Cladoceran Community in Shalabug Wetland, Kashmir

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ABSTRACT

The paper deals with the species composition and population dynamics of Cladocera (Crustacea) in Shalabug Wetland of Kashmir under the influence of certain environmental factors. The cladoceran fauna was formed by typical littoral community, being represented by sixteen species belonging to five families. The group, showing numerical surge in April against the lowest in February, was mainly composed of Daphnidae followed by Chydoridae, Macrothricidae, Bosminidae and Moinidae in decreasing order. The population dynamics was mainly influenced by water level fluctuations and macrophytic density.

Key words**:** Shalabug wetland, Kashmir, limnology, Cladocera

INTRODUCTION

The importance of Cladocera in the trophic dynamics of freshwater ecosystems has long been recognized. They are the consumers of first order, directly drawing energy from primary producers of the ecosystem, viz., phytoplankton, and in turn form the food of a large number of planktivorous fishes and other invertebrates and thereby help in transferring energy to higher trophic levels. Because of varied response to ecological features by different species, many of them act as reliable indicators of the trophic status of water bodies. A detailed limnological study of the Shalabug wetland (Kashmir) was conducted during 2005 and the present paper is based on a part of the data collected during this study and describes the diversity and distributional pattern of Cladocera in response to environmental characteristics in the wetland.

STUDY SITES

The Shalabug wetland is located to the west of Anchar lake, about 18 km away from Srinagar. Four sampling sites were chosen in the wetland (Fig. 1). These were located near the inlet from the Anchar lake (W1), open water area (W2), emergent vegetation zone (W3) and the outlet connected with the Sind stream (W4). Dominant forms of macrophytes in the wetland include: *Ceratophyllum demersum, Myriophyllum spicatum, M. verticillatum, Nymphaea* spp., *Potamogeton* spp., *Polygonum* spp., *Sparganium* *erectum, Nymphoides peltata, Utricularia flexuosa, Typha angustata* and *Phragmatis australis.*

MATERIAL AND METHODS

Qualitative and quantative samples of Cladocera were collected on monthly basis with the help of plankton net and were preserved in 4% formalin. Detailed taxonomic identification was carried out following Edmondson (1959), Smirnov (1974), Pennak (1978) and Michael and Sharma (1988). Analysis of water was done in accordance with the methods given in Mackereth (1973), CSIR (1974) and Eaton *et al.* (1995).

RESULTS AND DISCUSSION

Physicochemical Features

The data on the annual mean values of the physico-chemical characteristics of water recorded at four different sites are presented in Table 1. The annual mean air temperature recorded a range of 18.9°C (at W2) – 20.0° C (at W3), while the annual mean water temperature ranged between 15°C at W2 and 16°C at other sites. Temperature of the water showed a close relation with atmospheric temperature due to the shallow nature of the wetland, the depth varying from an annual mean of 0.3m at site W2 and W3 to 0.8m at site W2. Due to presence of significant quantities of suspended matter, including silt, the Secchi transparency was also quite low and ranged from 0.1m at W3 to 0.3m at W4. Dissolved oxygen, which is one of the most reliable parameters in assessing the trophic status and the magnitude of eutrophication in an aquatic ecosystem (Edmondson, 1966), showed an annual mean maximum of 7.0 mg/l at site W2 and a mean minimum of 4.4 mg/l at site W3. The carbon dioxide and pH didn't show any marked difference between the study sites and thus water seemed to be well buffered. As far as the total alkalinity is concerned it was mainly due to the presence of bicarbonates and recorded a spatial range of 178 mg/l (at site W3) to 190 mg/l (at site W4). The annual mean value of carbonate ions fluctuated in a narrow range of 3.0 mg/l at W3 to 4.7 mg/l at W1. The conductivity (379µS at site W4 – 420µS at site W3) and chloride (30 mg/l at site W3 – 41 mg/l at site W2) values of all the study sites were also quite high, indicating rich nutrient status.

All the three forms of nitrogen – nitrate (285µg/l at W2 to 385µg/l at W3), ammonia (224µg/l at W2 to 327µg/l at W1) and nitrite (17µg/l at W2 and W3 to 21µg/l at W1) – recorded low values in the wetland. However, phosphate-phosphorus and total phosphorus were recorded in appreciable quantities throughout the wetland, the range of fluctuations being 48µg/l at W3 to 54µg/l W2 and 226µg/l at site W2 to 321µg/l at site W1 for the two parameters respectively.

