

## Loricifera, an under known phyla: first record of higgins larva of *Armorloricus* (Loricifera: Nanaloricidae) from Indian waters

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Loricifera is the scarcely known phylum in the animal kingdom. Only twenty-two species in eight genera were described till today around the world. In the present study, a Higgins larva of *Armorloricus* (Loricifera: Nanaloricidae) is reported for the first time from the Indian waters. This record will contribute to the meiofaunal group of Indian seas. Morphological characteristics and distribution of the Higgins larva is provided.

**[Keywords:** New records, *Armorloricus*, Loricifera, Continental Shelf of India].

### Introduction

Loricifera is a phylum, constitutes very small to microscopic marine sediment-dwelling animals with a size ranging from 100 to 500  $\mu\text{m}$ <sup>1</sup>. This is one of the latest described phyla of the twentieth century which was included in the Metazoans<sup>2</sup>. The first specimen was collected in the 1970s, and later described in 1983 by Kristensen<sup>3</sup>. Till now, only twenty-two species belonging to eight genera were described in the world<sup>4, 5</sup>. Besides these described species, there are approximately 100 more than that have been collected and not yet described<sup>5</sup>. They have been found generally living in coarse sediments and subtidally, from relatively shallow waters<sup>6, 7, 8</sup> to the deep sea<sup>9, 5, 10</sup>. Recently, loriciferans have been reported living permanently in extreme environments, such as as a hypersaline, anoxic basin of the Mediterranean Sea<sup>11, 12</sup>. Hence they are found at all depths, in different sediment types, and in all latitudes<sup>4</sup>.

Loriciferans were characterized by a body with five sections: a protrusive mouth cone, a head (introvert) with rows of scalids (clavoscalids and spinoscalids), a neck with trichoscalids, a thorax, and an abdomen with a lorica consisting of plates or plicae (folds). The most common larval form of Loricifera, the Higgins larva, is divided into the

same sections as the adults.

In the present study, Higgins larva of *Armorloricus* (Loricifera) is reported for the first time from the Indian waters. This record will contribute to the meiobenthic checklist of Indian seas. The data reported here contribute to a better knowledge of the life cycle and biology of the genus and the loriciferan as a whole.

### Materials and Methods

As a part of the investigations on benthic productivity along the continental shelf and continental slope of India, sediment samples were collected on board the Indian research vessel FORV Sagar Sampada and inshore areas employing a shrimp trawler FKKD Koti. Two cruises were conducted (January 1999 and July 2000) for shelf, three cruises for slope in May-July during the years 2004, 2005 and 2006. Altogether 18 stations off six transects (Divi point, Kakinada, Visakhapatnam, Barua, Chilka Lake and Paradeep) were chosen covering 30, 50, 100, 150, 200, 500 and 1000 m depth sites off the north East Indian region. In October 2006, additional 18 stations (off same 6 transects) were sampled to cover 10, 20, 30m locations extending the scope of the investigation to the entire stretch between the coastal sites and up to

mid-slope. At each station, a glass corer (3.6 cm inner diameter) was used for collecting sediment samples of 10 cm length cores from grab (Smith-McIntyre, 0.1m<sup>2</sup>) hauls. The samples were transferred into plastic containers, living animals were narcotized with saturated MgCl<sub>2</sub> and preserved in 4% buffered formalin. The sediment samples were then processed through a set of two sieves with 500 µm and 42 µm mesh size. The residue retained on the 42 µm sieve was stored in glass container and preserved in 4% buffered formalin. Rose Bengal was used as stain prior to sorting and enumeration. Meiobenthos was counted on higher taxonomic level using a binocular microscope. The total number of organisms in the sample represented by different phyla was expressed in individuals per 10 cm<sup>-2</sup>.

### SYSTEMATICS

Phylum LORICIFERA Kristensen, 1983

Order NANALORICIDA Kristensen, 1983

Family NANALORICIDAE Kristensen, 1983

Genus: *Armorloricus* Kristensen and Gad, 2004

(Fig.1)

### Material examined

Higgins larva of *Armorloricus* (Loricifera) was observed off Barua (station 603, depth- 100m) of the North East Indian shelf.

