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New records of anomurans (Crustacea: Decapoda) from Gujarat, India

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Abstract

The present study recorded three species of anomuran crabs, two of Diogenidae and one of Porcellanidae from Indian waters, during the survey of crustacean fauna of Gujarat state from 2014– 2016. *Diogenes fasciatus* Rahayu & Forest, 1995 is reported for the first time from Indian waters, while *Clibanarius arethusa* De Man, 1888, *Pachycheles natalensis* (Krauss, 1843) are first time recorded from coastal waters of Gujarat State. The details of morphological characters and distribution pattern of the three anomuran crabs are given in the report.

Keywords: Range extension; Hermit crabs, Porcelain crabs, Rocky shores, Arabian Sea

1. Introduction

The coastline of Gujarat is longest among Indian states, extending about 1650 km, constituting about 21% of the Indian coastline [9]. The coastal area of Gujarat is divided into three regions viz. Gulf of Kachchh, Saurashtra coast and Gulf of Khambhat [9]. The coastal areas of state support various marine habitats such as mangroves, coral reefs, rocky shores, mudflats, sandy shores and estuaries that are rich in marine biodiversity [9]. The infraorder Anomura is most diverse in the body form among the decapod crustaceans [1]. For example, the species, classified under the superfamily Paguroidea generally have membranous or weakly calcified abdomen and hence require an external protective covering, such as a gastropod shell [1]. While the species of the family Porcellanidae bears characters such as flattened crab-shaped body which help them to occupy the crevices in rocks and other substrata [2,3]. The Anomura is one of the least studied groups of decapod crustaceans occurring in Indian waters. So far, total 112 species of hermit crabs (Paguroidea) belonging to 26 genera and 5 families are reported from Indian waters, of which 13 species are found in Gujarat State [4, 5]. The Porcellanidae is represented by 32 species belonging to 11 genera in Indian waters, of which 7 species are reported from Gujarat [3, 6, 7, 8, 9, 10]. The present study reports 3 species of anomuran crabs from coastal waters of Gujarat State, India. *Diogenes fasciatus* Rahayu & Forest, 1995 is reported for the first time from Indian waters, whereas the other two species, *Clibanarius arethusa* De Man, 1888, *Pachycheles natalensis* (Krauss, 1843) are first time reported from coastal waters of Gujarat State.

2. Materials and Methods

During the survey of crustacean fauna of Gujarat state, India (Fig. 1) from January 2014– December 2016, the specimens were collected by hand picking method at low tide in the intertidal zone. The specimens were cleaned, photographed and consecutively preserved in 70% alcohol and deposited in the Zoology Museum of Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat. The specimens were identified with the help of standard taxonomic keys and literature [13,17,24]. Specimens measured in millimetres (mm) and abbreviations used are as follows: SW: shield width; SL: shield length; CW: carapace width; CL: carapace length; coll.: collector.

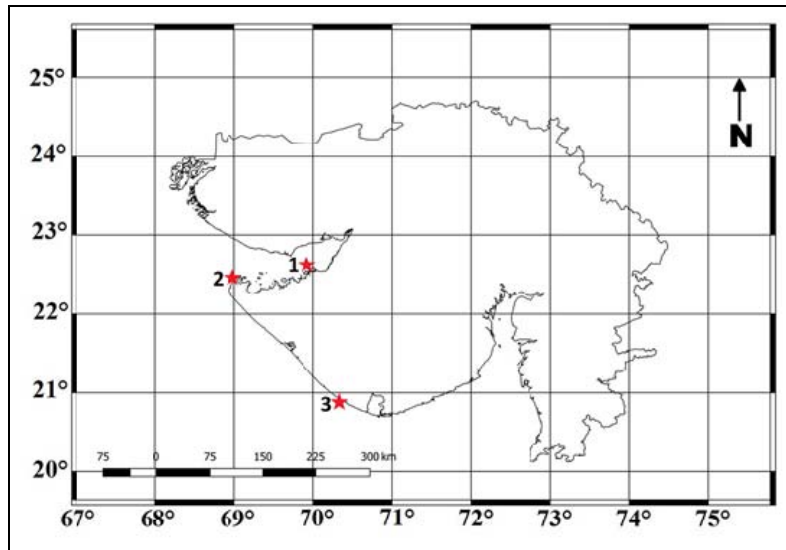


Fig 1: Location of collection sites in Gujarat State, India. **1.** Pirotan (22°36'15" N, 069°57'17" E); **2:** Shivrajpur (22°19'50" N, 068°56'56" E) **3.** Veraval (20°54'37" N, 070°21'05" E)

3. Results and Discussions

ORDER Decapoda Latreille, 1802

INFRAORDER Anomura MacLeay, 1838

FAMILY Diogenidae Ortmann, 1892

GENUS *Diogenes* Dana, 1851

Diogenes fasciatus Rahayu & Forest, 1995 (Fig. 2. a–c)

Diogenes fasciatus Rahayu & Forest, 1995: 388, Fig. 1; Rahayu ^[12]: 340; Siddiqui *et al.* ^[13]: 185, Fig. 13; Kazmi and Siddiqui ^[14]: 29, Fig. 28.

