

**Report of epibiont ciliates (Ciliophora: Suctorea) on pelagic ostracods (Crustacea: Ostracoda) from the Arabian Sea**

**Tapas Chatterjee<sup>1</sup>, Igor Dovgal<sup>2</sup>, Mandar Nanajkar<sup>3</sup> & Veronica Fernandes<sup>3</sup>**

<sup>1</sup>Crescent International School, Bario, Govindpur, Dhanbad 828109, Jharkhand, India. E-mail: [drtchatterjee@yahoo.co.in](mailto:drtchatterjee@yahoo.co.in)

<sup>2</sup>Institute of Marine Biological Research of Russian Academy of Sciences, 2, Nakhimov ave., Sevastopol, 299011, Russia. E-mail: [dovgal-1954@mail.ru](mailto:dovgal-1954@mail.ru)

<sup>3</sup>CSIR- National Institute of Oceanography, Dona Paula, Goa, 403004, India. E-mail: [mandar@nio.org](mailto:mandar@nio.org); [veronica@nio.org](mailto:veronica@nio.org)

**Abstract**

The article deals with the report of 5 suctorians viz. *Lecanophryella satyanandani* (Santhakumari, 1986), *Paracineta karunakarani* Santhakumari, 1986, *Ephelota gemmipara* (Hertwig, 1876), *Acineta foetida* Maupas, 1881 and *Pelagacineta* sp. on marine pelagic ostracods *Cypridina dentata* (Müller, 1906), from new localities of the Arabian Sea. Diagnostic characters of *Paracineta karunakarani* are emended. *Ephelota gemmipara* (Hertwig, 1876) and *Acineta foetida* Maupas, 1881 are reported here for the first time on planktonic marine ostracods. The representative of genus *Pelagacineta* is reported here for the first time as epibiont on ostracod host and also from the Indian Ocean.

**Key words:** Ciliates, epibiont, pelagic ostracods, Arabian Sea

## Introduction

The calcified surface of the crustacean exoskeleton provides an optimal habitat for ciliate epibionts (Fernandez-Leborans 2010) resulting in epibiosis of ciliates on crustaceans is rather common phenomenon (eg., Morado & Small 1995, Fernandez-Leborans & Tato-Porto 2000a, b, Fernandez-Leborans *et al.* 2012, Chatterjee *et al.* 2013a,b,c, 2014, 2019, Clamp *et al.* 2016). A number of peritrich and suctorian ciliates have been reported as epibionts on marine and freshwater ostracodes (eg., Matthes 1990, Griffiths & Evans 1994, Karan-Žnidaršič *et al.* 2006, Claps & Sampons 1994, Schödel 2004)

Two suctorian species, *Lecanophryella satyanandani* (Santhakumari, 1986) and *Paracineta karunakarani* Santhakumari, 1986 were found on marine ostracod *Cypridina dentata* (Müller, 1906) from the Arabian Sea (Santhakumari, 1986a).

The account deals with report of 5 suctorian species viz. *Lecanophryella satyanandani* (Santhakumari, 1986), *Paracineta karunakarani* Santhakumari, 1986, *Ephelota gemmipara* (Hertwig, 1876), *Acineta foetida* Maupas, 1881 and *Pelagacineta* sp. on marine pelagic ostracods *Cypridina dentata* (Müller, 1906), from new localities of the Arabian Sea. Diagnostic characters of *Paracineta karunakarani* are emended. *Ephelota gemmipara* (Hertwig, 1876) and *Acineta foetida* are reported here for the first time on planktonic marine ostracods. Species of the genus *Pelagacineta* is reported here first time as epibiont on ostracode host and also from the Indian Ocean.

## Materials and Methods

Zooplankton samplings were collected from the stations at different depths in the offshore Arabian Sea (Fig 1). Zooplankton were collected with a vertical haul by a multiple plankton net and placed in a clean plastic bottle. Samples were immediately preserved by adding 10% formaldehyde for further analysis. Microscopic analysis was carried out by Nikon Eclipse Ti2 Inverted microscope and photomicrographs were obtained by using a Nikon DS-Ri2 digital camera. Measurements of ciliates were made using the software TopView 3.7 for processing of digital images. The terminology and systematic position of suctorian ciliates follows Dovgal (2002 & 2013). Voucher specimens are kept in the collection of third author (Mandar Nanajkar, National Institute of Oceanography, Dona Paula, Goa).

