



Abundance of Genus *Brachionus* (Rotifer) of a Freshwater Wetland of District Howrah, West Bengal, India

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Abstract

The materials for the present limnological investigation were collected from the subsurface water of a managed fresh water wetland for one year. The wetland water is under domestic use (bathing and washing purpose). There is no sewage influx in this wetland. No macro vegetation is kept in this wetland as it is profusely used for pisciculture by using supplementary feed and fertilizer periodically round the year. The water parameters studied were pH, Dissolved Oxygen (DO), Carbon di Oxide (CO₂), Alkalinity (Alk), Hardness (Har) and Biological Oxygen Demand (BOD). In this study pH was always found to be alkaline and varied from 7.78 to 8.31. During the study DO showed its maximum fluctuation after CO₂ and varied from 4.4 to 11.4 mg/lit while CO₂ from 4 to 21 mg/lit. On the other hand alkalinity ranged from 138.5 to 252 mg/lit, hardness from 28.4 to 80 mg/lit and BOD from 1.2 to 8.3 mg/lit. The combined effect of the above physicochemical parameters might have promoted the growth of the *Brachionus* spp.

Except the above mentioned water parameters abundance of genus *Brachionus* was also observed. A total of 8 species of this genus was noted during this study. Among them 6 were dominant and occur 6 months and more. This genus in the studied wetland predominated by *Brachionus angularis*. Not only that they were numerically superior over others. The second numerically dominant species was *B. forficula*.

While statistical analysis was done it was observed that different species showed significant and positive correlation with pH, DO, hardness and inverse correlation with BOD.

Keywords:- Abundance, *Brachionus*, Rotifer, Freshwater, Wetland.

Introduction

Brachionus are minute aquatic animals which is very weak swimmer and a genus of planktonic rotifers which remains in an endless variety in all kinds of water habitat including the limnetic and deep regions of largest lakes and smallest puddles (Pennak, R. 1978). The sensitivity of *Brachionus* to the environment has made them an interesting and useful tool in studying pollution (Kiran *et. al.*, 2007). It also use as model organism in various other biological fields. It plays important role in the food chain by linking the primary producer and higher trophic label. It can transfer a majority of carbon fixed by the primary producer (Hart *et. al.*, 2000) to higher trophic level.

In India taxonomic studies on genus *Brachionus* (rotifer) began with the work of Anderson, H. (1889). Latter, contribution by Edmondson, W. T. and Hutchinson, G. E., (1934), Sewell, R.B.S. (1934), Ahlstrom, E. (1940), Arora, H. (1962), Nayar, C. (1965), Vasisht, H. and Battish, S. K. (1971), Sharma, B. K. (1996), Sudzuki, M. (1989), Arora, J. and Mehra, N. (2003), Whatkar. A. and Barbet, M. (2013), Dede, A. and Deshmukh, A. 2015), Manickam, N.*et. al.* (2017), Sharma, B. and Norho, N.

(2020) and many others had greatly increased our knowledge on fresh water *Brachionus* (rotifer) occurring in different parts of the country. There is meager report on *Brachionus* collected from freshwater bodies in different districts of West Bengal. Hence, the present work is taken up to contribute to the knowledge on freshwater *Brachionus* in West Bengal, India.

Materials and Methods

The present limnological study was started in January, 2019 and continued up to December, 2019 for 12 months at Howrah district of West Bengal.

Study area

The studied wetland is 0.7 hectare in area, almost rectangular in shape. It is a rain fed wetland. The average depth of this wetland is 2 meter at its mid-point and 1.25 meter at its study site depending upon the height of the water column and season. The wetland water is under domestic use (bathing and washing purpose). There is no sewage influx in this wetland. Semi scientific culture of IMC is practiced hereby using supplementary feed and fertilizer periodically. No macro vegetation is kept in this wetland as it is profusely used for pisciculture round the year so it is obviously a managed wetland.

HYDROLOGY

Collection of water sample

Water sample were collected from the wetland covering the less disturbed area by directly deeping polythene bottles, washed without detergents, first rinsed with 10% HCl, then with distilled water and dried at 95°C before use. For the estimation of dissolved oxygen the sample was collected in 250 ml glass stoppered bottles taking all precaution and replacing the stopper tightly under water.

