

## **CONTRIBUTIONS TO THE CLADOCERAN FAUNA (CRUSTACEA : BRANCHIOPODA : CLADOCERA) OF BIHAR**

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### **INTRODUCTION**

Although taxonomic studies on the Indian freshwater Cladocera were initiated by Baird (1860), these micro-crustaceans are still poorly documented from different regions and states of India (Sharma and Michael, 1987; Sharma, 1991). This generalization holds particularly true to the cladoceran fauna of Bihar and the earlier investigations from this state are so far restricted to the preliminary reports by Gurney (1907), Brehm (1950) and Nasar (1977).

This paper, an attempt to fill up the stated lacuna, deals with 41 species and subspecies of Cladocera from Bihar, with systematic notes on various rare and interesting taxa. Comments are made on the nature and composition of the examined taxocoenosis and on the distribution of the reported species and subspecies.

### **MATERIALS AND METHODS**

The material for the present study was obtained from wide range of aquatic biotopes from Dharbanga city (Lat. 26° 10' N; Long. 85° 57' E), Patna city (Lat. 25° 37' N; Long. 85° 13' E) and their adjacent localities. In all about 95 plankton samples were collected by towing a nylobolt plankton net (No. 25) and preserved in 5% formalin. Various cladocerans and their disarticulated appendages were mounted in Polyvinyl alcohol-lectophenol mixture. The details of head pores and their arrangements in the Chydorids were studied following the technique given by Megard (1965). Different species and subspecies were identified following the monographic works of Smirnov (1971, 1976, 1996), Smirnov and Timms (1983) and Michael and Sharma (1988). The drawings are made with Leitz-Dialux phase contrast microscope using a drawing-tube attachment and the measurements are indicated in millimeters (mm). The reference material is deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong-22.

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## LIST OF THE EXAMINED TAXA

Family : SIDIDAE

*Diaphanosoma sarsi* Richard, 1895*D. excisum* Sars, 1885*Sida crystallina* (O. F. Müller, 1776)\*

Family : DAPHNIIDAE

*Ceriodaphnia cornuta* Sars, 1885*C. reticulata* (Jurine, 1820)*Scapholeberis kingi* Sars, 1903\**Simocephalus vetulus* (O. F. Müller, 1776)*S. acutirostratus* (King, 1853)\**S. exspinosus* (Koch, 1841)*S. serrulatus* (Koch, 1841)\**Daphnia lumholtzi* Sars, 1885*D. carinata* King, 1853

Family : BOSMINIDAE

*Bosmina longirostris* (O. F. Müller, 1776)\**Bosminopsis deitersi* Richard, 1895\*

Family : MOINIDAE

*Moina micrura* Kurz, 1874\**Moinodaphnia macleayi* (King, 1853)\*

Family : MACROTHRICIDAE

*Macrothrix spinosa* (King, 1853)\**Echinisca triserialis* (Gurney, 1907)*Ilyocryptus spinifer* Herrick, 1882\**Guernella raphaelis* Richard, 1892\*

Family : CHYDORIDAE

Subfamily : CHYDORINAE

*Alonella clathratula* Sars, 1896\*\**Chydorus sphaericus* (O. F. Müller, 1776)*C. faviformis* Birge, 1893\**C. pubescens* Sars, 1901\**Ephemeroporus barroisi* Richard, 1894\**Dunhevedia crassa* King, 1853\*

## Subfamily : ALONINAE

*Alona rectangula* Sars, 1862\**Alona costata* Sars, 1862\**A. guttata* Sars, 1862\**A. pulchella* King, 1853\**A. monacantha tridentata* (Stingelin, 1904)\**A. quadrangularis* (O. F. Müller, 1776)\**Notalona globulosa* (Daday, 1905)\**Biapertura karua* (King, 1853)\**B. verrucosa pseudoverrucosa* (Sars, 1901)\**Acroperus harpae* (Baird, 1894)\**Leydigia australis ceylonica* (Daday, 1898)\**Camptocercus fennicus* Stenroos, 1898\*\**Oxyurella singalensis* (Daday, 1898)\**Kurzia longirostris* (Daday, 1898)\**Euryalona orientalis* (Daday, 1898)\*

New record from Bihar\*

New record from India\*\*

## NOTES ON RARE AND INTERESTING TAXA

*Sida crystallina* (O. F. Müller, 1776)

(Figs. 1 &amp; 2)

Large littoral species. Body oblong, carapace transparent; head large and clearly separated from body by a cervical depression. Distinct dorsal gland present. Postabdomen elongated, with about 14 lateral anal spines and a row of lateral setae. Rare in the examined material.