Station 14: Arabian Sea, Lat. 21°00'00"N and Long. 69°13'00"E (Fig. 1). At this sampling location, the sea surface temperature was 27.69°C and the salinity was 36.65 PSU (date of collection: 16/08/2017., Collector-4<sup>th</sup> author, VF).

Station 16: Arabian Sea, Lat. 20°00'00"N and Long. 64°00'00"E (Fig. 1). At this sampling location, the sea surface temperature was 27.69°C and the salinity was 36.50 PSU (date of collection: 19/8/2017., Collector-4<sup>th</sup> author, VF).

Station 18: Arabian Sea, Lat. 18°00'00"N and Long. 64°00'00"E (Fig. 1). At this sampling location, the sea surface temperature was 27.69°C and the salinity was 36.60 PSU (date of collection: 20/8/2017., Collector-4<sup>th</sup> author, VF)

## **Results and discussion**

Class Suctorea Claparède & Lachmann, 1859

Subclass Exogenia Collin, 1912

Order Metacinetida Jankowski, 1978

Family Paracinetidae Jankowski, 1978

Genus *Paracineta* Collin, 1911

*Paracineta karunakarani* Santhakumari, 1986

(Fig. 2A-C)

*Paracineta karunakarani* Santhakumari, 1986a, pp 473-475 Figs 2A, B (a-d); Padmakumar *et al.* 2015, 876, Fig. 2 A-C.

**Material examined**: Several specimens on pelagic ostracods *Cypridina dentata* (Müller, 1906) from stations 14 and 16.

**Diagnosis (*character emend.*)**. Suctorian ciliate with conical thecostyle, which cover only one third of the cell body and accrete to the substrate by rounded attaching disc. The body is more or less square to rectangular in shape. Clavate tentacles are evenly distributed at the apical body surface. The macronucleus is allantoidal, some irregular, but might look rounded depending upon the viewpoint on the individual. Reproduction by external (exogemmic) budding with formation of single, ellipsoid protomite on the apical body surface (Fig. 2C).

**Measurements from present find (in µm)**: (measurements taken from 2 ciliate individuals) body height 57-78; body width 41-40; thecostyle length 37-123; width of the upper thecostyle part 17-31; width of the basal thecostyle part 11-16; width of the attaching disc 7-11; length of the tentacles 6-21; size of macronucleus 32-71×6-11; size of protomite 31×41.

**Host:** *Cypridina dentata* (Müller, 1906) (Santhakumari, 1986b, Padmakumar et al., 2015, present find).

**Distribution:** West coast of India, the Arabian Sea.

**Remarks:** This species was first reported by Santhakumari, (1986) from south west coast of India on an ostracod *Cypridina dentata* (Müller, 1906). It was also reported from North Eastern Arabian Sea, 21°59'84" N; 65°59'52"E, on same ostracod (Padmakumar *et al.*, 2015). The epibiosis of the species on other pelagic ostracod, *Euconchoecia aculeata* (Scott, 1894) was not observed in investigations of Santhakumari (1986a) and Padmakumar *et al.* (2015).

Order Ephelotida Raabe, 1964

Family Ephelotidae Kent, 1881

Genus *Ephelota* Wright, 1858

***Ephelota gemmipara*** (Hertwig, 1876)

(Figs. 2D, 3A)

=*Podophrya gemmipara* Hertwig, 1876, p. 24

=*Hemiophrya gemmipara* (Hertwig, 1876) Kent, 1881

=*Dendrophrya gemmipara* (Hertwig, 1876) Sand, 1895

=*Alderia apiculosa* Pritchard, 1852

=*Ephelota apiculosa* (Pritchard, 1852) Wright, 1858

=*Podophrya pusilla* Koch, 1876

=*Hemiophrya pusilla* (Koch, 1876) Kent, 1881

=*Podophrya benedeni* Fraipont, 1878

=*Hemiophrya microsoma* Maupas, 1881

=*Ephelota crustaceorum* (Haller, 1878) Yagiu, 1980

**Material examined:** Two individuals on pelagic ostracods *Cypridina dentata* (Müller, 1906) from station 16 and 18.

**Diagnosis** (after Dovgal, 2013): Suctorian ciliate without lorica, with a massive, less often rounded body, somewhat extended upwards, with a flattened apical surface. There are two types of tentacles (long hunting and short sucking), which are located on the apical surface of the body, while hunting