### Diagnosis of Higgins – larva of *Armorloricus*

Body divided into regions mouth cone, introvert, thorax and Loric. Larvae 158 µm long including mouth cone, mouth cone without internal or external armature, eight four-segmented clavoscalids with tips pointing towards posteriorly, except the ventral pair which is larger and has anteriorly pointed tips, first row with eight spinose clavoscalids (cr1), four ventral ones divided into two segments, four dorsal ones into three, row 2 absent, row 3 (sr<sub>3</sub>) with full set of 15 spinoscalids which are composed of two segments, row 4 (sr<sub>4</sub>) with a mid dorsal scalid, a long mid dorsal scalid, a long dorsal pair with broad bases and three spines, and a mid ventral pair of hook shaped scalds, row

5 (sr<sub>5</sub>) with seven upper large claw like spinoscalids alternating with eight smaller lower spinoscalids, row 6 (sr<sub>6</sub>) with seven spinoscalids alternating with six long, filiform and flexible lower spinoscalids, row 7 (sr<sub>7</sub>) with eight spinoscalids with seven erect teeth on basal plates. Single spine in mid dorsal position leaf like. Thorax (Th) flexible with thin cuticle divided into six ventral and five dorsal transverse rows of thoracic plates (thr 1-5). Abdomen rectangular with honey comb ultra sculpture. Toes long with asymmetrical, leaf like mucrones (muc).

### Results and Discussion

The Higgins larva (2nos) were encountered only at Barua at 100 m depth (July 2000) where temperature observed was 25.3 °C, Salinity- 35.1 PSU, Dissolved oxygen - 2.56 ml.l<sup>-1</sup> and % organic matter was 2.04. Higgins larva was very rare. At the global level also, the species is quite rare, and limited to the few locations shown in Table 1.

### Conclusions

In the present study, Higgins larva of *Armorloricus* (Loricifera) is reported for the first time from the Indian waters. This record will contribute to the meiobenthic checklist of Indian seas. The data reported here contribute to a better knowledge of the life cycle and biology of the genus and the Loricifera as a whole.

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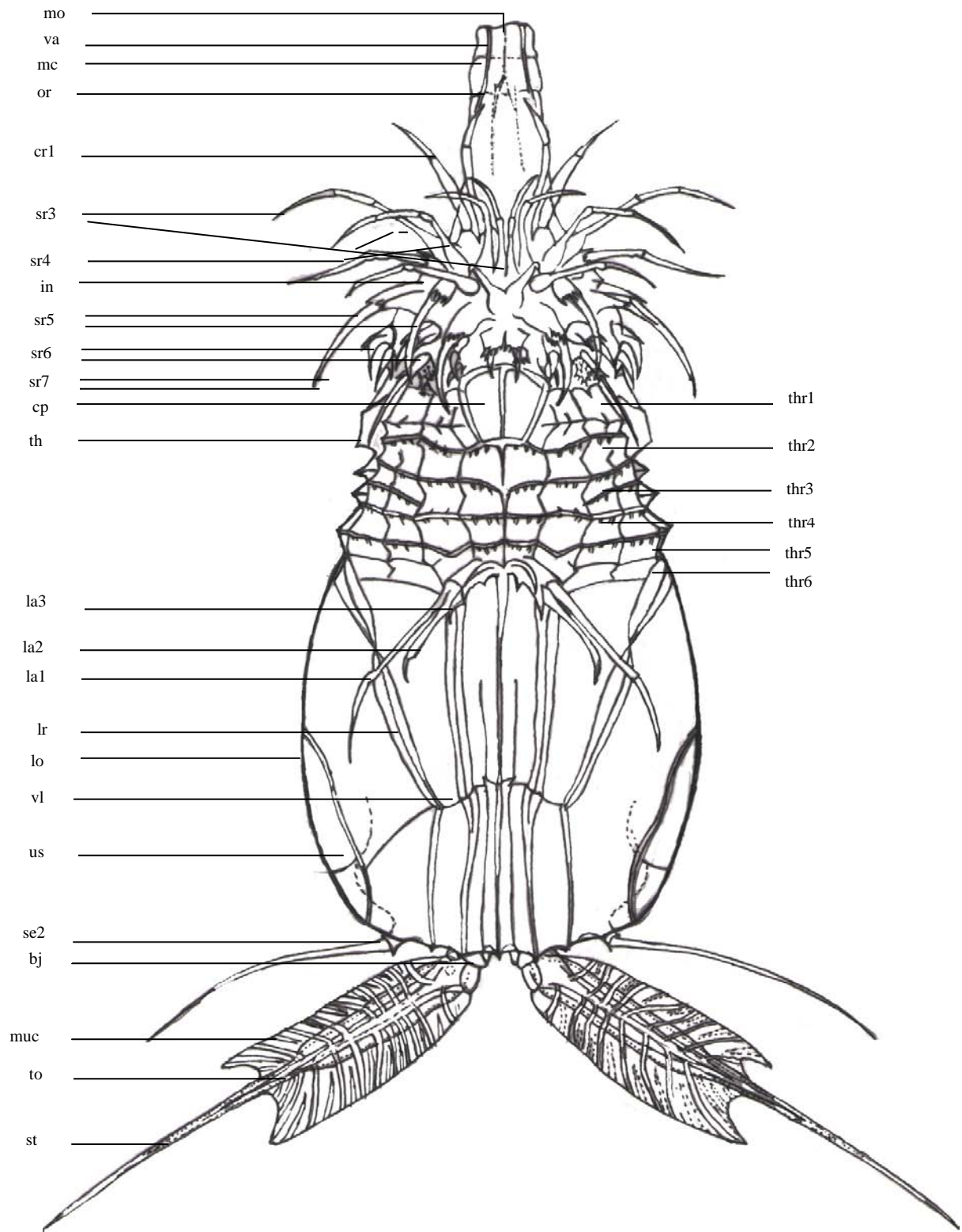
Table 1: Distribution of Loricifera around the world

