



RECENT FRESHWATER OSTRACODA FROM PERUMAL ERI (LAKE), CUDDALORE DISTRICT, TAMIL NADU - ZOOGEOGRAPHIC IMPLICATIONS

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ABSTRACT

Micropalaentological investigation has been done for the first time to study Recent freshwater Ostracodes from Perumal Eri, Cuddalore District, Tamil Nadu. For this purpose, ten surface sediment samples were collected and these samples have yielded nine species. They belong to the following genera: *Cyprinotus*, *Stenocypris*, *Candona*, *Cyclocypris*, *Ilyocypris* and *Darwinula*, 4 families, 2 superfamilies (Cypridacea and Darwinulacea) of the suborder Podocopa and the order Podocopida. Remarks and update synonymy for all the species are given. The zoogeographic distribution of the fauna reveals that the assemblage is confined to the Oriental Province and few forms are extended to the Ethiopian Province.

Keywords: Recent freshwater Ostracoda, Systematic Palaentology, Zoogeography, Tamil Nadu

INTRODUCTION

Ostracodes are bivalved micro-crustaceans belonging to Phylum Arthropoda. They inhabit all aquatic habitats including terrestrial environ. Because of their nature of well preservation, relative abundance in the sediments and sensitivity to environment showing rapid dispersion, they are valuable in the systematic and ecological studies. We find large number of individuals in the freshwater habitat which may be due to less competition for food in most environments allowing considerable frequency in a given area. The knowledge of their ecology and the agents that control them is useful in understanding the past climatic changes and helps in palaeoclimatological, palaeoecological and palaeozoogeographical interpretations. It is with this idea that the authors have carried out the present work in the Department of Geology, University of Madras, Chennai.

A survey of literature pertaining to the freshwater taxa of India has been done and a few important papers are mentioned here: Baird (1859), Bhatia (1968), Brady (1886), Daday (1909), Gurney (1906, 1907, 1920), Arora (1931), Klie (1927), Brehm (1950), Hartmann (1964), Bhatia and Khosla (1967a, b), Jain (1977), Jain *et al.*, (1969), Bhatia and Singh (1970 a, b, c, 1971 a, b, 1977), Singh (1971, 1972, 1973 a, b, c, 1974 a, b, 1977), Deb (1973), Bhatia and Mannikeri (1974), Battish (1981, 1982) and Harshey and Victor (1983). Sporadic occurrence of ostracodes from calcareous tuffs of the terrace deposit (Upper Siwalik) from Punjab was reported by Bhatia and Mathur (1973). Victor and Michael (1975) reported nine new species of freshwater ostracoda from Madurai and Victor and Fernando (1979) presented a detailed description of *Oncocypris pustulosa* Gurney and *Cypris mathaii* Arora. Habibnia and Mannikeri (1988), while reporting additional freshwater ostracodes from north of Jaisalmer town, discussed their zoogeographical affinities and provinces. Studies on fresh water ostracodes from the Dharwad region, Karnataka were initiated by Vaidya (1987), Mannikeri *et al.* (1987, 1989). Mannikeri and Vaidya (1987, 1990) reported 6 new species from the lakes and ponds of Dharwad city, Karnataka and Vaidya (1996) gave a brief note on zoogeographical distribution of Recent freshwater ostracodes from Dharwad. Sunny George and Martens (1993)

and Sunny George *et al.* (1993) described new species from temporary habitats of Kerala. Malik and Amarjit Singh (1994) reported six freshwater species from the Mansar Lake of Jammu and discussed the ecology with water characteristics.

Fossil and living representatives of marine ostracods of the Indian subcontinent have been fairly well studied. However, the taxonomical and ecological studies of freshwater ostracoda received scant attention. Hence, the present preliminary study has been undertaken since no account of work has been done from this area. The study involves the taxonomy and distribution of freshwater ostracods from the surface sediments of Perumal Eri (Eri means Lake in Tamil language), Cuddalore district, Tamil Nadu. The zoogeographic implication of these less calcified and delicate taxa is also discussed.