Analysis of water

The physic-chemical parameters of water studied are pH, Dissolved Oxygen (DO), Carbon di Oxide (CO₂), Alkalinity (Alk), hardness (har) and Biological Oxygen Demand (BOD). All the analysis of water samples were done according to the procedure stated by Welch, P. (1948), Michael, P. (1990) and APHA (2005).

Collection of Zoobiota

Zoo biota *Brachionus* (rotifer) was collected fortnightly between 8 am and 10 am in the morning of the sampling day by filtering 50 lit. of water, collected from the sub-surface through a bolting silk net (mesh size 25µ). It was concentrated into 100 ml and preserved in the field with 8% formalin.

Analysis of Zoobiota

The identification of zoobiota was done with the help of Davis, C. (1955), Edmondson, W. (1959), Battish, S. K.(1992) and Ward, H. and Whipple, G. (1959). Zoobiota (*Brachionus*) was counted with the help of Sedgwick-Rafter plankton counting cell. Three or sometime four such counts were done for each sample and counts were pooled and coted as monthly average. Computation for the number of individuals /liter (ind/lit)was worked out by the formula as suggested by Welch, P. (1948).

$$\text{Total Zooplankton (n)} = \frac{(a \times c)}{L}$$

n=No. of Zooplankton/lit of water

a=No. of Zooplankton in all count

c=Vol. of original concentration of sample in ml.

L=Vol. of original water sieved in lit.

Fortnightly data were pooled together as monthly average. Tables and Figures representing the variation of biotic and abiotic parameters have been drawn accordingly.

Results

The values of different physico-chemical parameters are shown in table-1 and briefly describe here. During study pH varies from 7.78 to 8.31, DO from 4.4 to 11.4 mg/lit, alkalinity from 138.5 to 252 mg/lit, CO₂ from 4 to 21 mg/lit, hardness form 28.4 to 80 mg/lit and BOD from 1.2 to 8.3 mg/lit.

Table-1:- Monthly variations of physico-chemical parameters (mg/lit) of water in a managed fresh water wetland.

Month	pH	DO	Alkalinity	CO ₂	Hardness	BOD
January	7.78	8.3	165	11	46	3.6
February	8.05	6.4	242	21	70.6	5.8
March	8.0	7.2	252	7	74.9	6.8
April	8.25	11.4	210	5	70	6
May	8.25	4.8	202	12	80	1.2
June	8.13	4.6	190	4	61.25	6
July	8.09	4.5	151	10.7	45.2	8.3
August	8.31	7.7	152.5	5	53.6	6.1
September	7.95	6.4	138.5	12.25	56.9	3.7
October	7.88	5.1	139.3	9.42	35.55	4.67
November	7.83	4.4	153	8.6	28.40	5
December	8.03	7.1	159	9.10	33.50	7.2

The numerical abundance of different species of genus *Brachionus* has been given in below with a view to emphasized their relative importance. (Table-2)

