

CRUSTACEAN ZOOPLANKTON OF DAMODAR RIVER

K. VENKATARAMAN

Marine Biological Station, Zoological Survey of India, Chennai-600 028, India

INTRODUCTION

Studies on lotic zooplankton are in many ways less advanced than those on the standing waters. The relatively poor state of knowledge on lotic zooplankton is partly due to economic reasons. The aquaculture industry has been on the whole less interested in the zooplankton of rivers and streams than those of lakes and reservoirs and so fewer scientists have worked on the former. The special features of the lotic habitats are that the changes in environment are often more rapid and less predictable and are influenced by factors such as flood and desiccation which frequently play a major role. Further, studies of stream plankton need much more effort than those in lentic habitat. Many wetland biologists consider zooplankton to be transients of the river biota, washed from lakes, ponds and backwaters. However, sufficient examples are available in literature indicating that the zooplankton of a river form an integral part of the lotic community and contribute significantly to the biological productivity of this ecosystem (Hutchinson, 1967; Hynes, 1970).

Extensive surveys of river zooplankton have been made in temperate regions, however, in tropical part of world such as in India, it is scanty and scappy. In view of filling up the gap in the knowledge on this potamofauna, to begin with, Damodar river was taken up for study. The present study on the potamozooplankton of river Damodar includes Cladocera, Conchostraca, Ostracoda and Copepoda.

KEY WORDS : Crustacea, Potamozooplankton, Damodar river, Biomonitoring.

MATERIAL AND METHODS

Zooplankton samples were collected using the method of Venkataraman (1992) from a total of eight stations, four sites viz. Jarindi, Telumuchu, Jamadoba and Domgarh pumping station, Sindri from Bihar state and four sites viz. Dishergarh, Burnpur, DTPS Site and Rondia from West Bengal (Fig.1).

Description of the study area : I. Bihar State

Station 1. Jarindi : Water is clear and slow moving, with less than one foot depth. Aquatic macrophytes and algal mats are seen growing where the water flow is very minimum. Human activities such as buffalow bathing and brick making are observed.

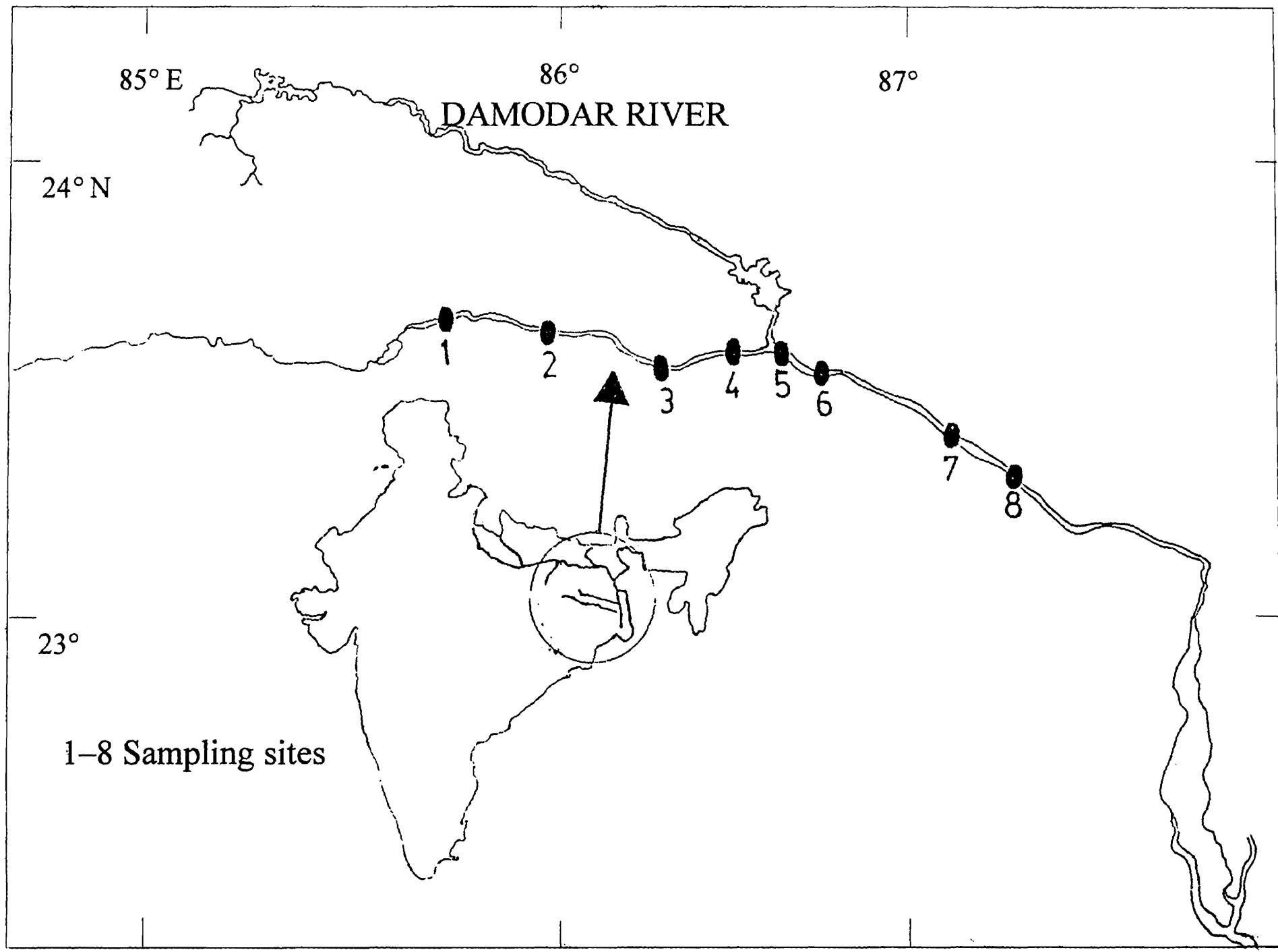


Fig. 1. Map showing the different stations where the collections are made. (1. Jarindi; 2. Telemuchu; 3. Jamadoba; 4. Sindri; 5. Disergarh; 6. Burnpur; 7. DTPS site; 8. Rondia).

