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SUBSTRATE SPECIFIC ZOOPERIPHYTON AND THEIR RELATIONSHIPS WITH WATER QUALITY PARAMETERS IN DHANMONDI LAKE, DHAKA, BANGLADESH

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Abstract

In the present investigation, zooperiphyton communities comprised protozoa, rotifera, copepoda, cladocera, ostracoda, conchostraca, insect's larvae, oligochaeta, nematoda and mollusca. The group of zooperiphyton on three substrates showed no significant differences ($P>0.05$). Rotifers and protozoans were the most dominant group of total zooperiphyton abundance among three substrates. The interrelationships between zooperiphyton groups and physicochemical features of water as well as among different groups of zooperiphyton revealed that abundance and growth of zooperiphyton on substrates are influenced by water quality parameters and each with others. The ranges of physicochemical features of water of Dhanmondi lake were suitable for zooperiphyton communities including aquatic biota and also play a significant role to settle zooperiphyton on three substrates. That can help in enhancing productivity of the lake as well as sustaining aesthetic value of aquatic system.

Key words: Zooperiphyton, Interrelationships, Water quality parameters, Dhanmondi lake

Introduction

Young (1945) described periphytonas an assemblage of organisms growing upon the free surfaces of submerged objects of water and covering them with a slimy coating. Organisms (both plants and animals) attached or clinging to stems and leaves of rooted plants or other surfaces projecting above the bottom are called periphyton (Odum 1971). Periphyton refer to a complex community of microbiota (algae, bacteria, fungi, animals, and inorganic and organic detritus) which are attached to substrata of inorganic or organic, living or dead objects (Wetzel 1983). Periphyton are an essential component of the aquatic food chain. They are the primary producers in freshwater bodies including lakes where different forms are present in various locations viz: epilithic (rock) epipsamic (mud), epiphytic (plant), epipelic (sediments) and epizoic (animals) forms (Kadiri 2002). Some periphyton are sensitive indicators of water quality assessment and produce the early warning signal of water pollution (Browder *et al.* 1998). Periphyton can both directly and indirectly serve as a major regulator of the nutrient dynamics in lakes (Wetzel 2001). Dhanmondi lake, a semi artificial water body has been considered as an important component of Dhaka Metropolis for both recreational and fish culture point of view. At present, part of the lake used for sport fishing and the Department of Fisheries

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Government of People's Republic of Bangladesh is operating aquaculture in the lake. Since its creation nearly half a century ago, the lake suffered tremendous threat of eutrophication until it was re-excavated a decade ago. During the pre-excavation period, a number of limnological researches have been carried out on the lake (Islam *et al.* 1979, Islam and Chowdhury 1979, Khondker *et al.*1988, Khondker and Rahim 1991, 1993; Khondker and Parveen 1992, Hasan *et al.* 1994). Khondker and Rahim (1993) also commented on the lake water quality by using periphytic and planktonic algae. Since there is no information available on zooperiphyton of the lake the present research on substrate specific zooperiphyton and their interrelationships with some water quality parameters was carried out.