The area under investigation is one of the major freshwater lakes of Tamil Nadu, Perumal Eri (Latitude 11° 31" to 11° 37" N; Longitude 79° 38" to 79° 42") in Cuddalore District. It forms a part of the toposheet No. 58M/10 published by the Survey of India. Neyveli Lignite Corporation (NLC) is located to the west of the lake at a distance of 10 km. All the treated and untreated effluents of NLC area discharged into this lake. During October and December, the lake gets filled up because of heavy rainfall. It has got an outlet connected to Uppanar River. However, during March to June, depth of water column in the lake remains shallow (ranges from 1 foot to 9 feet). The climate is characteristically tropical. Minimum temperature is recorded during December and January, whereas maximum temperature is recorded during summer (March-May).

MATERIALS AND METHODS

The surface sediment samples were collected from the Perumal Eri from 10 locations (Fig.1) during the month of March, 2002. Sample collection was made with the help of a van veen grab by making use of locally used catamaran/air filled large size tube. The depth of the water column ranges from 1 foot to about 9 feet during this period. All the sediment samples were subjected to standard micropalaentological techniques and ostracod specimens were separated from a unit weight of 50 ml wet sediment sample under a stereo-binocular microscope and counted. Subsequently, specific identification was made by

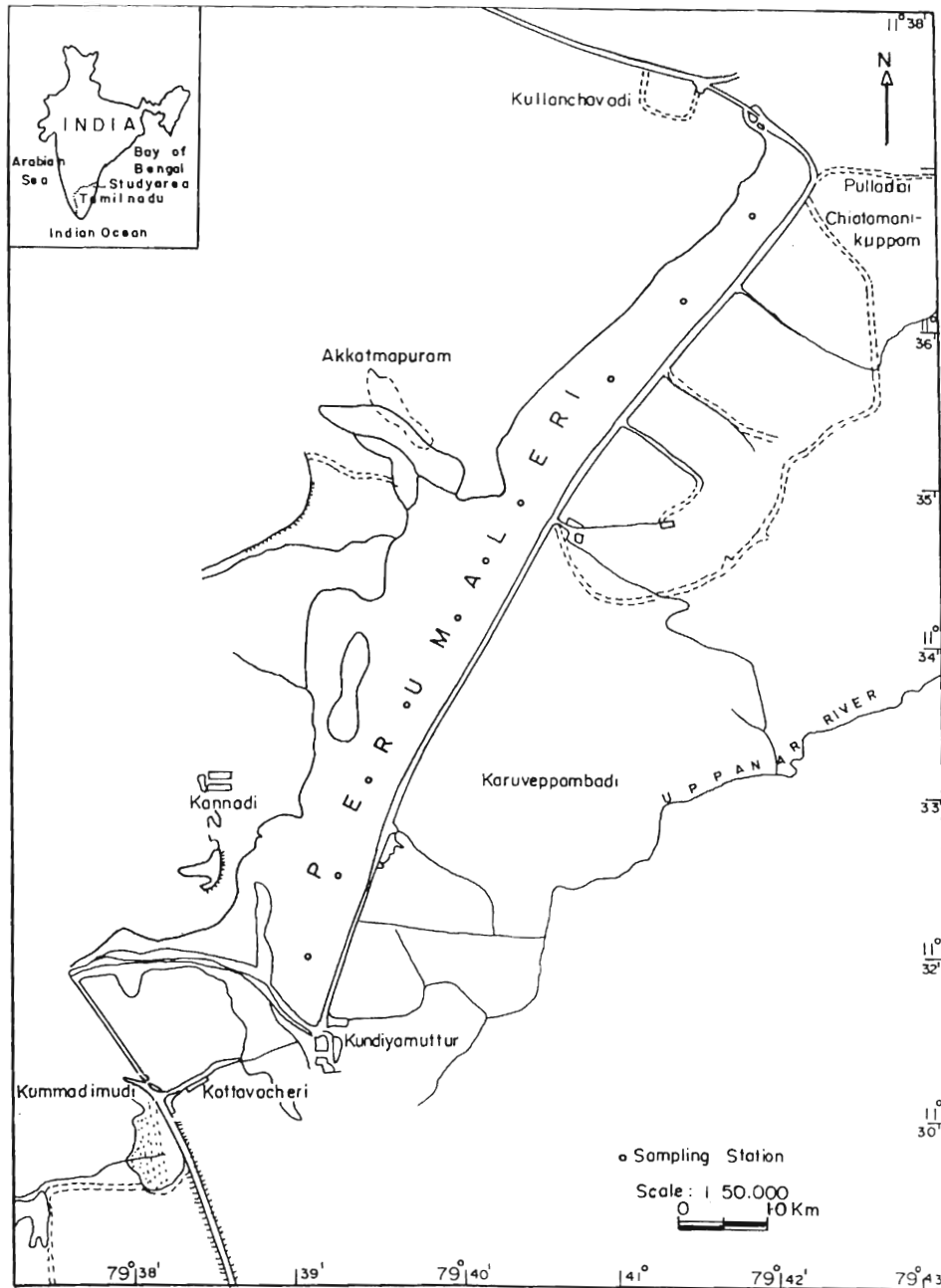


Fig. 1. Location of the sampling stations in Perumal Eri.

referring to literature on recent freshwater Ostracoda, Treatises of Van Morkhoven (1963), Moore (1961) and a monograph on freshwater Ostracoda by Bronshtein (1988). Though there are a few studies on the taxonomy, distribution and ecology of Recent freshwater ostracoda from other parts of India, the Recent and sub-Recent freshwater ostracodes from this region are not known. Scanning Electron Microscope photomicrographs of the species were taken using JEOL JSM 6360 and JEOL JFC 1600 Auto Fine (Platinum) Coater and presented in Pl. I.

SYSTEMATIC PALEONTOLOGY