tentacles are approximately equal in length with the height of the body. Macronucleus coronoid, in the form of a ring with the upper and lower processes. Stalk very long, dense, somewhat expanded upwards, often with small transverse folds, sometimes smooth. Reproduction by multiple exogemmic budding with the simultaneous formation of several protomites on the apical surface of the body. A swarmer in the form of a flattened ellipsoid with horseshoe macronucleus. There are 22-33 peripheral kineties on the swarmer weakly concave surface, which form a horseshoe-shaped ciliary field, and in addition 10-20 fragmentary kineties. Cyst spherical, with hyaline envelop, attached to the stalk of the trophont. Conjugation is isogamic, but one of the conjugates is usually smaller than the other is, and can break away from the stalk and probably dies.

**Host and substrate specificity:** Ubiquitous species, observed at inanimate substrates, algae, hydroids, bryozoans, etc. (Dovgal 2013).

This species was also found as epibiont on various copepods eg., *Calanus finmarchicus* (Gunnerus, 1765), *Candacia armata* (Boeck, 1872), *Pleuromamma borealis* (F. Dahl, 1893) and *P. gracilis* (Claus, 1863) (Rose 1924, Steuer 1928, Fernandez-Leborans & Tato-Porto 2000b). Santhakumari (1985) reported this species as epibiont on copepods *Euchaeta marina* (Prestandrea, 1833), *Candacia tuberculata* Wolfenden, 1905, *Labidocera acuta* (Dana, 1849), *Undinula vulgaris* (Dana, 1849), other two copepods of genera *Pontella* and *Labidocera* (species name written wrongly) and commented that this suctorian was found infesting chiefly the postero-dorsal region of cephalothorax. Santhakumari (1986a) reported this as epibiont on the zoea of pea crab *Porcellana* sp.

It has been found as epibiont on ostracod *Cypridina dentata* (Müller, 1906) – Present report.

**Measurements from present find (in µm):** (measurement taken from one individual) body length 76; body width 80; stalk length 214; stalk diameter 14; length of sucker tentacles 12-17; diameter 4; length of hunting tentacles 38-61.

**Distribution:** North Sea, Mediterranean, Adriatic, White, Black Seas, the Sea of Azov, in the Gulf of Mexico, from the coasts Japan and India (Dovgal 2013).

**Remarks:** *E. gemmipara* is widespread species, first described by Hertwig (1876) from the coast of the Helgoland Island (North Sea, Germany, type locality). In India *E. gemmipara* was reported earlier off Thootukodi (=Tuticorin), Kanyakumari (=Cape comorin), Karwar, Ratnagiri – Santhakumari (1985, 1986a). *Ephelota gemmipara* (Hertwig, 1876) is reported here for the first time as epibiont on planktonic marine ostracods from the Arabian Sea.

Order Vermigemmida Jankowski, 1973

Family Lecanophryidae Jankowski, 1973

Genus *Lecanophryella* Dovgal, 1985

***Lecanophryella satyanandani*** (Santhakumari, 1986)

(Fig. 3B)

=*Acineta satyanandani* Santhakumari, 1986b, 472-473, Figs. 1-D; Santhakumari 1997, 172-173; Padmakumar *et al.* 2015, 876-877, Fig. 4.

**Material examined:** Several specimens on pelagic ostracods *Cypridina dentata* (Müller, 1906) from station 18.

**Diagnosis:** Suctorian ciliate with cup shaped body furnished with three good developed actinophores (Fig 3B). Lorica absent. From 10 to 16 clavate tentacles located on the tops of actinophores. The protoplasm finely granular and the body straw colour. The shape of the macronucleus changes from oval to rounded. The attachment of the stalk to the host by means of a circular disc or basal plate.

**Measurements from present find** (taken from 8 ciliate individuals; in  $\mu\text{m}$ ): body length (before the bases of actinophores) 39-50, body width 34-45, body thickness 30, actinophore length 14-41, actinophore width 15-22, length of tentacles 15-34, stalk length 8-12, stalk diameter 5-6, size of macronucleus  $9 \times 13$ .

**Host:** *Cypridina dentata* (Müller, 1906) - Santhakumari (1986b, 1997), Padmakumar *et al.* 2015, Chatterjee *et al.* (2019), present find.