Materials and Methods

Detail of the morphometric features and geographical location of the lake has been furnished in Islam and Chowdhury (1979). The sampling for the present research was carried out monthly from December 2010 to August 2011 between 10:00 and 11:00 am. *Insitu* measurement of free CO_2, alkalinity, hardness, ammonia-nitrogen, nitrite-nitrogen were carried out by using HACH water quality testing kit (Model FF-2, USA); Air and water temperature, conductivity and TDS were measured by a HACH conductivity meter (Model HACH Sension5, USA). Lutron DO meter (Model DO 5509, Singapore) and HANNA pH meter (Model HI 8424, Italy) were used for determination of dissolved oxygen and pH of water respectively. Three locally available substrates namely *Swietenia macrophylla* (910 cm^2) and *Samanea saman* (980 cm^2) and *Bambusa vulgaris*(840 cm^2) were installed vertically at one meter depth in replicates with equal distance at the lake bottom. After one month later, zooperiphyton colonized on the substrates were scraped and washed by tap water. After washing the zooperiphyton samples were taken into plastic bucket then sieved through a series of standard sieves having mesh size in a 2.0, 0.92 and 0.2 mm for the collection of larger samples like Molluscan shell. The remained sieved water was filtered through 55µm meshed plankton net and finally concentrated to 25-100 ml. The filtrates were immediately preserved by 4% buffer formaldehyde solution. Zooperiphyton taxa were identified by using keys from Ward and Whipple (1959), Needham and Needham (1962), Wetzel (1983), Ali and Chakrabarty (1992), Smith (2001) and Siddiqui *et al.* (2007). The enumeration was done by using a compound microscope (NOVA 950 ES, China) with the help of Sedgewick-Rafter cell (SR-Cell, USA) and expressed as number per meter square (individual m^{-2}). Statistical analysis was done using Microsoft Office Excel 2007 and SPSS, a computer based program for Windows (Version 11.5, 2007. Systat, Inc. USA).

Results and Discussion

Water quality parameters: The air and water temperature varied from 18° to 31 °C and 19° to 32 °C respectively (Table 1). The almost all consistent results were reported by Hasan *et al.* (1994) from Dhanmondi Lake. In the present study, pH was found neutral to

Table 1. Monthly fluctuation of different physico-chemical parameters with their ranges and mean values (±SE) of Dhanmondi lake.

Parameters	Dec.`10	Jan.`11	Feb.`11	Mar.`11	Apr.`11	May`11	June`11	July`11	Aug.`11	Range	Mean ±SE
Air temperature (°C)	18.00	19.00	22.00	25.00	29.00	31.00	28.00	29.00	29.00	18.00-31.00	25.55±1.59
Water temperature (°C)	19.00	19.00	23.00	25.00	29.00	32.00	29.00	31.00	31.00	19.00-32.00	26.44±1.70
pH	7.50	7.00	8.00	8.00	8.00	7.50	7.77	8.50	8.70	7.00-8.70	7.88±.17
DO (mg/l)	7.50	8.50	5.00	8.60	8.50	7.50	3.40	7.50	8.50	3.40-8.60	7.22±0.60
Free CO_2 (mg/l)	35.00	25.60	28.50	35.60	21.50	36.40	17.00	14.20	17.00	14.20-36.40	25.64±2.90
Total Alkalinity (mg/l)	72.00	102.00	112.00	99.00	80.00	110.00	115.00	78.00	80.00	72.00-115.00	94.22±5.57
Hardness (mg/l)	80.00	96.00	99.00	101.00	99.00	103.00	84.00	87.00	96.00	80.00-103.00	93.88±2.72
Ammonia-nitrogen (mg/l)	0.60	0.70	2.40	1.10	.80	1.20	0.60	1.20	0.90	0.60-2.40	1.05±0.18
Nitrite-nitrogen (mg/l)	0.05	0.04	0.06	0.19	0.04	0.02	0.02	0.02	0.02	0.02-0.19	0.05±0.01
TDS (mg/l)	202.80	201.90	198.70	220.00	220.70	198.80	185.40	198.80	187.80	185.40-220.70	201.65±4.05
Conductivity (µS/cm)	452.00	462.00	402.00	455.00	462.00	376.00	386.00	376.00	386.00	376.00-462.00	417.44±13.03

Table 2. Monthly abundance (individual/m^2), range (individual/m^2) and mean values (±SE) of different groups of zooperiphytonon on bamboo, mehogoni and rain tree substrates in Dhanmondi Lake.

