

**Author Version:** *Cah. Biol. Mar.*, vol.58; 2017; 59-73

**Description of two new apseudomorphan Tanaidacea (Crustacea: Malacostraca: Peracarida) from the Kochi Backwaters, India**

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**Abstract**

Two new species of apseudomorphan tanaidaceans, *Pagurapseudopsis kochindica* and *Ctenapseudes indiana* are described as new to science. Specimens used in this study are based on an extensive sampling (79 locations) in the Kochi Backwaters during the Southwest monsoon and post-Southwest monsoon periods. A total of 109 individuals of *P. kochindica* and 180 individuals of *C. indiana* were examined. *P. kochindica* and *C. indiana* are distinguished from all the known species of their respective congeners by the structure and shape of cheliped.

**Résumé**

Deux nouvelles espèces de tanaidaceans apseudomorphan, *Pagurapseudopsis kochindica* et *Ctenapseudes indiana* sont décrites comme nouvelles pour la science. Spécimens utilisées dans cette étude sont basés sur un échantillonnage vaste (79 emplacements) dans les Backwaters Kochi pendant les périodes de mousson sud-ouest et Post-Ouest Monsoon. Un total de 109 individus de *P. kochindica* et 180 individus de *C. indiana* ont été examinés. La nouvelle espèce se distingue de toutes les espèces connues de leurs congénères respectifs par la structure et la forme de chélipède, nombre d'articles dans l'antenne, antennules et endopodes uropodes.

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**Key words:** Tanaidaceae, new species, *Pagurapseudopsis*, *Ctenapseudes*, Kochi Backwaters

## Introduction

Tanaidaceans represent an order of benthic crustaceans with limited dispersal (Bamber, 1998). They are predominantly marine, though a very few inhabit the freshwater habitats as well. More so is the case of Indian waters wherein even the taxonomic details of tanaidaceans are rare and, therefore, the taxonomic resolution of this group from this region remain only to the order level.

(Lang, 1970) reassigned the genus *Pagurapseudopsis* within the super family Apseudoidea. (Guțu 2006) formed family Pagurapseudopsidae. The morphological characters of *Pagurapseudopsis* require correction to the diagnosis based on the number of pleopods, considering that *P. ironica* has only two pairs of pleopods. While in *P. gracilipes*, *P. gymnophobia* and *P. ironica*, the differentiating morphological features are distinctive, such characters are not demonstrated by *P. gymnophobia ceylonica*. (Barnard, 1935) and (Băcescu, 1981) failed to confirm whether *P. g. ceylonica* is either a subspecies or a separate species, or is indeed synonymous with *P. gymnophobia*. The genus *Pagurapseudopsis* comprises five species (Anderson, 2013) and the present study introduced the sixth species to this genus.

Another member of the genus *Ctenapseudes* (= *Apseudes*) *chilkensis* was previously described from Chilka Lake located on the northeastern coast of India (Chilton, 1924). (Chilton, 1926) renamed *Apseudes sapensis* as *Ctenapseudes sapensis* based on specimens collected from Songkhla lagoon of Thailand. (Barnard, 1935) re-examined the specimens and compared them with other specimens collected from India, concluding that *A. chilkensis* has two forms: *A. chilkensis* and *A. sapensis*. (Bamber *et al.* 1996) designated the *Ctenapseudes* based on the new species *Ctenapseudes extravaganza*. (Bamber *et al.*, 1996), collected from Sri Lanka. At present the genus *Ctenapseudes* comprises of three species (Anderson, 2013) the present species is fourth member to this genus.

## Materials and Methods

### Study Area

The Kochi Backwaters is a large, shallow, monsoonal estuary situated from 9°40' to 10°12' N and 76°10' to 76° 30' E, along the south west coast of India. It is approximately 80 km long with its width varying from 0.5 to 4km in different regions. The estuary is connected to the Arabian Sea through a channel of about 450 m wide at Kochi and a relatively smaller opening at Azhikode. Kochi backwaters form the largest monsoonal estuary along the west coast of India, receiving freshwater inflow from seven rivers (Vijith *et al.*, 2009). As the rivers bring enormous volume of freshwater during the Southwest monsoon (July-August), the Kochi Backwaters transforms into a freshwater lake except near the inlet region (Jyothibabu *et al.*, 2006). Conversely, during the non-monsoon period, low freshwater inflow of rivers allows active salinity incursion and, as a result, the

downstream of the Kochi backwaters behaves as an extension of the adjacent Arabian Sea (Madhupratap, 1987; Qasim, 2003; Jyothibabu et al., 2006).

### **Sampling method**

Benthic sediment samples were collected using a VanVeen Grab (0.04m<sup>2</sup>) sampler from 79 stations along the salinity gradients in the Kochi backwaters (Figure 1), during the Southwest Monsoon and the Post-Southwest Monsoon period. The water depth and salinity at each sampling location was measured using a Conductivity Temperature Depth (CTD) Profiler (SEA-BIRD). Sediment samples were rinsed over a standard sieve (0.5mm mesh) and the macrofauna present was separated and preserved in a 5% rose bengal-formaldehyde solution. Subsamples of sediments were collected and placed in plastic bags for the sediment texture analyses using laser diffraction particle size-analyser (McCave & Syvitski, 1991). Tanaidaceans in the preserved samples were separated and stored in polythene sample vials at room temperature until detailed microscopy analyses were undertaken. The identification of the specimens were based on standard literature (Holdich & Jones, 1983; Guṭu 2006; 2008). Body length was measured from the tip of the cephalothorax to the apex of the pleotelson. The type specimens are deposited in the reference collection of the Indian Ocean Biological Centre (IOBC), National Institute of Oceanography, Regional centre-Kochi, India.