Material examined: ZL-AR-AN- 26, 1 male (SL 4.36 mm, SW 4.11 mm), Pirotan (22°36'15" N, 069°57'17" E), rocky intertidal area, 10 April 2015, coll. Jignesh Trivedi.

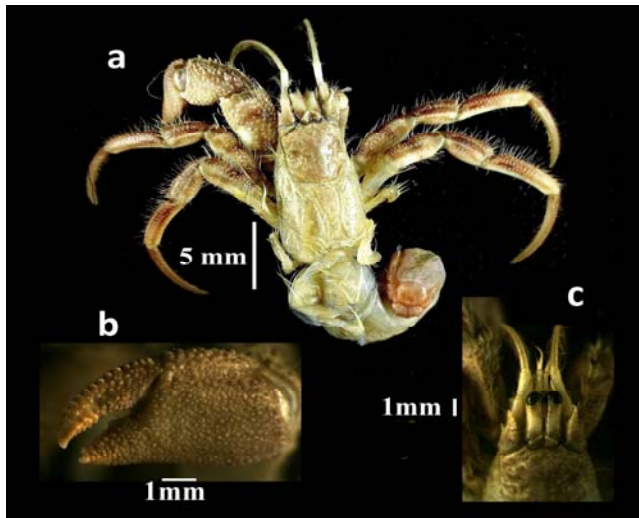


Fig 2: *Diogenes fasciatus* Rahayu & Forest 1995, male (SL 4.36 mm, SW 4.11 mm, ZL-AR-AN- 26). **a:** entire animal, dorsal view; **b:** left chela, outer view; **c:** anterior part of shield and cephalic appendages, dorsal view.

Diagnosis (modified from Siddiqui *et al.* ^[13]): Shield slightly longer than broad (Fig. 2.a). Rostrum rounded; lateral projections overreaching anterior margin of rostrum, each terminating in small spine. Intercalary rostral process simple. Ocular peduncles short, robust, with short setae on

ventrolateral region. Ocular acicles with 4 or 5 spines on distal margin. Antennal and antennular peduncles longer than ocular peduncles. Distal margin of cornea reaching penultimate segment of antennular peduncle. Proximal margin of penultimate segment of antennal peduncle reaching midlength of cornea. Antennal acicle triangular, almost reaching base of corneas; mesial margins each with 4-7 prominent spines; flagellum with long ventral setae (Fig. 2.c). Left cheliped with small flat-topped tubercles on outer surface of palm (Fig. 2.b). Palm with blunt to acute spines on upper and lower margins, row of tubercles on proximal angle parallel to proximal margin and continuing till midlength of palm, another tuberculated row present just above this row, gradually decreasing in size; outer surface of dactylus with 1 or 2 rows of subacute or blunt tubercles on upper margin. Carpus with row of moderate to strong spines on upper margin. Right cheliped palm bearing spinulose upper and lower margins. Chela covered with dense setae; carpus with spines on upper margin. Ambulatory legs with propodi shorter than dactyli, slightly spinose on dorsal margins; carpi covered with setae, each with 1 or 2 rows of spines on dorsal margin. Telson with left posterior lobe larger than right; terminal margins distinctly oblique, with small median cleft, each armed with spines.

Colouration: Shield, ocular acicles, basal segments of antennular and antennal peduncles, and chelipeds creamy white. Ambulatory legs brownish with white blotches.

Habitat: Rocky intertidal area

Distribution: Indonesia ^[11], Singapore ^[12], Pakistan ^[13, 14]. Now firstly reported from India (Fig. 1.1: Pirotan).

Remarks: The specimen examined in the present study agree with the descriptions and illustrations of *Diogenes fasciatus* by Rahayu and Forest ^[11] and Siddiqui *et al.* ^[13], but observed some morphological differences. The row of dorsal spines on the carpus and propodus of the ambulatory legs of the present specimen is weaker than that of the Pakistani specimens reported by Siddiqui *et al.* ^[13]. There is a shallow furrow (filled with tubercles in the proximal half) running parallel to the cutting edge of the dactylus of left chela (Fig. 2.b) in the

present specimen, but such furrow is not illustrated or mentioned in the descriptions by Rahayu and Forest [11] and Siddiqui *et al.* [13].