Substrates	Months	Protozoa	Rotifera	Copepoda	Cladocera	Ostracoda	Conchostraca	Insecta	Oligochaeta	Nematoda	Mollusca	G.Total	Percentage
Bamboo	Dec`10	2856.00	1190.00	714.00	476.00	714.00	.00	.00	.00	.00	60.00	6010.00	39%
	Jan`11	9639.00	9639.00	1428.00	2856.00	1785.00	.00	.00	.00	.00	108.00	25455.00	
	Febr`11	12510.00	15433.00	3336.00	1668.00	3753.00	.00	.00	.00	.00	144.00	36844.00	
	Mar`11	25980.00	31397.00	5236.00	2856.00	5712.00	.00	952.00	476.00	.00	504.00	73113.00	
	Apr`11	41652.00	44744.00	6664.00	4760.00	6188.00	476.00	1428.00	952.00	.00	1128.00	107992.00	
	May`11	15409.00	32106.00	3753.00	1251.00	4757.00	.00	1251.00	.00	.00	1032.00	59559.00	
	Jun`11	17493.00	24633.00	5355.00	4284.00	11442.00	1428.00	714.00	.00	.00	1032.00	66381.00	
	Jul`11	8211.00	21420.00	1785.00	1428.00	4641.00	1071.00	1071.00	.00	.00	1164.00	40791.00	
	Aug`11	9934.00	20562.00	2682.00	298.00	5364.00	894.00	894.00	.00	.00	1236.00	41864.00	
	Range	2856.00-41652.00	1190.00-44744.00	714.00-6664.00	298.00-4760.00	714.00-11442.00	.00-1428.00	.00-1428.00	.00-952.00	.00	60.00-1236.00	6010.00-107992.00	
	Mean (±SE)	15964.88 (±3878.47)	22347.11 (±4322.02)	3439.22 (±668.62)	2208.55 (±528.70)	4928.44 (±1013.47)	429.88 (±188.14)	701.11 (±187.91)	158.66 (±112.19)	.00	712.00 (±167.18)	50889.88 (±9938.36)	
	Percentage	32%	44%	7%	4%	10%	1%	1%	0%	0%	1%	100%	
Mehogoni	Dec`10	2200.00	440.00	660.00	.00	.00	.00	.00	.00	.00	99.00	3399.00	34%
	Jan`11	6600.00	5280.00	1990.00	990.00	2640.00	.00	.00	.00	.00	110.00	17610.00	
	Febr`11	2640.00	660.00	1100.00	.00	.00	.00	.00	.00	.00	77.00	4477.00	
	Mar`11	8448.00	24784.00	3168.00	2464.00	6336.00	.00	.00	.00	.00	220.00	45420.00	
	Apr`11	18920.00	26880.00	3960.00	3960.00	.00	.00	880.00	880.00	880.00	902.00	57262.00	
	May`11	10431.00	21960.00	3294.00	3843.00	52155.00	1647.00	5490.00	.00	2196.00	913.00	101929.00	
	Jun`11	3960.00	9240.00	6600.00	2640.00	3960.00	.00	.00	2640.00	.00	968.00	30008.00	
	Jul`11	46200.00	29040.00	1760.00	2200.00	2640.00	.00	.00	.00	.00	1111.00	82951.00	
	Aug`11	24640.00	13475.00	2695.00	1155.00	2695.00	.00	.00	.00	.00	1155.00	45815.00	
	Range	2200.00-46200.00	440.00-29040.00	660.00-6600.00	.00-3960.00	.00-52155.00	.00-1647.00	.00-5490.00	.00-2640.00	.00-2196.00	77.00-1155.00	3399.00-101929.00	
	Mean (±SE)	13782.11 (±4774.41)	14639.88 (±3780.18)	2803.00 (±593.75)	1916.88 (±494.06)	7825.11 (±5585.29)	183.00 (±183.00)	707.77 (±605.59)	391.11 (±297.37)	341.77 (±251.26)	617.22 (±158.11)	43207.88 (±11273.87)	
	Percentage	32%	34%	7%	4%	18%	0%	2%	1%	1%	1%	100%	

Contd.