**Distribution:** West coast of India, the Arabian Sea.

**Remarks:** Jankowski (1992) proposed to transfer *Acineta satyanandani* Santhakumari 1986, which was described as an epibiont on the marine seed shrimp *Cypridina dentata* (Müller, 1906) by Santhakumari (1986b) from Cochin, Kerala, south west coast of India

into genus *Lecanophryella* Dovgal, 1985 as *L. Satyanandani*. Dovgal (2002) agreed on this and adopted it as *Lecanophryella satyanandani*. Padmakumar *et al.* (2015) reported for the second time *Lecanophryella satyanandani* (reported as *Acineta satyanandani*) from the North eastern Arabian Sea  $21^{\circ}59'84''\text{N}$ ;  $65^{\circ}59'52''\text{E}$ , on same ostracod. Recently it was reported on ostracod *C. dentata* from surface pelagic waters off the central west coast of India, Arabian Sea, Lat.  $13^{\circ}20'35.00''\text{N}$  and Long.  $73^{\circ}44'45.00''\text{E}$  (Chatterjee *et al.* 2019).

Subclass Endogenia Collin, 1912

Order Acinetida Raabe, 1964

Family Acinetidae Ehrenberg, 1838

*Acineta foetida* Maupas, 1881

(Fig. 3C)

=*Acineta tuberosa* var. *foetida* Collin, 1912

=*Acineta tuberosa* Ehrenberg, 1834: Curds, 1985 (part.)

=*Acineta branchicola* Precht, 1935

**Material examined:** Several specimens on pelagic ostracods *Cypridina dentata* (Müller, 1906) from station 16.

**Diagnosis** (after Dovgal 2013): Suctorian ciliate with a triangular or trapezoidal, somewhat asymmetric body attached to the bottom of the lorica. The lorica is triangular or trapezoidal, asymmetric, often with transverse folds of irregular shape, usually located in its lower part. Stalk short, its length does not exceed the length of the body. There is the stalk extension (basal disk) in the zone of stalk-lorica connection, which can be immersed in the base of the lorica. The stalk is attached to the substrate by means of an attachment disk. Tentacles arranged in two apical bundles, actinophores poorly developed, sometimes absent. Macronucleus is rounded, central. Above the macronucleus single contractile vacuole positioned. Reproduction by endogemmic budding with forming of single ciliary swarmer. Swarmer stroller, flattened, with an apical scopuloid and four fully developed, diagonal, kineties and one shortened, kinety placed around the scopuloid.

**Measurements from present find:** (measurements taken from 3 individuals; in  $\mu\text{m}$ ) lorica length 32-40; lorica width 32-34; lorica thickness 16; size of macronucleus 10-16 $\times$ 11-13; length of tentacles 7-37; stalk length 6-15; stalk diameter 4; basal disk diameter 11.

**Hosts:** Ubiquitous marine and brackish-water species, observed on inanimate substrates, algae, but often found on representatives of crustacean (Dovgal, 2013).

The species was observed on representatives of crustacean orders, eg. (Dovgal, 2013), on Amphipoda – *Gammarus olivii* Milne-Edwards, 1830, *G. subtipicus* Stock, 1966, *Pontogammarus maeoticus* (Sowinsky, 1894) and *Orchestia bottae* Milne-Edwards, 1840; Isopoda – *Sphaeroma serratum* (Fabricius, 1787), *S. pulchellum* (Colosi, 1921) and *Idoteabaltica basteri* (Pallas, 1772); Decapoda – *Palaemon elegans* Rathke, 1837, *Crangon crangon* (Linnaeus, 1758), *Diogenes*

*pugillator* (Roux, 1829), *Astacusepto dactylus* Eschscholtz, 1823 and *Eriphia verrucosa* (Forskal, 1775); Ostracoda – *Cypridina dentata* (Müller, 1906) (present report)

**Distribution:** Widespread found in the Mediterranean, North, Baltic, Black Sea and the Sea of Azov, on the Pacific coast of Canada and the Atlantic coast of Mexico (Dovgal 2013). The Arabian Sea (Present report).

**Remarks:** *Acineta foetida* was registered as epibiont on benthic or meiobenthic organisms only. Our finding is a first registration of this species on planktonic marine Ostracoda.

Family Tokophryidae Jankowski, 1978

Genus *Pelagacineta* Jankowski, 1978

***Pelagacineta* sp.**

(Fig. 3D)

**Material Examined:** One individual as epibiont on pelagic ostracod *Cypridina dentata* (Müller, 1906) from station 16.

