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SEASONAL ABUNDANCE OF CRUSTACEAN COMMUNITY IN A POND ECOSYSTEM OF TRIPURA IN RELATION TO PHYSICO-CHEMICAL FACTORS

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The present study was undertaken on a perennial pond ecosystem of Tripura to study the seasonal abundance of crustacean fauna in relation to physico-chemical limnology during a period from March 2012 to February 2013. A total of 18 species of crustacean fauna were recorded and six out of 18 species were numerically dominant. Amongst crustacean fauna, *Ceridaphnia reticulata*, *Diaphanosoma excisum* and *Chydorus sphaericus* dominated in the cladoceran group, *Eucyclops agilis* and *Mesocyclops leuckarti* were the dominant copepods while as *Cypris* sp. was the dominant ostracod. Crustacean community followed a definite rhythm of seasonal abundance showing highest density in the summer (Cladocera: 607 ind. /L; Copepoda: 563 ind./L; Ostracoda: 78 ind./L) and lowest in the monsoon (Cladocera :176 ind./L; Copepoda: 123 ind./L; Ostracoda: 31 ind./L) during study period. Numerical abundance of crustacean fauna was observed in the peripheral zone of aquatic macrophytes. Notable physico-chemical parameters of the studied pond were also observed and their degree of influence over the seasonal abundance of crustacean fauna was noted. The result was evaluated through statistical analysis. Crustacean community when correlated with physico-chemical parameters indicated that the density of crustacean fauna was influenced by physico-chemical parameters of the pond ecosystem.

Key words : Crustacean community, sasonal abundance, physico-chemical factors, correlation coefficient, pond ecosystem

INTRODUCTION

Crustaceans an important constituent of zooplankton play vital role in aquatic food chains (Ahmed *et al.*, 2012). Besides being an important food item of fishes, the animalcules also find use as potential indicators of the trophic status of a water body since their structure and composition are highly affected by eutrophication (Patalas, 1972). They are also important for evaluating the influence of climate change and anthrogenic pressures on non-model systems (Buhay, 2011). Ponds are rich in components of biodiversity like flora, fauna of natural, local and regional significance (Ghanai *et al.*,. 2010) and diversity of zooplanktonic organisms is quite high in fertile standing water like pond (Sinha & Sinha, 1983; Sinha & Islam, 2002). Physico-chemical parameters which play key role in the maintenance of healthy environment of the lentic water bodies is also one of the most important determining factors on the occurrence and abundance of crustaceans (Chakrabarti, 2010).The temporal unpredictability of environmental conditions are known as a prerequisite factor for the structure of zooplankton communities (Rutherford *et al.*, 1999; Ruokolainen *et al.*, 2009). The physico-chemical parameters of water such as nutrient concentrations or oxygen conditions which often as a consequence of human activity in the catchment area, may often shape abundance and richness of micro invertebrate communities in the lentic ecosystem (Castro *et al.*, 2005; Chakrabarti, 2011). Therefore, in the present study, an attempt was undertaken to find out the degree of relationship of physico-chemical

parameters with the seasonal abundance of crustacean fauna in a freshwater pond ecosystem of Tripura.

MATERIALS AND METHODS

The present observation was carried out in a freshwater pond ecosystem located at kailashahar Sub-Division, Unokoti District of Tripura during March 2012 to February 2013. It lies geographically at the Latitude $24^0 19'$ N and Longitude $92^0 01'$ E. The pond is perennial and rectangular shaped, the surface area is of about 0.62 ha. The depth of water column the studied pond varies from 0.8 to 2.5 m. The littoral zone of the pond harbours some species of macrophytes such as *Eichhornia crassipes, Lemna minor* etc.

The crustacean zooplankton were collected by filtering 100 litre surface water through plankton net (mesh size 55µm) and fixed immediately with 4% formalin. The planktonic organisms were analysed quantitatively in the laboratory under the microscope through Sedgwick Rafter plankton counting cell and the results were expressed as individual per litre (ind./L). The crustacean fauna was identified following standard works of Pennak (1978), Battish (1992) and Edmondson (1992). For analysing physico-chemical parameters of water, monthly sampling was done from March 2012 to February 2013. Some limnological variables (water temperature, pH and transparency) were determined in situ and the remaining parameters were determined following the standard methods of APHA (1998).

