l)	Cladocera (org./l)	Copepoda(org./l)
Winter Season	OCT.	12	52	30	22
	NOV.	17	51	40	37
	DEC.	9	31	26	37
	JAN.	8	28	31	11
Summer Season	FEB.	10	32	44	14
	MAR.	16	41	60	20
	APR.	20	60	74	35
	MAY.	26	100	84	42
Rainy Season	JUN.	31	110	74	33
	JUL.	4	17	6	24
	AUG.	3	8	4	6
	SEP.	6	25	10	10
Total		44	160	94	73
Grand Total		162	555	483	292
Percentage(%) contribution		10.86%	37.19%	32.37%	19.57%

**Diagram-5 Express seasonal fluctuation in density of Zooplankton (Protozoa)****Diagram-6 Express seasonal fluctuation in density of Zooplankton (Rotifera)****Diagram 7. Express seasonal fluctuation in density of Zooplankton (Cladocera)****Diagram 8. Express seasonal fluctuation in density of Zooplankton (Copepoda)**

Highest density of Protozoans was noticed in the month of June while lowest density of Protozoans was recorded in the month of August (rainy season). Seasonal fluctuation in the density of Protozoans has given in diagram No. 5. Mean value of recorded density Rotiferans was in the range of org./L to 110 org./L. Maximum density of Rotifers was recorded in the month of June while their minimum density was recorded in the month of August (Rainy season). The finding is similar to those observed by Michael, (1964). Seasonal fluctuation density of Rotifers has given in Diagram No. 6. The mean value of recorded density of *Copepods* during study period was varied from 6 org./L to 4 org./L. Maximum density of this group was recorded in the month of May (Summer) and lower density of this group was noticed in the month of August(Rainy season). Seasonal fluctuation in the density of *Copepoda* has given in diagram No. 8.

It was noticed that density of Zooplankton was maximum in Summer, intermediate in winter and minimum in rainy season. Data of average value of seasonal density of recorded Zooplankton in the Pariyat river at study area (Jabalpur) has given in table No.-4.

Conclusion

Pariyat river was rich in diversity of Plankton. Registered Phytoplankton were belong to 35 species of 25 genera of different groups like as *Chlorophyceae* (12 species of 11 genera), *Euglenophyceae* (3 species of 2 genera), *Bacillariophyceae* (5 species of 5 genera) and *Cyanophyceae* (15 species of 7 genera). In the study period group *Chlorophyceae* was dominated over rest of Phytoplankton population. Registered Zooplankton were belong to 22 species of 16 genera of different groups like as Protozoa (3 species of

3 genera), *Rotifera* (12 species of 6 genera), *Cladocera* (5 species of 5 genera) and *Copepoda* (2 species of 2 genera). Among recorded Zooplankton Rotifer's population was dominant during entire study span. It was noticed that density of Plankton was maximum in summer, minimum in rainy season and intermediate in winter season.

REFERENCES

- Adoni, A.D. 1985. Work book on limnology, *Pratibha Publications*, Sagar (M.P).
- Alam, S.K. 2013. Hydrobiological and Physico- chemical analysis of the river Yamuna at Kalpi distt. Jalaun U.P. India, Ph.D. *Thesis (Zoology)* submitted to B.U. Jhansi.
- Battish, S.K. 1992. *Fresh water zooplankton of India*, Oxford and IBM publications.
- Dhanapathi, M.V.S.S.S. 2000. *Taxonomic notes on the Rotifers, from India*, Indian Associations of Aquatic Biologists (IAAB).
- Hassan, Fikrat, M., Taylor, W.D., Mayson, M.S., Al- Tae and Hassan, J.J. 2010. Phytoplankton composition of Euphrates river in Al- Hindiya barrage and Kifil city region of Iraq, *J. Environ. Biol.*, 31: 343- 350.
- Kadam, S.U., Kadam, S.S. and Babar, M. 2014. Phytoplankton diversity of reservoirs in Prabhani district Maharashtra, India, *Int. J. Curr.Microbio. App. Sci.*, p'[Vol.3 (8): 459-466, ISSN: 2319-7706.
- Khanna, D.R., Bhutiani, R., Matta, G., Singh, V. and Bhadauriya, G. 2012. Study of planktonic diversity of river Ganga from Devprayag to Roorkee, Uttarakhand (India), *Env. Cons. Jou.*, 13 [1&2], 211-217.
- Michael, R.G. 1964. Studies on the Zooplankton of a tropical fish pond, *Hydrobiologia*, 32 [1-2]: 47-68.
- Pandey, B.N., Mishra, A.K., Jha, A.K., and Lal, R.N. 1993. Studies on Phytoplankton of river Mahanadi, Katihar[Biha]., *Environ. Ecol.*, 11: 936-940.
- Prescott, G.W. 1962. *Algae of the Western Great Lakes Area*, W.M.C.
- Rajshekhhar, M., Vijaykumar, K. and Parveen, Z. 2010. Seasonal variations of zooplankton community in fresh water reservoir, Gulbarga District, Karnatka, South India, *In. J. of System Biology*, Vol. 2 (1): 6-11 ISSN: 0975-2900.
- Sampaio, E.V., Rocha, O., Tundisi, T.M. and Tundisi, J.G. 2002. Composition and abundance of Zooplankton in the limnetic zone of seven reservoirs of the Paranapanema river, Brazil. *Brazil Journal Biology* 62 (3): 525-545.
- Shinde, S.E., Pathan, T.S. Harsool- Savangidam, Auragabad, India, *J. Envi. Bio.*, 33: 643-647, ISSN: 0254-8704.
- Singh, D.N. 1990. Diurnal vertical migration of plankton in Mcpherson lake Allahabad, *Pro. Nat. Acad. Sci. India*, 60 (B)- II.
- Thirugnanmoorthy, K. and Selvaraju, M. 2009. Phytoplankton Diversity in relation to physico- chemical parameters of Gnanaprekasam Temple pond of Chidambaram in Tamilnadu, India, *Rece. Res.in Sc. and Tech.*, Vol. 1 (5): 235-238, ISSN: 2076- 5061.
- Water, T.P. 1977. Secondary production in Inland Waters, *Adv. In Eco. Res.*, 10:11-164.