*Ceriodaphnia reticulata* (Jurine, 1820)

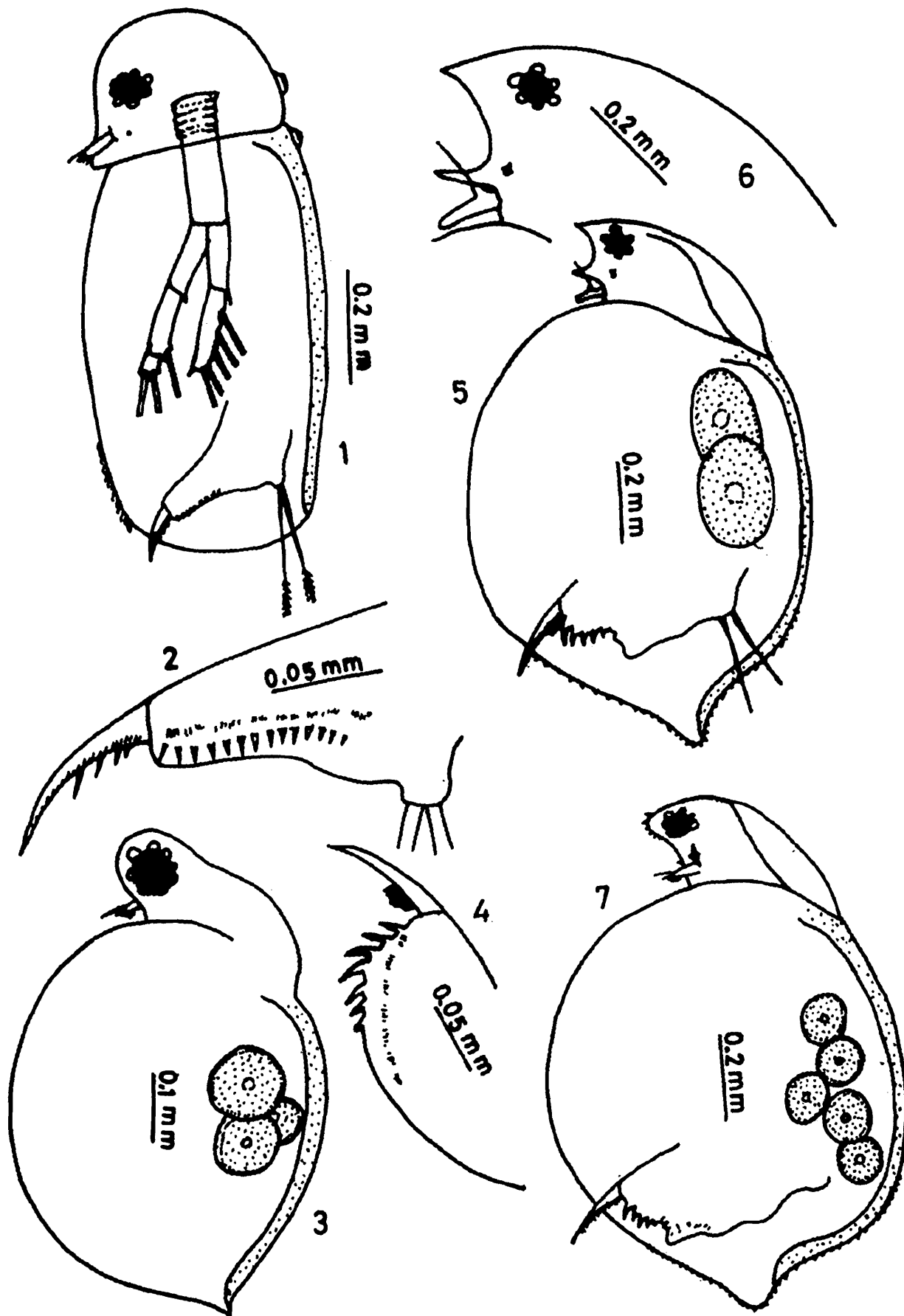
(Figs. 3 &amp; 4)

Carapace broadly rounded oval, valves with reticulate pattern. Head small and rounded. Eyes large and nearly filling frontal region of head. Postabdomen with 7 marginal anal spines and claw with a distinct pecten. Rare in the studied collections.