### **Results**

From the 79 stations in the in the Kochi backwaters, a total of 109 individuals of *Pagurapseudopsis* sp. nov. (57 male, 42 female and 10 juveniles) and 180 individuals of *Ctenapseudes* sp. nov. (72 male, 38 female and 70 juveniles) were analyzed. The detailed descriptions of the new species are given below.

### **Systematics**

Order Tanaidacea Dana, 1849

Suborder Apseudomorph Sieg, 1980

Family Pagurapseudopsididae Guṭu, 2006

Genus *Pagurapseudopsis* Shiino, 1963

***Pagurapseudopsis kochindica*** sp. nov. Pandiyarajan and Biju

(Figs 2 - 5)

### **Diagnosis**

Body sub-cylindrical, dorsoventrally flattened. Carapace palmette shaped, long, with a short and blunt bifurcate rostrum. Pereon with six free pereonites, two lateral notches present at fourth to sixth pereonites. Antennule flagella inner with eight articles, outer broader than the inner with 16 articles. Antenna with five

articles. Labrum concave in front with number of slender setae on the anterolateral edges. Labium deeply incised with oval lobes, with marginal setae and apically with two small spines. Male cheliped having tubercles on carpus, merus and basis but tubercles are absent in female cheliped. In male and female, claw of propod of cheliped lacking dentacles. Absence of tuberculiform processes on pereopods. Uropods filiform, biarmous with slender exopod composed of 8-9 articles and endopod with 18-19 articles.

### **Materials examined**

**Holotype:** Female with 4-8 embryo (7.3 mm), dissected, (Indian Ocean Biological Centre (IOBC) 0510-10-50-2015), Station 4, depth 6m, 01.08.2014, Kochi backwaters.

**Allotype:** Male (7.0 mm) (IOBC 0510A-50-2015), 01.08.2014.

### **Paratypes**

Southwest Monsoon: Three males, five females, station 4; two males, five females, station 8; three males station 12; four males, one female, station 18; two males, station 19; one male, two females, station 22; three males, station 23; one juvenile, station 24; one female, station. 27; two males, one juvenile, station 35; three juveniles, station 38; one male, station 45; two males, station. 50; two males, three females, one juvenile, station. 74; three males, one female, station 76; one male, station 14; one male, station 19; one male, station 30; one male, station 39; one male, station 71.

Post- Southwest Monsoon: Two males, station 9; two males, station 10; two males, station 21; two males, station 38; two males, station 40; two males, station 46; two females, station 54; two females, station 74; two females, station 76; three females, station 42; two males, three females, station 56; two juveniles, one female, station 57; two males, five females, two juveniles, station 58; three males, five females, station 77; five males, one female, station 78.

### **Description of species**

Holotype (female): Body sub-cylindrical, dorsoventrally flattened, about 7.3 mm in length with small setae on dorsal surface and edges (Fig 2A). Carapace palmette shaped, long, with a short and blunt bifurcate rostrum having fine setae on surface; anterolateral edge with 3-4 notches on each side; ocular lobes large, closely attached with carapace. Pereon with six rectangular free pereonites, first shortest, distinct from the carapace, 3.0 times as wide as long; pereonites 2 to 6 respectively 2.5, 1.8, 1.5, 1.6 and 1.7 times as wide as long, 2 and 3 with antero-lateral notch, 4 to 6 with two lateral notches, fourth is longer and more square than other five; third, fifth and sixth are almost equal in length, and longer than first. Pleon with five short, subequal, laterally triangular pleonites, combined length of pleonites 1 to 5 subequal to that of pereonites 5 and 6 combined; pleotelson as long as wide, slightly longer to that of pleonites 4 and 5 combined, with lateral lobes and apex shortly cleft.

Antennule: article 1, slender and long but shorter than carapace length, with small setae on lateral edges; article 2 2.5 times as shorter than article 1, but 1.8 times as long as article 3; article 4 shorter than broad, accessory flagellum with 8 articles; main flagellum with 16 articles with fine setae (Fig 2B). In juvenile of body length 3.7mm, antennular outer flagellum about two times as long as inner flagellum.

Antenna: half as long as antennule, composed of five peduncular articles, together slightly longer than the flagellum; article 1 short, but wider than the succeeding article, slightly produced at its inner distal angle, with six plumose setae on inner edge, outer with five; article 2 slightly longer than first article, but 1.5 times as shorter than article 4, with four setae on inner edge; article 3, 3.3 times as shorter than article 2 with two plumose setae on inner edge; article 4 longer than other article, with four setae on inner edge; article 5, thin slightly shorter than article 4, with two setae on inner distal edge, and two setae on outer distal edge; flagellum has six segments with three distal setae on the terminal segment (Fig 2C).

Labrum: concave in front, with number of slender setae on anterolateral edges (Fig 2D).

Mandible: triarticulated, with long lateral setae, article 1 and 3 subequal, but shorter than article 2; article 1 with nine long setae; article 2 and 3 bearing numerous short and long setae, tip of article 3 bearing six long setae (Fig 2E). Pars incisiva on the right with five denticles. Pars incisiva and lacinia mobilis on the left with six and five denticles, respectively (Fig 2F).

Labium: deeply incised with oval lobes, with marginal setae and apically with two setiform spines (Fig 2G).

Maxillule: with palp having two articles, last article thin and twice as long as article 1, terminating in five long setae; outer endite with eight blunt terminal spines; inner endite with four branching setae and one ciliate setae on distal edge (Fig 2H).