Substrates	Months	Protozoa	Rotifera	Copepoda	Cladocera	Ostracoda	Conchostraca	Insecta	Oligochaeta	Nematoda	Mollusca	G.Total	Percentage
Rain tree	Dec`10	1836.00	408.00	1020.00	816.00	.00	.00	.00	.00	.00	80.00	4160.00	27%
	Jan`11	816.00	408.00	612.00	204.00	.00	.00	.00	.00	.00	90.00	2130.00	
	Febr`11	3825.00	2295.00	1275.00	1020.00	.00	.00	.00	.00	.00	100.00	8515.00	
	Mar`11	14688.00	26010.00	3060.00	1530.00	5202.00	.00	.00	.00	.00	1010.00	51500.00	
	Apr`11	17952.00	45172.00	5304.00	4896.00	12240.00	.00	.00	.00	.00	1030.00	86594.00	
	May`11	31620.00	24990.00	2040.00	1530.00	8160.00	.00	.00	.00	.00	1100.00	69440.00	
	Jun`11	3672.00	13872.00	1632.00	816.00	12648.00	.00	.00	.00	408.00	1000.00	34048.00	
	Jul`11	7854.00	6069.00	2499.00	714.00	5355.00	714.00	.00	.00	714.00	800.00	24719.00	
	Aug`11	8160.00	11424.00	1632.00	1632.00	8160.00	1632.00	.00	.00	.00	1010.00	33650.00	
	Range	816.00-31620.00	408.00-45172.00	612.00-5304.00	204.00-4896.00	.00-12648.00	.00-1632.00	.00 .00	.00 .00	.00-714.00	80.00-1100.00	2130.00-86594.00	
	Mean (±SE)	10047.00 (±3311.96)	14516.44 (±5014.36)	2119.33 (±469.12)	1462.00 (±456.47)	5751.66 (±1670.67)	260.66 (±188.62)	.00 .00	.00 .00	124.66 (±86.31)	691.11 (±152.61)	34972.88 (±9833.13)	
	Percentage	29%	42%	6%	4%	16%	1%	0%	0%	0%	2%	100%	
Total	Range	816.00-46200.00	408.00-45172.00	612.00-6664.00	.00-4896.00	.00-52155.00	.00-1647.00	.00-5490.00	.00-2640.00	.00-2196.00	60.00-1236.00	2130.00-107992.00	100%
	Mean (±SE)	13264.66 (±2288.11)	17167.81 (±2544.86)	2787.18 (±340.22)	1862.48 (±280.54)	6168.40 (±1910.04)	291.18 (±105.46)	469.62 (±213.25)	183.25 (±106.55)	155.48 (±89.47)	673.44 (±88.78)	43023.55 (±5891.34)	
ANOVA	df	2,24	2,24	2,24	2,24	2,24	2,24	2,24	2,24	2,24	2,24		
	F	0.551	1.039	1.282	0.580	0.191	0.458	1.235	1.149	1.22	0.098		
	S	0.584	0.369	0.296	0.567	0.827	0.638	0.309	0.334	0.299	0.907		

slight alkaline and varied from 7.00 to 8.70 (Table 1). The concentration of dissolved oxygen ranged from 3.40 to 8.70 mg/l in the month of June 2011 and March 2011 (Table 1). Free CO_2 fluctuated from 14.20 mg/l in July 2011 to 36.40 mg/lin May 2011 (Table 1). Total alkalinity of water varied from 72 to 115mg/l in December 2010 and June 2011 (Table 1). The total hardness varied from 80 to 103mg/l in the month of December 2010 and May 2011 (Table 1). The Ammonia-nitrogen concentration ranged from 0.60 to 2.40mg/l with the maximum in February 2011 and minimum in December 2010 and June 2011 (Table 1). Nitrite –nitrogen ranged from 0.02 to 0.19 mg/l and it was maximum in March 2011 and minimum in May- August 2011 (Table 1). Islam and Saha (1975) observed similar results from Ramna lake, Dhaka. The minimum total dissolved solids were 185.40 mg/l in June and maximum was 220.70 mg/l in April (Table 1). Conductivity varied from 376 to 462.83 µS/cm of which maximum value was observed in April 2011 and minimum in July 2011 (Table 1). When physicochemical quality of water (post-excavation period of the lake) are compared with those of Khondoker and Parveen (1993) i.e. pre-excavation of bottom material marked differences were observed and it was observed that conductivity, alkalinity, free CO2 content and nitrate dropped significantly. Water temperature fluctuated in the same manner both in the study of Khondoker and Parveen (1993) and the present one. However, a slight increase in the maximum pH has been observed in the present investigation.

