

# Biodiversity of Ostracods In Kozhappalur Lake, Tamilnadu, India

Uma Chandra N.<sup>1</sup>, Revathi K.<sup>2\*</sup>, Rekha V.<sup>3</sup> and M. Noornissabegum<sup>4</sup>

<sup>1</sup>Department of Zoology, Auxilium College, Gandhi Nagar, Vellore, T.N., India

<sup>2</sup>Meenakshi Academy of Higher Education and Research, Chennai, T.N., India

<sup>3</sup>Department of Zoology, D.K.M College for Women, Vellore, T.N., India.

<sup>4</sup>PG and Research Department of Zoology, Ethiraj College for Women, Chennai, T. N., India

(Received 7 February, 2022; Accepted 28 April, 2022)

## ABSTRACT

The present study is based on planktonic Ostracods collected from Kozhappalur Lake twice a month over a period of one years (January, 2019 to December, 2019). In total, seven species belonging to six genera were identified. The detailed description of Ostracods recorded during this study is presented for substantiating the taxonomic relevance of the study.

**Keywords:** Ostracods, Kozhappalur Lake, Biodiversity

## Introduction

Ostracods are a class of the Crustacea (class Ostracoda), commonly known as seed shrimps which are typically around 1 mm in size varying from 0.2 to 30 mm. Their bodies are flattened from side to side and protected by bivalve-like, chitinous valve. The hinge of the two valves is in the upper region of the body. They are grouped together based on gross morphology. They are found in almost all aquatic environments including hot springs, caves, within the water table, semi-terrestrial environments, in both fresh and marine waters, within the water column as well as on (and in) the substrate (Martens, 2000). Ostracods are sensitive to changes in the water quality and are regarded as valuable bio-indicators therefore they are used in investigation of water quality. Their community structure not only allows estimates of the level of pollution, but also indicates the trend of general conditions over time. If changes in species diversity and population

abundances result from either direct or indirect environmental stressors, then the changes in biota may be used to elucidate changes in the environment (Puri, 1964). Living Ostracods are used as bio monitors in wetlands, streams and springs. They form an important component in the food of aquatic micro-organism (Kornicker and Sohn, 1971). Today Ostracods are playing an important role in Quaternary climate change research. Ecological and biogeographically databases are being compiled from many researchers world wide. Using Geographical Information Systems (GIS) the data can be portrayed spatially. Ostracod databases are the North American Non-Marine Ostracods Database (NANODE) and the Arctic Ostracods Database (Cronin *et al.*, 2002).

## Materials and Methods

Samples were collected twice a month from January 2019 to December 2019 from Kozhappalur,

(<sup>1</sup>Assistant Professor, <sup>2</sup>Research Director, <sup>3</sup>Assistant Prof., <sup>4</sup>Assistant Prof.)

Villupuram District, Tamil Nadu, India. The main source of water to this lake is rainwater.

A bolting silk plankton net No.10 (154/mm) was used to collect the sample. Several sweeps were made just above the substratum of the habitat and also among weeds. The bottom of the habitat was also disturbed to ensure the collection of ostracods living in the upper most layer of the substratum. The samples were then transferred to polythene containers with a small quantity of water. Samples were immediately fixed and preserved in 5% formalin. These collections were later filtered with the help of Tyler sieves of different mesh sizes and thus small Ostracods were also separated. Ostracods were separated under a stereoscopic dissection microscope, using a pair of dissection needles and 70% methanol was used as the preservative. For dissections, the ostracods were removed to a glass cavity dish containing 70% alcohol and the valves were separated under a dissection microscope using a pair of fine tungsten needles set in metal holders. The valves were mounted on micropalaeontological slides. The soft parts were transferred to a clean glass slide, and the appendages were teased out in a drop of polyvinyl lactophenol, stained with lignin pink (Edward Gurr Lond). The appendages were arranged in the desired positions and the preparation was allowed to dry for 10 to 12 hours. Whenever a quick preparation was needed, the slides were placed on a hot plate to minimise the drying period. Then a coverslip was placed over the dissection using a fresh drop of DPX mountant. Identification was carried out under higher magnifications (10x25 or 10x40) and the figures were drawn using camera lucida

## Results and Discussion

### Key Characters

Class: **Ostracoda**

Seed or mussel shrimps, no compound eyes, carapace calcified.