S.No	Locality	Reference
1	Roscoff, France	Kristensen (1983)
2	Southeastern United States Coastal Waters	Higgins and Kristensen (1986)
3	Izu-Ogasawara Trench. Western Pacific.	Kristensen and Shirayama (1988)
4	Livorno, Italy	Todaro and Kristensen (1998)
5	Faroe Bank in the North Atlantic	Heiner (2004)
6	Kilinailau Tranch, north of Papua New Guinea	Gad (2004)
7	Roscoff, France	Kristensen and Gad (2004)
8	Faroe Bank in the North Atlantic	Heiner and Kristensen (2005)
10	Laptev Sea	Gad and Martínez (2005)
11	Deep sea of the Angola Basin (Atlantic)	Gad (2005)
12	Fort Pierce, FL, USA	Kristensen et al. (2007)
13	Galapagos Spreading Center	Heiner and Neuhaus (2007)
14	Faroe Bank in the North Atlantic	Heiner and Kristensen (2009)
15	New South Wales, Australia	Heiner et al. (2009)
16	Australia	Mass et al. (2009)
17	Mediterranean sea	Danvaro et al. (2010, 2012)
18	Iberian Peneinsula	Pardos and Kristensen (2013)
19	Channel of Mozambique, Indian ocean	Kristensen et al. 2013
20	Barua, 100m depth , North east coast shelf	Present study

### Abbreviations used in figures and text

mo	-	mouth opening
va	-	oral valves
mc	-	mouth cone
or	-	oral ridge of larva
cr1	-	first row of scalids (clavoscalids)
sr <sub>3-7</sub>	-	third to seven row of spinoscalids
cp	-	right closing plate of thorax
th	-	unit of thorax
la3	-	anteroventral locomotory appendage
la2	-	anteromedial locomotory appendage
la1	-	anterolateral locomotory appendage
lr	-	lorica ridge
lo	-	lorica
vl	-	ventral lorica
us	-	ultrasculpture of lorica
se2	-	posterolateral sensora seta
bj	-	ball and socket joint of toe
muc	-	mucrones of larva toe
to	-	toe
st	-	spine- tip of toe
thr <sub>1-6</sub>	-	first to six row of thorax plate

Fig. 1: Higgins Larva of *Armorloricus* (Loricifera) Kristensen, 1983



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