Table 1: Mean value of physico- chemical parameters of Shalabug wetland recorded from Dec., 2004 to Nov., 2005

PARAMETERS		Site W1	Site W2	Site W3	Site W4
Air temperature (°C)	R	8-33	5-34	8-33	6-31
	M	19.6 (± 8.9)	18.9 (± 10.2)	20(±8.7)	19.3 (±9.2)
Water temperature (°C)	R	5-30	4-27	5-28	5-30
	M	16 (± 8.9)	15 (±8.3)	16(±8.9)	16(±8.8)
Transparency (m)	R	0.0.3	0.1-0.4	0.1-0.2	0.2-0.4
	M	0.2 (±0.1)	0.2 (±0.1)	0.1(±0.0)	0.3(±0.1)
Depth (m)	R	0.2 - 0.5	0.4 - 1.2	0.1 - 0.6	0.3 - 0.8
	M	0.3(±0.1)	0.8(±0.3)	0.3(±0.2)	0.5(±0.2)
DO (mg/l)	R	3.8 - 9.1	4.0 - 12.5	2.0 - 7.5	2.4 - 8.5
	M	6.5 (±2.0)	7.0(±2.9)	4.4(±2.1)	5.5(±2.0)
Free CO_2 (mg/l)	R	Ab-16.4	Ab-14.2	Ab-9.5	Ab-14.5
	M	8.4(±4.1)	7.6(±4.4)	7.1(±2.9)	8.4(±3.8)
Carbonate (mg/l)	R	Ab-6.2	Ab-5.4	Ab-3.0	Ab-4.0
	M	4.7 (±2.1)	4.0(±2.0)	3.0(±0.0)	4.0(±0.0)
Total alkalinity (mg/l)	R	104-298	9-300	100-264	104-288
	M	185(±62)	184(±68)	178(±57)	190(±59)
pH(units)	R	7.2-8.0	7.3-8.7	6.6-7.9	7.1-8.8
	M	8 (±0.3)	8(±0.4)	7(±0.4)	8(±0.4)
Conductivity (µS/25° C)	R	303-487	294-467	358-472	275-481
	M	380(±52.4)	382(±56.7)	420(±36.4)	379(±69.3)
Chloride (mg/l)	R	30-59	23-61	24-38	22-40
	M	41(±10)	42(±12)	30(±5)	31(±6)
Nitrate-Nitrogen (µg/l)	R	143-625	123-610	146-602	135-533
	M	329(±182)	285(±158)	385(±160)	292(±146)
Ammonical–Nitrogen (µg/l)	R	213-398	174-294	153-314	152-300
	M	327(±51)	224(±43)	243(±57)	239(±57)
Nitrite-Nitrogen (µg/l)	R	Tr-31	4-29	Tr -27	Tr -29
	M	21(±10)	17(±9)	17(±8)	19(±7)
Ortho-phosphate (µg/l)	R	34-98	20-101	26-81	20-89
	M	53(±23)	54(±25)	48(±18)	51(±21)
Total –phosphate (µg/l)	R	215-598	174-294	139-396	102-375
	M	321(±113)	226(±96)	255(±102)	231(±85)

R=Range; M=Mean; Ab= Absent; Tr = Traces

Biological Features

16 species of Cladocera were recorded from the wetland (Table 2). Of these seven belonged to family Chydoridae, four to Daphnidae, two each to Macrothricidae and Bosminidae, and one to Moinidae. Species number was highest at site W2 and W4 (13 spp. at each site), followed closely by W1 (12), and site W3 (11). The peak population was observed in April (13.3%), while the lowest population (4.6%) was recorded in February (Fig 2).

Table 2: List of species recorded in Shalabug wetland from Dec., 2004-Nov. 2005.

	Family: Chydoridae		**Family Daphnidae**
1	*Chydorus sphaericus*	10	*Daphnia rosea*
2	*C. ovalis*	11	*D. magna*
3	*Graptoleberis testudinaria*	12	*D. pulex*
4	*Alona rectangula*	13	*Simocephalus* sp.
5	*A. guttata*		**Family Bosminidae**
6	*A. monocantha*	14	*Bosmina longirostris*
7	*Pleuroxus denticulatus*	15	*B. coregoni*
	Family Macrothricidae		**Family Moinidae**
8	*Macrothrix rosea*	16	*Moina micrura*
9	*Illyocryptus* sp		