*Simocephalus acutirostratus* (King, 1853)

(Figs. 5 &amp; 6)

Carapace large, oval or rhomboid and with a distinct posterior protuberance situated in the longitudinal axis of body. Head small and produced anteriorly into characteristic acute projection.



Figs. 1-7. *Sida crystallina* (O. F. Müller) : Fig. 1, parthenogenetic female, Fig. 2, postabdomen; *Ceriodaphnia reticulata* (Jurine) : Fig. 3, parthenogenetic female, Fig. 4, postabdomen; *Simocephalus acutirostratus* (King) : Fig. 5, parthenogenetic female, Fig. 6, head (enlarged); *S. serrulatus* (Koch) : Fig. 7, parthenogenetic female.

Rostrum pointed. Ocellus small and punctiform. Postabdomen broad, with 7 anal spines increasing in size distally. Claw long and slender, with pecten of 10–12 teeth and denticles.

*Simocephalus serrulatus* (Koch, 1841)

(Fig. 7)

Carapace oval, broadened behind middle and with small posterior protuberance. Head with salient acute anterior angle and number of minute denticles. Ocellus rhomboidal. Postabdomen with about 8 anal spines; claw elongated and with fine setules on its concave margin. Rare in the studied material.

*Bosminopsis deitersi* Richard, 1895

(Figs. 8 & 9)

Carapace oval or oblong; posterior-ventral corner with small mucro-like process and 1–2 spinules. Head large, with supraocular depression. Antennulus united at base and diverging at apex. Postabdomen tapering distally and with 7 small anal spines. Claw large and with a large basal spine. Rare in the examined material.

*Moinodaphnia macleayi* (King, 1853)

(Figs. 10–12)