Zooperiphyton: The zooperiphyton communities of the lake were comprised of protozoa, rotifera, copepoda, cladocera, ostracoda, conchostraca, insect's larvae, oligochaeta, nematoda and mollusca. Substrate wise zooperiphyton communities and their monthly abundance, range, mean values and ANOVA values among substrates of the lake have been presented in the Table 2. Using three substrates, the abundance of total zooperiphyton varied from 2130 individual/ m^2 in rain tree in January 2011 to 107992 individual/ m^2 in bamboo in April 2011 (Table 2). In case of bamboo, it ranged from 6010 individual/ m^2 in December 2010 to 107992 individual/ m^2 in April 2011. While, in mehogoni substrates, it varied from 3399 individual/ m^2 in December 2010 to 101929 individual/ m^2 in May 2011. Whereas, in rain tree it fluctuated from 2130 individual/ m^2 in January 2011 to 86594 individual/ m^2 in April 2011. The group of zooperiphyton on three substrates showed no significant differences ($P>0.05$) (Table 2). Rai *et al.* (2008,2010) recorded as 459826 ± 32266 individual/m^2 and 592770 ± 233709 individual/m^2 from bamboo and 472123 ± 71505 individual/m^2 and 469218 ± 31646 individual/m^2 from rice straw substrates in fresh water fish ponds of Bangladesh. On the basis of percentage composition 39% zooperiphyton settled on bamboo, 34% on mehogoni and 27% on rain tree substrates (Table 2). Seasonally, the highest value of zooperiphyton was observed in summer and the lowest in winter (Fig. 1). Sarwar and Zutshi (1988) also found maximum values of periphyton in winter and spring. Alam *et al.* (1997) observed the highest primary peak of periphyton in the month of March-April followed by secondary and tertiary peaks of lesser magnitude in the months of June and October respectively. Periphytic protozoans were dominant group in Dhanmondi lake

among three substrates namely bamboo, mehogoni and raintree; it formed 32%,32% and 29%of the total zooperiphyton abundance respectively (Table 2). Wenhui (1997) reported

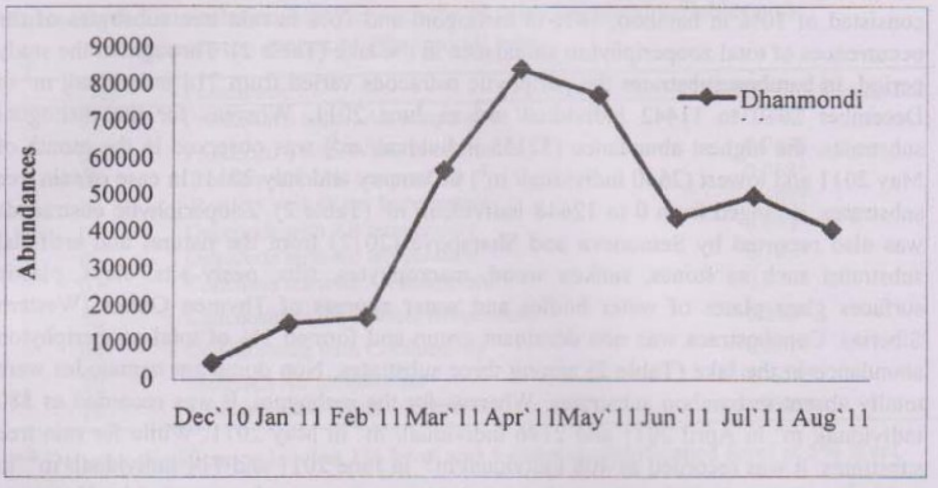

Fig. 1.Abundance of zooperiphyton population in Dhanmondi lake in different months.

