



First Distribution Record of the Isopod *Afrocerceis kenyensis* Müller, 1995 (Crustacea: Isopoda: Sphaeromatidae) from Indian Waters

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ABSTRACT Isopods of the family Sphaeromatidae are called as 'marine pill-bugs'. The present account confirms the expansion of Zoogeographical Distribution of an isopod species namely, *Afrocerceis kenyensis* from Kenya and Karachi Coasts to Gulf of Kachchh, northwest coast of India. Present study also describes a female 'allotype specimen' for the first time. The specimen is identified by having an elongated sac like 'marsupium' with egg mass at the posterior margin of 7th pereonite in the posterior-ventral side. *A. kenyensis* is the first generic record from Indian waters. *A. kenyensis* observed to inhabit in cryptic coral reefs habitats on the inter-tidal regions the Gulf of Kachchh. Detailed morphological variations between male and female specimens are also described.

INTRODUCTION

Isopods are arthropods, occurs in all significant realms including terrestrial, freshwater and marine habitats. In the marine ecosystem, isopods have been described across all oceans and depths from inter-tidal regions down to depths of 4,900m (Schotte et al. 2009). Except for few species, most of them have adapted into a benthic lifestyle while some regained their swimming abilities (Hessler and Strömberg 1989). A great variety of morphological and functional traits is reflected by a wide range of feeding strategies from detritus and filter-feeders, ectoparasites and active predators. Around 10000 species of isopods have been discovered worldwide, including 4500 marine isopods. With size ranging from 0.3mm to 50cm (Boyko et al. 2008; Martin and Davis 2001; Brusca 1997).

Species belonging to the suborder Sphaeromatidea are characterized by having respiratory pleopods inside a branchial chamber (Brandt and Poore 2003) and commonly called 'marine pill-bugs.' The family Sphaeromatidae, are characterized by seven pereon segments, seven pereopods and a pleon of two distinct segments. India is the host of 311 isopod species belonging to 133 genera which group in 38 families (Dev

Roy 2012). Several studies in the past recorded the presence of 17 (from Sphaeromatidae family) species belonging to 9 genus from Indian waters.

The genus *Afrocerceis*, which comes under the family sphaeromatidae, consist of only one described species, *A. kenyensis*. This species mainly occurs in reef flat, seagrass bed and dead coral (Müller 1995). Distribution of *Afrocerceis* isopods was recorded from Watamu in Kenya, (Müller 1995) and the present account confirms the distribution of the species from Gulf of Kachchh in Indian waters for the first time.

MATERIAL AND METHODS

The specimens were observed and collected while studying cryptic faunal assemblages on artificial structures deployed on the inter-tidal pools in Narara (GPS N 22°28'58.91" and E 69°42'48.02") of Gulf of Kachchh Marine National Park, north-west coast of India (Fig.1). During low-tides, the reef flat of Narara gets almost entirely exposed and holding only 0.5 meter – 1m water at the inter-tidal pools. After collection, the specimens were preserved in formalin solution. Morphological characters of the isopod specimens were recorded by dissecting the samples under a stereomicroscope (Leica 120HD). The specimen was identified by comparing their morphological characteristics with the descrip-

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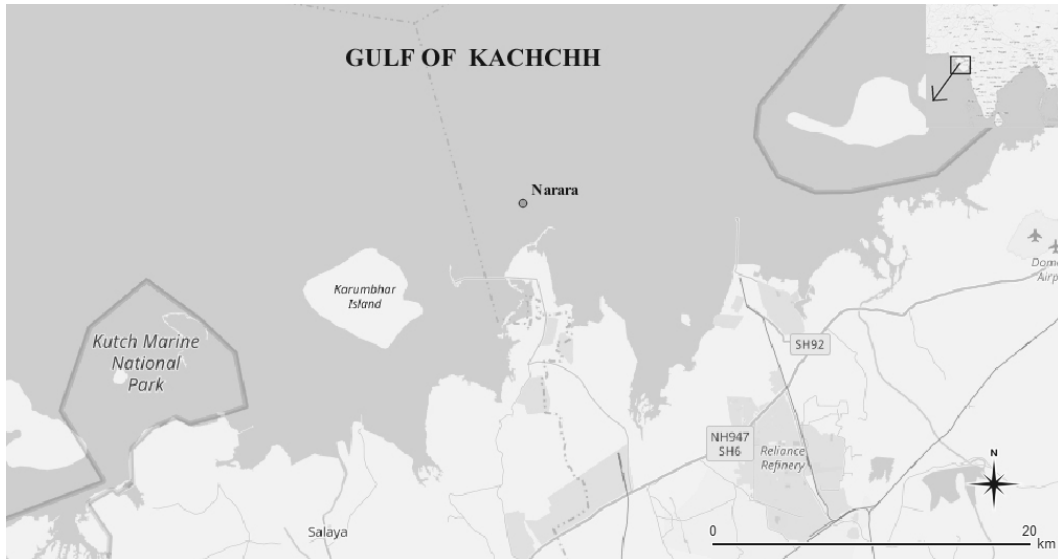