**Brief Description:** Suctorian ciliate with the costyle. The body is ovoid, dorso-ventrally compressed and discoidal in shape lying at the top of a thecostyle that widens considerably to form a cupped lorica-like anterior region. Numerous capitate tentacles located anteriorly and evenly distributed at cell body surface. The shape of macronucleus and mode of reproduction was not observed.

**Measurements (µm):** body height 64; body width 109; height of anterior region of the thecostyle 57, width 34; length of stalk-like part of the the costyle 140; diameter 19, length of the tentacles 34-67.

**Remarks:** Based on shape of body and dimensions, the present species is related to *Pelagacineta campanula* (Schröder, 1907) epibiont on marine copepods *Euchaeta* sp. and *Metridia* sp. from Antarctic waters (Schröder 1907, Curds 1987) and *Pelagacineta hebensis* Gregori *et al.* 2015 epibiont on *Paraeuchaeta hebes* (Giesbrecht, 1888) from continental shelf at Ria de Vigo, N. E. Atlantic waters, Galician coast, Spain (Gregori *et al.* 2015). *Pelagacineta campanula* is characterised by ribbon-like, branched macronucleus, whereas *Pelagacineta hebensis* has ovoid macronucleus. Since, we were not able to observe the morphology of macronucleus in present specimen, the identification of the present specimen up to species level is kept in abeyance. Present report is the first record of the genus *Pelagacineta* as epibiont on ostracod host and this genus is also reported for the first time from the Indian Ocean.



## Acknowledgements

Second author's (IG) work was made within the framework of research issue of Kovalevsky Institute of Marine Biological Research AAAA-A19-119060690014-5. Third and fourth authors (MN & VF) are thankful to authority of CSIR- NIO, Goa (India) for permission to collect materials.

## References

- Chatterjee T., Fernandez-Leborans G., Ramteke D. & Ingole B. (2013a) New records of pibiont ciliates (Ciliophora) from Indian coast with descriptions of six new species. *Cahiers de Biologie Marine*, 54, 143–159.
- Chatterjee T., Fernandez-Leborans G. & Senna A.R. (2013b) Ciliate epibionts on *Melita petronio* Senna *et al.*, 2012 (Crustacea: Amphipoda) from Brazil. *Cahiers de Biologie Marine*, 54, 393–404.
- Chatterjee T., Kotov A. & Fernandez-Leborans G. (2013c) A checklist of epibiotic ciliates (Peritrichia and Suctoria) on the cladoceran crustaceans. *Biologia*, 68 (3), 439–477.
- Chatterjee T., Fernandez-Leborans G. & Schizas N. (2014) Report of *Thecacinetia calyx* (Ciliophora: Suctorea) as an epibiont of harpacticoid copepods from Caribbean mesophotic reefs. *Caribbean Journal of Science*, 48, 44–48.
- Chatterjee T., Dovgal I., Nanajkar M. & Bogati K. (2019) Note on the genus *Lecanophryella* (Ciliophora: Suctorea) with description of a new species from west coast of India. *Zootaxa*, 4612, 494–500.
- Clamp J.C., Chatterjee T. & Fernandez-Leborans G. (2016) Occurrence of *Epistylis anastatica* (Linnaeus, 1767) (Ciliophora: Peritrichia) on *Mesocyclopsis abellae* Dussart & Fernando (Crustacea: Copepoda: Cyclopoida) in India, with an annotated checklist of species of *Epistylis* reported as epibionts of cyclopoid copepods and resources for their identification. *Zootaxa*, 4168, 525–540. doi.org/10.11646/zootaxa.4168.3.5
- Claps M.C. & Sampons M.R. (1994) First record of *Lagenophrys discoidea* Kellicott (Ciliophora, Peritricha, Lagenophryidae), ectocommensal of Argentinian ostracods. *Iheringia*, 76, 167–170.
- Curds C.R. (1987) A revision of Suctoria (Ciliophora, Kinetofragminofora). 5. The *Paracineta* and *Corynophrya* problem. *Bulletin of the British Museum (Natural History) Zoology*, 52, 71–106.
- Dovgal I.V. (2002) Evolution, phylogeny and classification of Suctorea (Ciliophora). *Protistology*, 2 (4), 194–270.
- Dovgal I.V. (2013) *Fauna of Ukraine: in 40 Vols. Vol. 36. Ciliates—Ciliophora. Issue 1. Class Suctorea*. Naukova Dumka, Kiev, 267 pp. [in Russian with English summary]
- Fernandez-Leborans G. (2010) Epibiosis in Crustacea: An overview. *Crustaceana*, 83 (5), 549–640.
- Fernandez-Leborans G. & Tato-Porto M.L. (2000a) A review of the species of protozoan epibionts on crustaceans. I. Peritrich ciliates. *Crustaceana*, 73, 643–683. doi.org/10.1163/156854000504705