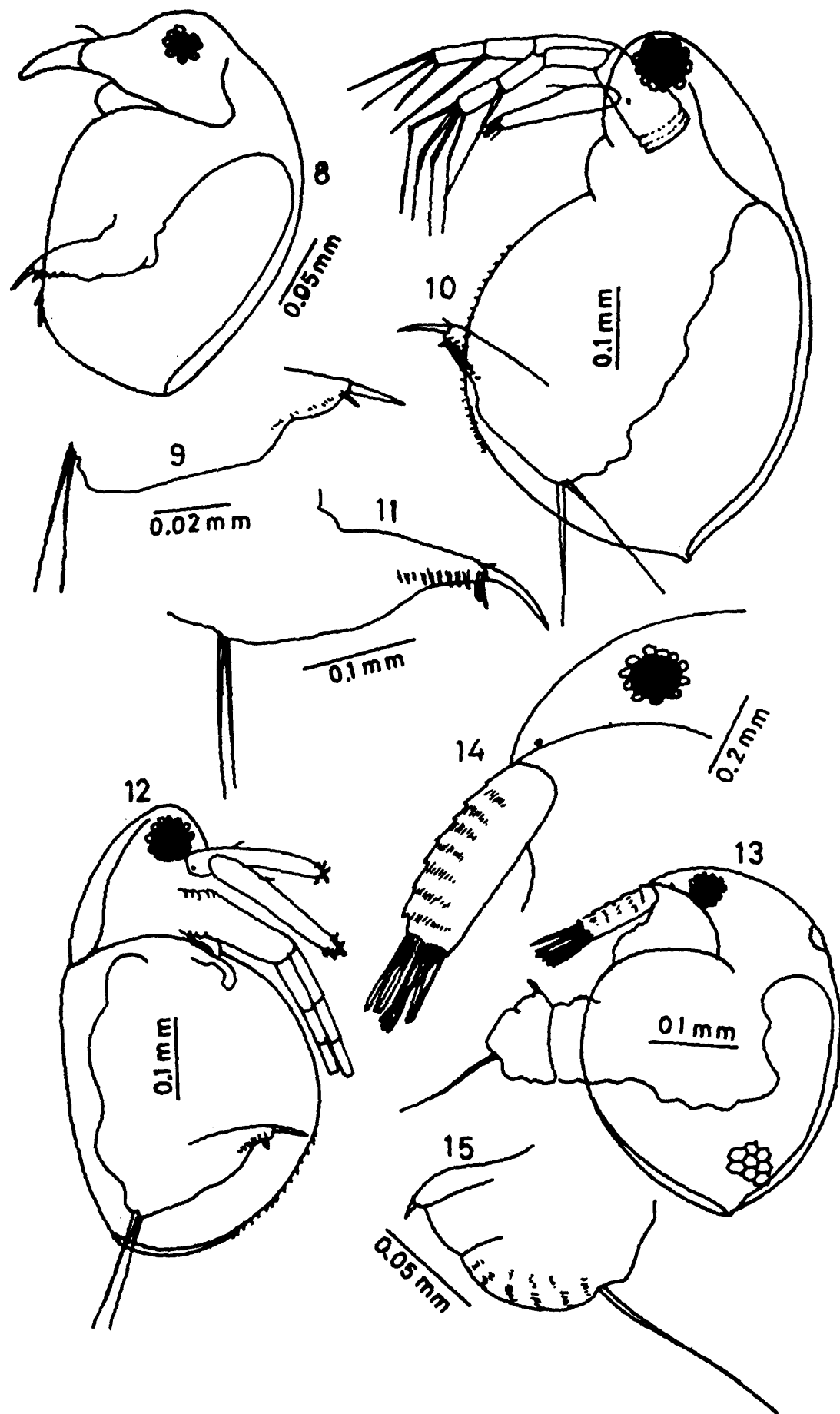
*Female* : Body large and compressed. Head small and trigonal in shape; eyes large and filling frontal part of head, ocellus present; antennules elongated, thin and movable. Abdominal process large and horse-shoe shaped. Postabdomen elongated distally, with 7–12 feathered teeth and a distinct bident tooth; claw distinct and with setae on concave margin. Several specimens observed presently.

*Male* : Body slender and elongated. Head distinct, antennules large, with sensory papillae and hook at distal end. First leg with distinct hook. Postabdomen with 6–8 feathered teeth and a bident tooth. Claw with setae on concave margin. Rare in the studied material.

*Guernella raphaelis* Richard, 1892

(Figs. 13–15)

Carapace small and oval in outline; valves with reticulations. Head broad, with distinct eye and small ocellus. Antennules short and robust, with incisions and serrulations on anterior margin. Postabdomen small, tapering distally and with transverse row of spinules. Claw short. Very rare in the examined material.



**Figs. 8–15.** *Bosminopsis deitersi* Richard : Fig. 8, parthenogenetic female; Fig. 9, postabdomen; *Moinodaphnia macleayi* (King) : Fig. 10, parthenogenetic female, Fig. 11, postabdomen, Fig. 12, male; *Guernella raphaelis* Richard : Fig. 13, parthenogenetic female, Fig. 14, head (enlarged), Fig. 15, postabdomen.

*Alonella clathratula* Sars, 1896

(Figs. 16–19)

Differentiated from the closely related *A. excisa* in having more elongated body; valves with polygons and longitudinal striations; posterior margin of valves almost straight and at right angle with the ventral margin. Rare in the studied material.

*Chydorus faviformis* Birge, 1893

(Fig. 20)

Body rounded in outline; head-shield and carapace with characteristic deep polygonal cells. Rostrum pointed and ventrally directed. Labral plate with convex anterior margin. Postabdomen wide, with 9–10 anal spines and groups of lateral setae; preanal corner distinctly projecting. Claw with two basal spines and setae on concave margin.

*Chydorus pubescens* Sars, 1901

(Fig. 21)

Body almost globular, valves reticulated and covered with diagnostic velvet-like coating of short, stiff setules. Head broad, rostral projection less protruded. Labral plate rounded. Postabdomen slightly tapering distally, with 8–10 anal spines and groups of lateral setae; with distinct preanal corner. Claw with two basal spines and setae on concave margin.