Fig. 1. Map showing the sampling site

Source: OpenStreetMap (OSM). It is done with the help of QGIS

tion given by Müller (1995). Voucher specimens (Registration No. C 7214/2) were deposited at the National Zoological Collections, General Non-Chordate division of Zoological Survey of India, Indian Museum, Kolkata, India.

however the alcohol preserved samples showed loss of pigmentations and they turned white.

RESULTS

Habitat

Specimens were obtained from small crevices and shaded parts of coral reef rocks, coral rubbles, boulders, and sediments at a depth of 1 meter during low-tide.

Materials Examined

A total of 7 specimens including 1 male and 6 females were examined.

Morphological Description

Preserved specimens are yellowish orange to brown in color. Size of the specimens was measured up to 1.0cm-1.2cm. Colour of the spec-

imens did not show much variation after preservation in formalin solution. Studied specimens had slightly convex or inverted boat-shaped dorsal side with a prominent horizontal ridge at the central part. Cephalon was short and wide which extend as a blunted triangle shaped anterior end. Antennae originated from the ventral side of the cephalon and covered entirely by wider first pereonite when seen from dorsally (Fig. 2a).

Unlike the first pereonite coxae, the coxae of remaining pereonite were ventrally interlocked by anterior rounded tubercle. As for the coxae of the first pereonite, their attachment area showed dorsally visible an incomplete suture line. The specimens also had a triangular pleotelson with a semicircular distal ventilation slit. The specimen also contains subacute epistome with a roughly triangular shaped distal part (Fig. 2a). At the posterior margin of 7th pereonite, there were no penes noticed as mentioned by Müller in 1995; instead, an elongated sac like marsupium with eggs was observed at posterior-ventral side. The first antenna was consisting of 3 peduncular articles where the first peduncular article was larger than the rest two articles combined and bore antero-dorsally feather like setae. The second article was wider in shape with a lateral tooth-like process. The first antenna was