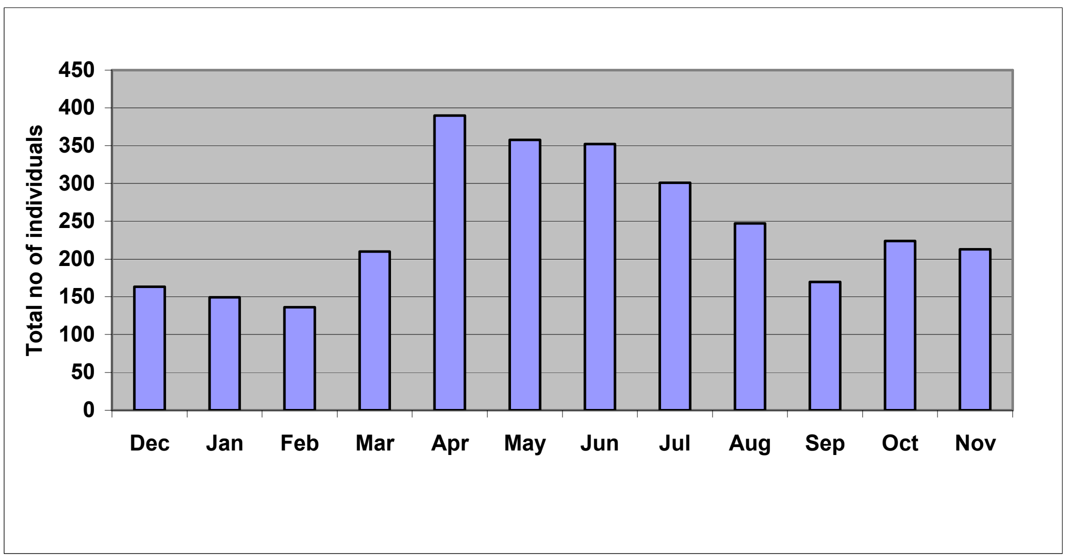

Fig. 2: Monthly fluctuation in the population of Cladocera in Shalbug wetland

Almost similar results have already been obtained by Yousuf (1989) in the Manasbal lake. The maximum population of Cladocera occurred in spring at a time when temperature, dissolved oxygen were conducive and the food source in the form of phytoplankton and microbial organic matter was in abundance (Schmitz and Osborne, 1984; Beaver *et al.*, 1999). A comparison of study sites revealed that highest population density was recorded at W1 (40.3%) and lowest at W2 (13.5%). The highest population density recorded at W1 seems to be related with the diverse macrophytic community sustaining rich periphytic algal growth at the site (Smyly, 1958; Straskraba, 1965; Cowell *et al.*, 1975; Nordlie, 1976; Pandit, 1980; Fry and Osborne, 1980). An analysis of the composition of the population of different families at site W1 (Fig. 3) revealed that Chydoridae was the dominant component (46.2%), followed by Bosminidae (41.2%) and Daphnidae (30.1%). Dominance of chydorids and bosminids seems to be related to the eutrophic nature of the water (Schmitz and Osborne, 1984; Korovchinsky, 1986; Brancelj and Sket, 1990; Balkhi and Yousuf, 1992; Beaver *et al.*, 1999). On the whole sequence of dominance among the cladoceran groups in the wetland was: Daphnidae > Chydoridae > Macrothricidae >Bosminidae > Moinidae (Fig 4).

