

Some porcelain crabs (Decapoda: Anomura) from the Andaman Sea, India, with an identification key to Indian porcellanids

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ABSTRACT

The present study provides systematic accounts of three porcellanid species collected onboard Fishery Oceanographic Research Vessel “Sagar Sampada” from the Andaman Sea. The record of *Petrolisthes scabriculus* (Dana, 1852) confirms the occurrence of this species in Indian waters. *Polyonyx biunguiculatus* (Dana, 1852) is reported for the first time from India. *Porcellanella haigae* Sankarankutty, 1963, previously described from the Gulf of Mannar, is recorded for the first time from the Andaman Sea. An updated identification key to all the 33 species of porcellanid crabs known from the Indian Exclusive Economic Zone is also provided.

KEYWORDS

Fauna, Galatheoidea, Indian Ocean, new record, porcelain crabs

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INTRODUCTION

The Indian Exclusive Economic Zone comprises three water bodies, namely the eastern Arabian Sea, western and southeastern Bay of Bengal, and western Andaman Sea, which differ significantly in physical and biological characteristics (Panikkar and Jayaraman, 1966; Varkey et al., 1996). The earliest records of porcellanid crabs from Indian waters comprised nine species, including three new to science, from the Nicobar Islands during the “Novara” expedition (Heller, 1862; 1865). Several studies (Thurston, 1887; 1890; 1895; Henderson, 1893; Sankarankutty, 1961; 1962; 1963) reported 12 species from the southeastern coast of India, including one new genus, *Pseudoporcellanella* Sankarankutty, 1962 and two new species. Extensive studies of the porcellanid fauna of the western coast of India (Sankolli, 1965; 1966a; 1966b; 1968; Hiller et al., 2010; Trivedi et al., 2017) further yielded eleven species including three new species. Heller (1865) reported *Porcellana scabricula* Dana, 1852 (= *Petrolisthes scabriculus*) from the Nicobar Islands, but Haig (1965) suggested reconfirmation due to possible confusion with *Petrolisthes militaris* (Heller, 1862). Recent studies also provided additional reports of porcellanids from Indian waters, including three new zoogeographical records (Prakash et al., 2013a; Kumaralingam et al., 2015; Josileen et al., 2020; Chowdhury and Mitra, 2023; Silambarasan et al., 2023). Prakash et al. (2013b) listed 30 species from 11 genera of porcellanid crabs in Indian waters. The most recent checklist of the Indian anomuran fauna (Patel et al., 2022) updated all the previous records of 12 genera and 32 species of porcellanids. A recent study by Fang et al. (2023; 2024) further showed the presence of *Petrolisthes shanyingi* Fang, Dong, Yang and Li, 2024 in the Indian EEZ based on previously published reports. Most recently, Mitra et al. (2024) described *Raphidopus dhritiae* Mitra, Chowdhury and Bose, 2024, from West Bengal.

The present paper reports three porcellanid species based on material collected from the Indian EEZ, i.e., *Petrolisthes scabriculus* (Dana, 1852) as a definite occurrence in the region, *Polyonyx biunguiculatus* (Dana, 1852) as the first record from the region, and *Porcellanella haigae* Sankarankutty, 1963, as a new record in the Andaman Sea. Even though several studies have documented porcellanid crabs in Indian

waters, there is no identification key to all the known species in the area. In the present study, we fill this gap by providing a consolidated identification key to all the known genera and species of porcellanids of the Indian EEZ.

MATERIALS AND METHODS

The specimens examined were primarily obtained onboard the Fishery Oceanographic Research Vessel (FOR/V) “Sagar Sampada” during cruise number 388 (off Andaman and Nicobar Islands, August 2019), using a Naturalist’s dredge and chain dredge (Fig. 1). The specimens were cleaned, and the morphological characters were photographed using a Leica M80 stereo-zoom microscope equipped with a Leica MC170 HD microscope camera and Leica Application Suite imaging software. Measurement of carapace and appendages was made with the scaling tool provided in the Leica Application Suite imaging software. The map used in the present study was plotted using ODV mapping software version 5.3.0 (Schlitzer, 2022).