Station 2. Telumuchu : Water is fast flowing and highly turbid with fly ash from a thermal power station nearby. The depth is two feet. Macrophytes such as *Hydrilla* sp. and *Lemna* sp. are present. Kathra and Dugdha coal washeries are present in this area.

Station 3. Jamadoba : Water is fast flowing and turbid with fly ash. The substratum is rocky. Bhowara and Jamadoba coke plants are present in this area.

Station 4. Domgarh pumping station, Sindri : Water is clean with sandy substratum. Aquatic macrophytes are seen growing but are clogged with grease and oil. Human activities such as buffalow bathing, brick making and fishing are observed. F.C.I. Sindri Plant, pathardih and Bhojudin coal washeries are present in this area.

II. West Bengal State

Station 5. Dishergarh : Main stream is fast flowing with clean water and sandy substratum. Activities such as buffalow and human bathing are noticed. *Vallisneria* sp. are seen growing on the banks where the water flow is very less.

Station 6. Burnpur : Substratum is sandy and the main stream is fast flowing with more than 1-2 m depth and eroding and depositing type. Macrophytes such as *Hydrilla* sp. and *Vallisneria* sp. are observed. Water is clean with algal mats on the shallow regions of the bank.

Station 7. DTPS site : Water is black in colour with fly ash and substratum is rocky and deep upto 3m. Industrial waste from Bengal paper mill and D.T.P.S. are discharged in to the river in this area.

Station 8. Rondia : Water is clean with sandy bottom and fast flowing. Macrophytes such as *Hydrilla* sp., *Najas* and *Vallisneria* sp. are observed on the banks of the river.

DESCRIPTION OF SPECIES COLLECTED

1. *Diaphanosoma excisum* Sars, 1885

1885. *Diaphanosoma excisum* Sars, *Norske. Vidensk Selsk. Forhandl. Christiania.*, **8** : 1-46.

1993. *Diaphanosoma paucispinosum* Brehm, *Arch. Hydrobiol. Suppl.* **11** : 631-771.

Material examined : Females from Jamadoba of Bihar, Dishergarh of Westbengal State.

Female : Size 1.05 mm. Head large and rounded anteriorly. Eye small. Posteroventral corner broadly rounded with 5-9 marginal denticles followed by a series of fine setules. Claw serrated on the distal convex surface; concave surface with three long basal spines.

Distribution : India—Andaman and Nicobar Islands, Rajasthan, Tamil Nadu and Tripura states. Elsewhere—common in tropical regions.

Remarks : Very common. Occurs in all types of habitat except in marshes.

2. *Diaphanosoma sarsi* Richard, 1895

1895. *Diaphanosoma sarsi* Richard, *Ann. Mus. Civico. Stor. Nat. Genova.*, **14** : 565-578.

1898. *Diaphanosoma singalense* Daday, *Terms.Fuzetek.*, **21** : 1-123.

Material examined : Females from Dishergarh, West Bengal State

Female : Body size 1.25 mm. Eye large, fills the head almost completely. Long setae on margin of ventral fold. Posteroventral corner with 17-23 spines. Postabdomen with characteristic setae on the lateral side.

Distribution India-Bihar, Rajasthan, Meghalaya, Tamil Nadu and Tripura.

Remarks : Occur mostly among aquatic macrophytes.

3. *Pseudosida bidentata* Herrick, 1884

1884. *Pseudosida bidentata* Herrick, *Goel and Nat. Hist. Survey Minnesota, Ann. Rep.*, **12** : 1-191

1953. *Pseudosida szalayi* Brehm, *Ost. Zool. Zeit.*, **4** : 241-345.

Material examined : Females from Rondia, West Bengal State.

Female : Body size 1.20 mm. Body elongated oval; head short; eye relatively small and situated near to the anteroventral corner. Antennules unsegmented, long and attached to the posteroventral part of the head. Antenna not extending beyond the posterior margin of valves. Ventral margin with a series of long setae followed by a series of spinules on the posteroventral corner. Postabdomen with 10 groups of lateral spines. Claw long with 3 basal spines.

Distribution India-Andaman and Nicobar Islands, Rajasthan, Tripura and Tamil Nadu. Elsewhere- South East Asia, South Africa and South America.

Remarks Mostly occur among aquatic macrophytes.

4. *Latonopsis australis* Sars, 1888

1888. *Latonopsis australis* Sars, *Forth. Vidensk. Selsk. Christiania*, **8** : 1-46.

1892. *Latonopsis occidentalis* Birge, *Trans. Wis. Acad. Sci. Arts and Letts.*, **4** : 77-109.

Material examined : Females from Dishergarh, Burnpur, and DTSP site of West Bengal State.

Female : Body size, 1.70 mm. Head large with antennule on the ventral side. Eye large, situated very near to anterior margin of the head; ocellus conspicuous; setae on antenna : 4-7/0-1-4. Ventral margin ornamented with rows of long hairs at the anterior side, medium hairs at the middle and three long setae at the posteroventral corner. Postabdomen broad with two spines at the base of the claws, anal denticles 10-12.

Distribution India Rajasthan, Tripura and Tamil Nadu.

Remarks : Mostly occur among aquatic macrophytes.

5. *Scapholeberis kingi* Sars, 1903

1903. *Scapholeberis kingi* Sars, *Arch. Math. Nat.*, **25** : 1-44.

1853. *Daphnia mucronata* King, *Proc. R.Soc. van. Diemens land*, **2** : 243-263.

Material examined : Females from Domgarh pumping station, Sindri of Bihar State.

Female : Body size 0.59 mm. Body rounded dorsally. Head small and slightly depressed, rostrum rounded and projecting ventrally. Eye large, ocellus small, situated closer to the rostrum than to the eye. Valves with lines and reticulations; posterior ventral margin has a long denticle. Postabdomen broad, dorsal margin with five or six denticles. Claw curved dorsally with spinules along the concave surface.

Distribution : India : Andaman and Nicobar Islands, Kashmir, Rajasthan, Meghalaya, Assam and Tamil Nadu. Elsewhere : Africa, North and South America, South East Asia and China.

Remarks : Occurs in the surface of the water body.

6. *Simocephalus vetulus* (O. F. Muller, 1776)

1776. *Daphnia ventula* O.F. Muller, *Havniae*, 1-282.

1898. *Simocephalus ventuloides* Sars, *Zool. Mus. Imp. Acad. Sc.* 3.