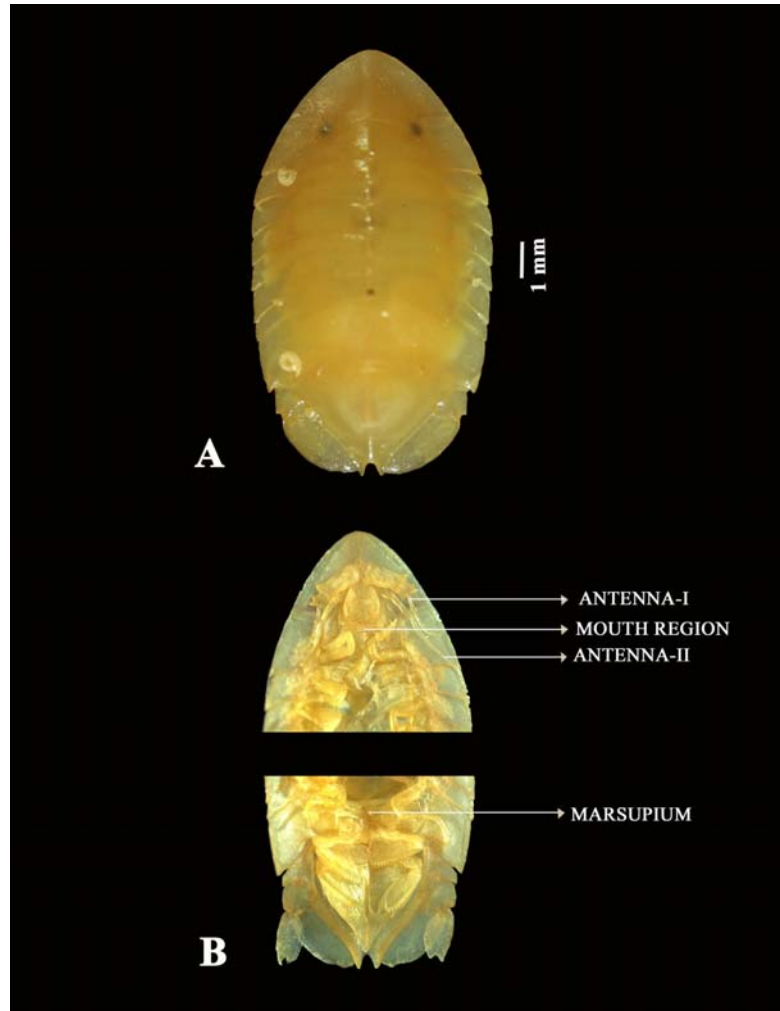


Fig. 2. *Afrocerceis kenyensis* from Gulf of Kachhh, a). Dorsal view, b). Ventral view

shorter than the second antenna. The second antenna was 5-articulated and elongated. The first antenna had a comparatively wider palp (Fig. 2b). The left mandible was 3-articulated with 1st and 3rd were almost the same in size, and the 2nd one was slightly bigger than the other two (Fig. 3a). The first article was bearing a row of 14 spines while 2nd article contained nine spines. The smaller inner lobe of Maxilla-I consists of 3 distal plumose spines, whereas the bigger outer lobe bore 9 distal robust spines which are partly denticulated with small superficial seta (Fig. 3b).

As for the Maxilla-II 4 slender spines observed in the outer lobe of the outer ramus, whereas the inner lobe of the outer ramus consists of 5 slender spines, and inner ramous is slightly bigger than the outer ramous, which contains 4 distal plumose setae, medio dorsal plumose spine and setules along the median margin (Fig. 3.c). The endite of maxilliped (Fig. 3d) observed with one coupling hook and anterior part included a single row of stout spines. There were seven pairs of pereopods present in the specimen, among them 4th (Fig. 3h) and 5th (Fig. 3i) pereopods were

almost similar looking, stout and stronger whereas 2nd (Fig. 3f), 3rd (Fig. 3g) and 7th (Fig. 3k) pereopods were very weak and slender in appearance. From the 5 pairs of pleopods 1st pleopod (Fig. 3l) was slightly larger than the endopodite and contained serrated edge whereas endopodite was broad and triangular with an oval distal end, as for the 2nd pleopod (Fig. 3m) endopodite was larger than the exopodite, and like the 1st pleopod exopodite, 2nd exopodite also with serrated edged and endopodite was broad in the proximal and narrow in the distal end. The 3rd pleopod (Fig. 3n) had a slightly larger endopodite than exopodite and had a shape of an elongated triangle. 4th pleopod (Fig. 3o) had an equal length of rami with transverse ridges and slender endopodite, and 5th (Fig. 3p) pleopod was

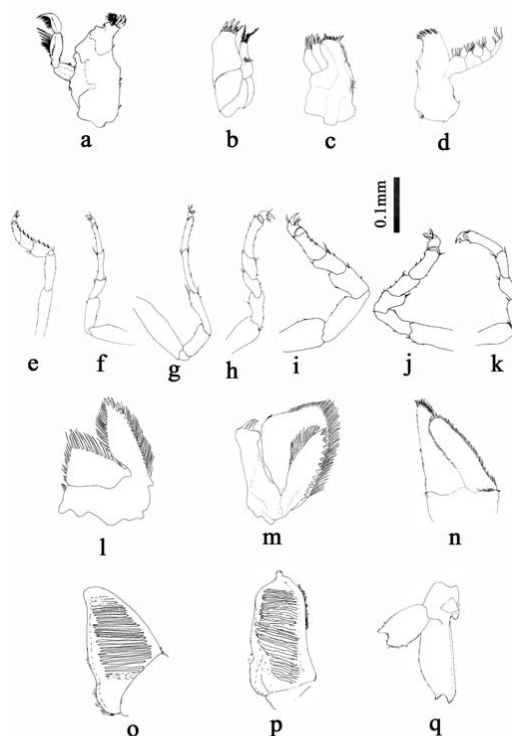


Fig. 3. Appendages of *Afrocerceis kenyensis*; a). mandible (left), b). maxilla-1; c). maxilla-2; d). maxilliped, e). pereopod-1, f). pereopod-2, g). pereopod-3, h). pereopod-4, i). pereopod-5, j). pereopod-6, k). pereopod-7, l). pleopod-1, m). pleopod-2, n). pleopod-3, o). pleopod-4, p). pleopod-5, q). uropod

