



E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(4): 658-662
© 2017 JEZS
Received: 24-05-2017
Accepted: 25-06-2017

Swapnil Gosavi
Marine Biodiversity and Ecology
Laboratory, Department of
Zoology, Faculty of Science, The
Maharaja Sayajirao University
of Baroda, Vadodara- 390002,
Gujarat, India.
<http://orcid.org/0000-0003-3321-5836>
swapnil.gosavi4@gmail.com

Jignesh N Trivedi
Marine Biodiversity and Ecology
Laboratory, Department of
Zoology, Faculty of Science, The
Maharaja Sayajirao University
of Baroda, Vadodara- 390002,
Gujarat, India.
jntrivedi26@gmail.com

Dhruva J Trivedi
Marine Biodiversity and Ecology
Laboratory, Department of
Zoology, Faculty of Science, The
Maharaja Sayajirao University
of Baroda, Vadodara- 390002,
Gujarat, India.
djtrivedi4@gmail.com

Kauresh D Vachhrajani
Marine Biodiversity and Ecology
Laboratory, Department of
Zoology, Faculty of Science, The
Maharaja Sayajirao University
of Baroda, Vadodara- 390002,
Gujarat, India.
kauresh@gmail.com

Correspondence

Kauresh D Vachhrajani
Marine Biodiversity and Ecology
Laboratory, Department of
Zoology, Faculty of Science, The
Maharaja Sayajirao University
of Baroda, Vadodara-
390002, Gujarat, India.
kauresh@gmail.com.

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

Swapnil Gosavi, Jignesh N Trivedi, Dhruva J Trivedi and Kauresh D Vachhrajani

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.

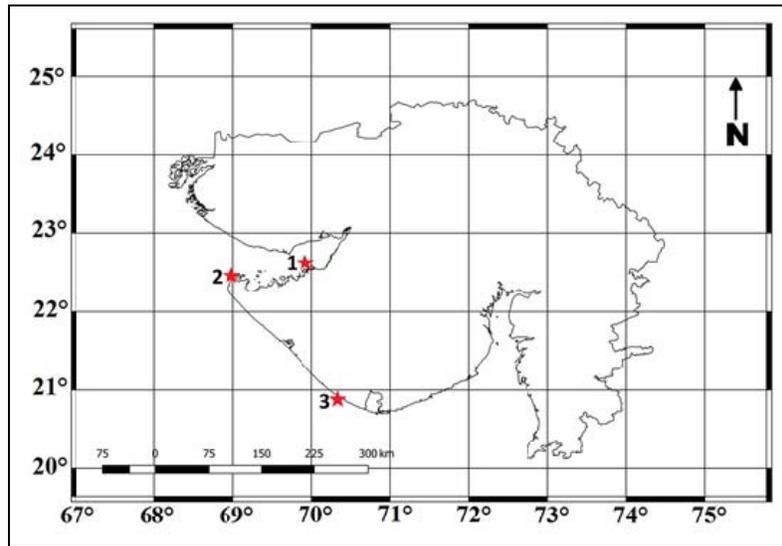


Fig 1: Location of collection sites in Gujarat State, India. **1.** Pirotan (22°36'15" N, 069°57'17" E); **2:** Shivrajpur (22°19'50" N, 068°56'56" E) **3.** Veraval (20°54'37" N, 070°21'05" E)

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.

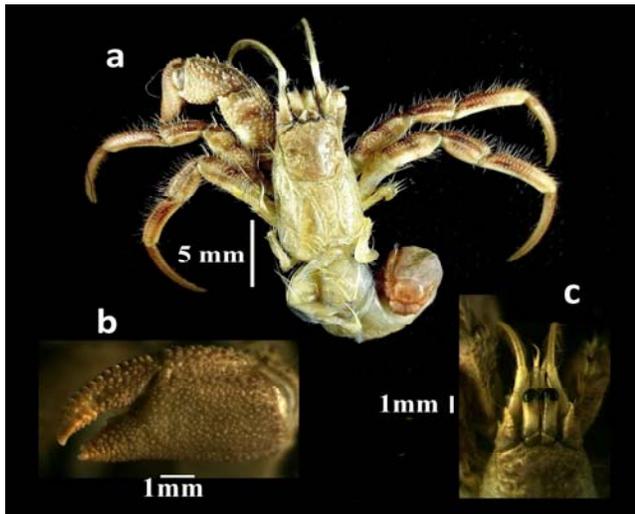


Fig 2: *Diogenes fasciatus* Rahayu & Forest 1995, male (SL 4.36 mm, SW 4.11 mm, ZL-AR-AN- 26). **a:** entire animal, dorsal view; **b:** left chela, outer view; **c:** anterior part of shield and cephalic appendages, dorsal view.

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.