*Alona monacantha tridentata* (Stingelin, 1904)

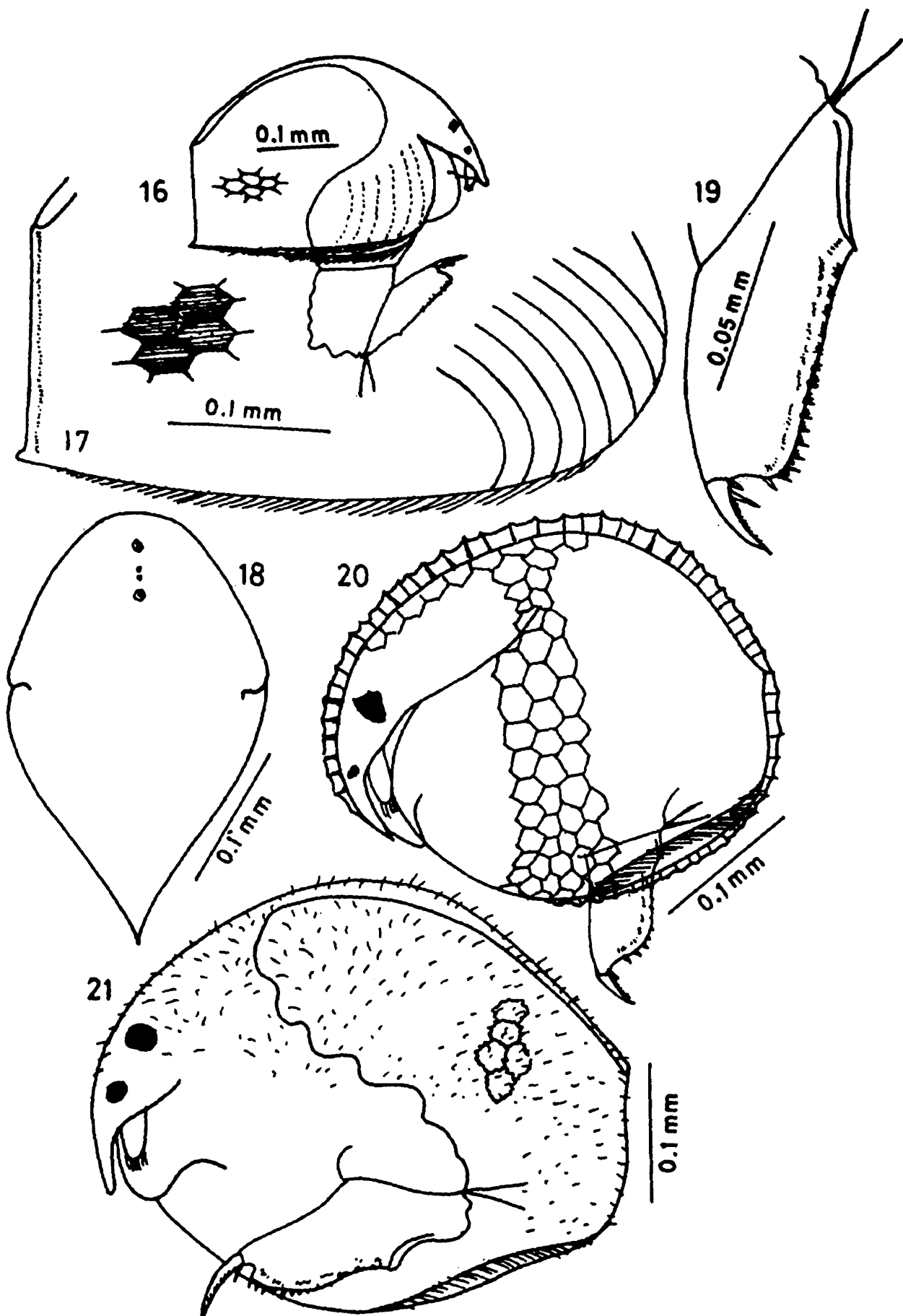
(Figs. 22 &amp; 23)

Body oval in outline, valves marked with longitudinal lines; postero-ventral corner of valves with 2–3 denticles. Rostrum long and blunt, antennules not reaching apex of rostrum. Postabdomen with distinct preanal corner, with about 10 anal spines and groups of lateral setae; distal seta in each group longest and a few distal setae projecting beyond dorsal margin of postabdomen. Claw with a basal spine and setae on concave margin.