GENUS *Clibanarius* Dana, 1852

Clibanarius arethusa De Man, 1888 (Fig. 3. a–c)

Clibanarius arethusa De Man, 1888: 252; Alcock [16]: 48, plate 4, Fig. 3; McLaughlin *et al.* [17]: 135.

Material examined: ZL-AR-AN- 25, 2 males (SL 9.10–9.86 mm, SW 7.54–7.80 mm), 2 females (SL 8.29–11.02 mm, SW 7.08–9.36 mm), Veraval (20°54'37" N, 070°21'05" E), rocky intertidal area, 14 October 2016, coll. Swapnil Gosavi.

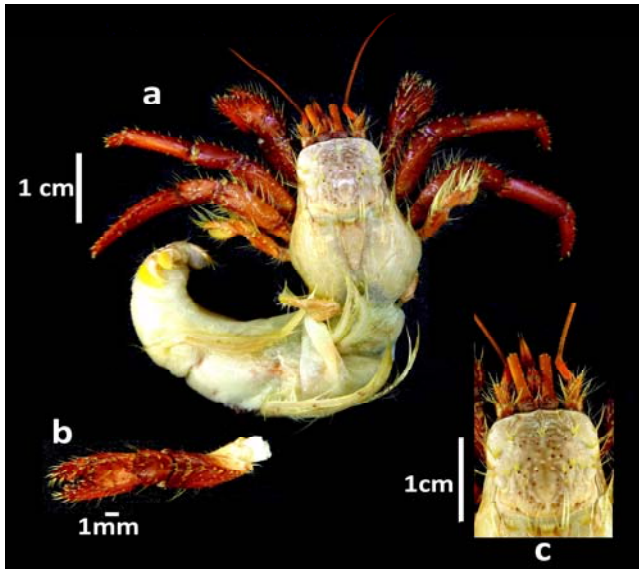


Fig 3: *Clibanarius arethusa* de Man, 1888, female (CL 11.02 mm, CW 9.36 mm, ZL-AR-AN- 25). **a:** entire animal, dorsal view; **b:** left cheliped, dorsal view; **c:** shield and cephalic appendages, dorsal view.

Diagnosis (modified from McLaughlin *et al.* [17]): Shield slightly longer than broad (Fig. 3.a). Ocular acicles with 3 terminal spines. Antennular peduncles only reaching distal margins of corneas; antennal acicle short, reaching distal margin of fourth peduncular segment (Fig. 3.c). Chelipeds subequal, right somewhat longer, robust (Fig. 3.b); dorsal surfaces of palms with scattered spines and sparse tufts of stiff setae, mesial spines greater than lateral spines, dorsomesial margins of palms each with row of 4 or 5 small spines; carpi each with 1 conspicuous distal spine on dorsomesial margin. Dactyli of ambulatory legs each with row of 5 or 6 small corneous spines over entire length of ventral margin; dactylus of left third pereopod stout, subequal to or slightly longer than propodus. Telson asymmetrical with weak median cleft separating posterior lobes, right terminal margin with 5 or 6 spinules, left terminal margin with 5-7 corneous tipped spines increasing in size laterally, both rows of spines not extending onto lateral margins.

Colouration: Cephalothorax greyish. Ocular peduncles brown. Antennular peduncles brown; flagellums light brown. Antennal peduncles dark brownish except, ultimate segment and flagella light brownish. Chelipeds and ambulatory legs dark, lacking stripes or bands.

Habitat: Rocky intertidal area.

Distribution: Mergui Archipelago, Vietnam and Taiwan [17]. In India, Karnataka [18], Kerala [19], Tamil Nadu [19], Andaman and Nicobar Islands [20], and now Gujarat State, India (Fig. 1.3: Veraval).

Remarks: The present specimen well agrees with the description and illustrations of *Clibanarius arethusa* by McLaughlin *et al.* [17]. *Clibanarius arethusa* is similar to *Clibanarius rutilus* Rahayu, 1999 in general appearance and colouration, but different from the latter by the following morphological characters. In *C. arethusa* the rostrum is slightly longer than lateral projections (*C. rutilus*: distinctly longer than the lateral projections); ocular peduncles are longer than width of shield (*C. rutilus*: 4/5 the width of shield); the antennal peduncles are distinctly shorter than the ocular peduncles (*C. rutilus*: equal in length or slightly shorter than the ocular peduncles) [21]. Recently Kachhiya *et al.* [29] reported *C. rutilus* for first time in India water. However, their specimens require detailed examination because taxonomic description and photograph of specimen given by Kachhiya *et al.* [29] is insufficient to distinguish between *C. arethusa* and *C. rutilus*. Hence, the identity of *C. rutilus* in Indian waters is doubtful.