Maxilla: broad, outer lobe of movable endite bearing six long pinnate setae; inner lobe of movable endite with dense sickle shaped setae and one ciliate setae; outer lobe of fixed endite with five forked setae, two pinnate setae; inner lobe of fixed endite with one row of ten ciliate setae (Fig 2I).

Maxilliped: broad with small rectangular basis, longer than wide, with four plumose setae on outer edge; palpus with four articles; article 1 short and wide with one plumose setae on outer edge; article 2 large, inner edge with numerous simple setae and outer edge denticulated, with two distal setae; article 3, 1.5 time as short as article 2, wider distally, five long setae on inner distal end; article 4 smaller than others with seven distal setae on inner edge. Endite with four small blunt setae and five simple setae on rostral margin and five basally swelled distally setulate setae and two coupling hooks on median edge (Fig 3A).

Epignath: cup shape, with strong bent spine bearing fine setulose setae on distal end (Fig 3B).

Cheliped: setose, margin of sub-oval basis with numerous long setae. Exopodite reduced with two articles bearing to distal plumose setae; merus small, 1.5 times as long as wide, with 17- 19 simple setae on tergal edge; Carpus longer than basis and merus, 2.5 times as long as wide; tergal and sternal edge respectively with 18 and 21 simple setae; propodus slightly shorter than carpus with robust fixed finger with 29 sternal edge and 32 simple setae on tergal edge; unguis cutting edge with eight spiniform serrate setae and small tubercle; dactylus subequal to propodal finger with eight strong serrate setae and small tubercle, unguis slightly longer than that of propodus (Fig 3C).

Pereopod 1: exopodites slender with three plumose setae; basis 5.5 times as long as width, with numerous simple setae on both edge; ischium wider than long; with simple setae on both edge merus slightly shorter than carpus, with numerous simple setae on both edge; carpus three times as longer than width, both edge with numerous long simple setae; propodus longer than carpus, with eight robust setae on the sternal edge, four on the tergal edge, one long simple setae and one microstructure on distal edge; dactylus thin and long (Fig 3E).

Pereopod 2: long, slender with cylindrical articles; basis 4.5 times as long as wide; ischium short, wider than long, merus shorter than carpus, about two times as long as width; carpus slightly smaller than propodus, three times as long as wide; propodus with seven robust setae and one simple setae on sternal edge, two robust setae and one simple setae on tergal edge, distal edge with two long setae; dactylus long and robust (Fig 4A).

Pereopod 3: slightly shorter and narrower than pereopod 2; basis 4.3 times as long as width; ischium short same as long as width; merus shorter than carpus, about 1.7 times as long as width; carpus longer than propodus, sternal edge with three simple setae and four strong setae; propodus 4.6 times as long as width, with five robust setae on sternal edge, two simple setae on tergal edge and one microstructure and one long setae on distotergal end; dactylus thin and long (Fig 4B).

Pereopod 4: long, slender with cylindrical articles; basis 4.5 times as long as width; fine numerous setae on tergal edge and one fine setae on sternal edge; ischium short, wider than long; merus slightly longer than ischium, with five strong setae on sternal edge and two long setae on disto tergal edge; carpus slightly longer than propodus, 4.2 times as long a width, eight strong setae and two simple setae on sternal edge, six long setae on tergal edge; propodus 4.8 times as long as width, four robust setae on sternal edge, four strong setae and one microstructure on distotargal edge; dactylus thin and long (Fig 4C).

Pereopod 5: subequal in size and similar to pereopod 4, except for the lack of microstructure on the distotargal edge of propodus (Fig 4D).

Pereopod 6: basis long, 4.3 times as long as width; ischium short, wider than long; merus about two times as longer than width; carpus longer than merus with four strong setae and 11 simple setae on sternal edge, six simple setae and one strong setae on tergal edge; propodus subequal to merus, five robust setae and two simple setae on sternal edge, four long setae on tergal edge, four simple setae on distotergal edge; dactylus thin, with curved unguis (Fig 5A).

Pleopod: five pairs, slender, biramous covered with subequal rami, bearing long plumose setae all around (Fig 5B-D).

Uropods: filiform, biarmous; basis longer than width, with numerous simple setae on both edges. Exopod slender composed of 8-9 articles and endopod with 18-19 articles (Fig 5E).

#### **Allotype (male):**

Body more setose narrower than female, about 7.0 mm in length. Cheliped of male are stronger than that of female. Cheliped (Fig 3D) setose, basis round with long setae everywhere, two small tuberculiform processes on anterosternal edge. Exopodite 2 articulated, with two plumose setae. Merus small, with numerous setae and two small tuberculiform processes on sternal edge. Carpus longer than merus, with three tuberculiform process on sternal edge. Propodus slightly longer than carpus, with robust finger, 20 strong setae on sternal edge, eight simple setae on tergal edge and one claw. Cutting edge with nine strong serrate setae and small tubercle. Dactylus subequal to propodal finger, with seven strong serrate setae and one small tubercle. Claw slightly longer than that of propodus. Pleopods well-developed.