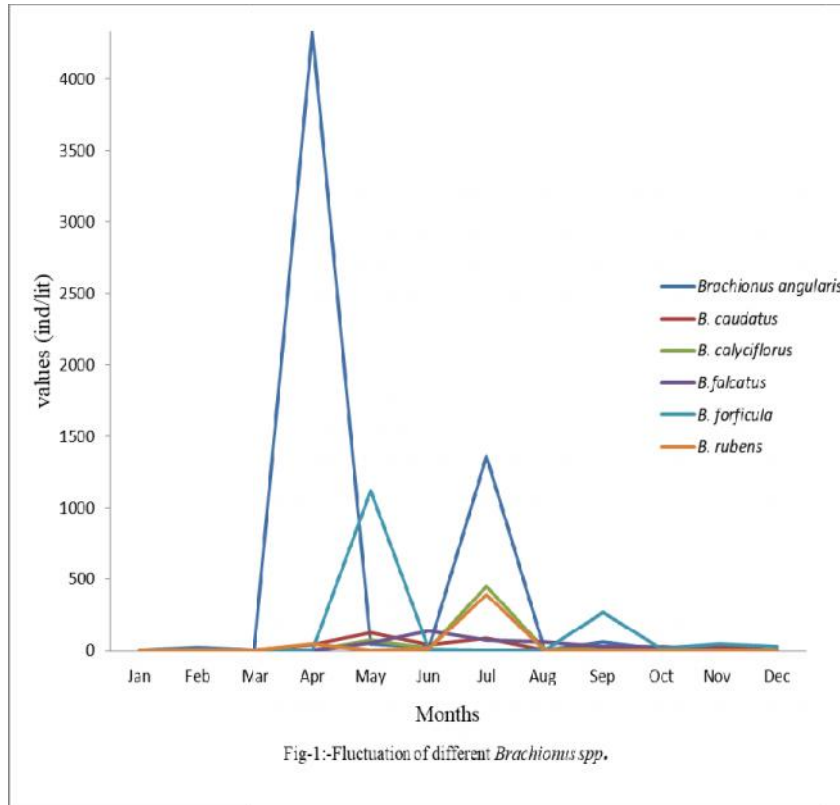
Table-2: Monthly numerical abundance of *Brachionus* species (ind/lit) in a managed freshwater Wetland.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Brachionus angularis</i>	-	19	3	4332	47	18	1360	1	59	6	1	1
<i>B. caudatus</i>	-	7	-	40	123	38	87	-	30	22	25	3
<i>B. calyciflorus</i>	-	1	-	-	76	12	453	8	7	-	1	1
<i>B. diversicornis</i>	1	-	-	-	16	5	2	-	-	3	-	1
<i>B. falcatus</i>	-	-	-	-	53	135	70	61	25	27	6	1
<i>B. forficula</i>	-	6	-	-	1118	8	-	1	268	15	45	25
<i>B. quadridentatus</i>	-	-	-	-	-	-	4	-	1	1	-	-
<i>B. rubens</i>	-	-	-	48	-	16	391	-	-	1	-	-

In the present investigation genus *Brachionus* was the principal components and a part of the rotifer population and the seasonal fluctuation of total *Brachionus* was chiefly determined by the fluctuation pattern of *B. angularis*.

During this study genus *Brachionus* was represented by a total number of 8 species (Table-2) of which *B. angularis*, *B. caudatus*, *B. calyciflorus*, *B. falcatus*, *B. forficula* and *B. rubens* were more dominant.

B. angularis- In the studied wetland this species was most dominant and two peaks were noted in April (4332 ind/lit) and July (1360 ind/lit) (Fig-1).



B. caudatus-During study it occurred in 9 months out of twelve with a maximum of 123 ind/lit in May and a minimum of 3 ind/lit in December.(Tab-2).

B. calyciflorus-In the study maximum value was 453 ind/lit and minimum value was 1 ind/lit.

B. falcatus- This species occurred during 8 months (May to December) with two peaks, the largest (135 ind/lit) was in June and the smallest (27 ind/lit) in October (Fig-1).

B. forficula- It was also noticed during 8 months with three peaks, the largest (1118 ind/lit) in May, other (268 ind/lit) in September and the smallest (45 ind/lit.) in November.(Fig-1).

B. diversicornis- Throughout the entire study this species was observed in 6 months with a maximum of 16 ind/lit and a minimum of 1 ind/lit.(Tab-2).

B. rubens- During study it was found only in 4 months with a maximum of 391 ind/lit in July.

B. quadridentatus- It occurred only in 3 months with a maximum of 4 ind/lit.

Table:-3: Simple correlation coefficient (r) between different *Brachionus* spp. and physico-chemical parameters.

	pH	DO	Alkalinity	CO ₂	Hardness	BOD
<i>Brachionus angularis</i>	.3184	.5074*	.2133	-.2151	.2331	-.0053
<i>B. caudatus</i>	.4365*	-.0249	.1093	.0811	.2850	-.0412
<i>B. calyciflorus</i>	.2245	-.1048	-.0860	.0992	-.0452	.0544
<i>B. falcatus</i>	.3110	-.1510	-.0798	-.2028	.0762	-.1282
<i>B. forficula</i>	.3036	-.0416	.1514	.1936	.4236*	-.5120*
<i>B. rubens</i>	-.1669	-.2137	-.2137	.1064	-.2450	.3255

*p<.05

In order to delineate statistical relationship between the physico-chemical parameters of water of the studied wetland and their potential effect on the prevailing *Brachionus* population simple correlation coefficient between the *Brachionus* species with each of the studied physico-chemical parameters of water have been compounded.