Statistical analyses were performed using SPSS Software (Version 11.5). The Pearson's correlation coefficient (r) was made for the statistical interpretation of the parametric relationship between the physico-chemical parameters of water and crustacean species density of the studied pond.

RESULTS AND DISCUSSION

The list of crustacean species of the studied pond was presented in Table I. Seasonal variations in the mean density values (ind. /L) of crustacean community were presented in Fig. 1.

Table I : List of crustacean species in the studied pond

Cladocera		
1. Alona monocantha	*5.Chydorus sphaericus*	*9 Sida crystallina*
2. Bosmina longirostris	*6. Diaphanosoma excisum*	*10. Simocephalus vetulus*
3. Ceriodaphnia reticulata	*7. Macrothrix spinosa*	
4. Ceriodaphnia cornuta	*8. Moina brachiata*	
Copepoda:		
11. Cyclops scutifer	*13.. Diaptomus* sp.	*15. Nauplius larvae*
12. Eucyplops agilis	*14. Mesocyclops leuckarti.*	*16. Paracyclops* sp.
Ostracoda		
17. *Cypris* sp.	18. *Stenocypris* sp.	

Crustacean community in the present study representing a total of 18 species. Amongst crustacean fauna, cladocera was the dominant group quantitatively as well as qualitatively registering 10 species. After cladocera, copepoda was the second dominant group in terms of both species number and density registering 06 species. Ostracoda was

the least represented group registering only 02 species. The most dominant cladoceran species recorded in the studied pond were *Ceriodaphnia reticulata, Chydorus sphaericus* and *Diaphanosoma excisum*. Among copepod, the dominant species recorded were *Eucyplops agilis* and *Mesocyclops leuckarti* while as *Cypris* sp. was the dominant ostracod.

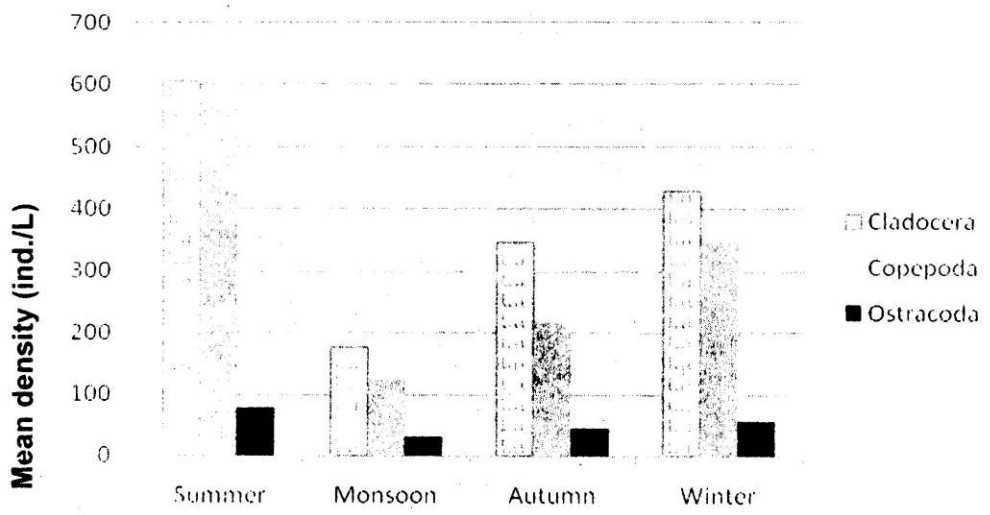

Fig. 1 : Seasonal variations in the mean density values (ind./L) of crustaceans of theStudied pond water from March 2012 to February 2013.

Seasonal variations in the population density (mean density) of crustaceans of the studied pond water revealed that cladocera population depicted its maximum density (607 ind. /L) in summer followed by winter (429 ind./L) and minimum density (176 ind./L) in monsoon months. Copepod population showed its maximum density of 563 ind. /L in summer and minimum density of 123 ind./L in monsoon. However, ostracod population depicted its maximum density of 78 ind. /L in summer and minimum density of 31 ind. /L in monsoon (Fig. 1). The maximum abundance of cladoceran population in summer may be attributed to favourable temperature and availability of food in the form of bacteria, nanoplankton and suspended detritus while in monsoon, the factors like water temperature, dissolved oxygen, turbidity and transparency play an important role in controlling the diversity and density of cladocera (Alam *et al.*, 1987; Muragan *et al.*, 1998). Several researchers (Subbamma, 1992; Gerten & Adrian, 2002; Somani & Pejaver 2004) also observed maximum abundance of copepod population in summer months. The present study recorded maximum ostracod population in summer months while minimum in monsoon. Similar observation was also made by Sunkad & Patil (2004).