The classification proposed by Hartmann and Puri (1974) is followed in the present study. All the hypotypes are deposited in the museum of Department of Geology,

University of Madras, Chennai.

- Subclass **Ostracoda** Latreille, 1806
- Order **Podocopida** Mueller, 1894
- Suborder **Podocopa** Sars, 1866
- Superfamily **Cypridacea** Baird, 1845
- Family **Cyprididae** Baird, 1845
- Subfamily **Cyprinotinae**, Bronshtein, 1947
- Genus **Cyprinotus** Brady, 1886
- Cyprinotus salinus* (Brady)
- (Pl. I, fig. c)

Cypris salina - Brady, 1868, pp. 368, pl. 26, figs. 8-13.

Cyprinotus salina (Brady) - Muller, 1900, p. 76, pl. 16, figs. 1-2, 10, 12.

Cyprinotus salinus (Brady) - Wauer, 1957, pp. 30-31, pl. 9, figs. 1-6; Bhatia, 1968, p. 471, pl. 1, figs. 1a-c, pl. 5, fig. 9; Vaidya (1987), p. 33-

35. pl-2. Figs. 1a-c.

Description: The somewhat large carapace is sub-ovate in lateral outline, compressed laterally with maximum height in the middle. Dorsal margin is strongly arched and ventral margin is less convex. Both the ends are rounded. Surface uniformly pustulose with fine hair. Inner lamella large anteriorly and less so posteriorly. Radial pore canals numerous, simple and straight. Right valve overlaps the left valve throughout the margin, conspicuously at dorsal and ventral margins. Both the anterior and posterior margins are finely spinose. In dorsal view, the maximum thickness is seen in the posterior end.

Remarks: This species was originally described by Brady (1868) from Sri Lanka. Bhatia (1968) reported this species for the first time from Indian region, from the Pleistocene rocks (Upper Karewas) of Kashmir. It occurs rarely in Perumal Eri.

Dimensions: Length 1.10 mm., Height 0.78 mm. thickness 0.61 mm.

Genus *Stenocypris* Sars, 1889

***Stenocypris major* (Baird)**

(Pl.I, fig.k,l)

Cypris cylindrica Sowerby var. *major* Baird, 1859, p.23, pl.63, fig.4.

Stenocypris major (Baird) – Ferguson, 1969, Discussion in text – Fig. 1.1: figs.3, 1-3. - Singh, 1977, p.369, pl.VII, figs.6-9. Bhatia and Singh, 1977, p.405, pl.2, fig.1, pl.3, figs.3-4, pl.4, fig.2, pl.5, fig. 2. – Vaidya, 1987, p.42-44, to pl.3, figs.1a-c.

