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COPEPOD PARASITES OF SNAPPERS, *LUTJANUS SPP* (PISCES, LUTJANIDAE) WITH DESCRIPTION OF A NEW CALIGID COPEPOD, *CALIGUS RIVULATUS SP NOV* (COPEPODA, CALIGIDAE) FROM VISAKHAPATNAM COAST, INDIA

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ABSTRACT

Five species of copepods were obtained during a survey of copepod parasites from Snappers, *Lutjanus* (Pisces: Lutjanidae) of Visakhapatnam Coast, India. Of these five species, four are redescriptions and one new species is obtained and described in detail. The redescriptions are of (*Caligus asperimanus* Pearse, 1951; *C. Robustus* Bassett-Smith, 1898; *Sagum tuberculatum* Pillai, 1967 and *Hatschekia clava* Kabata, 1991). *Caligus rivulatus sp.nov* is characterized in having a number of special features in its first and second legs when compared to other already described species. The second segment of exopod of first leg bears 3 setae on the inner margin. These setae possess strong spines on the inner margin and plumose on the outer margin. In the second leg the exopod bears a spatula shaped structure in the place of spine. This structure is quite long, 3 jointed and reaches the lateral plumose setae. These are found to be special structures which separate it from other species of *Caligus*.

Key Words: *Lutjanus*, *Caligus Asperimanus*, *C. Robustus*, *Sagum Tuberculatum*, *Hatschekia Clava*, *Caligus Rivulatus*

INTRODUCTION

Lutjanus are commonly known as Snappers and belong to the family Lutjanidae. These are rocky fish and abundantly occur throughout the Indian coast. These fishes are commercially known for their delicacy as food fish and have good quality of proteins and other nutrients. They harbour a wide variety of copepod parasitic fauna. These fishes are usually parasitized by copepods of the family, Caligidae, Acanthosomatidae and Dichelesthidae (Ho, 1963; Ho *et al.*, 2000; Ho and Lin, 2004; Rodriguez, 2004; Yuniar *et al.*, 2007 and Morales *et al.*, 2008). Genus and species identification of parasites have been done with the aid of standard books (Yamaguti 1939, 1954; Pillai 1985; Cressey 1964, 1967, 1970, 1991 and Kabata 1965, 1966, 1968). The genus *Caligus* is a large genotype and is frequently encountered in teleosts and occasionally in elasmobranchs from all over the world. More than 150 species of the genus have been reported. A few noted scientists have reported different species of *Caligus* from India (Gnanamuthu, 1947, 1948, 1950a, 1950b; Kurian 1949, 1961; Rangnekar 1956, 1957, 1959; Rangnekar and Murti 1950; Rangnekar *et al.*, 1953; Redkar *et al.*, 1950; Pillai 1963, 1967, 1969, 1985; Silas and Ummerkutty 1967, Hameed and Pillai 1973 and Pillai and Natarajan 1977). Only two species, *Caligus asperimanus* Pearse, 1951; *C.robustus* Bassett-Smith, 1898 and a new species *Caligus rivulatus* were obtained in the present study however the other species, *C.rotundigenitalis* Yü, 1933; *C. quadratus* Shiino, 1954; *C.chiastos* Lin & Ho, 2003 and *C.epidemicus* Hewitt, 1971 which also parasitizes Lutjanid teleosts (Ho and Lin 2004, 2005; Ho *et al.* 2007 and Venmathimaran *et al.*, 2009) were not obtained.

MATERIALS AND METHODS

100 fishes of *Lutjanus sp.* were collected from harbour and local fish markets of Visakhapatnam during 2008 to 2009. The species available at Visakhapatnam coast are *Lutjanus johnii* Bloch, *L.*

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fulviflamma Forskal and *L. rivulatus* Cuvier. These fishes were brought to the laboratory and examined for copepod parasites. Gills were carefully removed, filaments were carefully teased, and the contents were observed under the stereomicroscope. The collected copepod parasites are fixed in 10% formalin. For the purpose of identification, the parasites were kept in cavity blocks with a few drops of lactic acid for 12-24 hours for clearing. Mouth parts and all appendages were dissected and diagrams are drawn with the aid of Camera lucida (Reis with 4X, 10X, 25X and 40X magnifications). Measurements are given in millimeters unless otherwise mentioned. Photomicrographs were taken under the Nikon compound microscope (40X, 100X). Parasites were preserved and stored in the Museum of Zoology Department, Andhra University, Visakhapatnam (ZDAU).