#### **Remarks**

*Pagurapseudopsis kochindica* sp. nov. resembles to *P. ceylonica* (Băcescu, 1981), but it differs in the following features (1) *P. kochindica* sp. nov. rostrum bifurcates with blunt end while in *P. ceylonica* (Băcescu, 1981), rostrum bifurcate with pointed end. (2) *P. kochindica* sp. nov. antenna with 11 segments while that of *P. ceylonica* (Băcescu, 1981), has 10 segments. (3) In female, *P. kochindica* sp. nov., cheliped lacking tubercle while *P. ceylonica* (Băcescu, 1981), a small tubercle present on carpus. (4) In male, *P. kochindica* sp. nov. cheliped having tubercles on carpus, merus and basis, while *P. ceylonica* (Băcescu, 1981), single small tubercle present on carpus. (5) *P. kochindica* sp. nov., claw of cheliped propodus without denticles while that of *P. ceylonica*, claw with three chitinous denticles. (6) Uropodal exopod and endopod with 8-9 and 18-19 articles respectively while in *P. ceylonica*, there are 7 and 16-17 respectively.

The new species also resembles *P. thailandica*, (Angsupanich, 2001), but can be distinguished by the absence of spiniform process on the cheliped carpus of male, absence of tuberculiform process on the pereopod, variations in number of articles on flagellum of antennule, antenna and segment of uropodal exopod and endopod.

### **Body length**

Adult male 6.6 – 7.0 mm (n=57), adult female 7 - 7.3 mm (n=42).

### **Etymology**

The specific name is designated for the city adjacent to the type locality.

### **Ecological note**

Theses tanaidaceans recorded from the Kochi backwaters are euryhaline (0-28) in habit, their optimum salinity was mesohaline (8-15) as they were abundant in this salinity range.

### **Associated fauna**

*Villorita* sp., several genera of polychaetes belonging to *Glycera* sp., *Glycinde* sp., *Capitella* sp., *Prionospio* sp., and *Scolelepis* sp., gastropods and harpacticoid copepods.

Order: Tanaidacea Dana, 1849

Suborder: Apseudomorpha Sieg, 1980

Family: Parapseudidae Guțu, 1981

### **Genus: *Ctenapseudes* Bamber, Ariyananda & Silva, 1996**

In the present specimens, all the diagnostic characters of *Ctenapseudes* described by (Bamber, et al, 1996) are agreeing except cheliped character. In present specimens, female cheliped stout, while in male it is slender, so the present diagnosis of Genus *Ctenapseudes* revised as follows.

Carapace with rostrum without lateral spines, six free pereonites, five free pleonites, first pleonites bearing a dorsal row of setae, body otherwise sparsely setose; pleotelson pentangular. First antenna bi-flagellates, second antenna with squama. Mandible with triarticulated palp, distal two articles with combs of serrate setae on inner margin; first maxilla with two articulated palp; maxilliped palp four articulated, articles no longer than wide, endite without leaf like spine. Cheliped and first pereopod with exopodite and with rostral row of setae; cheliped stout or slender; first pereopod without spinose apophysis on coxa, flattened densely setose and with sterna apophysis. Five pairs of pleopod with foliaceous, uni-articulated rami. Cheliped sexually dimorphic.

***Ctenapseudes indiana* sp. nov.** Pandiyarajan and Biju

(Figs 6-8)

### **Diagnosis**

Body dorsoventrally flattened. Carapace barrel shaped with acute sharp triangular rostrum, eyes present. Pereon with free pereonites, pleon with five short broad triangular pleonites, Pleotelson with numerous fine



long setae, posterior end triangular. Inner antennular flagellum longer than outer flagellum in both sexes. Antenna composed of five peduncular articles. Mandible with triarticulated palp. Maxilliped palp four articulated. Absence of spines on outer edge of article 2 of maxilliped palp. Ischium of pereopod 2 bearing a sternal spine. Female cheliped stout, but in male it is thin. Cutting edge of fixed finger of cheliped bearing seven conical teeth distally in both sexes. Uropodal exopod with 10-11 articles and exopod with 38-40 articles.

### **Materials Examined**

**Holotype:** Female (7.5 mm), dissected, (IOBC 0511-10-50-2015), station 4, depth 6m 05.08.2014, Kochi backwaters.

**Allotype:** Male (8.0 mm) (IOBC 0511A-10-50-2015), 05.08.2014.

### **Paratypes**

Southwest Monsoon:-Two males, four females, station 4; eleven males, station 8; two males, station 12; one female, station 14; six females, station. 18; two males, five juveniles station 19; one male, one female, station 27; two juveniles, station 35; four males, two females, three juveniles, station 38; one male, station 40; one female, station 43; one male, ten juveniles, station 44; one male, station 45; one male, station 60; two males, three females & five juveniles station 74; two males, four females station 76.

Post- Southwest Monsoon:- one male, station 6, 12, 13, 16, 24, 39, & station 40; two males, station 17, 30 & station 58; one female, station 33 & 34; two females, station 56; one juvenile, station 21; three males, one female, station 42; one male, one female, two juveniles, station 46; two males, one juvenile, station 54; four males, one juvenile, station 57; four females, two juveniles, station 60; four males, station 71; two males, one female, 18 juveniles, station 74; ten males, two females, three juveniles, station 76; eleven juveniles, station 77; one male, three females, eight juveniles, station 78.

### **Description of species**

**Holotype (female):** Body dorsoventrally flattened, about 7.5 mm in length. Carapace barrel shaped, 1.2 times as wide as long, with acute triangular rostrum; ocular lobes distinct anterolaterally produced; pereon with six free pereonites, 1-6 pereonites respectively 2.5, 2.8, 1.8, 1.3, 1.2 and 1.3 times as wide as long, laterally smooth, with very fine setae at anterior corners. Pleon with five short, broad, laterally triangular pleonites and pleotelson; pleonites 1-5 more or less equal in length, pleonite 1 with transverse row of small and dense plumose setae mid-dorsally; pleonites 1-4 bear short plumose setae on lateral margins; pleotelson 1.4 times as long as wide, with numerous fine plumose setae on lateral edge; posterior end triangular (Fig 6A).