- Fernandez-Leborans G. & Tato-Porto M.L. (2000b) A review of the species of protozoan epibionts on crustaceans. I. Suctorian ciliates. *Crustaceana*, 73, 1205–1237. <https://doi.org/10.1163/156854000505209>
- Fernandez-Leborans G., Chatterjee T. & Grego M. (2012) New records of epibiont ciliates (Ciliophora) on Harpacticoida (Copepoda, Crustacea) from the Bay of Piran (Gulf of Trieste, Northern Adriatic). *Cahiers de Biologie marine*, 53, 53–63.
- Gregori M., Fernandez-Leborans G., Roura A., Gonzalez A.F. & Pascual S. 2015. Description of a new epibiotic relationship (Suctorian–Copepoda) in NE Atlantic waters: from morphological to phylogenetic analyses. *Acta Zoologica*, 97 (2), 165–176.
- Griffiths H.I. & Evans J.G. (1994) Infestation of the freshwater Ostracod *Cyprina ophthalmica* (Jurine) by the Peritrich *Nüchterleinella corneliae* Matthes. *Archiv für Protistenkunde*, 144, 315–317
- Jankowski A.V. (1992) New generic combinations for some species of Ciliophora. *Tsitologia*, 34 (4), 171. [in Russian]
- Karan-Žnidaršič T., Nikolić V., Simić G.S. & Petrov B. (2006) The Occurrence of Epibionts and Endobionts of Ostracoda (Crustacea) in some parts of the Danube basin in Serbia. Proceedings 36th International Conference of IAD. Austrian Committee DanubeResearch / IAD, Vienna, 246–249.
- Matthes D. (1990) *Nüchterleinella corneliae* n. g., n. sp., ein Peritrich auf *Cyprina ophthalmica* (Ostracoda). *Archiv für Protistenkunde*, 138, 139–141.
- Morado J.F. & Small E.B. (1995) Ciliate parasites and related diseases of crustacean: a review. *Reviews in Fisheries Science*, 3(4), 275–354.
- Padmakumar K.B., Lathika C.T., Anilkumar V. & Sanjeevan V.N. (2015) Occurrence of epibiotic suctorian protozoans on marine ostracod *Cypridina dentata* (Müller, 1906) in the North Eastern Arabian Sea. *Indian Journal of Geo-Marine Sciences*, 44 (6), 874–878.
- Rose M. (1924) Notes faunistiques sur les Copépodes pélagiques des cotés de France. *Bulletin of the Society of Zoology, France*, 49, 328–332.
- Schröder O. (1907) Die Infusorien der Deutschen Sudpolar-Expedition 1901–1903. In: von Drygalski, E. (Ed.), *Deutschen Sudpolar-Expedition 1901–1903*, 9, 349–360.
- Santhakumari V. (1985) Epizoic and ectoparasitic protozoans from planktonic copepods of the southwest and southeast coasts of India with the description of a new species. *Journal of the Marine Biological Association of India*, 27 (1 & 2), 29–38.
- Santhakumari V. (1986a) Epizoic and ectoparasitic protozoans from crab larvae. *Mahasagar-Bulletin of the National Institute of Oceanography*. 19 (1), 65–67.
- Santhakumari, V. (1986b) Two new species of suctorians, *Acineta satyanandani* sp. nov. and *Paracineta karunakarani* sp. nov. epizoic on ostracods. *Indian Journal of Fisheries*, 33 (4), 471–475.
- Santhakumari V. (1997) Studies on the associates parasites of zooplankton from south west and south east coasts of India. *Journal of the Marine Biological Association of India*, 39 (1 & 2), 171–174.

Schödel H. (2004) New and rare epizoic peritrichs (Protozoa, Ciliophora) on ostracods (Arthropoda, Crustacea) with description of a new family, Bezedniellidae fam. nov. *Lauterbomia*, 49, 107–128.