Remarks: The present cosmopolitan species is known to occur in various parts of India. The adult carapace is elongate ovate, laterally compressed, end margins almost rounded narrowly, with a straight dorsum and sinuate ventral margin; inner lamella wide at the anterior, less so in the posterior margins. Surface smooth. LV larger than RV.

The present specimens are same as those recorded by Vaidya (1987) except for being slightly smaller in size.

Dimensions: Length 0.98 mm., Height 0.42 mm.

***Stenocypris hislopi* Ferguson**

(Pl.I, fig.i,j)

Stenocypris hislopi Ferguson, 1969, pp. 68 – 71, figs. 1-6. - Bhatia and Mannikeri, 1974, pp. 84-85, pl.2, figs. 3a-b. - Bhatia and Singh, 1977, pp. 403-405, pl.4, fig.3, pl.5, fig.3. - Jain, 1977, p.357, pl.2, figs. 1 a-c-Vaidya, 1987, pp.44-46, pl.3, figs.2a-b.

Remarks: The specimens in the present material are very identical to those described by Vaidya from Dharwad. The said species is originally described by Ferguson from Nagpur Central India. It is very close to *S. major* (Baird) but differs from it in being smaller in size, with typical unequal marginal pore canals forming a sort of 'S' shape at the anterior end. This is an endemic species known from Oriental Province.

Dimensions: Length 1.2 mm., Height 0.46 mm.

Subfamily *Candoninae* Daday, 1900

Genus *Candona* Baird, 1845

***Candona lactea* Baird**

(Pl.I, fig.d)

Candona lactea Baird, 1845, p.225, pl.18, fig.25-27. - Bhatia, 1968, p.472, pl.2 figs. 5a-c; pl.5, figs.1-2. - Bhatia and Singh, 1971, p.218, fig.5. - Bhatia and Khosla, 1979, p.336, fig.2B. - Malik and Amarjit Singh, 1994, p.6, pl.1.figs. f, g; figs.3 IV,V.

Description: The carapace is moderately inflated, elongate-ovate with maximum length at the venter. Inner lamella moderately wide at anterior end and less so at posterior end.

Marginal zone is narrow with numerous, simple radial pore canals. Dimorphism pronounced. Hinge adont. Surface is smooth. This species occurs most abundantly in the present material.

Remarks: From India, this species has been reported from the upper Siwalik beds near Chandigarh (Bhatia and Khosla, 1967), the upper Karewas of Kashmir (Bhatia, 1968), fresh water lakes of Kashmir Valley (Bhatia and Singh, 1970, 1971), Dal Lake from Kashmir and Mansar Lake, Jammu (Malik and Amarjit Singh, 1994)..

Dimension: Length 0.58 mm, Height 0.40 mm

***Candona* sp.**

(Pl.I, fig.e)

Remarks: This species is left under open nomenclature due to want of more literature on this genus.

Dimension: Length 0.63 mm., Height 0.48 mm., Thickness 0.42 mm

Family *Cyclocyprididae* Kaufmann, 1900

Genus *Cyclocypris* Brady and Norman, 1889

***Cyclocypris laevis* (Mueller)**

(Pl.I, fig.a,b)

Cyclocypris laevis (Mueller), Bhatia and Singh, 1970, pp. 257-259, fig. 3. - Singh, 1977, p.374, pl.X, figs. 11-12. - Mannikeri, Vaidya and Habibnia, 1989, p.169, pl.1,fig.9.

Description: The medium-sized valve is subovate in lateral outline with moderately arched dorsum and almost straight ventral margin. Both the anterior and posterior ends are rounded. Muscle scar pattern and hinge as for the genus. Surface is smooth. Left valve larger than the right and overlaps throughout entire margin. Dimorphism pronounced.

Remarks: This species was recorded for the first time from India by Bhatia and Singh (1970) from Dal Lake, Kashmir.

Dimensions: Length 0.80 mm., Height 0.46 mm.