similar to the 4th pleopod with a lobe with a toothed edge like structure (denticulate). Uropod had a 1.5-time longer endopodite when compare to exopodite (Fig. 3q), and distal margin of exopodite consist of few dentations, whereas endopodites ended with blunted lobes.

As there is no previous description of female specimen of *A. kenyensis*, presented description of the specimen can be assigned as 'allotype' specimen.

DISCUSSION

Distribution of the *Afrocerceis kenyensis* has been reported previously only from Kenya waters (Müller 1995). As the species has the distribution record up to Karachi coast, there is a higher probability of being present in the Gulf of Kachchh region as it is very close to Karachi coast. Distribution record of the species showed its adaptation to living in tropical and even in sub-tropical extreme conditions also. Further, this species has a higher chance of its distribution in shallow waters of other tropical and sub-tropical regions. In India, most of the isopods were reported from the Cymothoid family. There are 17 species of Sphaeromatidae isopods have been previously reported from Indian waters so far (Table 1), but present study confirms the distribution of *Afrocerceis kenyensis* for the first time in Indian waters as a new generic report.

Based on Müller's (1995) description total length of the holotype specimen was only 4 mm. However, the studied specimen from Gulf of Kachchh was double the size, that is, ranged from 1.0cm to 1.2cm. Holotype male specimen was dorso-ventrally flattened, whereas the current specimens had a slightly convex or inverted boat-shaped dorsal side with a prominent vertical central ridge (Fig. 2a). Unlike the holotypic specimen, the second pleopod of the studied specimens lacks appendix masculina, which is a clear indication about that the studied specimen being a female of the *Afrocerceis kenyensis*. Colour of the holotypic male specimen was varied from the studied female specimen, that is, holotype male was green to greenish brown, but, examined female specimens were yellowish orange to brown. Most of the other characters of the studied specimen were agreed with the holotype specimen, described by Müller in 1995.

So, the present study recorded the morphological description of a female specimen of *A. kenyensis* for the first time.

Due to its extreme flattened body and similar shaped pleotelson, this species has a close resemblance with the monotypic genus *Platycerceis* (Baker 1926), which has one single species *Platycerceis hyalina*. However there are many differences observed between these two species like *P. hyalina* the antenna are not completely covered by cephalon. The second article of the first antenna lacks tooth-shaped, lateral processes. The coxae of the 2nd -6th pereopods are not interlocked, and they are robust. The second pleopod of this genus has a smaller endopodite. The uropodal rami are styliform not flattened like *A. kenyensis*. Another close resemblance *A. kenyensis* is observed with the genus *Cerceis* because of having flat body shape. However, the differences are much more apparent as the body of *Cerceis* are much more robust, and pleotelson shows either tubercles or ridges. The eyes are laterally situated, and the enlarged proximal article of the first antenna has lateral projections to accommodate the second article. 2nd, 3rd, 6th and 7th pereopods are robust, and the posterior claw of them are not pectinate (see Tables 1 and 2 from Appendix).

In Gulf of Kachchh, *A. kenyensis* observed to inhabit in cryptic habitats of the coral reefs at a depth less than 1.0 meter during low-tides and 5 meters during high-tides. Müller (1995) also mentioned inter-tidal and shallow sub-tidal as the preferred habitats of the species, where the substrate made of dead coral boulders and influenced by more or less strong wave action during tidal changes. Intertidal areas of the Gulf of Kachchh is such type of habitat only. They are free swimmers, and their body shape adapted them the agility in swimming and prefer to live in their habitats. The configuration of their body aid to reduce the lateral pressure in the water current and differently shaped pereopods with denticulate posterior claws on pereopods also may assist them to adhere to drifting water current. It is observed that their encounter increased during the post-winter season in Gulf of Kachchh. Many specimens collected during the post winter season were brooders and found with orange colored eggs in their marsupium sac, which evident some clue about their breeding