Material examined : Females from Burnpur and Rondia of West Bengal State.

Female : Body size 2.2 mm. Shape broadly oval or rhomboid. Dorsal margin moderately to strongly arched; posterior part of dorsal margin with distinct denticles. Head small with large eye and elongated ocellus. Postabdomen with 10 anal spines and a long, curved and denticulated claw.

Distribution : India : Punjab, Kashmir, Karnataka, Bihar and Tripura.

Remarks : Mostly occur among aquatic macrophytes.

7. *Ceriodaphnia cornuta* Sars, 1885

1885. *Ceriodaphnia cornuta* Sars, *Norske. Vidensk. Selsk. Forhandl. Chirstiania*, **8** : 1-46.

1894. *Ceriodaphnia rigaudi* Richard, *Revue. Biol. Nord. France*, **6** : 360-378.

Material examined : Females from Jarindi, Jamadoba of Bihar State and from Dishergarh of West Bengal State.

Female : Body size 0.39 mm. Head depressed and separated from the carapace by a dorsal depression. Antennules short and broad, with a long seta and a group of sensory setae on the apex. Eye large, ocellus absent. Postabdomen with four or five curved denticles. Claw long, gently curved with a series of setules along the concave surface.

Distribution : India : Andaman and Nicobar Islands, Rajasthan, Meghalaya, Tamil Nadu and Tripura states. Elsewhere : South East Asia, China and other tropical regions.

Remarks : Very common. Occurs in all types of habitat, especially shallow ponds. Both horned and hornless individuals are found together with *D. excisum* and *M. micrura*.

8. *Moina micrura* Kurz, 1874

1874. *Moina micrura* Kurz, *Sitzber. K. Acad. Wiss. Wein. Math. Nat.*, **69** : 40-46.

1892. *Moina dubia* Guerne et Richard, *Mem. Soc. Zool. France.*, **5** : 526-538.

Material examined : Females from Jarindi, Jamadoba, Domgarh pumping station in Sindri of Bihar State and Dishergarh of West Bengal State.

Female : Body size 0.73 mm. Head large, rounded with a deep cervical depression posteriorly. Eye large, ocellus absent. Antennules long and movable with a group of sensory setae on apex. Postabdomen with 6-8 ciliated lateral spines. Claw long, slightly curved dorsally, with pecten at base.

Distribution : India : Bihar, Rajasthan, Tamil Nadu, Tripura and Andaman and Nicobar Islands. Elsewhere : Africa, USSR, South East Asia and Europe.

Remarks : Very common. This is the most widely distributed species of the genus *Moina*.

9. *Bosmina longirostris* (O. F. Muller, 1776)

1776. *Lynceus longirostris* O. F. Muller, *Havniae* : 1-273.

1862. *Bosmina longirostris* Sars, *Forhandl. Vidensk. Christiania.*, 144-167.

Material examined : Females from Dishergarh of West Bengal State.

Female : Body size 0.59 mm. Shape oval. Posterodorsal corner distinctly angular, posteroventral corner with spines. Eye large. Antennules curved. Postabdomen quadrate. Claw with spinules.

Distribution : India : Kashmir and Meghalaya. Elsewhere : Cosmopolitan.

Remarks : Occur in running water and limnetic regions of the wetland.

10. *Bosmina deitersi* Richard, 1895

1895. *Bosminopsis deitersi* Richard, *Bull. Soc. Zool. DeFrance.*, **20** : 96-98.

1984. *Bosminopsis deendrai* Rana, *J. Bombay nat. Hist. Soc.*, **81** : 668-699.

Material examined : Females from Dishergarh of West Bengal State.

Female : Body size 0.38 mm. Body oval. Head rounded, rostrum long with two lateral branches. Eye large. Valves with polygonal reticulation, dorsal margin with cervical depression, ventral margin with a long and pointed marginal spine on the posteroventral corner. Postabdomen with 4-6 groups of short spinules. Claw serrated with a large basal spine.

Distribution : India : Delhi and Rajasthan. Elsewhere : South East Asia, Africa, North and South America.

Remarks : Not common. Occurs in open waters and rivers.

11. *Macrothrix spinosa* King, 1853

1853. *Macrothrix spinosa* King, *Pap. Proc. R. Soc. Van Diemens Land*, **2** : 243-263.

1915. *Macrothrix spinosa dentata* Phayfair, *Proc. Linnean Soc. N.S. Wales.*, **34** : 93-151.

Material examined : Females from Jarindi, Jamadoba, Domgarh pumping station in Sindri of Bihar State and Dishergarh, DTSP site, Rondia of West Bengal State.

Female : Body size 0.41 mm. Body rounded oval; dorsal margin serrated. Head rounded, ventral margin slightly concave with slightly pointed anteroventral corner. Antennules short, with a long seta near its base. Eye large, ocellus small and situated much nearer to the base of antennules than to the eye. Postabdomen broadly rounded. Claw short and serrated on the concave surface.

Distribution : India : Andaman and Nicobar Islands, Manipur, Rajasthan, Tripura and Tamil Nadu. Elsewhere : Cosmopolitan.

Remarks : Very common. Occurs in all types of habitats.

12. *Echinisca triserialis* (Brady, 1886)

1886. *Macrothrix triserialis* Brady, *Intellectual Observer*, **12** : 416-424.

1971. *Echnisca triserialis* Smirno, *USSR Acad. Sci. Zool. Institute Nova. Ser. No. 101. Leningrad*, 539 pp.

Material examined : Females from Telumuchu of Bihar State and Burnpur, Rondia of West Bengal State.

Female : Size 0.56 mm. Body oval, dorsal margin with a slight cervical depression. Eye large, ocellus small and situated nearer to the apex of rostrum than to the eye. Antennules long with a long lateral seta. Antennae short with a longest seta having two or three longer spines in the middle. Postabdomen bilobed with rows of spines increasing in size proximally. Claw short and serrated without basal spine.

Distribution : India : Andaman and Nicobar Islands, Rajasthan and Tamil nadu. Elsewhere : Cosmotropical.

Remarks : Very common. Occurs in all the marshes of West Bengal.

13. *Ilyocryptus spinifer* Herrick, 1882

1882. *Ilyocryptus spinifer* Herrick, *10th Annual Rep. Geol. and Nat. Hist. Survey Minn.*, 235-252.