**Antennule:** article 1 of peduncle about 2.2 times as long as wide, with four simple setae on outer edge, three simple setae on inner edge and four simple setae on distosternal edge; article 2 about 0.5 times the length of

article 1 and about three times as long as article 3; with three simple setae on outer edge and four simple setae on distal part of outer edge; article 3 short, same as long as width, with three simple setae on distal part of the outer edge and one simple setae on distal part of inner edge; article 4 short, with a simple setae on inner edge, inner flagellum with 17-19 articles outer with 19-25 articles, outer flagellum about 1.3 times as long as inner flagellum (Fig 6B).

Antenna: subequal in length to peduncle of antennules, composed of five peduncular articles, together slightly longer than flagellum; article 1 of peduncle short, with median projection terminating sharp tooth on inner distal angle; article 2 slightly longer than article 5, bearing squama with five long setae; article 3 shortest, slightly wider than long, with small setae on distal part of inner edge; article 4 1.8 times as short as article 5, with one simple setae on distal part of inner edge; article 5, 2.3 times as long as width, with one simple setae on inner edge, flagellum eight articulated; article 1 with four long simple setae on outer edge and two short simple setae on inner edge (Fig 6C).

Labrum: apex convex, with three tufts of fine setae on anterior margin (Fig 6D).

Mandible: palp stout, triarticulated; article-1 short with four long setae on inner edge; article 2 bearing ten long setae and comb of short spines on sternal edge, and two long setae on anterotergal edge; article 3 with comb of short spines on sternal edge and four long setae on tip; molar process distally with grinding surface; pars incisive and lacinia mobilis with four denticles, five accessory setae on setiferous lobe (Fig 6E).

Labium: terminal lobe bearing two apical setiform spines and dense setae on lateral and medial margins (Fig 6F).

Maxillule: palp two articulated, article 2 slightly shorter than first, with six unequal setae; outer endite with five blunt terminal spines and two subapical plumose setae; inner endite with three branching and four ciliate setae on distal edge (Fig 6G).

Maxilla: outer lobe of movable endite with five long pinnate setae; inner lobe of movable endite with five long pinnate and three sickle shaped setae; outer lobe of fixed endite with four forked and two pinnate setae; inner lobe of fixed endite with row of six ciliated setae and another row of 12 ciliate setae (Fig 6H).

Maxilliped: basis slightly wider than long, palp of four articles, article 1 short and wide; article 2 largest, without spines, 11 simple setae on inner edge and five simple setae on distal outer corner;

Article 3 much smaller than article 2, triangular with many long and short simple setae on inner edge; article 4 very small, with seven simple setae on distal end; endite with four coupling hooks on inner side, row of nine spine on rostral side (Fig 6 I-J).

Epignath: cup shaped, with strong spine bearing fine setulose setae near tip (Fig 6K).

Cheliped: triarticulated exopodite, distal article with four plumose setae; basis narrow swollen distally, 2.5 times as wide; merus small, about two times as long as wide, with two tergal setae; carpus slightly longer than basis, about 2.5 times as long as wide, with ten simple setae on sternal edge; propodus shorter than carpus, slender fixed finger, distally square, with 11 strong setae on sternal edge and short claw, cutting edge of fixed finger with row of seven robust setae; dactylus slightly longer than fixed finger, claw longer than that of fixed finger (Fig 7A).

Pereopod 1: triarticulated exopodite, with six plumose setae on distal article; basis about 2.7 times longer than wide, one simple seta on distosternal edge; ischium short, wider than long, with three simple distosternal setae; merus equal in length to carpus, with 14 setae on sternal edge and one stout distosternal stout spine; carpus distotergal expanded, with numerous long simple setae on both margins, and with one long distotergal and two sternal stout spine; propodus narrower than carpus, with numerous long seta on both margins, with two sternal stout spines; dactylus short, about as long as adjacent spines, with some sternal denticles, and very small claw (Fig 7B).

Pereopod 2: basis 2.3 times as long as wide, subequal to combined length of ischium, merus and carpus; with two plumose setae on tergal edge and two simple distosternal setae; ischium short, wider than long with one sternal spine and two simple setae; merus shorter than carpus, with distosternal spine and 11 simple setae; carpus about two times as long as wide, with three long spines and 12 simple setae on sternal edge and six tergal setae; propodus about three times as long as wide, with two sternal spine and eight sternal setae, nine simple setae on tergal edge and three long distal setae; dactylus with claw shorter than propodus (Fig 7C).

Pereopod 3: slightly shorter and narrower than pereopod 2, basis swollen, 2.2 times as long as wide; ischium short, same as long as wide, with seven simple setae on sternal edge; merus about two times as short as carpus, with one long sternal spine and seven simple setae; carpus 2.8 times as long as wide, with one small distotergal spine and three long distotergal setae, sternal edge bearing two spines and eight long setae; propodus about three times as long as wide, with five long setae on sternal edge, and three irregular spines and three long setae on distal part; dactylus with claw same as long as propodus (Fig 7D).

Pereopod 4: basis swollen, 3.3 times as long as wide, with one simple distosternal setae; ischium small, wider than long, with three long distosternal setae; merus about 1.6 times as short as carpus, with seven simple sternal setae, three distosternal setae and one distotergal setae; carpus with nine simple sternal setae, three long distosternal setae and one simple setae on distotergal edge; propodus slender, shorter than carpus, with three simple sternal setae and three long setae and three spines on distal end; dactylus with its claw slightly shorter than propodus (Fig 8A).