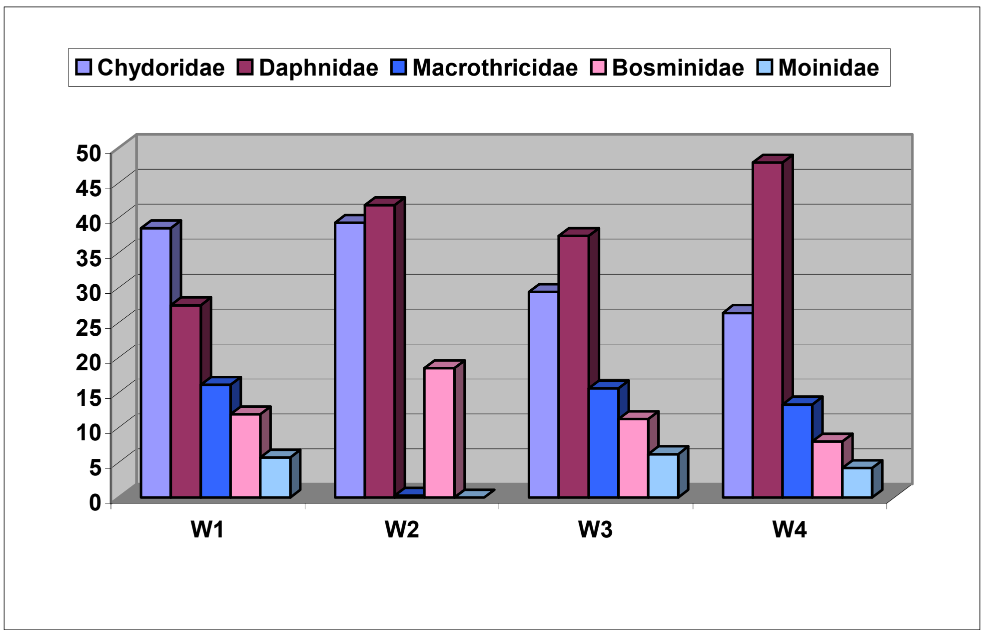

Fig 3: Percentage contribution of different families of cladocera in Shalbug wetland

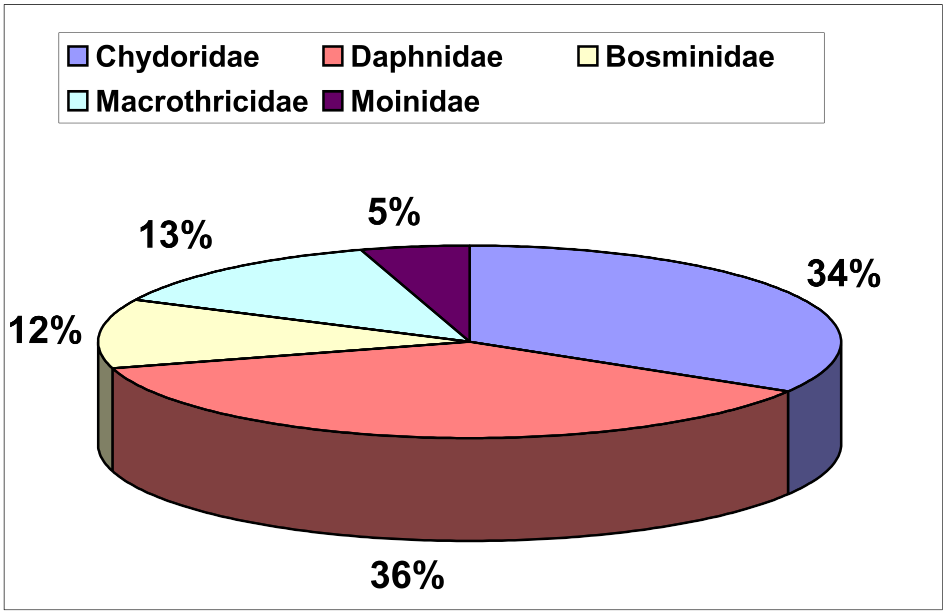

Fig. 4: Dominance pattern of different cladoceran families in Shalbug wetland

The wetland is readily divisible into two distinct areas, i.e., (i) area with sparse vegetation (site W2 and W4) and (ii) area having dense macrophytic vegetation (site W1 and W3). Most of the cladoceran species recorded from the wetland were common in both the areas as they are free swimming forms and have better locomotory power than rotifers (Edmondson, 1959; Korovchinsky, 1991) and only a few species like *Illyocryptus* sp., *Simocephalus* sp. and *Alona guttata,* are restricted to the sparsely vegetated areas. *Alona monocantha* and *Daphnia pulex* were only absent from site W3. However, the most dominant species in the wetland were *Chydorus sphaericus, Macrothrix rosea, Graptoleberis testudinaria, Daphnia magna, D. rosea, D. pulex, Bosmina longirostris* and *Pleuroxus denticulatus*. All these are true representatives of shallow eutrophic habitats and were widely distributed in the wetland almost throughout the year. Others were only seasonal in their occurrence. However, most of the seasonal species, except a few rarer ones like *Illyocryptus* sp., *Simocephalus* sp. and *A. guttata* also recorded good population whenever present.

According to Pennak (1957) crustacean plankton in a freshwater habitat at a particular moment is generally composed by one dominant species, one or two sub-dominant species and the remaining species make up only a small fraction of the whole population. The present data do not support this view. This is probably due to the fact that the shallow nature of the wetland supports a rich population of macrophyte community, which in turn provides varied microhabitats for different animal associations including cladocera. It may be concluded that the cladoceran fauna of the wetland is characterized by typical littoral cladoceran community mainly influenced by the fluctuations in the water level and the macrophytic density.

ACKNOWLEDGEMENT

The first author is highly thankful to Mr. Imtiyaz Ahmad Lone, Divisional Wildlife Warden and his staff for extending facilities in the wetland during survey period.

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