RESULTS AND DISCUSSION

Five copepod species namely, *Sagum tuberculatum* Pillai, 1967 (Family Acanthosomatidae) and *Hatschekia clava* Kabata, 1991 (Family Dichelesthidae) *Caligus asperimanus* Pearse, 1951; *C. robustus* Bassett-Smith, 1898, *Caligus rivulatus* sp. nov (Family Caligidae) were obtained and are described.

***Sagum tuberculatum* Pillai, 1967 (Figures 1-1B)**

Description. Female. Total body length 3.94. Second antenna flanged by ventral foldings of anterolateral lobes of the cephalothorax, basal segment with one large process, distal with two. Second leg basipod transversely elongated and sparsely spiny. Exopod smaller with a long spine. Endopod with 3 short spines.

Host. *Lutjanus fulviflamma*

Location. Gills

No. of parasites. Two females

No. of hosts infected. One

Discussion. The genus *Sagum* was first erected by Wilson (1913) with the type species *S. flagellatum*. *S. tuberculatum* was erected by Pillai (1967) from *Lutjanus* sp. from India. Pillai did not describe the second leg as he could not observe it. In the present specimen second leg is clear and described.

***Hatschekia clava* Kabata, 1991 (Figures 2-2A)**

Description. Female. Total length 0.73-0.86. Cephalothorax 0.09-0.12 x 0.12-0.17; Genital segment 0.54-0.65 x 0.02-0.15; Abdomen 0.03-0.05 x 0.04-0.05; Egg sacs measure 0.35-0.36 x 0.18-0.19. Second antenna two segmented with long penultimate segment, highly flattened, slender and distal segment curved to a hooked claw.

Host. *Lutjanus fulviflamma* & *L. johnii*

Location. Gills

No. of parasites. 25 females

No. of hosts infected. 15

Discussion. The genus *Hatschekia* was first erected by Poche (1902) with *H. hippoglossi* Kroyer, 1837 as its type species. Later different species of these parasites from various fish hosts were reported. From *Lutjanus* itself, three different species were reported, *H. oblonga* Wilson, 1913; *H. elongata* Redkar et al. 1950 and *H. clava* Kabata, 1991. Present parasites resemble *H. clava* described by Kabata (1991). These were reported from *L. chrysotaenia* from Queensland. This is reported from India for the first time.

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Figure 1: *Sagum tuberculatum* Pillai, 1967; **Figure 1A:** Second antenna;
Figure 1B: Leg-2;
Figure 2: *Hatschekia clava* Kabata, 1991; **Figure 2A:** Second antenna;
Figure 3: *Caligus asperimanus* Pearse, 1951; **Figure 3A:** Second antenna;
Figure 4: *Caligus robustus* Bassette-Smith, 1898, Female; **Figure 4A:** *C. robustus*, Male;
Figure 4B: Second antenna.

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***Caligus asperimanus* Pearse, 1951 (Figures 3-3A)**

Description. Total length 2.18-2.36. Cephalothorax 0.88-0.98 x 0.90-1.11; Genital segment 0.38-0.45 x 0.30-0.31. Abdomen two segmented, first segment shorter than second measuring 0.16-0.17 x 0.14-0.17 and second 0.18-0.21 x 0.13-0.14. Second antenna two segmented, basal segment large with a pair of adhesion pads and distal, short with two short claws and a small naked seta.