Pereopod 5: similar size to pereopod 4; but basis more swollen, four times as long as wide; ischium short, wider than long, with three distosternal setae; carpus 1.3 times as long as propodus, with ten long setae and

one small distosternal spine; propodus slender, with five long setae and one spine on sternal edge, and six long setae on distal end; dactylus slightly shorter than propodus (Fig 8B).

Pereopod 6: basis swollen, 2.2 times as long as wide, with one plumose setae and one small simple setae on sternal edge; ischium short, wider than long, with three long distosternal setae; merus slightly longer than wide, with six sternal setae and two tergal plumose setae; carpus about 2.3 times as long as merus, 2.6 times as long as propodus; with two sternal spine, ten sternal setae and six simple tergal setae; propodus about 1.5 times as long as wide, with five simple setae on sternal edge, five long setae and three short fine setae on distal end; dactylus shorter than propodus (Fig 8C).

Pleopods: biarmous, five pair, all similar, with oval rami, bearing long plumose setae; endopodites longer than exopodites (Fig 8D).

Uropods: filiform, biramous; basis longer than wide, slightly produced inner proximal edge bearing four simple setae, outer edge with four plumose setae; endopod about 4.2 times as long as exopod; exopod with 10-11 articles; exopod with 38-40 articles (Fig 8E).

#### **Allotype (male):**

Body more setose than female, about 8 mm in length. Antennule and antenna similar to female. Antennular outer flagellum longer than inner flagellum. Cheliped (Fig 7E) thin, exopodite triarticulated, with five plumose setae on distal article; basis about two times as long as wide, with two small simple setae on sternal edge and two setae on distosternal edge; merus short, about two times as long as wide, with ten sternal setae; carpus longer than basis and propodus, about 3.5 times as long as wide; with 12 strong setae on sternal edge; propodus shorter than carpus, with 11 strong setae on sternal edge; fixed finger slender, cutting edge with seven tooth like processes; dactylus slightly longer than fixed finger. Pereopods 1-6 similar to those of female. Pleopods well-developed similar to those of female.

#### **Remarks**

*Ctenapseudes indiana* sp. nov. morphologically similar to *Ctenapseudes sapensis* (Chilton, 1926), but distinguished by following characters: (1) the inner antennular flagellum in both sexes of *Ctenapseudes indiana* sp. nov. is longer than outer flagellum while in *Ctenapseudes sapensis* (Angsupanich, 2010), female antennular flagellum is subequal. In *Ctenapseudes sapensis* Angsupanich, 2010, inner flagellum with 15–16 articles, and outer with 11–13 articles. But in *Ctenapseudes indiana* sp. nov., inner flagellum with 19-25 articles; outer flagellum with 18-19 articles (2) *Ctenapseudes indiana* sp. nov., female cheliped stout while that of male thin whereas in *C. sapensis* the reverse is true. (3) In new species cutting edge of fixed finger of cheliped bearing seven robust setae, in both sexes, where as *Ctenapseudes sapensis* (Angsupanich, 2010), this type of setae are absent in cutting edge of fixed finger. (4) In new species, article 2 of maxilliped palp without spines on outer

edge, while in *Ctenapseudes sapensis* (Angsupanich, 2010), three stout spines are present in article 2. (5) In new species, ischium of pereopod 2 bearing one sternal spine while this spine is absent in *Ctenapseudes sapensis* (Angsupanich, 2010).

### **Body length**

Adult male 7.4 - 8 mm (n=72), adult female 7.2 – 7.5 mm (n=38).

### **Etymology**

The species is named for India, the country where the specimens were collected.

### **Ecological note**

Theses tanaidaceans recorded from the Kochi backwaters are euryhaline (0-28) in habit, their optimum salinity was mesohaline (8 - 15) as they were abundant in this salinity range.

### **Associated fauna**

*Villorita* sp., several genera of polychaetes belonging to *Glycera* sp., *Glycinde* sp., *Capitella* sp., *Prionospio* sp., and *Scolecopsis* sp., gastropods and harpacticoid copepods.

### **Acknowledgements**

The authors thank Director, National Institute of Oceanography, India for the facilities and constant support. The authors express their gratitude to CSIR for financial support to the Institutional project 'OCEANFINDER'. We thank Dr. Magdalena Błażewicz-Paszkowycz and Mr. Piotr Józwiak, Department of Invertebrate Zoology & Hydrobiology, University of Lodz, Poland for helping in species identification. We thank anonymous reviewers for the critical review, which has helped to increase quality of the paper considerably. This is NIO contribution.

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### Figure Legends:

Figure 1. Map representing sampling locations in Kochi Backwaters where sediment samples were collected during the Southwest monsoon and post-Southwest monsoon periods.

Figure 2. *Pagurapseudopsis kochindica* sp. nov. holotype. Female: (A) body, (B) antennule, (C) antenna, (D) labrum, (E) Mandible, (F) left pars incisiva & lacinia mobilis, (G) labium, (H) maxillule, (I) maxilla.

Figure 3. *Pagurapseudopsis kochindica* sp. nov. holotype. Female: (A) maxilliped, (B) epignath, (C) Female cheliped, (D) Male Cheliped, (E) pereopod I.