FAMILY Porcellanidae Haworth, 1825

GENUS *Pachycheles* Stimpson, 1858

Pachycheles natalensis (Krauss, 1843) (Fig. 4. a–b)

Porcellana natalensis Krauss, 1843: 58, pl.4, Fig. 1a-c

Pachycheles natalensis— Barnard [23]: 472, Fig. 87 a- f; Hiller *et al.* [24]: 202, Fig. 3; Mustaquim [25]: 158, Fig. 7.

Material examined: ZL-AR-AN-22, 9 males (CL 3.22–4.85 mm, CW 3.38–5.27 mm.), 4 females (CL 3.76–3.86 mm, CW 4.24–4.77 mm.), Shivrajpur (22°19'50" N, 068°56'56" E), rocky intertidal area, 12 November 2016, coll. Jignesh Trivedi.

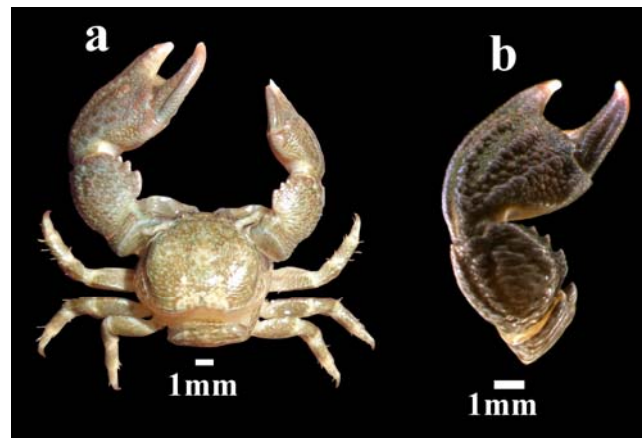


Fig. 4. *Pachycheles natalensis* (Krauss, 1843), female (CL 4.65 mm, CW 5.61 mm), ZL-AR-AN-22; **a:** entire animal, dorsal view; **b:** larger cheliped, dorsal view

Diagnosis (modified from Hiller *et al.* [24]): Carapace broader than long, dorsal surface convex and smooth (Fig. 4.a); external orbit angle forming blunt teeth. Branchial region with blunt transverse ridges. Pterygostomial flap divided into 2 separate regions. Antennal peduncle with second article bearing slightly pointed tubercle; third and fourth articles slightly granulated. Chelipeds unequal in size; meri each with 1 lobe on dorso-anterior margin distally; carpi as broad as

long or slightly longer with 3 or 4 teeth decreasing in size distally on dorso-anterior margin; carpi and palms covered with large granules and with 3 and 2 longitudinal crests, respectively (Fig. 4. b). chela convex on anterior margin; fingers of larger cheliped with wide gape bearing tuft of setae; fingers of smaller cheliped with narrow gape; dactyli each with curved tip and denticulate cutting edge. Ambulatory legs granulated, with simple setae on margins; dactyli with 3 spines on ventral margin. Telson 5 plated. Males with pair of gonopods.

Colouration

Carapace brown, with dull white triangular patch on posterior region. Chelipeds brown, with white tips of fingers. Ambulatory legs also brown, with white bands on proximal and distal parts of meri, propodi and dactyli.

Habitat: Lower intertidal zone, in crevices of stones; sympatric with *Pachycheles tomentosus* Henderson, 1893

Distribution: So far reported from the western Indian Ocean to Red Sea, eastern Arabian Sea, African coast southward to Mozambique and Madagascar [23, 3]. In India, Maharashtra [26], Tamil Nadu [3], Goa [24], and now Gujarat State (Figure 1.2: Shivrajpur).

Remarks: The specimens examined in the present study agree with the description and illustration of *Pachycheles natalensis* given by Hiller *et al.* 2010 [24], but varies in some morphological characters, the longitudinal ridges on the dorsal surfaces of the carpus and palm of each cheliped are prominent only in the larger specimens. A single specimen had the left pterygostomian flap divided into 3 plates unlike 2 plates in other specimens. The massive chelipeds of *Pachycheles* species may be similar to that of species of *Polyonyx* Stimpson, 1858, but differs in the shapes of the antennal peduncles and pterygostomian flaps [27].

4. Conclusion

In the present study, *Diogenes fasciatus* is first report from Indian waters, this record adds one more species to the existing list of hermit crabs known from Indian waters [5]. Overall, it adds two species of hermit crabs and one species of porcellanid crabs to the checklist of anomuran crabs of Gujarat State and suggests that the coastal areas of Gujarat State have a great potential for future studies on anomuran diversity.

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