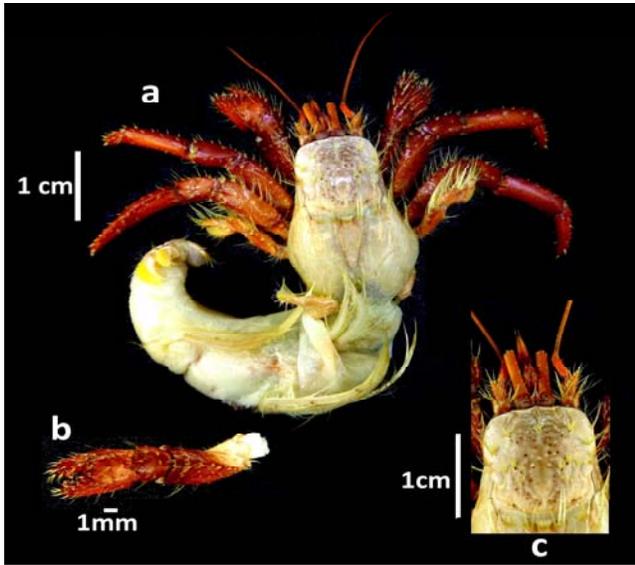


Fig 3: *Clibanarius arethusa* de Man, 1888, female (CL 11.02 mm, CW 9.36 mm, ZL-AR-AN- 25). **a:** entire animal, dorsal view; **b:** left cheliped, dorsal view; **c:** shield and cephalic appendages, dorsal view.

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.

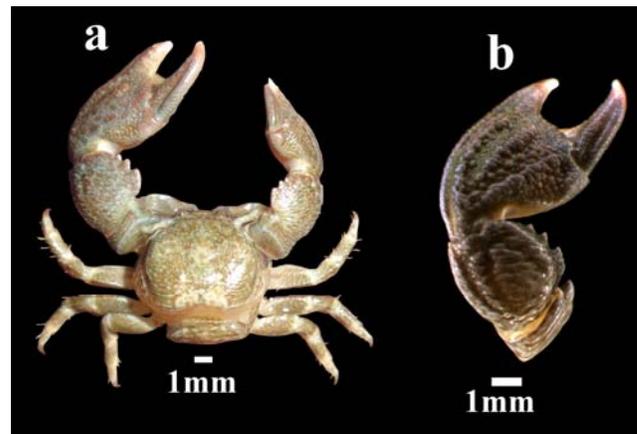


Fig. 4. *Pachycheles natalensis* (Krauss, 1843), female (CL 4.65 mm, CW 5.61 mm), ZL-AR-AN-22; **a:** entire animal, dorsal view; **b:** larger cheliped, dorsal view

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 pterygostomial 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 pterygostomial 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.

5. Acknowledgements

Authors are thankful to the Earth System Sciences Organization (ESSO), Ministry of Earth Sciences, New Delhi, India, for the financial assistance under the research project entitled "Studies on Brachyuran crabs of Saurashtra coast" (Sanction No.: MoES/16/06/2013-RDEAS of 11-11-2014). Moreover, to the Gujarat Biodiversity Board, Government of Gujarat, India, for financial support under research project entitled "Documentation of Crustacean (Phylum Arthropoda) Biodiversity of Gujarat (Sanction No.: GBB/RS/2037-41/2013-14 of 13-03-2014). The authors are also thankful to Dr. Bhavik Patel for preparation of map of study area.

6. References

- McLaughlin PA. Comparative Morphology of Recent Crustacea. San Francisco, CA: W.H. Freeman. 1980; 12:1-177
- Osawa M, McLaughlin PA. Annotated checklist of anomuran decapod crustaceans of the world (exclusive of the Kiwaioidea and families Chirostylidae and Galatheidae of the Galatheoidea) Part II - Porcellanidae. The Raffles Bulletin of Zoology Supplement. 2010; 23:109-129.
- Prakash S, Kumar TT, Khan SA. Checklist of the Porcellanidae (Crustacea: Decapoda: Anomura) of India. Check List. 2013; 9(6):1514-1518.
- Trivedi JN, Osawa M, Vachhrajani KD. A new species of the genus *Diogenes* Dana, 1851 (Crustacea: Decapoda: Anomura: Diogenidae) from Gujarat, northwestern India. Zootaxa. 2016; 4208(2):189.
- Trivedi JN, Vachhrajani KD. An annotated checklist of hermit crabs (Crustacea, Decapoda, Anomura) of Indian waters with three new records. Journal of Asia-Pacific Biodiversity. 2017; 10(2):175-182.
- Trivedi JN, Vachhrajani KD. First record of two porcellanid crabs from Gujarat state, India (Crustacea: Decapoda: Porcellanidae). Journal of Marine Biological Association of India. 2013; 55:55-8.
- Sivasubramanian K, Ravichandran S, Anbuhezhan R. First discovery of porcellanid crab, *Porcellanella picta* (Crustacea: Decapoda: Porcellanidae), from southeast coast of India. Journal of Asia-Pacific Biodiversity. 2014; 7(3):248-251.
- Kumaralingam S, Raghunathan C, Venkataraman K. First record of the commensal porcelain crab, *Neopetrolisthes spinatus* (Crustacea: Decapoda: Anomura: Porcellanidae), from India. Marine Biodiversity Records. 2015; 8(90):1-3.
- Trivedi DJ, Trivedi JN, Soni GM, Purohit BD, Vachhrajani KD. Crustacean fauna of Gujarat state of India: A review. Electronic Journal of Environmental Science. 2015; 8:23-31.
- Beleem I, Poriya P, Gohil B. Porcelain crabs (Crustacea: Decapoda: Anomura) of western coast of India. Marine Biodiversity Records. 2016; 9(1):43.
- Rahayu DL, Forest J. Le genre *Diogenes* (Decapoda, Anomura, Diogenidae) en Indonésie, avec la description de six espèces nouvelles. Bulletin du Muséum National d'Histoire Naturelle, Paris [1994] (4). 1995; 16(A):383-415.
- Rahayu DL. Notes on littoral hermit crabs (excluding Coenobitidae) (Crustacea: Decapoda: Anomura) mainly from Singapore and peninsular Malaysia. The Raffles Bulletin of Zoology. 1996; 44:335-355.
- Siddiqui FA, Kazmi QB, McLaughlin PA. Review of the Pakistani species of *Diogenes* Dana 1851 (Decapoda Anomura Paguroidea Diogenidae). Tropical Zoology. 2004; 17(2):155-200.
- Kazmi QB, Siddiqui FA. An illustrated key to the Malacostraca (Crustacea) of the northern Arabian Sea. Part 6: Decapoda Anomura. Pakistan Journal of Marine Sciences. 2006; 15(1):11-79.
- De Man JG. Report on the Podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F.R.S., Superintendent of the Museum, parts IV and V. Journal of the Linnean Society, London. 1888; 22:177-240.
- Alcock A. Anomura. Fasc. I. Pagurides. Catalogue of the Indian Decapod Crustacea in the Collection of the Indian Museum 2. Indian Museum, Calcutta. 1905, 197.
- McLaughlin PA, Rahayu DL, Komai T, Chan TY. A Catalogue of the Hermit Crabs (Paguroidea) of Taiwan.