Subclass: **Podocopa**

Second antenna with well developed endopodite armed with claws at tip; exopodite either absent or present as a rudimentary scale or simple, long seta.

#### 1. *Cypris protubera* Victor and Fernando, 1979 (Fig. 1 A-F)

1979 *Cypris protubera* Victor and Fernando, *Rec. Zool. Suvr. India*, P.165, Figs. 54-62.

2006 *Cypris protubera* Gulam Mohideen, Ph.D. Thesis. P.45, Fig.59.

Family: **Cyprididae** Baird, 1845

Abdomen with furca, third legs backwardly and dorsally directed, modified as scratch feet. It is further divided into 4 subfamilies.

Subfamily: **Cypridinae** Baird, 1845

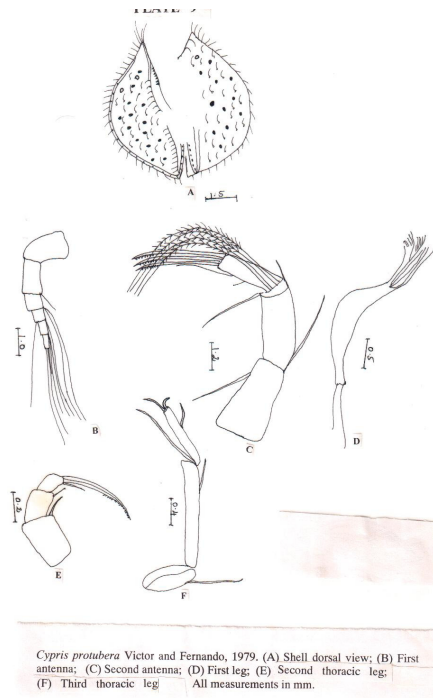
Legs three with short terminal segment, a beak like claw and a reflexed seta is present, endopodite of leg one is unsegmented. Cypridinae has 7 genera.

Genus: **Cypris** O.F. Muller, 1776

Carapace tumid, width greater than height. Natatory setae of second antenna well developed and reaching to or beyond the tips of the terminal claws. Ultimate podomere of the maxillary palp with a width about one-third its length. Furcal rami well developed. Its length more than 20 X least width, dorsal setae present.

Length: 1.50-1.54mm; height 0.94-0.97; width 0.96-0.98mm.

*Description:* Valves tumid; dorsum boldly arched, sloping smooth posteriorly; anterior margin of both valves with a narrow flange; anteroventral margin with prominent protuberance; valve margin hairy except dorsally; surface covered with hairs; left



#### 2. *Cypris subglobosa* Sowerby, 1840 (Fig. 2 A-H)

valve slightly larger than right. Natatory setae of the second antenna smooth, not reaching the tips of the terminal claws. Maxillary spines toothed. First thoracic leg with respiratory plate bearing five setae. Second thoracic leg with a terminal claw pectinate in its distal half. Terminal segment of the third leg with a prominent claw, a small sinuate claw like projection and a reflexed seta, dorsal surface of the penultimate segment with four short spines and the seta in the middle setulate. Furcal rami symmetrical, both the claws pectinate, dorsal margin covered with ten groups of spines along the entire length.

*Distribution:* Tiruchirapalli Dt., Madurai Dt. and Kozhappalur (Villupuram District) in Tamil Nadu.

1840 *Cypris subglobosa* Sowerby, *Tr. Geol. Soc. Lond, Ser., 2, 5: 47 fig.3*

2005 *Cypris subglobosa* Patil and Talmale, *Fauna of Nathasagar Wetland, Wetland Ecosystem series, 7: 64.*

Family: **Cyprididae** Baird, 1845

Abdomen with furca, third legs backwardly and dorsally directed, modified as scratch feet. It is further divided into 4 subfamilies.

Subfamily: **Cypridinae** Baird, 1845

Legs three with short terminal segment, a beak like claw and a reflexed seta is present, endopodite of leg one is unsegmented. Cypridinae has 7 genera.