1914. *Ilyocryptus halyi var longiremis* Stingelin, *Mem. Soc. Neuchatel. Sci. Nat.*, **5** : 600-638.

Material examined : Females from Domgarh pumping station in Sindri of Bihar State and Dishergarh of West Bengal State.

Female : Body size 0.76 mm. Body oval. Head small. Eye large, ocellus small, situated about halfway between eye and base of antennules. Antennules long with a group of sensory setae on distal end. Valves with a series of long feather-like setae on ventral side. Postabdomen with slight

depression in the middle. Preanal margin with eight marginal denticles, postanal margin with 12 denticles up to anal groove and with five long and stout spines on the lateral surface.

Distribution : India Andaman and Nicobar Islands, Rajasthan, Tamil Nadu, Tripura and Meghalaya. Elsewhere : South East Asia, China, Australia and North and South America.

Remarks : Mostly found at the bottom debris.

14. *Chydorus ventricosus* Daday, 1898

1898. *Chydorus ventricosus* Daday, *Termes. Fuzetek.*, **21** : 1-123.

1966. *Chydorus brehmi* Biswas, *Crustaceana*, **11** : 113-114.

1971. *Chydorus eurynotus brehmi* comb.n.Smirnov. *USSR Acad. Sci. No. 101. Leningrad*, 539 pp.

Material examined : Females from Domgarh pumping station in Sindri of Bihar State and Rondia of West Bengal State.

Female : Body size 0.74 mm. Body oval. Posteroventral corner rounded, with denticle. Valves with hexagonal markings. Rostrum long and pointed. Labrum long, curved anteriorly and slightly pointed. Postabdomen long with distinct preanal corner. Dorsal margin with 9-10 anal denticles. Claw setulated along concave surface with basal spines.

Distribution : India : Gujarat, Andaman and Nicobar Islands, Rajasthan and Tamil Nadu. Elsewhere : South East Asia, Sri Lanka, China and Africa.

Remarks : Mostly found among aquatic macrophytes.

15. *Chydorus reticulatus* Daday, 1898

1898. *Cydorus reticulatus* Daday, *Termes Fuzetek*, **21** : 1-123 (p 27).

Material examined : Females from Domgarh pumping station, Sindri of Bihar, Dishergarh, Burnpur and Rondia of West Bengal.

Female : Body size 0.25mm. Shape spherical with a well marked postero-dorsal corner. Valves reticulated with hexagonal pattern and puntations inside the patterns. Posteroventral corner rounded without denticles. Rostrum curved posteriorly. Antennules about ½ the length of rostrum. Ocellus situated closer to the eye than to the apex of rostrum. Labral plate slightly depressed anteroventrally. Postabdomen with distinct preanal corner and indistinct postanal corner. Dorsal margin with 6-7 anal denticles. Claw setulated along the concave surface and with 2 basal spines.

Remarks : Mostly found among aquatic macrophytes.

16. *Chydorus barroisi* Richard, 1894

1894b. *Pleuroxus barroisi* Richard, *Revue Biol. Nord, France*, **6** : 360-378.

1895. *Chydorus barroisi* Sars, *Vidensk. Selsk. Skrifter I. Math. Naturv. Klases* : 1-56. (p 25-28).

1982. *Ephemeroporus barroisi* (Richard) Frey, *Hydrobiologia*, **86** : 231-261.

Material examined : Females from Jarindi of Bihar State and Burnpur, Ronda of West Bengal State.

Female : Body size 0.32 mm. Body elliptical in shape with a spine in the posteroventral corner. Carapace ornamented with striation. Labrum with 3-5 denticles. Postabdomen with 7-9 unequal spines and a long basal spine.

Distribution : India : Gujarat, Rajasthan, Tamil Nadu, Tripura and Andaman and Nicobar Islands.

Remarks : Mostly found among aquatic macrophytes.

17. *Chydorus pubescens* Sars, 1901

1901. *Chydorus pubescens* Sars, *Arch. Math. Nat.*, **23** : 1-102.

1955. *Chydorus kallipygos* Harding, *Trans. Linn. Soc. London.*, **1** : 329-354.

Material examined : Females from Jamadoba of Bihar State.

Female : Body size 0.26 mm. Body rounded, dorsal and ventral margin bulge. Valves reticulated with dots within the hexagonal cells. Surface of valves with short hairs. Postabdomen narrow distally with 8-9 pointed denticles. Claw with 2 basal spines.

Distribution : India : Assam. Elsewhere : South East Asia.

Remarks : Mostly found among aquatic vegetation.

18. *Chydorus eurynotus* Sars, 1901

1901. *Chydorus pubescens* Sars, *Archiv for math. Og. Naturv.* XXIII, **3** : 1-102 (p 70).

1974. *Chydorus eurynotus* (Sars, 1901) Smirnov, *Fauna of the USSR, Crustacea* 1(2) : 1-644 (p 376).

Material examined : Females from Burnpur of West Bengal State.

Female : Body size 0.24 mm. Body oval, posterodorsal and posteroventral corners distinct. Valves with faint reticulation. Rostrum slightly curved posteriorly. Ocellus smaller than eye, situated closer to eye, than to apex of rostrum. Postabdomen with 10-12 short denticles. Claw with two basal spines.

Distribution : Elsewhere : South East Asia, Africa and South America.

Remarks : This species is a synonym of *C. pubescens* Sars, 1901 however; Michael and Hann (1979) considered this species as valid. It is found among aquatic macrophytes.

19. *Pseudochydorus globosus* (Baird, 1843)

1843. *Pseudochydorus globosus* Baird, *Ann. Mag. Nat. Hist.*, **68** : 81-95 (p 90).

Material examined : Female from Dishergarh of West Bengal State.

Female : Body size 0.79 mm. Body spherical, posteroventral corner rounded, without denticles. Valves with polygon marking. Rostrum pointed. Antennules not reaching the apex of rostrum.

Ocellus smaller than eye and situated nearer to eye than to the apex of rostrum. Postabdomen with 20 anal spines decreasing in size proximally. Claw with two basal spines.

Distribution : India Tamil Nadu and Meghalaya. Elsewhere : Holartic, Ethiopian, Indomalayan and Australian region.