The density of crustacean zooplankton is governed by abiotic factors (physico-chemical factors). Cladocera showed significant positive correlation with water temperature ($r = 0.812$, $P < 0.05$) and pH ($r = 0.827$, $P < 0.01$). However, this group showed negative correlation with ammonia ($r = - 0.439$, $P < 0.01$) and free carbon dioxide ($r = - 0.503$, $P < 0.01$). Relation between copepods and abiotic variables revealed significant positive correlations with water temperature ($r = 0.723$, $P < 0.05$) and pH ($r = 0.743$, $P < 0.01$). However, significant negative correlations were observed with free

carbon dioxide (r = - 0.407, P< 0.05), total alkalinity (r = - 0.541, P < 0.01) and nitrate nitrogen (r = - 0.761, P< 0.05). As regards to ostracod population, positive correlation was obtained with total alkalinity (r = 0.603, P< 0.05) where as negative correlation was observed with water temperature (r = - 0.425, P< 0.05) (Table II).

Table II : Correlation of crustacean groups with physico-chemical parameters of the studied pond.

Groups	WT	Transp	pH	DO	TA	CO_2	Cl	NH_4-N	NO_3-N	OP	TP
Cladocera	.812(*)	-.158	.827(**)	-.157	-.217	-.503(**)	-.207	-.439(**)	-.153	-.613	-.173
Copepoda	.723(*)	.704	.743(**)	-.231	-.541(**)	-.407(*)	.047	-.217	-.761(*)	-.521	-.209
Ostracoda	-.425(*)	.157	-.0.14	-.172	.603(*)	-.007	-.147	.123	.537	.273	.101

*: Correlation at 0.05 (2-tailed) **: Correlation at 0.01 (2-tailed) Abbreviation: WT: Water temperature, Transp: Transparency, DO: Dissolved oxygen, TA: Total alkakinity, CO_2: Free carbon dioxide, Cl: Chloride, NH_4-N: ammonical nitrogen, NO_3-N: Nitrate nitrogen, OP: Orthophosphate phosphorus, TP: Total phosphate phosphorus

The present observation shows that cladoceran fauna are comparatively more abundant under the macrophytes than those of the exposed littoral areas in the studied pond. Several researchers (Bozkurt & Guven, 2009; Rajagopal *et al.*, 2010) opined that the availability of the cladoceran fauna in higher numerical abundance around the macrophytes than those of the exposed littoral areas indicates that the periphery of macrophytes forms a suitable ecological niche condition for cladoceran population. Beisner *et al.* (1997) also opined that lower abundance of cladocera in the vegetation free areas was due to sunlight factors.

The present study also depicted that crustaceans (cladocera and copepoda) showed significant positive correlation with temperature (cladocera : r = 0.812, P < 0.05 ; copepoda : r = 0.723, P< 0.05), thereby indicating that temperature exert significant impact on the crustacean abundance, an observable fact well supported by Beisner *et al.*(1997) and Bhuiyan & Nessa (1998). A direct relation was also observed between the pH and crustaceans which corroborates with the findings of Basu *et al.* (2010). However, in the present study, significant negative correlation was observed in between free carbon dioxide and crustaceans (cladocera : r = - 0.503, P < 0.01 ; copepoda : r = - 0.407, P< 0.05). Several researchers (Welch, 1952; Moshood, 2009) also observed similar findings. As regards to copepods, a significant negative correlation was also noticed with total alkalinity (r = - 0.541, P < 0.01). Nasar (1997) also observed inverse relation between the copepods and total alkalinity. An inverse relationship also exist copepods and nitrate nitrogen (r = - 0.761, P< 0.05). Michael (1968) opined that when concentration of nitrate was more, the copepod abundance of was less.

From the present observation it can be inferred that different crustacean groups although have different environment requirements, many of them co-exist in the same water mass, the significant positive correlations with water temperature (r = 0.723, P< 0.05) and pH (r =ir abundance may vary with seasons due to the dynamic nature of

the aquatic ecosystem and might be due to optimal condition in the physico-chemical parameters of the lentic ecosystem.

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