Genus: **Cypris** O.F. Muller, 1776

Carapace tumid, width greater than height. Natatory setae of second antenna well developed and reaching to or beyond the tips of the terminal claws. Ultimate podomere of the maxillary palp with a width about one-third its length. Furcal rami well developed. Its length more than 20 X least width, dorsal setae present

Length: 1.43-1.45 mm; width: 1.18 mm; height: 0.92-0.94.

*Description:* Valves subglobular, tumid, right valve with a flange at the rounded anterior margin, posterior margin narrowly produced; left valve without a flange, both anterior & posterior margins broadly rounded; dorsum convex; ventral margin almost straight and slightly sinuate in the right valve; both anterior and posterior margins hairy; valve overlaps variable; surface with thickly set thimble-shaped depressions and minute hairs. Natatory setae of sec-

ond antenna well developed and reaching to or beyond the tips of the terminal claws. First thoracic leg and respiratory plate bearing five setulate setae. Second thoracic leg with an end claw pectinate; segments three and four fused. Third thoracic leg with a claw and a reflexed seta. Furcal rami symmetrical, slender.

*Distribution in India:* Nagpur, Bombay Dt., Pandharpur in Maharashtra, Bhopal in Madhya Pradesh; Chitoor, Guntur area, and Yanam – Godavari delta in Andhra Pradesh; Madurai Dt., Tiruchirapalli Dt., Kanyakumari, Kozhappalur in Villupuram Dt. and Ambattur in Tiruvallur Dt. in Tamil Nadu, Trivandrum in Kerala.

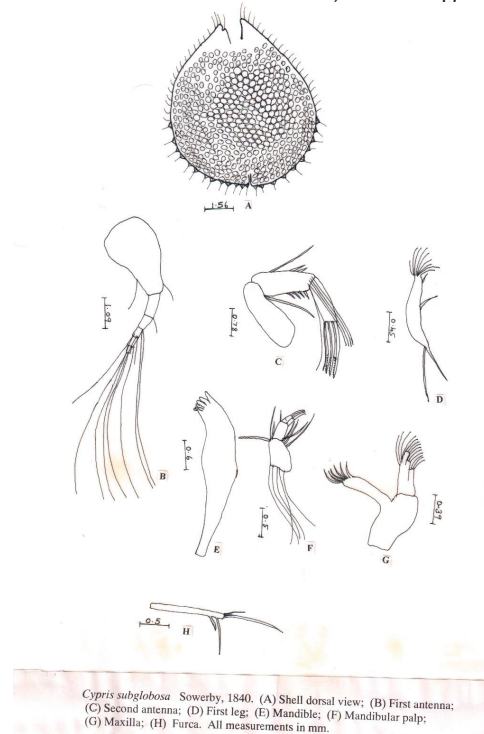
*Distribution in other countries:* Indonesia, Malaysia, Philippines, Sri Lanka, Japan, Venezuela, USA, Yugoslavia and USSR.

1886 *Cypris purpurascens* Brady, *J. Linn. Soc. Zool., 19: 298, Pl. XXVIII, Figs. 12-14.*

1995 *Strandesia purpurascens* Harshey, *Fauna of Kanha Tiger Reserve, P. 31.*

Family: **Cyprididae** Baird, 1845

Abdomen with furca, third legs back-



3. *Strandesia purpurascens* (Brady) 1886 (Fig. 3 A-H)

wardly and dorsally directed, modified as scratch feet. It is further divided into 4 subfamilies.

Subfamily: **Cypridinae** Baird, 1845

Legs three with short terminal segment, a beak like claw and a reflexed seta is present, endopodite of leg one is unsegmented. Cypridinae has 7 genera.

Genus: **Strandesia** Vavra, 1895

Valves moderately elongate, subelliptical, dorsum convex, hinge margin variable, usually left valve overlaps the right. Sensory club of the second antenna long, natatory setae well developed. Furcal rami symmetrical, slender and long.

Length: 0.81 – 0.85 mm. Height 0.42 – 0.44mm.