Remarks Guerne (1907) recorded this species from Calcutta and after that it is not found again either by Sharma (1978).

20. *Dunhevedia crassa* King, 1853

1853. *Dunhevedia crassa* King, *Pap. Proc. R. Soc. Van Diemens Land*, 2 : 243-263.

1971. *Dunhevedia crassa crassa* Smirnov, *USSR Acad. Sci. Zool. Institute Nova. ser. No. 101. Leningrad*. 539 pp (p 320-322).

Material examined : Female from Jamadoba, Domgarh pumping station in Sindri of Bihar state and Dishergarh, Burnpur, DTPS site, Rondia of West Bengal State.

Female : Body size 0.53mm. Body curved dorsally. Posteroventral corner of valves with a bifurcated denticle. Rostrum blunt, labrum rounded with pointed apex. Ocellus small and situated slightly closer to eye than to apex of rostrum. Postabdomen with groups of scattered spinules, claw setulated with one basal spine.

Distribution : India : Gujarat, Rajasthan, Tamil nadu, Tripura and Andaman Nicobar Islands. Elsewhere : South East Asia, Australia and USSR.

Remarks : Not common. Occurs in marshes.

21. *Alona pulchella* King, 1853

1853. *Alona pulchella* King, *Pap. Proc. R. Soc. Van Diemens land.*, 2 : 243-263.

1933. *Alona arenaria* Brehm, *A. Ch. Hydrobiol., Suppl.* 11 : 631-771.

Material examined : Females from Jamadopa, Domgarh pumping station in Sindri of Bihar state and Dishergarh of West Bengal State.

Female Body size 0.52 mm. Shape oval, without spines on the posteroventral corners and reticulations on the carapace. Antennules not reaching apex of rostrum, Labrum with pointed apex. Postabdomen with straight dorsal margin and 7-9 anal denticles present. Claw with a medium sized basal spine.

Distribution : India : Gujarat. Elsewhere : Cosmotropical.

Remarks : Mostly found among aquatic macrophytes.

22. *Alona rectangula* Sars, 1862

1862. *Alona rectangula* Sars, *Forhandl. Vidensk. Selsk. Christiania*, 144-167.

1971. *Alona rectangula rectangula* Smirnov, *USSR Acad. Sci. Zool. Institute Nova. Ser. No. 101. Leningrad*. 539 pp.

Material examined : Females from Jamadoba of Bihar State and Rondia of West Bengal State.

Female : Body size 0.31 mm. Shape rectangular, maximum height slightly before middle. Posterodorsal corner with a slight angle, posteroventral corner rounded without denticle. Valves with striations forming a rectangular pattern. Antennules not reaching the apex of rostrum. Postabdomen with 7-8 groups of anal denticles and claw long basal spine.

Distribution : India : Gujarat, Rajasthan, Meghalaya and Kashmir. Elsewhere South East Asia, Africa and USSR.

Remarks : Mostly found among aquatic macrophytes.

23. *Alona karua* King, 1853

1853. *Alona karua* King, *Pap. Proc. R. Soc. Van Diemens Land* 2 : 243-263.

1971. *Biapertura karua* Smirnov, *USSR Acad. Sci. Zool. Institute Nova ser. No. 101. Leningrad.* 539 pp.

Material examined : Females from Domgarh pumping station, Sindri of Bihar State.

Female : Body size 0.29 mm. Body with distinct lines and polygonal pattern. Posteroventral corner rounded with 2-3 denticles followed by a row of setules. Antennules not reaching apex of rostrum. Ocellus small, situated closer to eye. Postabdomen broadly rounded. Claw with a short basal spine.

Distribution : India : Andaman and Nicobar Islands, Meghalaya, Tamil Nadu and Tripura. Elsewhere : Cosmopolitan.

Remarks : Very common. Occurs in all marshy habitats of West Bengal. Fernando (1974) and Michael and Sharma (1988) included this species under the genus *Biapertura*. However, Frey (1980) did not agree to this and hence, it was not included under the genus *Biapertura*.

24. *Alona guttata* Sars, 1862

1862. *Alona guttata* Sars, *Forhandl. Vidensk. Selask. Christiania.*, : 250-302 (p 51-52).

Material examined : Females from Domgarh pumping station, Sindri of Bihar State.

Female : Body size 0.32mm. Valves without striation, posteroventral corner rounded. Antennules not reaching apex of rostrum. Ocellus smaller than eye, situated half way between eye and apex of rostrum. Plate of labrum rounded with groups of setae at the posterior region. Postabdomen without denticles. Claw slightly long with a series of stules along the concave margin.

Distribution : India : Himachal Pradesh, West Bengal, Tripura, Tamil Nadu and Andaman Islands. Elsewhere : Cosmopolitan.

Remarks : Mostly found among aquatic macrophytes.

25. *Alona verrucosa* Sars, 1901

1901. *Alona verrucosa* Sars, *Arch. Math. Nat.*, **23** : 1-102.

1988. *Biapertura verrucosa* Michael and Sharma, Fauna of India, Cladocera, 262 pp.

Material examined : Female from Dishergarh and DTSP site of West Bengal State.

Female : Body size 0.28 mm. Body elongated oval. Posteroventral and posterodorsal corners rounded. Antennules not reaching apex of rostrum. Ocellus small, situated slightly closer to eye than to apex of rostrum. Postabdomen with 5-6 denticles. Claw with a short basal spine.

Distribution : India : Gujarat, Tamil Nadu, Rajasthan and Tripura. Elsewhere South East Asia, Ethiopian and Neotropical regions.

Remarks : Fernando (1974) and Michael and Sharma (1988) included this species under the genus *Biapertura*. However Frey (1980) did not agree to this and hence, it was not included under the genus *Biapertura*.

26. *Alona davidi* Richard, 1895

1895. *Alona davidi* Richard, *Mem. Soc. Zool. France*, **7** : 237-243.

1971. *Alona davidi davidi* Smirnov, *USSR Acad. Sci. Zool. Institute Nova ser. No. 101. Leningrad*, 539.

Material examined : Females from Rondia of West Bengal State.

Female : Body size 0.35 mm. Maximum height slightly before middle. Posterodorsal and posteroventral corners rounded. Rostrum blunt. Ocellus smaller than eye. Postabdomen with prominent preanal and postanal corners. Claw with short basal spine.