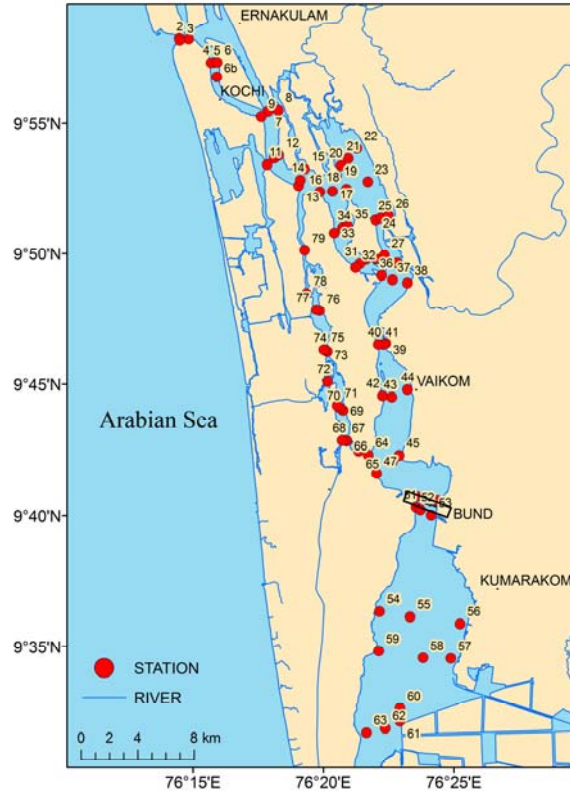
Figure 4. *Pagurapseudopsis kochindica* sp. nov. holotype. Female: (A) pereopod II, (B-D) pereopods III-V.

Figure 5. *Pagurapseudopsis kochindica* sp. nov. holotype. Female: (A) pereopods VI, (B) pleopod I, (C) pleopod III, (D) pleopod V, (E) uropods.

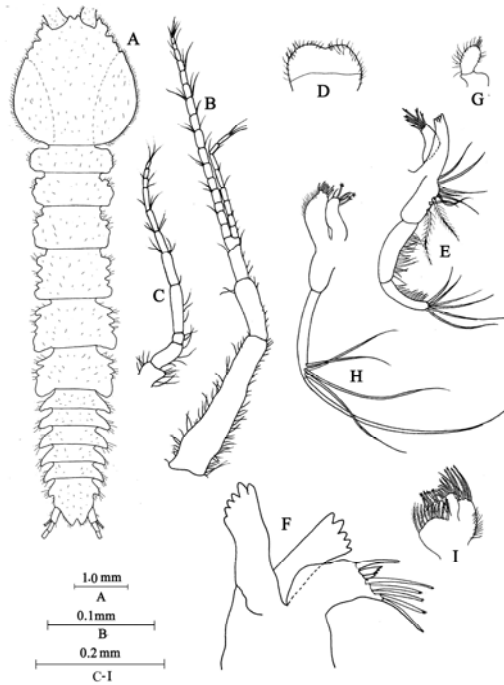
Figure 6. *Ctenapseudes indiana* sp.nov. holotype. Female: (A) body, (B) antennule, (C) antenna, (D) labrum, (E) mandible, (F) labium, (G) maxillule, (H) maxilla, (I) maxilliped, (J) endite, (K) epignath.

Figure 7. *Ctenapseudes indiana* sp.nov. holotype. Female: (A) cheliped, (B) pereopod I, (C) pereopod II, (D) pereopod III; allotype. Male: (E) cheliped.

Figure 8. *Ctenapseudes indiana* sp.nov. holotype. Female (A) Pereopod IV, (B) Pereopod V, (C) Pereopod VI, (D) Pleopod, (E) uropod.