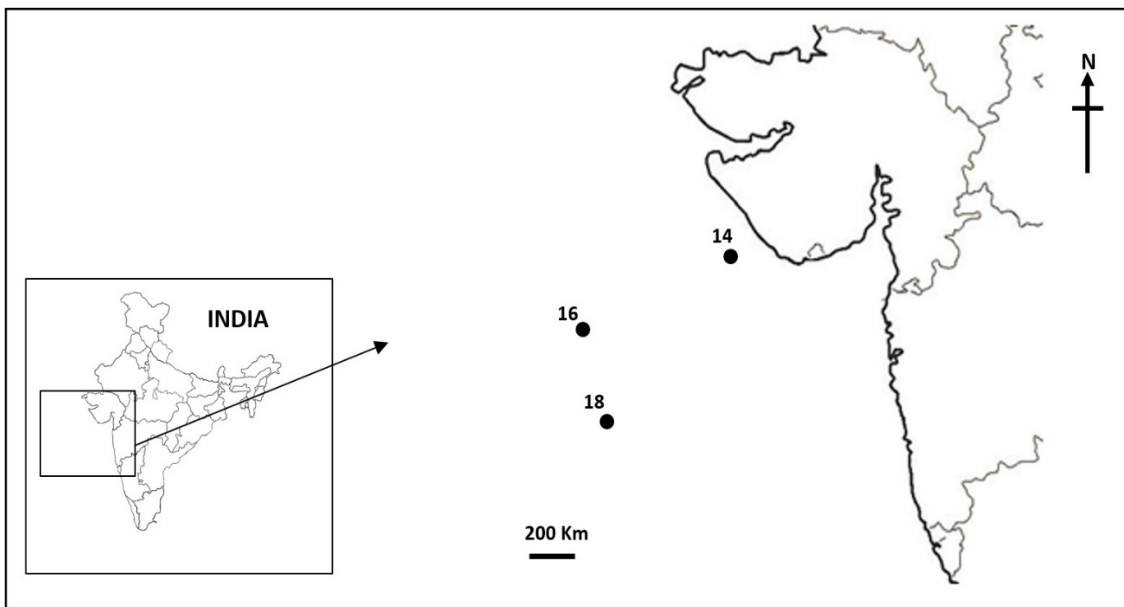
Steuer A. (1928) Über eine neue *Paracineta* aus dem Südatlantik. *Sitzungsberichte der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe. Wien*. 137, 297–301.

**Legends for the figures:**

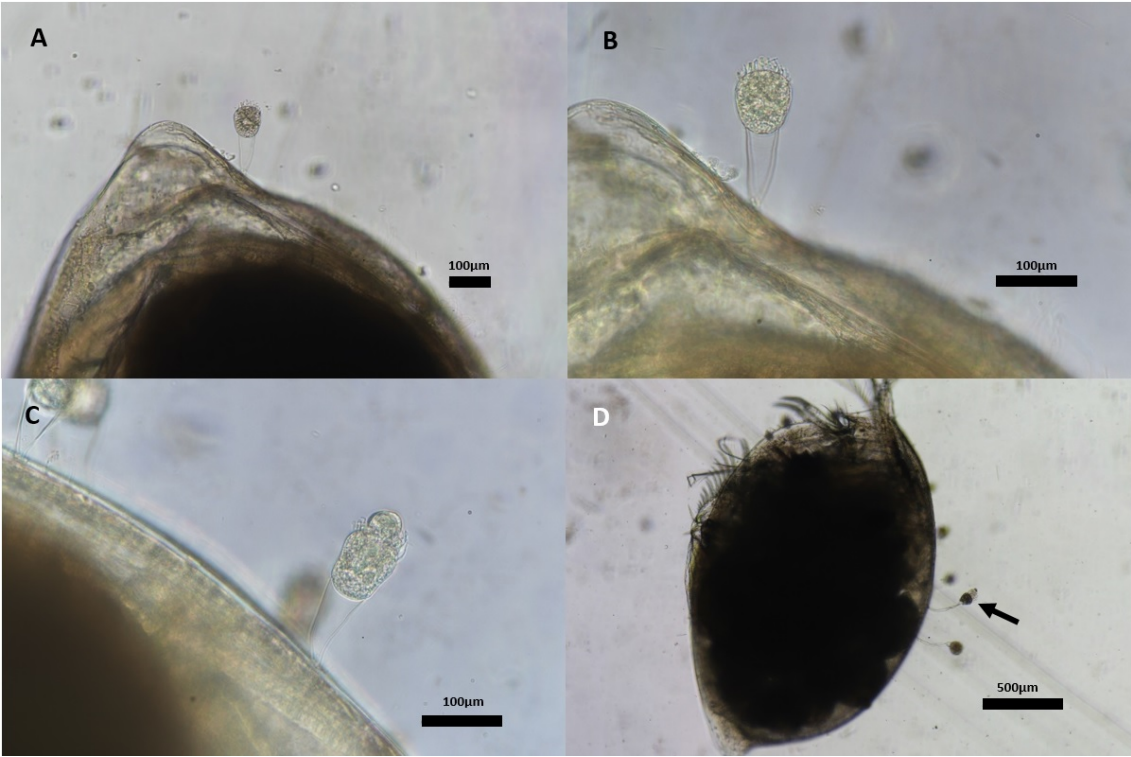
**Fig. 1.** The map of study area.