season. Coral reefs organisms of the Gulf of Kachchh are quite distinctive regarding their isolation and their high degree of adaptation to survive in such extreme oceanographic and climatic conditions (Dixit et al. 2010). Likewise, *A. kenyensis* also have high adaptation to living in extreme temperature (up to 34°C during low-tides) and heavy sediment influenced region. Their dispersal potential is limited to adult movement such as passive and a lesser extent active migration. As these isopods brood their offspring in their ventral brooding pouch (marsupium) there is less possibility of their larval dispersal from the adjacent waters. The geographical isolation of the Gulf of Kachchh and distributions of these isopods have reflected the potential of the Gulf of Kachchh as an older center of origin and radiation. The ecological role of this species in coral reef ecosystem also needs to be studied in detail.

CONCLUSION

Isopoda has been proved as a widespread and useful taxon to assess large-scale patterns in biodiversity and biogeography for several reasons. The present study confirms the new distribution range of the *A. kenyensis* in Indian water, as well as the description of the 'allotype' female specimen of this animal for the first time and habitat preferences as well. Morphological variations of both the male and female specimens are also compared. Further study on this species will also give insight to its actual habitat range, and their dispersal pattern.

AVAILABILITY OF DATA AND MATERIALS

All data generated during this study are included in this article and the specimens are deposited in the National Zoological Collections, General Non-Chordate Division of Zoological Survey of India, Indian Museum, Kolkata, India with a Registration number: C 7214/2.

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APPENDIX

Table 1: comparison of Genus character between *Afrocerceis* and present specimen

<i>Body parts</i>	<i>Afrocerceis</i>	<i>Present specimen</i>
Body	Body smooth, dorsoventrally flattened (Weakly convex ventrally).	Body smooth, dorsoventrally flattened (Weakly convex ventrally).
Head	Cephalon with posterodorsal, well pigmented eyes. Antennae covered by flattened cephalon. Second article of antenna 1 with robust, lateral tooth-shaped tubercles, proximal article lacking lateral projections	Cephalon with posterodorsal, well pigmented eyes. Antennae covered by flattened cephalon. Second article of antenna 1 with robust, lateral tooth-shaped tubercles, proximal article lacking lateral projections
Pereon	The pereon comprised of 7 segments. A distinct suture line present between pereonites 2-7 and laterally expanded coxae, first coxae fused with pereonite. Pereopods 1, 4 and 5 much more robust than remaining pereopods.	A distinct suture line present between pereonites 2-7 and laterally expanded coxae, first coxae fused with pereonite. Pereopods 1, 4 and 5 much more robust than remaining pereopods.
Pleon	Pleon with one free pleonite between posterolateral margins of 7 th pereonite. Pleotelson triangular, with semi-circular distal ventilation slit. Second peduncular article of antennules with short lateral, tooth-shaped tubercles.	Pleon with one free pleonite between posterolateral margins of 7 th pereonite. Pleotelson triangular, with semi-circular distal ventilation slit. Second peduncular article of antennules with short lateral, tooth-shaped tubercles.

Table 2: Comparison with *Afrocerceis kenyensis* Müller, 1995, with present specimen

<i>Body parts</i>	<i>Afrocerceis kenyensis</i> described by Müller, (1995)	<i>Present specimen</i>
Body	Body of the specimen is dorsoventrally flattened	----- same -----
Head	Cephalon 1.4 times wider than long, laterally flattened parts covering antennae, well pigmented eyes located posterodorsally. 2 pairs of antenna are present and they are covered by cephalic shield	----- same -----
Pereon	The pereon comprised of 7 segments. Pereonite 1 considerably longer than remaining pereonites. Coxae of pereonites 2-7 with distinct suture, these coxae ventrally interlocked by anterior, rounded tubercle. Among the pereopods 1 st , 4 th and 5 th are stouter than the 2 nd , 3 rd , 6 th and 7 th pereopod.	----- same -----
Pleon	Pleotelson with one free pleonite located between posterolateral margins of pereonite 7, two pairs of suture lines of fused pleonite section extending to posterior margin. 4th and 5 th pair of pleopod converted into respiratory organ.	----- same -----
Penes and Appendix masculina	Present	Absent
Brood pouch or Marsupium	Absent	Present