Distribution : India : Rajasthan, Andaman and Nicobar Islands and Tamil Nadu.

Remarks : Common. Occurs only in marshes.

27. *Notoalona globulosa* (Daday, 1898)

1898. *Alona globulosa* Daday, *Termes. Fuzetek.*, **21** : 1-123.

1987. *Notoalona globulosa* Rajapaksa and Fernando, *Hydrobiologia*, **144** : 131-153.

Material examined : Females from Dishergarh of West Bengal State.

Female : Body size 0.36 mm. Valves with striations. Rostrum short and blunt, antennules not reaching the apex. Ocellus smaller than the eye, situated closer to the eye than to the apex of rostrum. Labrum serrated on anteroventral margin. Postabdomen long with 12 to 13 anal denticles, claw long with short basal spine.

Distribution : India : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu. Elsewhere : South East Asia, Neotropical and Nearctic regions.

Remarks : Rare. Occurs in small numbers in marshes.

28. *Leydigia acanthocercoides* (Fischer, 1854)

1854. *Lynceus acanthocercoides* Fischer, *Bull. Soc. Imp. Nat. Mosc.*, **27** : 423-434.

1875. *Leydigia acanthocercoides* Kurz, *Sitzber. K. Acad. Wiss. Wein. Mth. Nat.*, **69** : 40-46.

Material examined : Females from Rondia of West Bengal State.

Female : Body size 0.89 mm. Valves with longitudinal lines. Rostrum blunt, antennules not reaching apex of rostrum. Ocellus smaller than eye, situated closer to the eye than to the apex of rostrum. Labrum rounded with fine setae. Postabdomen with about 18 groups of small denticles, each group consists of 3 or 4 denticles with the distal-most denticle being the longest of each group. Claw with a short basal spine.

Distribution : India : Gujarat, Rajasthan, Andaman and Nicobar Islands and Tamil nadu. Elsewhere : South East Asia, Ethiopian, Neotropical and USSR.

Remarks : Rare. Occurs in reddish-brown ponds of West Bengal.

Order CONCHOSTRACA

Family CYCLESTHERIIDAE

29. *Cyclestheria hislopi* (Baird, 1860)

1860. *Cyclestheria hislopi* (Baird) *Proc. Zool. Soc. London* **28** : 445-446.

1973. *Cyclestheria hislopi* (Baird) *J. Madurai University Suppl. 1. pp.* 63.

Material examined : Many females from Telumuchu of Bihar State and Rondia of West Bengal State.

Female : Shell thin, transparent and nearly rounded. Umbone close to the anterior extremity. Shell with 6-7 growth lines. The ocellus large equal to the size of as eyes. The antennules or the first antennae unsegmented, clubshaped with sensory hairs at their tips. The second antennae biramous with each flagellum 7-jointed and each joint bearing setae. The telson large, armed with 7-8 pairs of strong hooks, the first pair long and serrated on the edge; the second pair near the root armed with about 10 rather stout spines.

Distribution : Common. Occur throughout Indian subcontinent.

Remarks : This is the first record of its occurrence in West Bengal.

Sub-class OSTRACODA

Family CYPRIDIDAE

30. *Stenocypris distincta* (Victor and Fernando, 1979)

1979. *Stenocypris distincta* (Victor and Fernando, 1979) *Rec. Zool. Surv. India* **74(2)** : 196-200.

Material examined : Females from Telumuchu of Bihar State.

Female : Length-3.20 mm. Valves elliptical; valves elongate; anterior and posterior margins rounded; left valve slightly larger than the right; radial band of septa prominent, wider anteriorly and narrow posteriorly; valve margins hairy except dorsally; valve surface with puncta and hairs; ventral margin slightly concave in the middle, dorsum with a low arch sloping posteriorly. Natatory setae of the second antenna well developed, not reaching the tips of the terminal claws and smooth; sensory club three segmented, claws toothed. Second thoracic leg with a long terminal scythelike claw, second segment with a single seta, hairy; dorsal surface and margin having groups of spines and ventral margin hairy. Furcal rami asymmetrical, terminal and subterminal claws of both rami toothed, dorsal setae absent; right ramus curved broader with dorsal margin heavily toothed, terminal seta more than $\frac{1}{2}$ the length of the terminal claw; left ramus straight, dorsal margin with groups of teeth covering $\frac{1}{4}$ the length of the ramus, terminal seta more than two-thirds the length of the terminal claw.

Distribution : Madurai, India.

Remarks : This is the first record of its occurrence in Bihar and West Bengal.

31. *Parastenocypris canaliculata* Hartmann, 1964

1964. *Parastenocypris canaliculata* Hartmann *Syst. Beih.* 3 : 1-155.

1979. *Parastenocypris canaliculata* Hartmann *Rec. Zool. Surv. India* 74(2) : 205-206.

Material examined Females from Telemuchu of Bihar State.

Female : Valves with irregular, continuous pore canals along the margins; surface with minute hairs. Asymmetrical furca, bent at the proximal end; right ramus with groups of stronger spines for $\frac{2}{3}$ the the length of the ramus, on the dorsal margin; left ramus is also armed with spines but they are relatively weak. Length 2.08 mm and height 0.91 mm.

Remarks : This is the first record of its occurrence in West Bengal.

Order COPEPODA

Family DIAPTOMIDAE

32. *Rhinediaptomus indicus* Kiefer, 1936

1936. *Rhinediaptomus indicus* Kiefer *Zool. Anz.* XIII.

2001. *Sinodiaptomus (Rhinediaptomus) indicus* Keifer *J. Aqua. Biol.* 16(1-12) pp 7.

Material examined Females from Tamadoba of Bihar State and DTSPS site of West Bengal State.

Female : Body size 1.45 mm. Metasomal wings asymmetrical; urosome 3-segmented. P₅: Coxal process is short and conical claw bears fine hairs along the inner margin; exopodite 3 not distinct and bears 2 unequally long setae; endopod long, cylindrical, tip sloping inwards with 2 spinules and few hairs.

Distribution : Occur throughout Indian sub continent.

Remarks : This is the first record of its occurrence in West Bengal.

33. *Paradiaptomus greeni* Gurney, 1906

1906. *Diaptomus greeni* Gurney *Proc. Asiat. Soc. Bengal (New series)* 2 : Calcutta.