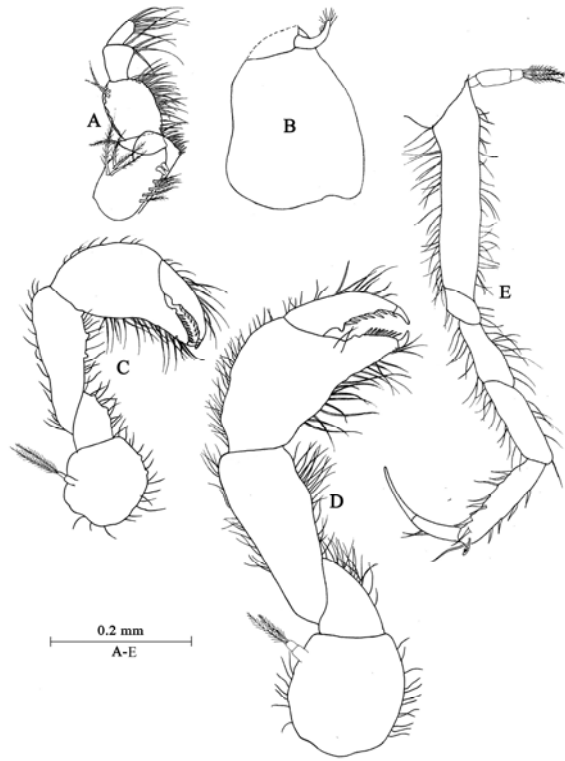


**Fig.1.**

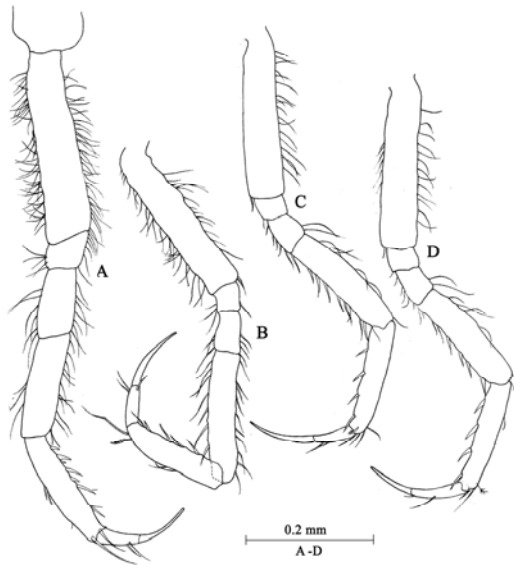


**Fig.2.**





**Fig.3.**



**Fig.4.**

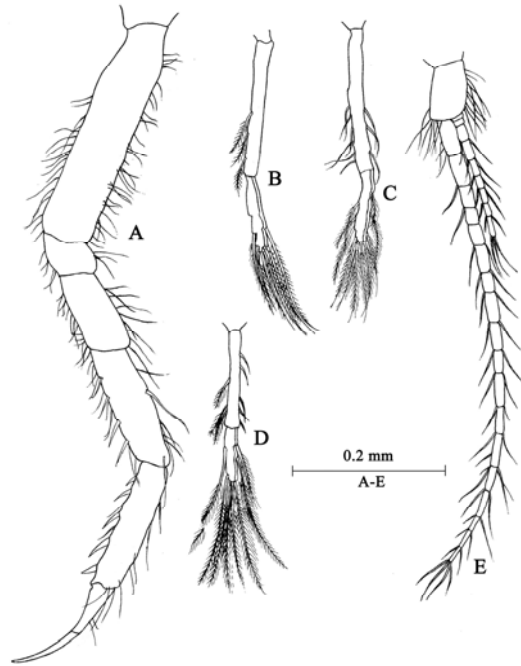


Fig.5.

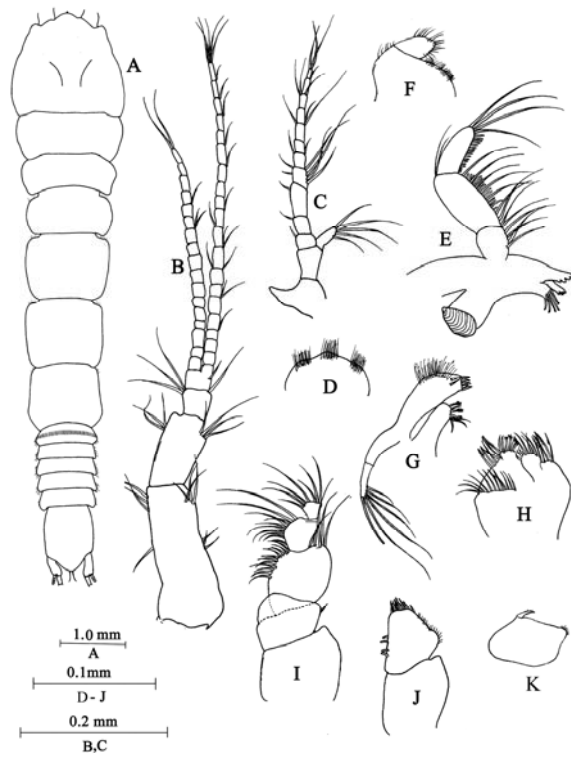
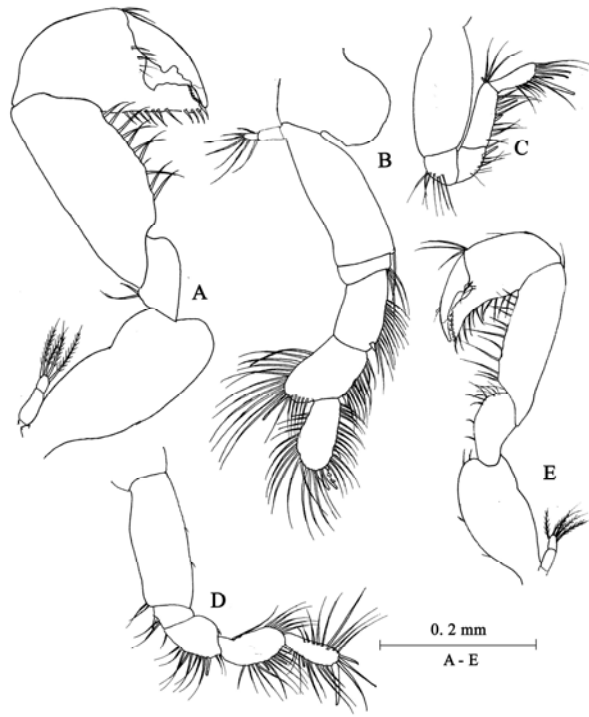
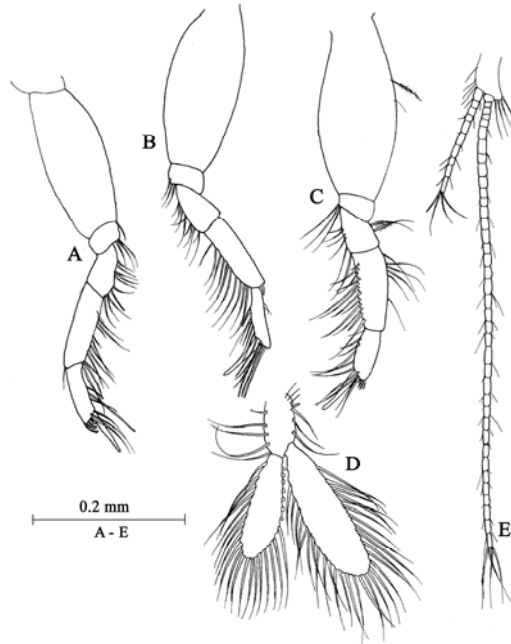


Fig.6.



**Fig.7.**



**Fig.8.**