**Description:** Valves subelliptical, laterally elongate, both anterior and posterior margins rounded, left valve slightly larger, overlapping the right, anterior, posterior and ventral margin hairy, dorsum convex, evenly arched ventral margin, straight, valve surface vesicular. Natatory setae of the second antenna smooth, reaching the tips of the toothed terminal claws. Sensory club three segmented. Maxillary spines smooth. Second thoracic leg with a faintly toothed, long scythe-like claw, second segment lined with unequal hairs on the ventral margin and a single seta, seta in the third segment hairy. Terminal podomere of the third leg with a single beak shaped claw and a reflexed seta. Furcal rami symmetrical, terminal and sub terminal claws slender with spines, terminal seta little longer than the terminal claw and smooth, dorsal seta setulate on the dorsal aspect, and little shorter than half the length of sub-terminal claw.

**Distribution in India:** Ramanathapuram Dt., Kozhappalur in Villupuram Dt., Madurai and Surrounding areas in Tamil Nadu, Kanha Tiger Reserve, Madhya Pradesh.

**Distribution in other countries:** Sri Lanka, Malaysia, Indonesia and Thailand

1938 *Heterocypris anomala* Klie, *Bull. Biogeogr. Soc. Jpn.*, 8: 23, Abb. 1-7.

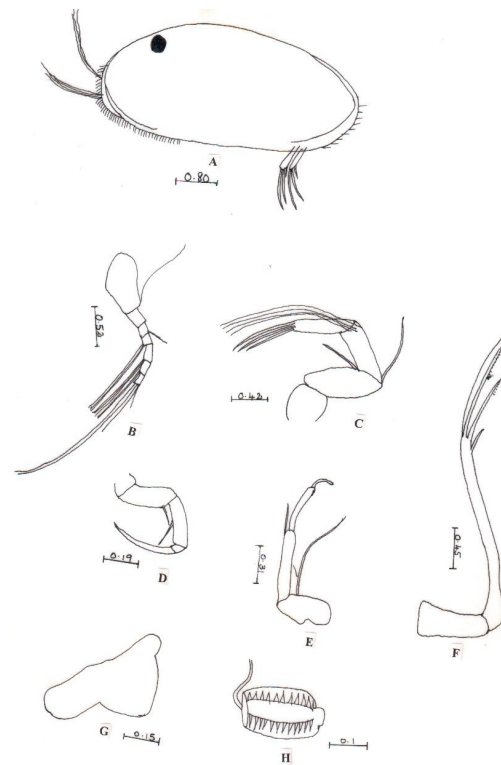
2005 *Hemicypris anomala*, Patil and Talmale, *Fauna of Nathsagar Wetland, Wetland Ecosystem series*, 7: 70.

Family: **Cyprididae** Baird, 1845

Abdomen with furca, third legs backwardly and dorsally directed, modified as scratch feet. It is further divided into 4 subfamilies.

Subfamily: **Cypridinae** Baird, 1845

Legs three with short terminal segment, a beak like claw and a reflexed seta is present, endopodite of leg one is unsegmented. Cypridinae has 7 genera.



*Strandesia purpurascens* (Brady) 1886. (A) Shell lateral view; (B) First antenna; (C) Second antenna; (D) Second thoracic leg; (E) Third thoracic leg; (F) Furca; (G) Hemipenis; (H) Zenkers organ. All measurements in mm.

#### 4. *Hemicypris anomala* (Klie) 1938

(Fig. 4 A-K)

Genus: **Hemicypris** Sars, 1903

Subtriangular or subovate valves; moderately compressed; dorsum convex smoothly arched or subangulate medially venter straight or slightly concave right valve always overlaps the left, left valve with tubercles along the margin at least posteriorly. Natatory setae of the second antenna reaching beyond the tips of the terminal claw; Furca well developed symmetrical with both dorsal and terminal setae.