2000. *Paradiaptomus greeni* Gurney *Fauna of Tripura (part 4)*, pp 261.

Material examined : Females from Dishergarh and Rondia of West Bengal State.

Female : Body size 2.30 mm. Metasomal wings are large and lamellate; genital segment with a bilobed projection on right and a digitiform process on left margin; urosome 2-segmented. Extremities of body pink coloured.

Family CYCLOPOIDAE

34. *Mesocyclops hyalinus* Rehberg, 1880

1880. *Mesocyclops hyalinus* Rehberg, *H. zologischer Anzeiger*, 3 : 301-303.

2001. *Mesocyclops hyalinus* Rehberg, *J. Aqua. Biol.*, 16(1-12) : 7.

Material examined : Females from Jarindi, Telumuchu, Jamadoba and Domgarh pumping station, Sindri of Bihar State, Burnpur and Rondia of West Bengal State.

Female : Body size 0.9 mm. A₁ reaching slightly beyond the metasome and consisting of 17 segments; last 2 segments together longer than the previous three; last segment with a smooth hyaline membrane without any notches. Inner spine of P₅ apical or subapical in position on the second segment. Inner terminal spine of P₄ endopod distinctly longer than outer terminal spine and shorter than the terminal segment. Inner margin of the caudal ramus bare.

35. *Mesocyclops aspericornis* (Daday, 1906)

1906. *Mesocyclops aspericornis* Daday, *Math. Termeszl ertes.*, 24 : 34-77.

1907. *Cyclops leuckarti*, *Rec. Indian Mus.*, 1 : 21-33.

Material examined : Females from Domgarh pumping Station, Sindri of Bihar State and DTSP site of West Bengal State.

Female : Body size 0.9 to 1.3mm. A₁ reaching slightly beyond the metasome and 17-segmented; last 2 segments together longer than the previous three hyaline plate of the last segment with several indistinct notches or serration), some times with one deep notch as in male. Inner spine of P₅ at middle of second segment and shorter than the terminal seta. Inner margin of caudal ramus bare. A specific diagnostic character of *leuckarti* is the conspicuously ribbed outer margin of the basis of the maxilla.

DISCUSSION

Twenty eight species of Cladocera, one species of Conchostraca, two species of Ostracoda and four species of Copepoda were collected from eight different sampling stations in Damodar river (Table 1). Among Cladocera *M. spinosa* and *D. crassa* and a cyclopoid copepod *M. hylinus* were found to occur in as many as six collection sites. The species such as *Diaphanosoma sarsi*, *Pseudosida bidentata*, *Scapholeberis kingi*, *Bosmina longirostris*, *Bosminopsis deitersi*, *Chysorus pubescens*, *C. eurynotus*, *Pseudochydoras globosus*, *Alona guttata*, *A. davidi*, *Notalona globulosa*, *Leydigia acanthocercoides*, *Stenocypris distincta*, and *Paracentrocypris canaliculata* are available in only one collection spot (Table 1).

The eight sampling stations have been compared by means of the Sorensen index of similarity for Cladocera. This was calculated for each combination of stations according to the following equation (Sorensen, 1948) : $S = \frac{2C}{a+b} \times 100$, where 'C' is the number of species common to both associations, 'a' the number of species in one association and 'b' the number of species in the other association. The resultant Sorensen indices for 28 pairs of stations are given in Table 2. The indices are generally high, reflecting the smaller number of similar species involved and their wide distribution, but the two groups of stations are easily discernible. Jamadoba, Damgarh, Burnpur and Rondia have high-interrelated indices. Telemuchu has less indices showing the amount of pollution Load.

Index of biotal dispersity (IBD) of Koch (1957) was used to assess how widely dispersed the cladoceran species are between a number of stations. $IBD = \frac{T-S}{S(n-1)} \times 100$ where 'T' is the arithmetica sum of species living in each of 'n' compared associations, and 'S' is the total list of species in 'n' compared associations. If each station had a completely different set of species Cladocera, 'S' would equal 'T' and the IBD would be zero. If each station had an identical set of species 'T' would equal n X S and the IBD would be 100.

When the Koch index for all eight stations is calculated the resulting IBD is 17.4, but if separate indices are calculated for the four stations (Jamadoba, Domgarh, Burnpur and Rondia) there is an increase in the IBD (24) and 14 for rest of the stations. The large increase in IBD when the less polluted stations in West Bengal region (stations 5-8) are considered separately, indicates that these stations resemble each other in their fauna of planktonic Cladocera much more closely than they resemble the polluted stations in Bihar State (Stations 1-4). This is in good agreement with the Sorensen indices. The IBD for Cladocera of Bihar part of Damodar is 15 and the IBD for West Bengal part is 20. The validity of describing members of the zooplankton especially Cladocera as an indicator organism has been questioned by a number of authors because of the lack of basic knowledge of the ecological characteristics and requirements of individual species as well as communities (Bartsch and Ingram, 1966). Sladeck (1973) has extensively reviewed the subject and listed the saprobic indication of over five hundred species of rotifers. Nevertheless, many rotifer species are considered to be indicators of the trophic nature of their habitat (Pejler, 1957;

Table 1. Occurrence of Crustacean Zooplankton at eight different stations of Damodar river (1. Jarindi, 2. Telumuchu Bridge, 3. Jamadoba water works, 4. Domgarh Pump Station, 5. Dishergarh, 7. Singaran (DTPS SITE), 8. Rondia.