*Leydigia australis ceylonica* (Daday, 1898)

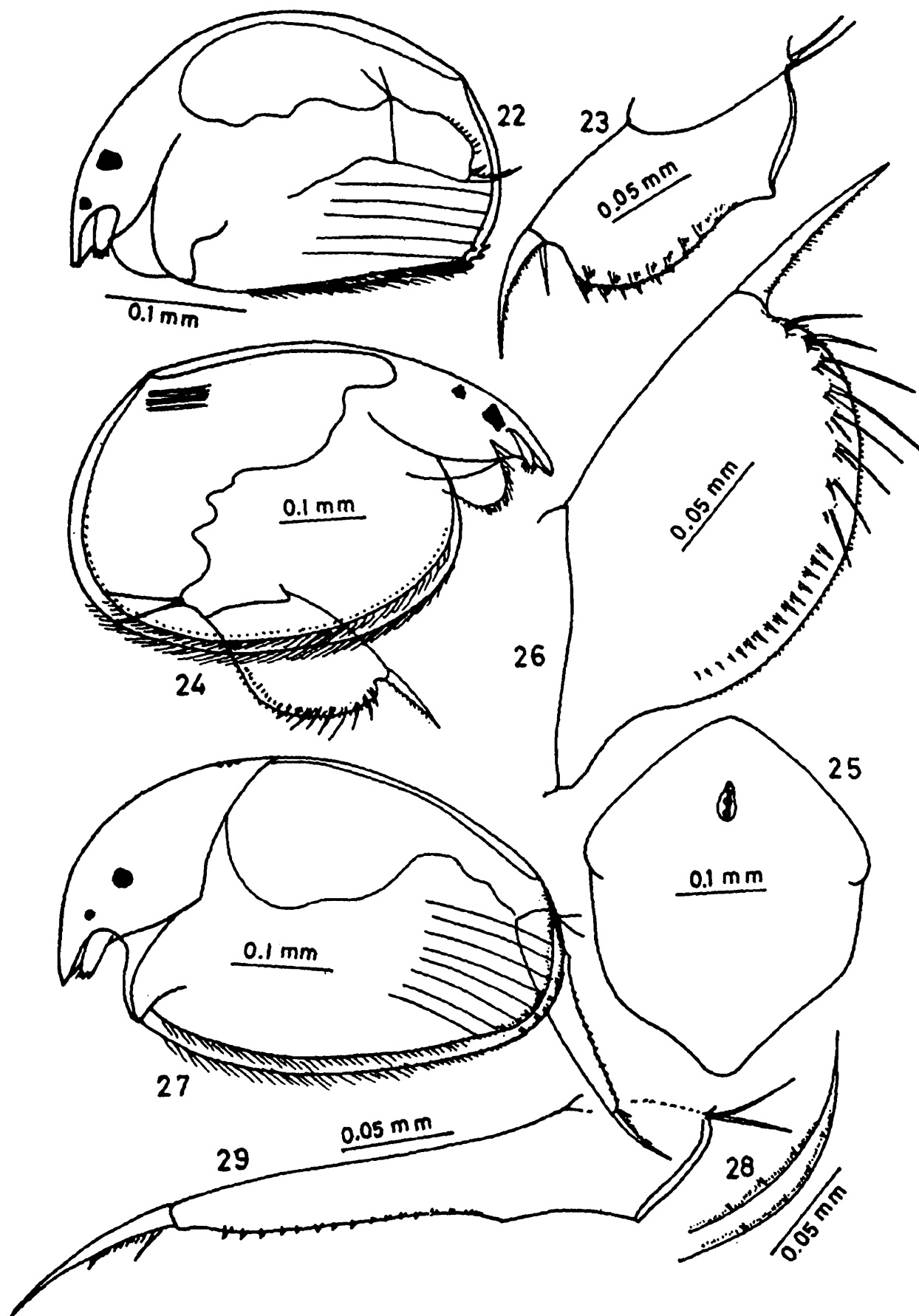
(Figs. 24–26)

Body oblong, valves with longitudinal lines and dots. Ocellus larger than eye, situated nearer to eye than to apex of rostrum. Postabdomen widest in middle, distal corner rounded; lateral setae in groups of three, distal seta longest in each group and proximal seta shortest; 12–14 groups of spinules present. Claw without basal spine, with setae on concave margin. Only two specimens observed presently.