Host. *Lutjanus johnii*

Location. Gills

No. of parasites. Three males

No. of hosts infected. One

Discussion. The genus *Caligus* was proposed by Muller (1785) and *Caligus asperimanus* was erected by Pearse (1951) from *Lutjanus analis* (Cuvier). Present parasite resembles *C. asperimanus* in all characters except for a minor difference in the first leg. Endopod is oblong and the terminal setae of exopod bears a rim of setules at the basal region in *C. asperimanus* described by Pearse, but in the present parasites, endopod is rudimentary and setae are uniformly plumosed. Except for these differences the present parasite resembles *C. asperimanus* described by Pearse (1951) in all characters. These parasites were also reported by Cressey (1991) from different species of *Lutjanus*. This is reported from India for the first time.

***Caligus robustus* Bassett-Smith, 1898 (Figures 4-4B)**

Description. Female. Total length 2.28; Cephalothorax 0.90 x 1.15; Genital segment 0.53 x 0.67; Abdomen 0.28 x 0.21. Male. Total length measures: 1.73; Cephalothorax 0.75 x 0.83; Genital segment 0.28 x 0.29; Abdomen 0.16 x 0.15. Second antenna two segmented, basal segment is with one adhesion pad. First leg basipod is large with one short plumose seta in the inner proximal region and vestigial endopod is oblong with two spines.

Host. *Lutjanus fulviflamma*

Location. Gills

No. of parasites. One male and 1 female

No. of hosts infected. One

Discussion. *Caligus robustus* was reported by Bassett-Smith in 1898 from various species of *Caranx*, *Thynnus*, *Megalaspis*, *Bathystoma*, *Paratractoa*, *Neothunnus*, *Lutjanus* etc., from various localities. But it is a common report from various species of *Caranx*. The present parasites resemble *C.robustus* in the body shape, legs and other appendages. Hence are considered as *C.robustus*.

***Caligus rivulatus* sp. nov**

Family CALIGIDAE Dana, 1852

Genus *Caligus* Muller, 1785

Caligus rivulatus sp. nov (Figure 2.1-2.11 and Figure 3.1-3.3)

Material examined.- Seven male parasites from the gills of 5 *L. rivulatus*, collected during 2008-2009. Live colour brown. Only one or two parasites were obtained from each fish. **Holotype.** Male: INDIA: Andhra Pradesh, Visakhapatnam coast, Andhra University Campus, Coll. Sowjanya.P, 14.xii.2008 (ZDAU). **Paratype.** 6 males, INDIA: Andhra Pradesh, Visakhapatnam coast, Andhra University campus. Holotypes and paratypes of the parasites are deposited in the Museum of Department of Zoology, Andhra University, Visakhapatnam, (Collection No. AUMDZ 129) and are further likely to be transferred them to the Zoological Survey of India, Hyderabad.

Male. Total length: 2.36-3.12. Cephalothorax longer than wide, measuring 0.76-0.80 x 0.73-0.90. Frontal lunules large and widely separated. Frontal plate prominent and projecting. Posterior median lobe broad and round. Lateral lobes blunt. Posterior sinuses wide. Genital segment longer than wide, barrel shaped, broad at median, measuring 0.56-0.58 x 0.30. Two lobe like extensions from ventral region on either side of genital segment are present posteriorly. Vestigial fifth legs present as setae. Abdomen single segmented, much longer measuring 0.30-0.44 x 0.16-0.18. Caudal rami longer than wide with