**Fig. 2.** A–C. *Paracineta karunakarani* Santhakumari, 1986; D. *Ephelota gemmipara* (Hertwig, 1876) on the ostracod host *Cypridina dentata* (Müller, 1906) .

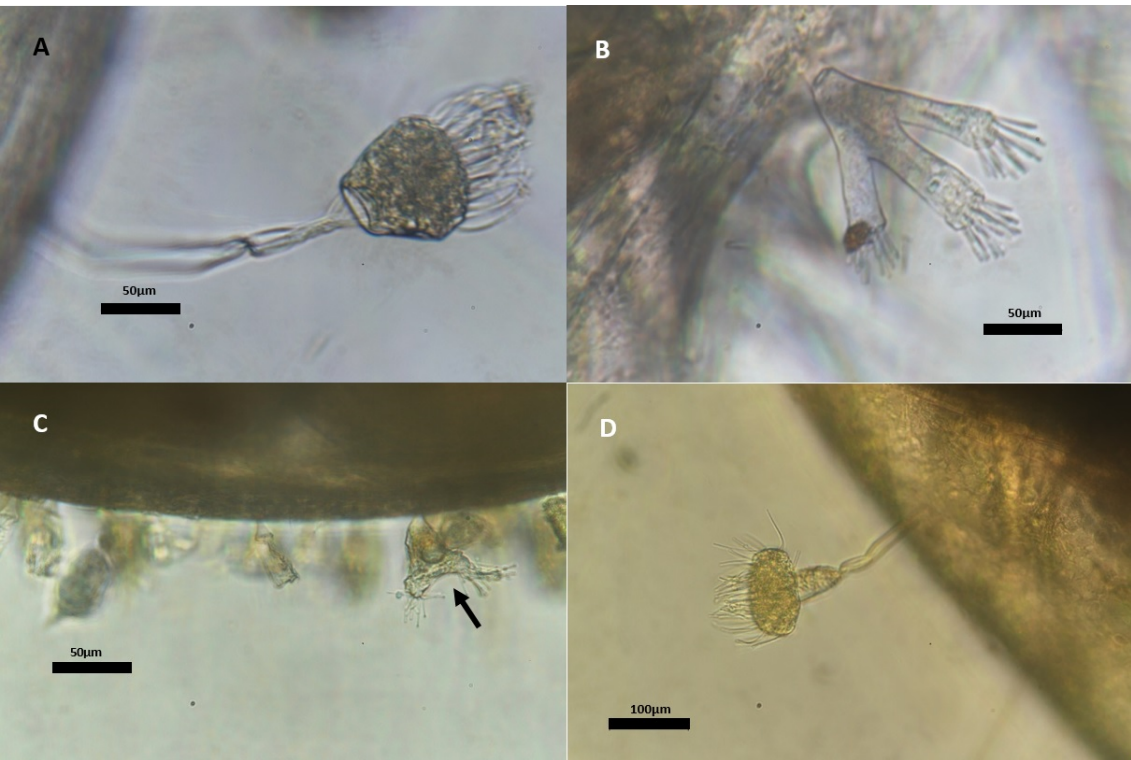
**Fig. 3.** A. *Ephelota gemmipara* (Hertwig, 1876); B. *Lecanophryella satyanandani* (Santhakumari, 1986); C. *Acineta foetida* Maupas, 1881; D. *Pelagacineta* sp.



**Fig. 1**



**Fig. 2**



**Fig. 3**