Family *Ilyocyprididae* Kufmann, 1900

Subfamily *Ilyocypridinae* Kufmann, 1900

Genus *Ilyocypris* Brady and Norman, 1889

***Ilyocypris bradyi* Sars**

(Pl. I, fig.f)

Ilyocypris bradyi Sars, 1890, pp.59-60. - Swain, 1963, pp. 807-808, pl. 95, fig.9 pl.96, fig. 13 a-b, text fig. 4b. -Bhatia,1968,pp.471-476, pl. 4, fig.1, pl.5, figs.21-22 (et syn); Singh, 1974, pp.98 -99, figs. 12-19. 1977,p.375, pl.II, fig.1-8. - Bhatia and Singh, 1977, p.410, pl.8, fig.13. - Jain, 1977, p.358, pl II, figs. 4a-b. - Vaidya, 1987, p.58-59, pl.5, figs.3a-c.

Description: The carapace is subquadrate in lateral outline. Anterior end broadly rounded and posterior end truncate. Dorsal margin straight and ventral margin is concave. Inner lamella moderately wide. Radial pore canals numerous, straight and simple. Typical central muscle scar pit sare the characters of the species. Hinge is adont. Surface is ornamented with two prominent sulci in anterodorsal region and lateral nodes which, however grade towards *I. gibba* (Ramdohr).

Remarks: *Ilyocypris*, because of its typically ornamented surface and subquadrate outline, can be easily distinguished from all other freshwater Cyprididae. This species was recorded from the Karewas of Kashmir by Bhatia (1969) and from the lakes of Dharwad city by Vaidya (1987) and Mannikeri and Vaidya (1987).

Dimensions: Length 0.80 mm, Height 0.46 mm.

Ilyocypris gibba (Ramdohr, 1808)
(Pl.I, fig.g,h)

Cypris gibba, Ramdohr, 1808, p.91, pl.3, figs. 13-17.

Ilyocypris gibba (Ramdohr) - Brady and Norman, 1889, p.107, pl.22, figs. 1-5. - Staplin, 1963, pp.1187 - 1190, pl.160, figs. 36,37,39 (*et syn*). - Swain 1963, pp.806-807, pl.96, fig.14, text fig. 4a (*et syn*). - Mathur 1972, p.394, fig.2f. - Bhatia and Singh 1977, p.410, pl.2, fig. 14-15. - Singh, 1977, p.375, pl.XI, figs.9-14. - Jain, 1977, p.358, pl. II, figs. 5a-b. - Mannikeri, Vaidya and Habibnia, 1989, p.169-170, pl. I, figs. 10a-b.

Description: The carapace is sub-reniform in lateral outline. Both the ends are rounded, inner lamella moderately wide. The two mandibular scars are marked on the outside of the valves by separate small depressions. Both the central and dorsal muscle scars best visible on the inner surface of the valve, where they are situated on the areas caused by the outer sulci.

Remarks: This species can be easily distinguished from *I. bradyi* by its subreniform outline. This species is characteristic of temporary and permanent running waters with sufficient current action (Stapling, 1963). It commonly lives in association with *I. bradyi* and occurs along with *Darwinulina stevensoni* and *Candonopsis kingsleii* along the margins of the lake; this has been reported from Kashmir and Punjab (Singh, 1977); (Bhatia and Singh, 1977) and Dharwad (Mannikeri and Vaidya, 1994).

Dimensions: Length 0.71mm, Height 0.46 mm.

Superfamily Darwinulacea Brady and Norman, 1889

Family Darwinulidae Brady and Norman, 1889

Genus Darwinula Brady and Robertson, 1885

Darwinula stevensoni (Brady and Robertson)

(Pl.I, fig.m)

Polycheles stevensoni, Brady and Robertson, 1970, pp.25-26, pl.7, figs.1-7, p.10; figs. 4-14.

Darwinulina stevensoni (Brady and Robertson), Brady and Norman, 1889, pp.122-123, pl.10, figs. 7-13, figs. 1-9; pl.23, figs.5.- Bhatia, 1968, pl3, figs. 5a-b; pl.5, fig.13. - Malik and Amarjit Singh, 1994, pp.5-6, pl.1, figs. a, b, c; figs.3 I,II and III.