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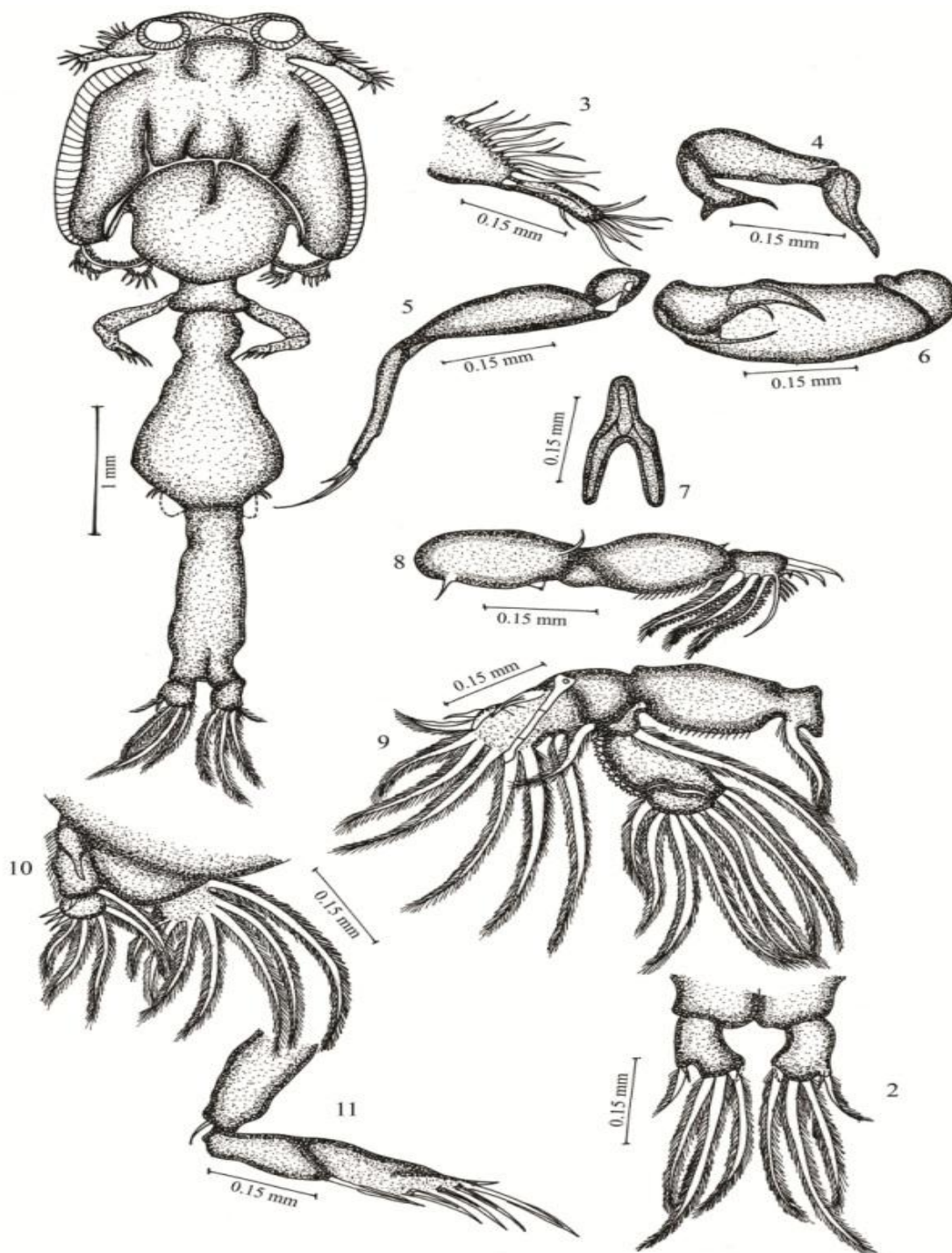


Figure 1: *Caligus rivulatus* sp.nov – Dorsal View; Figure 2: Caudal rami; Figure 3: First antenna; Figure 4: Second antenna; Figure 5: Maxilla; Figure 6: Maxillipede; Figure 7: Sternal furca; Figure 8: Leg-1; Figure 9: Leg-2; Figure 10: Leg-3; Figure 11: Leg-4

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hairy inner surface and measuring 0.20-0.33 x 0.16-0.17. Caudal rami bear four plumose setae and two naked spines. Of the long plumose setae, median seta longer than the other setae. First antenna two segmented, basal segment broad and conical with 13 and distal with 9 naked setae respectively. Second antenna two segmented; basal segment large, bearing a prominent long posterior process, a small median adhesion pad and an outer proximal spine whereas distal segment long and forms a strong claw with a blunt terminus. Maxilla two segmented. Basal segment large and distal long with two unequal claws. The outer claw flanged and much longer than the inner naked claw. Maxilleped two segmented, basal segment large with distal spine and distal curved to a claw with a naked spine. Sternal furca with a triangular narrow base and furca long, diverges from the base and measures 0.12-0.15 x 0.05.