Brachionus angularis - Only positive and significant correlation was observed between this species and dissolved oxygen ($r = 0.5074$, $p < 0.05$) (Table-3).

B. caudatus - Here, significant and positive correlation existed with pH ($r = 0.4365$, $p < 0.05$) (Table-3).

B. calyciflorus - No significant correlation existed between this species and any of the physico-chemical parameters (Table-3).

B. falcatus - Here also no significant correlation existed between this species and any physico-chemical parameters (Table-3).

B. forficula - Significant and positive correlation was noted with hardness ($r = 0.4236$, $p < 0.05$) and negative correlation with BOD ($r = -0.5120$, $p < 0.05$) (Table-3).

B. rubens - No significant correlation existed between this species and any of the physico-chemical parameters (Table-3).

Discussion

Brachionus spp are almost universally present in fresh water habitat and constitute an important component of zoo biota. The seasonal occurrence and abundance of genus *Brachionus* showed that *B. angularis* was exceptionally abundant throughout the study period and clearly dominant over other species. According to Datta, N.C. et. al., (1987) *B. angularis* was numerically abundant and dominant over other *Brachionus* spp. A similar observation was also observed here. In this studied wetland the seasonal fluctuation of the total *Brachionus* population was influenced by the fluctuation of *B. angularis* alone. Higher abundance of this species during summer corroborates the observations of Michael, P. (1969) and Byars, J. (1960). Pennak, R. (1955) stated that when more than one species of a genus occur in a water body only one species would be more abundant, this is also in agreement with the present observation. In this study *B. angularis* showed its highest abundance, which is perhaps the effect of patchiness of this species in April (4332 ind/lit) and July (1360 ind/lit).

According to O'Brein, J. and Noyelles, De. (1972) pH has been implicated as a major factor exerting significant effect on the abundance of *B. angularis*. From the statistical analysis also a positive correlation is noted between pH and *B. angularis*.

B. caudatus was recorded in 9 months and showed its peaks in monsoon, post monsoon and summer which is in agreement with Michael, R. (1969) and Deb et. al. (1987). The occurrence of *B. calyciflorus* was recorded during 8 months with a maximum of 453 ind/lit in June, which is in agreement with the observation of Michael, R. (1969). In order of abundance *B. forficula* was second to *B. angularis* with a high value of 1118 ind/lit in May. On the other hand *B. falcatus* was recorded in 8 months with a maximum of 135 ind/lit in June. The other species *B. rubens* occurred only in 4 months with a maximum of 391 ind/lit in July. The remaining species was recorded with few numbers. These trends have also been observed by Chaudhuri, S. (1989). However, in oligotrophic fresh water, all these species have been reported to occur throughout the year (Michael 1964; Mukhopadhyay et. al., 1981). Sharma, B. (1983) opined that *B. angularis*, *B. calyciflorus* and *B. Rubens* are indicator species from India specially to those of eutrophic condition of water, while *B. falcatus*, *B. forficula* and *B. diversicornis* are found comparatively in pollution free water. Here also the same result was observed.

From simple correlation it is evident that different species of *Brachionus* showed positive correlation with pH, hardness and DO. The positive correlation of pH with *Brachionus* supports the finding of Bandyopadhyay B.K. (1985). On the other hand *Brachionus* population coincided with high DO content which is in agreement with Nayar, C. (1965) and Vasisht, H. and Sharma, B. (1976).

Conclusion

In conclusion it is quite judicious to mention that the cycle of abundance of zoobiota is highly variable from species to species within an aquatic ecosystem and even from one to another. It is also notable that the effect of competitive interaction may be expected to influence the seasonal variation in the abundance of *Brachionus* population.

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Abbreviations Used:-

- DO= Dissolved oxygen
 CO₂= Carbon di oxide
 BOD= Biological oxygen demand
 ind/lit= individuals/liter
 mg/lit= miligram/liter
 Alk = alkalinity
 Har = Hardness