that protozoans were dominant group as micro-zooperiphyton with percentages of 38.10% at Dianshan Lake in China. The abundance of protozoans zooperiphyton of bamboo substrates varied from 2856 to 41652 individual/ m^2. While in the mehogoni substrates, it ranged from 2200 to 46200 individual/ m^2. In case of rain tree substrates, it fluctuated from 816 to 31620 individual/ m^2 (Table 2). Rotifers was the most dominant group among three substrates and it comprised of 44% in bamboo, 34% in mehogoni and 42% in raintree substrates in order to occurrence of total zooperiphyton abundance (Table 2). The total abundance of zooperiphyton among all three substrates of periphytic rotifers varied from 408 to 45172 individual/ m^2. In case of bamboo pole, it fluctuated from 1190 individual/ m^2 in December 2010 to 44744 individual/ m^2 in April 2011. Whereas, on the mehogoni branch, rotifers settled on and ranged from 440 in December 2010 to 29040 in July 2011. While, in rain tree substrates, the highest abundance was 45172 individual m^{-2} in April 2011 and lowest 408 individual/ m^2 in December 2010 (Table 2). More or less similar results had been observed by Wahab *et al.* (1999) from Bangladesh and Green (2003) from a tropical swamp, the Okavango Delta, Southern Africa. Copepods constituted 7% in bamboo and mehogoni and 6% in raintree in order to occurrences of total zooperiphyton abundance among three substrates of the lake (Table 2). The abundance of total periphytic copepods varied from 612 to 6664 individual/ m^2. Periphytic cladocera constituted 4% of total zooperiphyton abundance among three substrates (Table 2). In the bamboo poles, it diverses from 298 individual/ m^2 in August 2011 to 4760 individual/ m^2 in April 2011. Whereas, in mehogoni substrates the maximum abundance (3960 individual m^{-2}) was recorded in April 2011 and minimum

(990 individual/ m^2) in January 2011. In case of rain tree substrate, it fluctuated from 204 in January 2011 to 4896 in April 2011 (Table 2). Cladocera was also reported by Azim *et al.* (2002) from Bangladesh water. Ostracods settled on three substrates and also consisted of 10% in bamboo, 18% in mehogoni and 16% in rain tree substrates of the occurrences of total zooperiphyton abundance in the lake (Table 2). Throughout the study period, in bamboo substrates the periphytic ostracods varied from 714 individual/ m^2 in December 2010 to 11442 individual/ m^2 in June 2011. Whereas for the mehogoni substrates, the highest abundance (52155 individual/ m^2) was observed in the month of May 2011 and lowest (2640 individual/ m^2) in January and July 2011. In case of rain tree substrates, it ranged from 0 to 12648 individual/ m^2 (Table 2). Zooperiphytic costracods was also reported by Semoneva and Sharapova (2012) from the natural and artificial substrates such as stones, sunken wood, macrophytes, silts, peaty sits, clays, plastic surfaces glass plates of water bodies and water courses of Thymen Oblast (Western Siberia). Conchostraca was non dominant group and formed 1% of total zooperiphyton abundance in the lake (Table 2) among three substrates. Non dominant nematodes were totally absent in bamboo substrates. Whereas for the mehogoni, it was recorded as 880 individual/ m^2 in April 2011 and 2196 individual/ m^2 in May 2011. While for rain tree substrates, it was recorded as 408 individual/m^2 in June 2011 and 714 individual/ m^2 in July 2011 (Table 2) during the study period. Nematodes was also reported by Hosain *et al.* (2011) from Curzon hall pond. Periphytic grazer molluscan fauna was non dominant group of zooperiphyton abundance of three substrates (Table 2) in the lake. The total abundance of periphytic grazer molluscan fauna fluctuated from 60 to 1236 individual/ m^2. Macrozooperophytic molluscan fauna had also been reported by Skalskaya *et al.* (2008) from a small river and Sharapova (2010a and b). Periphytic insecta was one of the least dominant zooperiphyton among three substrates (Table 2). It was recorded from bamboo sticks and mehogoni branches and was totally absent from rain tree substrates (Table 2). Sharapova (2010b) observed that chironomid larva settled on immersed willow and stones from the UK river. Zooperiphytic oligochaeta was also non dominant group among three substrates in the lake (Table 2). Throughout the study period, oligochaeta was not found from rain tree branches but it was observed from bamboo and mehogoni substrates (Table 2). Sharapova (2010a) reported pollution signal producing periphytic oligocheats on rubble bedding at the base bridge and concrete pieces at Obrochnoye (oxbow lake) lake of the Tura River in Russia.