Figs. 16–21. *Alonella clathratula* Sars : Fig. 16, parthenogenetic female, Fig. 17, valve (enlarged), Fig. 18, head-shield, Fig. 19, postabdomen; *Chydorus faviformis* Birge : Fig. 20, parthenogenetic female; *C. pubescens* Sars : Fig. 21, parthenogenetic female.





**Figs. 22–29.** *Alona monacantha tridentata* (Stengelin) : Fig. 22, parthenogenetic female, Fig. 23, postabdomen; *Leydigia australis ceylonica* (Daday) : Fig. 24, parthenogenetic female, Fig. 25, head-shield, Fig. 26, postabdomen; *Camptocercus fennicus* Stenroos : Fig. 27, parthenogenetic female, Fig. 28, postero-ventral corner of valves, Fig. 29, postabdomen.

*Camptocercus fennicus* Stenroos, 1898

(Figs. 27–29)

Body elongated, postero-ventral corner of valves with 2–5 denticles distinctly separated by margin of valves. Rostrum pointed. Valves with longitudinal lines. Antennules almost reaching apex of rostrum. Postabdomen with 19–20 anal denticles and a row of lateral groups of setae. Claw with setae on concave margin and with a basal spine at some distance from the base of each claw.

## DISCUSSION

Forty-one species and subspecies of Cladocera documented presently from Bihar reflect fairly rich and diversified taxocoenosis. This feature is important in light of a conservative estimate (Fernando and Kanduru, 1984; Sharma and Michael, 1987) of occurrence of upto 60–65 species of these entomostraceous crustaceans from tropical and subtropical parts of India. The examined taxa, however, present a distinct contrast to only nineteen species reported by earlier workers (Gurney, 1907; Brehm, 1950; Nasar, 1977) and, hence, raise their overall qualitative diversity from Bihar to 48 species. In addition, the studied cladoceran communities register greater generic diversity (27 genera) as compared with 37 genera so far known from India (Sharma, 1991). Further, the recorded species and subspecies belong to six families which, in turn, represent two phylogenetic stems of this group (Smirnov and Timms, 1983) namely the Ctenopoda and the Anomopoda; the former includes only the family Sididae while all the five families of the latter (Macrothricidae-Chydoridae-Bosminidae-Moinidae-Daphniidae) are represented in this study.

*Alonella clathratula* and *Camptocercus fennicus* are interesting new records to the Indian Cladocera. In addition, 29 species and subspecies are new records from Bihar. The former chydorid was designated (Smirnov, 1971) as a subspecies of *Alonella excisa* while Smirnov (1996) subsequently raised it to the status of a distinct species. Besides certain morphological differences, the two species are characterized by differences in their distributional limits; *A. clathratula* occurs in the Neotropical region, South America, Australia and Java while *A. excisa* is a cosmopolitan species. On the other hand, *Camptocercus fennicus* comprises first report from the Oriental region and it is so far known from the Palearctic region and N. W. part of erstwhile European USSR. The authors, however, believe that re-examination of earlier Indian records particularly of *Camptocercus rectirostris-australis* group may reveal wider distribution of the stated species in this country. Overall cladoceran diversity from Bihar figures next to that of Jammu & Kashmir (59 species) and West Bengal (52 species). Chydoridae (21 species) > Daphniidae (9 species) constitute dominant fraction of the documented species. Such a feature confirms with the general composition of the Indian Cladocera (Sharma, 1991) and also with the faunas of various regions/states of this country.