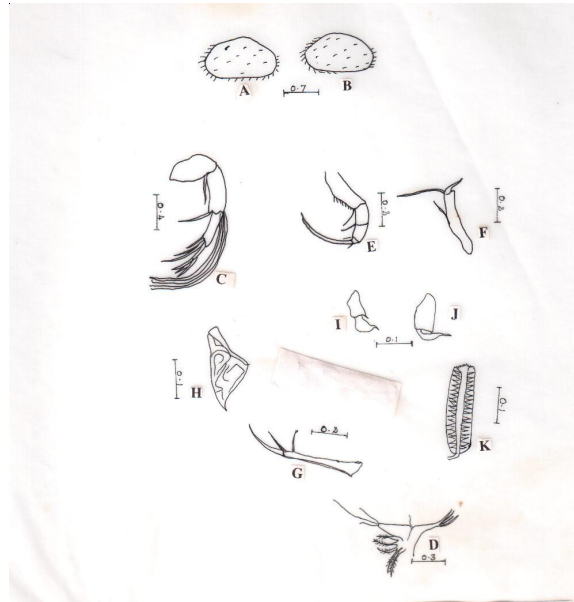
Length: 0.70 – 0.75 mm. Height 0.42 – 0.45 mm.

**Description:** Subtriangular or subovate valves, unequal, moderately compressed, right valve always overlaps the left, left valve tuberculated, convex dorsum; somewhat angular with greatest height in the middle; valve margins hairy, valve surface with short hairs not very dense. Natatory setae of the second antenna reaching beyond the tips of the terminal claws. Maxillary spines two, one toothed and one smooth. Endopodite of the first leg with three setae. Second thoracic leg with a long end claw and

second segment with a single seta. Third thoracic leg with a beak shaped claw and a reflexed seta. Furca well developed, symmetrical and straight. Dorsal margin of the ramus finely spinose.

*Distribution:* Tirupathur, Pondicherry, Madurai Dt., Virudhachalam, Kozhappalur, South Bombay, Maharashtra, Travancore, Kerala.

5. *Cyprretta fontinalis* Hartmann, 1964



*Hemicypris anomala* (Klie) 1938. (A) Right valve, external view; (B) Left valve, external view; (C) Second antenna; (D) First thoracic leg; (E) Second thoracic leg; (F) Third thoracic leg; (G) Furca; (H) Hemipenis; (I) Right prehensile palp, Male; (J) Left prehensile palp, Male; (K) Zenkers organ. All measurements in mm.

(Fig. 5 A-F)

1964 *Cyprretta fontinalis* Hartman, *Int. Rev. gesamten Hydrobiol. Syst. Beih.* 3:1-155

2005 *Cyprretta fontinalis* Patil and Talmale, *Fauna of Nathsagar wetand, wetland ecosystem series 7:* 71.

Family: **Cyprididae** Baird, 1845

Abdomen with furca, third legs backwardly and dorsally directed, modified as scratch feet. It is further divided into 4 subfamilies.

Subfamily: **Cyprrettinae** Hartmann, 1964

Slender, leg-like furcal rami, better developed than that of cypridopsines, and the well-developed radial septa in the anterior margin of the valves, apart from the usual characters of Cyprididae.

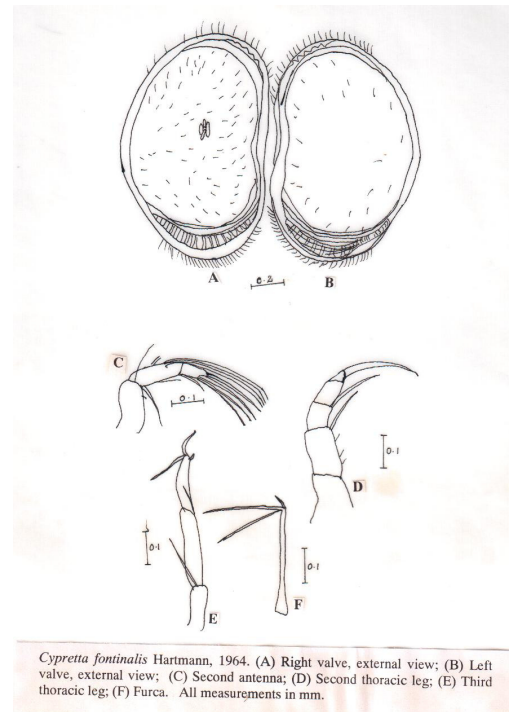
Genus: *Cyprretta* Vavra, 1895

Small valves less than 1 mm is greatest length, tumid carapace, surface smooth, punctate or reticulate, left and right valves equal or unequal, anterior margin of the adults always with well defined septa. Furcal rami well developed, symmetrical slender and flexible, terminal seta present or absent, dorsal seta present.