- National Taiwan Ocean University, Keelung. 2007, 367.
- 18 Dineshbabu AP, Durgekar RN, Zacharia PU. Estuarine and marine decapods of Karnataka inventory. Fishing Chimes. 2011; 30:20-24.
 - 19 Thomas MM. On a collection of hermit crabs from the Indian waters. Journal of Marine Biological Association of India. 1989; 31:59-79.
 - 20 Reddy KN, Ramakrishna G. On the pagurid crabs (Crustacea-Decapoda) from Andaman and Nicobar islands. Records of Zoological Survey of India. 1972; 66:19-30.
 - 21 Rahayu DL. Descriptions of two new species of hermit crabs, *Clibanarius rubroviria* and *C. rutilus* (Crustacea: Decapoda: Anomura: Diogenidae) from Indonesia. The Raffles Bulletin of Zoology. 1999; 47(2):299-307.
 - 22 Krauss F. Die südafrikanischen Crustaceen. Eine Zusammenstellung aller bekannten Malacostraca, Bemerkungen über deren Lebensweise und geographische Verbreitung, nebst Beschreibung und Abbildung mehrerer neuer Arten. E. Schweizerbart, Stuttgart. 1843, 68.
 - 23 Barnard KH. Descriptive catalogue of South African decapod Crustacea (crabs and shrimps). Annals of the South African Museum. 1950; 38:471-481.
 - 24 Hiller A, Harkantra S, Werding B. Porcellanid crabs from Goa, eastern Arabian Sea (Crustacea: Decapoda: Porcellanidae). Journal of the Bombay Natural History Society. 2010; 107(3):201-212.
 - 25 Mustaqim J. Species of porcellanid crabs from Karachi. Pakistan Journal of Zoology. 1972; 4(2):153-159.
 - 26 Sankolli KN. On the Porcellanidae (Crustacea: Anomura) of Ratnagiri along the west coast of India. In: Proceedings of the Symposium on Crustacea held at Ernakulam from January 12 to 15, 1965. Part I. Marine Biological Association of India. Symposium Series. 1968; 2: 295-313. [Imprint 1966 but published in 1968][See Low and Ng (2012)^[28]]
 - 27 Osawa M, Chan TY. Part III Porcellanidae (Porcelain crabs). In: T.-Y. Chan (ed.). Crustacean Fauna of Taiwan: Crab-like Anomurans (Hippoidea, Lithoidoidea and Porcellanidae). Keelung: National Taiwan University, 2010, 67-181.
 - 28 Low MEY, Ng PKL. The decapod crustaceans described by C. Sankarankutty, and a replacement name for *Jonesius Sankarankutty*, 1962 (Crustacea: Brachyura: Domeciidae), preoccupied by *Jonesius Yamaguti*, 1959 (Cestoda: Cyclophyllidea: Hymenolepididae). Zootaxa. 2012; 3363:59-62.
 - 29 Kachhiya P, Raval J, Poriya P, Kundu R. Diversity and new records of intertidal hermit crabs of the genus *Clibanarius* (Crustacea: Decapoda: Diogenidae) from Gujarat coast off the northern Arabian Sea, with two new records for the mainland Indian coastline. Journal of Threatened Taxa. 2017; 9(6): 10334-10339.