Description: The medium-sized thin carapace is elongate and ovate in lateral outline. Both the ends are rounded. Right valve is larger than left, overlapping distinctly along anterior, posterior and ventral margins. Muscle scar pattern rosette-shaped, consisting of ten scars. Hinge is adont.

Remarks: This cosmopolitan species was originally described by Brady and Robertson (1870). In India, this species has been reported from Mansar Lake, Jammu (Malik and Amarjit Singh, 1994).

Dimensions: Length 0.68 mm, Height 0.38 mm.

ZOOGEOGRAPHIC DISTRIBUTION

The entire world is divided into six faunal realms viz.,

Palaeartic, Ethiopian, Oriental, Australian, Nearctic and Neotropical zoogeographical regions, based upon their distribution. The Indian region is classified under Oriental Province. The Oriental region is bounded by Himalayas in the north but without any physical boundary in the southeast corner. This region includes Indian, Sri Lankan, Indo-Chinese and Indo-Malayan sub-regions. The Oriented region is known for its varied physical features. It represents tropical climate but northern part of India is temperate. The Oriental fauna exhibits considerable resemblance with that of the Ethiopian region. The resemblance is so marked that few zoogeographers prefer to club these two regions under a single realm, the Palaeotropical region. The Ethiopian region consists of Africa, south of Sahara, Madagascar and southern Arabia. As nearly the whole of the Ethiopian region lies between the tropics, the conditions here for the existence of life are more or less uniform. Since Sahara desert forms an effective barrier between the Palaeartic and Ethiopian regions, the fauna in the north and south are quite distinct. The fauna of this region is rich, varied and well marked. Some of the forms are endemic to this region with no living representatives outside the region. Moreover, few forms are strongly similar with Oriental fauna, due to similar tropical climate. The freshwater forms are also called the limnobiotic fauna. The terrestrial waters in lakes and rivers contain very limited fauna due to their freshness and continuous flow. The fauna living in standing water bodies like pond, lake or swamp are called lentic. Hence, the ostracod fauna from Perumal Eri can be described as Limnobiotic lentic fauna.

Stenocypris major and *S. hislopi* are also known from Oriental Province. *Ilyocypris gibba* and *I. bradyi* are cosmopolitan species, known to occur from Recent lakes and Pleistocene deposits of different parts of the Oriental zoogeographical province. The remaining species recorded here are cosmopolitan in distribution. Overall, the present fauna of Perumal Eri belong to the Oriental province, of which few taxa exhibit considerable resemblance with that fauna of the Ethiopian province.

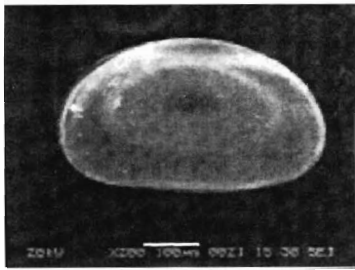
CONCLUSION

To study the Recent freshwater ostracodes, ten surface sediment samples were collected from the Perumal Eri, Cuddalore district, Tamil Nadu, which yielded nine ostracod taxa of the order Podocopida. Among these, *Candona* sp. followed by *Ilyocypris gibba* are found to occur in all the sediment samples and distributed. This is the first attempt that these thin and fragile fauna have been encountered from this part of the region. Detailed synonymy for all the species is given. An update literature survey from the Indian subcontinent pertaining to these forms is presented. These forms exhibit three to four molt stages. Adult specimens are seldom recorded, may be due to pollution in the lake being discharged from Neyveli Lignite Corporation. The present faunal assem-

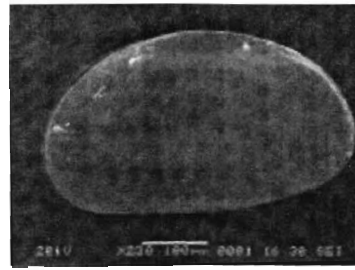
EXPLANATION OF PLATE I

- a-b. *Cyclocypris laevis* (Mueller), LV external view;
c. *Cyprinotus salinus* (Brady) LV external view;
d. *Candona lactea* (Baird) LV external view;
e. *Candona* sp., RV external view;
f. *Ilyocypris bradyi* sars, RV external view;
g-h. *I. gibba* (Ramdohr) Carapaces LV external view;