Length: 0.83-0.86mm, height: 0.52-0.54mm and width: 0.60-0.62mm.

*Description:* Valves tumid, narrow at anterior end and broad at posterior side, right valve overlapping the left, valves without any ornamentation and with hairs sparsely present at the posterior end and regularly present at the anterior region and ventral. Anterior margin of valve with a well-defined septa. Second antenna with the natatory setae almost reaching the tips of terminal claws. Second thoracic leg with distal claw curved. Terminal podomere of the third leg with a long claw, two small claws and a reflexed seta. Furcal rami symmetrical, terminal and subterminal claws slender, dorsal seta less than one fourth of the length of subterminal claw and terminal seta rudimentary.

*Distribution:* Palani hills and Kozhappalur in Villupuram Dt. of Tamil Nadu, Mountainous terrains of Maharashtra.



*Cyprretta fontinalis* Hartmann, 1964. (A) Right valve, external view; (B) Left valve, external view; (C) Second antenna; (D) Second thoracic leg; (E) Third thoracic leg; (F) Furca. All measurements in mm.

6. *Centrocypris horrida* Vavra, 1895

(Fig. 6 A-B)

1895 *Centrocypris horrida* Vavra, *W iss. Anst.*, 12: 18 Figs. 7, 1-9.

1993 *Centrocypris horrida* Venkataraman, *J. Andaman Sci.Assoc.*, 9(1&2):93. Fig. 1

Family: **Notodromadidae** Kaufmann, 1900

Medium sized, pustulose valves and well developed symmetrical furca.

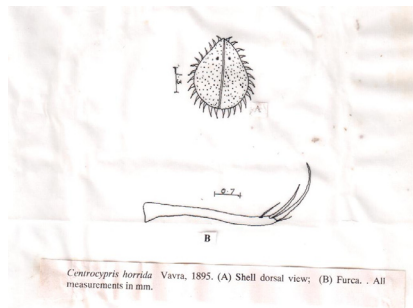
Genus: *Centrocypris* Vavra, 1895

Strongly tumid, subquadrate valves, equal or unequal, surface spinose or tuberculate. Well developed natatory setae of the second antenna reaching beyond the tips of terminal claws. Symmetrical furca with slender terminal and subterminal claws.

Length: 1.3mm, Height: 0.8mm and Width: 1.0mm.

*Description:* Valves tumid, margins armed with large thick spines; mid dorsum and venter straight; surface tuberculate. Maxillary palp with four smooth spines; terminal podomere of third thoracic leg with two curved claws and a stout claw-like projection. Furca symmetrical terminal and subterminal claws slender; dorsal seta more than half the length of subterminal claw, terminal seta short.

*Distribution:* Palani hills in Tamil Nadu; Yanam swamp in Andhra Pradesh and Kozhappalur in Villupuram District of Tamil Nadu.



### 7. *Candonopsis putealis* Klie, 1932

(Fig. 7 A-F)

1932 *Candonopsis putealis* Klie, 1932, *Arch.Hydrobiol.spl.*, 11: 455, Figs. 24- 31.

1979 *Candonopsis putealis* Victor and Fernando, *Rec.Zool.Surv.India*, 74(2): 223, Figs. 358-365.

Family: **Eucandonidae** Swain, 1961

The family Eucandonidae was erected, based on the structure of the second antenna as a major criterion in addition to the other characters (Swain, 1961) Eucandonidae lack completely the natatory setae.

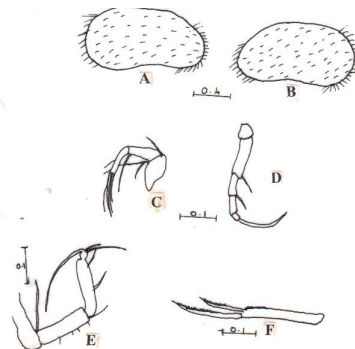
Genus: *Candonopsis* Vavra, 1891

Valves medium to large, elongate, laterally compressed, unequal, higher behind the middle, usually inner duplicature broad anteriorly, thinly calcified. Natatory seta of the second antenna absent.

Length: 0.77mm, height: 0.40mm.