	1	2	3	4	5	6	7	8
Phylum Arthropoda								
Class Crustacea								
Subclass Branchopoda								
Order Cladocera								
1. Family SIDIDAE								
Genus <i>Diaphanosoma</i>								
1. <i>Diaphanosoma excisum</i> Sars	-	-	+	-	+	-	-	-
2. <i>Diaphanosoma sarsi</i> Richard	-	-	-	-	+	-	-	-
Genus <i>Pseudosida</i>								
3. <i>Pseudosida bidentata</i> Herrick	-	-	-	-	-	-	-	+
Genus <i>Latonopsis</i>								
4. <i>Latonopsis australis</i> Sars	-	-	-	-	+	+	+	-
2. Family DAPHNIIDAE								
Genus <i>Scapholeberis</i>								
5. <i>Scapholeberis kingi</i> Sars	-	-	-	+	-	-	-	-
Genus <i>Simocephalus</i>								
6. <i>Simocephalus vetulus</i> (O.F.M.)	-	-	-	-	-	+	-	+
Genus <i>Ceriodaphnia</i>								
7. <i>Ceriodaphnia cornuta</i> Sars	+	-	+	-	+	-	-	-
3. Family MOINIDAE								
Genus <i>Moina</i>								
8. <i>Moina micrura</i> Kurz	+	-	+	+	+	-	-	-
4. Family BOSMINIDAE								
Genus <i>Bosmina</i>								
9. <i>Bosmina longirostris</i> (O.F.M)	-	-	-	-	+	-	-	-
Genus <i>Bosminopsis</i>								
10. <i>Bosminopsis deitersi</i> (Richard)	-	-	-	-	+	-	-	-
5. Family MACROTHRICIDAE								
Genus <i>Macrothrix</i>								
11. <i>Macrothrix spinosa</i> king	+	-	+	+	+	-	+	+
Genus <i>Echinisca</i>								
12. <i>Echinisca triserialis</i> (Brady)	-	+	-	-	-	+	-	+
Genus <i>Ilyocryptus</i>								
13. <i>Ilyocryptus spinifer</i> Herrick	-	-	-	+	+	-	-	-

Table 1. Cont'd.

	1	2	3	4	5	6	7	8
6. Family CHYDORIDAE								
Subfamily Chydorinae								
Genus <i>Chydorus</i>								
14. <i>Chydorus ventricosus</i> Daday	-	-	-	+	-	-	-	+
15. <i>Chydorus reticulatus</i> Daday	-	-	-	+	+	+	-	+
16. <i>Chydorus barroisi</i> (Richard)	+	-	-	-	-	+	-	+
17. <i>Chydorus pubescens</i> Sars	-	-	+	-	-	-	-	-
18. <i>Chydorus eurynotus</i> Sars	-	-	-	-	-	+	-	-
Genus <i>Pseudochydorus</i>								
19. <i>Pseudochydorus globosus</i> (Baird)	-	-	-	-	+	-	-	-
Genus <i>Dunhevedia</i>								
20. <i>Dunhevedia crassa</i> King	-	-	+	+	+	+	+	+
Subfamily Aloninae								
Genus <i>Alona</i>								
21. <i>Alona pulchella</i> King	-	-	+	+	+	-	-	-
22. <i>Alona rectangula</i> Sars	-	-	+	-	-	-	-	+
23. <i>Alona karua</i> King	-	-	+	-	+	+	-	+
24. <i>Alona guttata</i> Sars	-	-	-	+	-	-	-	-
25. <i>Alona verrucosa</i> Sars	-	-	-	-	+	-	+	-
26. <i>Alona davidi</i> Richard	-	-	-	-	-	-	-	+
Genus <i>Notalona</i>								
27. <i>Notalona globulosa</i> (Daday)	-	-	-	-	+	-	-	-
Genus <i>Leydigia</i>								
28. <i>Leydigia acanthocercoides</i> (Fischer)	-	-	-	-	-	-	-	+
Order Conchostraca								
Family CYCLESTHERIIDAE								
Genus <i>Cyclestheria</i>								
1. <i>Cyclestheria hislopi</i> (Baird)	-	+	-	-	-	-	-	+
Subclass Ostracoda								
Order Popocopida								
Suborder Podocopa								
Family CYPRIDIDAE								
Subfamily Stenocyprinae								
Genus <i>Stenocypris</i>								
1. <i>Stenocypris distincta</i> Victor & Fernando	-	+	-	-	-	-	-	-
Genus <i>Parastenocypis</i>								
2. <i>Parastenocypis canaliculata</i> Hartmann	-	+	-	-	-	-	-	-

Table 1. Cont'd.

	1	2	3	4	5	6	7	8
Subclass COPEPODA								
Suborder Calanidae								
Family DIAPTOMIDAE								
Genus <i>Rhinediaptomus</i>								
1. <i>Rhinediaptomus indicus</i> Kiefer	-	-	+	-	-	-	+	-
Genus <i>Paradiaptomus</i>								
2. <i>Paradiaptomus greeni</i> Gurney	-	-	-	+	-	-	+	-
Family CYCLOPIDAE								
Genus <i>Mesocyclops</i>								
3. <i>Mesocyclops hyalinus</i> Rehberg	+	+	+	+	-	+		+
4. <i>Mesocyclops aspericornis</i> (Daday)	-	-	-	+	-	-	+	-

Table 2. Sorensen indices for Cladocera from eight stations on Damodar River.

	Jarandhi	Telumuchu	Jamadoba	Domgarh	Burnpur	Disherghar	Singar	Rondia
Jarandhi	-	0	46	31	46	17	25	25
Telumuchu	0	-	20	20	12	22	40	15
Jamadoba	46	20	-	44	40	24	31	38
Domgarh	31	20	44	-	48	24	31	38
Burnpur	46	20	40	48	-	33	40	29
Disherghar	17	22	24	24	33	-	33	60
Singaran	25	40	31	31	40	33	-	25
Rondia	25	15	38	38	29	60	25	-

Arora, 1966; Hodgkinson, 1970). The dominance of certain eurytopic Cladocera found in the present study in the polluted regions of the Damodar river such as *C. cornuta*, *M. micrura*, *M. spinosa* and *C. barroisi* can be used as an indicator of pollution as found in other studies (Campbell, 1939; Gaufin and Tarzwell, 1952; Hynes, 1959).

SUMMARY

In tropical part of world including India, extensive survey of river zooplankton is scanty and scrapy than the temperate. In view of filling up the gap in the knowledge on this potamofauna, to begin with, Damodar river was taken up for study. A total of eight stations, four in Bihar and four

in West Bengal of Damodar river were studied for their crustacean zooplankton. Among the zooplankton collected such as Cladocera, Conchostraca, Ostracoda and Copepoda, Cladocera dominated with 28 species, 18 genera and six families. *Ceriodaphnia cornuta*, *Moina micrara*, *Macrothrix spinosa* and *Chydorus barroisi* were found to occur in most polluted regions of the river. Jamadoba, Domgarh, Burnpur and Rondia have high interrelated Sorensen indices with high IBD (24) when compared to other polluted stations (14).

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