Interrelationships: The interrelationships between some water quality parameters and different zooperiphyton groups were determined and presented in Tables 3 and 4. In Dhanmondi lake, protozoans showed significant positive correlation with the air temperature and the water temperature. Zooperiphytic rotifers exhibited positive correlation with air temperature and water temperature. Copepods had a positive correlation only with air temperature. Ostracods positively related with air temperature and water temperature of water. Conchostraca showed positive correlation with air temperature, water temperature and conductivity of water. The periphyton grazer

molluscan fauna significantly correlated with air temperature and water temperature of water of Dhanmondi lake (Table 3).

Table 3. The interrelationships between the physico-chemical variables and zooperiphyton groups of Dhanmondi lake.

Sl. No	Parameters	Correlation (r)
01	Protozoan's with Air temperature	0.767*
02	Protozoan's with Water temperature	0.7448
03	Rotifers with Air temperature	0.758*
04	Rotifers with Water temperature	0.669*
05	Copepods with Air temperature	0.693*
06	Ostracods with Air temperature	0.707*
07	Conchostraca with Air temperature	0.770*
08	Conchostraca with Water temperature	0.838*
09	Conchostraca with Conductivity	0.801*
10	Mollusca Air temperature	0.961**
11	Mollusca with Water temperature	0.960**

** Denotes significance level at 1% level and * denotes significance level at 5% level.

Among the zooperiphyton groups of Dhanmondi lake, rotifers showed significant positive correlation with protozoans, copepods, cladocera, and molluscans.Cladocera showed strong positive correlation with copepoda and oligichaeta. Molluscans exhibited strong positive relationships with conchostraca. Ostracods expressed positive correlation with insects and nematode. Insects had positive relationships with nematodes (Table 4).

Table 4. The interrelationships among zooperiphyton groups in Dhanmondi lake.

Sl. No	Parameters	Correlation (r)
01	Rotifers with Protozoans	0.789*
02	Rotifers with Copepods	0.838**
03	Rotifers with Cladocera	0.879**
04	Rotifers with Mollusca	0.706*
05	Cladocera with Copepods	0.885**
06	Cladocera with Oligocheats	0.719*
07	Mollusca with Conchostraca	0.829**
08	Ostracoda with Insects	0.938**
09	Insecta with Nematodes	0.957**

** Denotes significance level at 1% level and * denotes significance level at 5% level.

From the present investigation, it may be stated that the zooperiphyton composition, distribution and abundance were influenced by water quality parameters such as air and temperature and conductivity as well as each with others. Alam *et al.* (1997) reported a significant correlation coefficient between periphyton density and water temperature

from a tropical pond receiving effluents from medical college complex (Aligarh, India) and domestic sewage. Rai and Sharma (1986) also calculated correlation coefficients among of the environmental factors with total cell counts and species diversity indices. Thus, zooperiphyton community may be helpful to use as sensitive indicator tool for determination of the ecological status as well as aesthetic value of lake aquatic system. The present investigation also indicates that zooperiphyton communities were well diversified and water quality properties of that lake were found to be suitable for aquatic biota including fish.

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