*Description:* Subrectangular valves, laterally elongate, anterior and posterior margins rounded, densely hairy, left valve little larger than the right, overlap insignificant, dorsum nearly straight, ventral margin slightly concave, valves thin, covered with minute hairs. Second antenna slender, natatory setae absent, sensory club four segmented, terminal podomere with four elongate claws. Mandibular palp narrowly produced with a short basal segment, the terminal segment with two claw like spines. Second thoracic leg with a long, scythe-shaped smooth terminal claw, second segment with a single seta. Ventral margin of second segment lined with a row of hairs. Terminal segment of the third thoracic leg short, with three setae of which one is reflexed and longer than the penultimate segment, penultimate segment with two setae on the ventral side, dorsal margin with three or four spines, segment previous to the penultimate podomere is lined with a row of paired spines on the ventral aspect and two distinct spines on the dorsal aspect. Furca symmetrical, both dorsal and terminal setae absent, subterminal claw about two third of the length of the terminal claw, both the claws armed with two distinct groups of spines, dorsal margin of the ramus lined with two groups of spines.

*Distribution:* Trivandrum in Kerala., Kozhappalur in Villupuram Dt. and Vepampattu Pond in Thiruvallur Dt. in Tamil Nadu.



*Candonopsis putealis* Klie, 1932. (A) Right valve, external view; (B) Left valve external view; (C) Second antenna; (D) Second thoracic leg; (E) Third thoracic leg; (F) Furca. All measurements in mm.

## Conclusion

The results obtained during the present study demonstrate that Kozhappalur Lake supports the growth of quite a number of Ostracod species. The Lake water should be properly maintained to conserve its Ostracod diversity.

## Acknowledgements

Authors are grateful to Dr. Thirumalai (Director, ZSI-Chennai), Dr.M.B.Ragunathan (Scientist, ZSI-Chennai), and Dr. Ragunathan (Scientist, ZSI-Andhaman).

## References

- Brady, G. S. 1886. Notes on Entomostraca collected by Mr. Haly in Ceylon. *J. Linn Soc. Zool.* **19**: 239-315.
- Cronin, T. M., Boomer, I., Dwyer, G. S. and Rodrequez-Lazaro, J. 2002. Ostracoda and Paleocyanography, in Ostracode: applications in Quaternary Research, Geophysical Monograph 131, American Geophysical Union, pp.99-116.
- Hartmann, G. 1964. Asiatische Ostracoden, Systemtische und Zoogeographische Untersuchungen. *Int. Rev. gesamt. Hydrobiol. Syst. Beih.* **3**: 1-155
- Klie, W. 1932. Die Ostracoden der Deutschen Limnologischen Sunda Expedition. *Arch. Hydrobiol. Suppl.* **11**: 447-502.
- Klie, W. 1938. Ostracoden aus Formosa. *Bull. Biogeogr. Soc. Jpn.* **8** : 21-33.
- Kornicker, L. S. and Sohn, I. G. 1971. Viability of Ostracode eggs egested by fish and effect of digestive fluids on Ostracode shells, ecologic and paleo-ecologic implications. *Bull. Centre Rech. Pau.* **5**: 125-135.
- Martens, K. 2000. The Non-Marine Ostracods (Ostracoda) of Southern Africa. Freshwater Biology, Royal Belgian Institute of Natural Sciences, Vautierstraat 29, B-1000 Brussels, Belgium.
- Puri, H. S. 1964. Ostracods as ecological and Palaeoecological indicators *Publicazioni della Stazione Zoologica di Napoli.* **33**, supplemento (Symposia, 1963).
- Sowerby, J. and De. C. 1840. Organic remains collected by Malcolmson and described by James De Carle Sowerby. *Trans. Geol. Soc. London.* **2**: 5-47
- Vavra, W. 1895. Die Von Dr. F. Stuhlmann gesammelten Ostracoden Zanzibar. *Jahrb. Hamburgischen. Wiss. Anst.* **12**: 1-23.
- Victor, R. and Fernando, C. H. 1979. The Freshwater Ostracods (Crustacea Ostracoda) of India. *Rec. Zool. Surv. India.* **74** (2): 149-242.