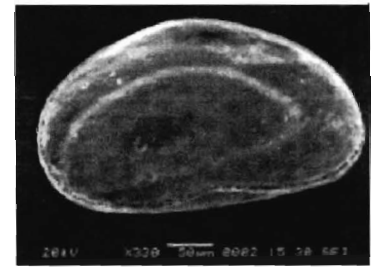
- i-j. *Stenocypris hislopi* Ferguson
i. LV Right valve external view;
j. LV external view;
k-l. *S. major* (Baird) LV internal view; m. *Darwinulina stevensoni* (Brady and Robertson), RV external view.



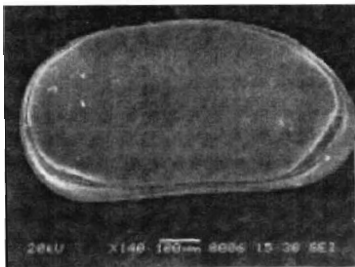
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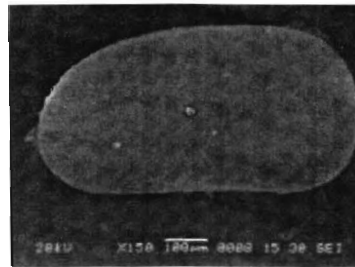
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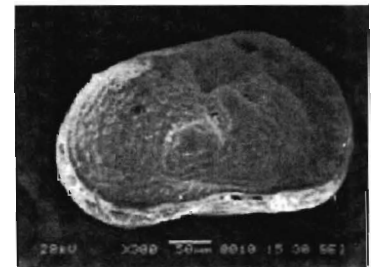
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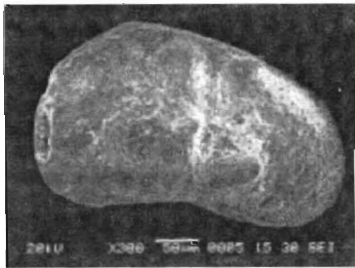
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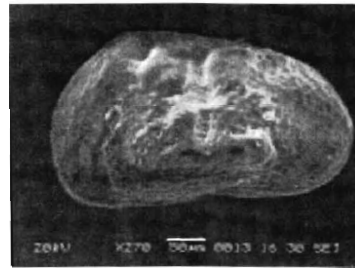
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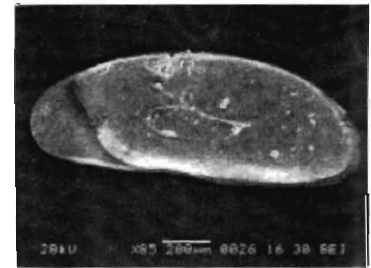
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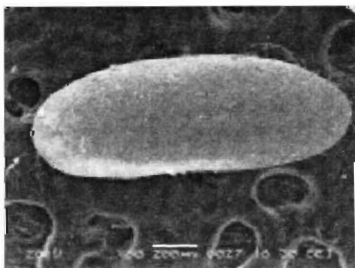
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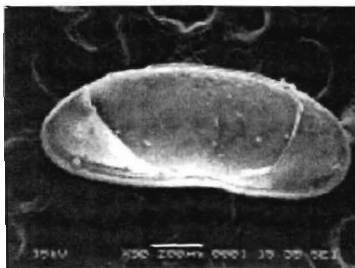
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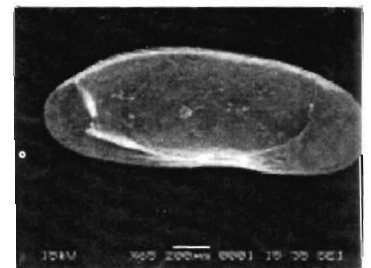
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m

blage mostly occurs in association with *Darwinula stevensoni*, *Candona lactea*, *C. sp.* and *Ilyocypris gibba*.

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