Figure 3: (1: Microphotograph of *Caligus rivulatus* sp.nov (40X); 2: Microphotograph of *C. rivulatus* - Leg-1 (100X); 3: Microphotograph of *C. rivulatus* - Leg-2 (100X))

Leg 1-. Basipod with one proximal and one distal naked setae; vestigial endopod rudimentary. Basal segment of exopod broad with hairy inner margin and short naked spine on the outer distal corner. Distal with three terminal claws which reduce in size towards internal side with a small spine at the middle of the last terminal claw. A terminal long seta present with setules at the base of outer edge. Three long setae present on the inner margin, armed with stout and robust spines on the outer margin and long plumose setae along the inner margin. All spines are of equal size. This character separates the present parasites from all other species of *Caligus* described so far. In general, the setae of exopod segment may be either plumose or naked.

Leg 2. - Exopod bears a long peculiar spatula shaped structure instead of a spine. This structure is long, three jointed and terminal part is lanceolet shaped. It crosses the other two segments reaching the lateral plumose setae. Second spine is smaller when compared with the first structure and is more or less parallel to the external margin of the third segment reaching only half of its length. Third segment bears two dagger shaped or broad spines one below the other, terminal one projecting outside and flanged. It also bears an extra long seta in addition to the normal three terminal setae. This seta is plumose on the internal margin and flanged on the external margin. Endopod first segment with three stout spinules on outer distal corner, second segment with a double row of stout triangular spines along the outer edge, last segment with six plumose setae on the outer proximal corner.

Leg 3.- Exopod with hairy outer margin; basal claw of exopod strong not reaching third segment. First segment with one naked seta externally and one long plumose seta internally and second with three spines and four long plumose setae. Endopod with hairy outer margins and with seven long plumose setae terminally. Apron present in between exopod and endopod.

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Leg 4. - Three segmented; first segment with long outer spine. Second and third with five finely flanged claws. Terminal most claws is longer than other claws; mid three claws are of sub equal size. All claws with prominent pectenate bases.

Leg 5. - Vestigial fifth legs are seen as two setae on either side of the posterior region of the genital segment.

Female - Not obtained.

Etymology: The species name *rivulatus* is named after the species of the host as the genus name already exists.

In the present study, seven male copepods were obtained which belong to the genus *Caligus*, since they possess typical characters of the genus *Caligus* like having the frontal plates with prominent lunules, free 4th thoracic segment, typical abdomen and appendages. The present parasites differ in the special characters of legs from all other species of *Caligus* till now described. However, it shows some resemblances with *C.mutabilis*. The second segment of exopod of first leg of these parasites bears 3 setae on the inner margin, which possess strong spines on their inner margin and plumose on the outer margin. The presence of spines is seen in *Caligus mutabilis* described by Wilson (1905) from *Centropristis striatus*. But these parasites differ in many features from the present parasites including the shape. The first leg of *C. mutabilis* differs from the present parasite in having a spiny patch on the basipod, and the setae present on the inner margin are plumose where as in the present parasite they are naked. Terminal marginal setae bear a rim of external spines and plumose internally in both the species. At the same time spines of *C. mutabilis* decrease in size from the base to the terminal region where as they are of same size throughout the seta in the present parasites. However the second leg spines of present species show much variation and uniqueness from *C. mutabilis*. Exopod bears a long spatula shaped structure in the place of first spine. The spatula is three jointed and reaches the lateral plumose setae. The other two spines are also different from previously compared species. In addition present parasites differ from *C. mutabilis* in the shape of the sternal furca and caudal setae. When compared with other species described from *Lutjanus*, these parasites show clear variations in the first and second legs stated as above. Two species described in the present study, *C.asperimanus* and *C.robustus* show clear differences from the new species. A thorough study has been made on these species and other related species of *Caligus*. But the characters which are present in this species are unique and not present in other species. The presence of long spatula shaped structure and other structures of second and first legs are special characters present in the species. Considering the distinguishing characters, the present parasites are considered as a new species and named as *Caligus rivulatus* (*sp.nov.*).

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