Abundance of Cosmopolitan species and occurrence of several Cosmotropical species in the examined material imparts general tropical character to the cladoceran fauna of Bihar. This salient feature is in conformity with the general composition of cladoceran communities from other tropical

regions (Fernando, 1980; Fernando and Kanduru, 1984; Dussart *et al.* 1984; Sharma and Michael, 1987; Sharma, 1991). Further, the samples studied from Bihar are notable for qualitative dominance of littoral or periphytic forms (29 species) and fewer euplanktonic species namely *Diaphanosoma sarsi*, *D. excisum*, *Daphnia carinata*, *D. lumholtzi*, *Ceriodaphnia cornuta*, *C. reticulata*, *Bosmina longirostris*, *Bosminopsis deitersi*, *Moina micrura* and *Moinodaphnia macleayi*. Of these, the members of the Bosminidae depict rare occurrence while *D. carinata*, *D. lumholtzi*, *C. cornuta* and *Moina micrura*, often, indicate swarms in eutrophic ponds characterized by the blooms of the blue-green alga, *Microcystis aeruginosa*. Identical feature is commonly noticed in eutrophic astatic waters in peninsular India (Sharma, 1991). The general paucity of planktonic Cladocera is attributed to the fact that majority of the samples are obtained from water bodies with aquatic macrophytes and relatively few collections belonged to open-water habitats.

The majority of the documented species are identified by their parthenogenetic females. Interestingly, the males of seven species viz., *Daphnia lumholtzi*, *D. carinata*, *Moina micrura*, *Moinodaphnia macleayi*, *Ephemeroporus barroisi*, *Biapertura karua* and *Acroperus harpae* are, however, examined in the present study. Among these, *M. macleayi* deserves special mention as its male is known till now only from South Andamans (Venkataraman, 1992). Hence, the present report of the male of the stated moinid species is the first record from the Indian mainland and the second record from the Oriental region.

The present study indicates several examples of local distributional interest from India. The macrothricid *Guernella raphaelis* is known for disjunct distribution, with reports from Rajasthan and West Bengal. *Simocephalus acutirostratus* appears to occur in Central India and southwards (Sharma, 1991) while *S. serrulatus* is so far known from S. India and Meghalaya. Of the other notable species, *Chydorus faviformis* is documented from Jammu & Kashmir and Meghalaya; *C. pubescens* is known from Assam and Meghalaya in N. E. India; *Alona monacantha tridentata* is confined to Tamil Nadu; *Alona guttata* is restricted to Jammu & Kashmir and Nilgiri hills while *Leydigia australis ceylonica* is recorded from Tamil Nadu and Kerala in S. India. In addition, *Ceriodaphnia reticulata* is examined so far from Rajasthan; *Macrothrix spinosa* is distributed in Rajasthan, Manipur and Tamil Nadu and *Kurzia longirostris* is observed from West Bengal, Kerala, Tamil Nadu and Rajasthan. Fernando and Kanduru (1984) indicated more southern distribution of *Bosminopsis deitersi* in India; Michael and Sharma (1988) examined it from Kerala, Delhi and Rajasthan; the authors (unpublished data) noticed its wider distribution in North-Eastern India while the stated species is very rare in the samples examined from Bihar.

## SUMMARY

Forty-one species and subspecies of Cladocera belonging to 27 genera and six families are presently recorded from Bihar. *Alona clathratula* and *Camptocercus fennicus* are new records from India. In addition, 29 species and subspecies are new to the fauna of Bihar. The males of seven species are observed in this study, including the first report of the male of *Moinodaphnia macleayi*

from the Indian mainland. The examined taxocoenosis depicts general tropical character, shows qualitative importance of Cosmopolitan and littoral or periphytic elements, registers abundance of the members of the Chydoridae. *Guernella raphaelis*, *Simocephalus acutirostratus*, *S. serrulatus*, *Chydorus faviformis*, *C. pubescens*, *Alona monacantha tridentata*, *A. guttata*, *Leydigia australis ceylonica*, *Ceriodaphnia reticulata*, *Macrothrix spinosa*, *Kurzia longirostris* and *Bosminopsis deitersi* are examples of local biogeographic interest in India. In general, the cladoceran fauna of Bihar exhibits fairly rich species and generic diversity.

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