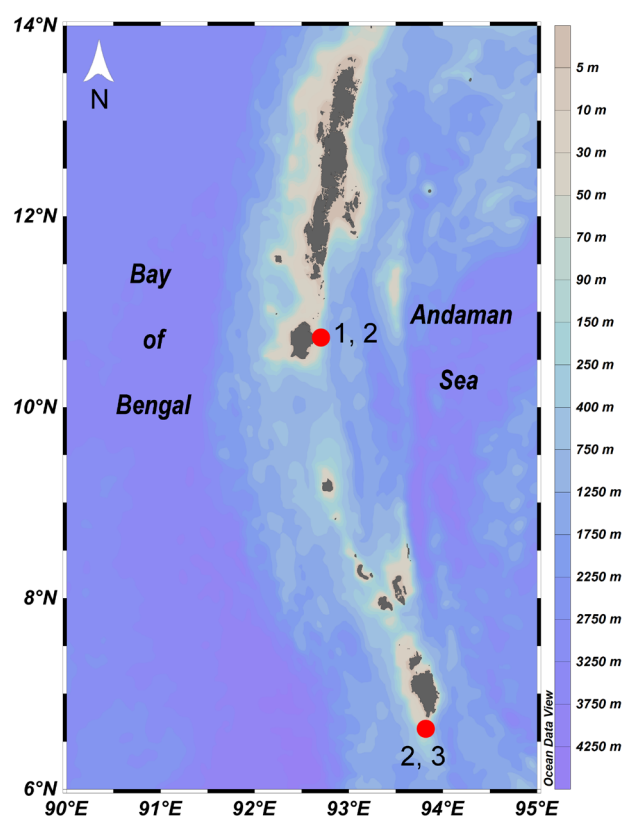


Figure 1. Map of the study area indicating the sites of sample collection of porcellanid taxa in the Indian EEZ. 1, *Petrolisthes scabriculus* (Dana, 1852); 2, *Polyonyx biunguiculatus* (Dana, 1852); 3, *Porcellanella haigae* Sankarankutty, 1963.

The terminology used for porcellanids mainly follows that of Osawa and Chan (2010). Specimen size is indicated by carapace length (CL) measured on the dorsal midline from the tip of the rostrum to the posterior margin of the carapace and by the maximum width of the carapace (CW). The material examined is deposited as part of a reference voucher collection in the Referral Centre, Centre for Marine Living Resources & Ecology (CMLRE), which is the regional node of the Ocean Biodiversity Information System (OBIS) for the Indian Ocean. The occurrence data associated with the specimens will be available on the OBIS portal (<https://obis.org/>).

SYSTEMATICS

Family Porcellanidae Haworth, 1825

Genus *Petrolisthes* Stimpson, 1858

Petrolisthes scabriculus (Dana, 1852) (Figs. 2A, 3)

Porcellana scabricula Dana, 1852: 424 [type locality: Sulu Sea]. — Dana, 1855: pl. 28 fig. 13.

Porcellana (Petrolisthes) scabricula: De Man, 1888: 411.

Petrolisthes scabriculus: Haig, 1964: 358, fig. 2. — Haig, 1965: 98. — Nakasone and Miyake, 1968: 107, fig. 4. — Haig, 1979: 120, fig. 1. — Haig, 1989: 98. — Hsieh et al., 1997: 291, figs. 5F, 10. — Osawa, 2007: 28, fig. 8c, d. — Osawa and Chan, 2010: 157, figs. 123, 124. — Osawa, 2014: 260, fig. 2D.

Material examined. 1 male (6.18 × 6.17 mm) (IO/SS/ANO/00176), Andaman Sea, off Little Andaman Island, India, FOR/V “Sagar Sampada” station 38806, 10.72°N 92.72°E, 53 m depth, chain dredge, 10.viii.2019, coll. V.P. Padate.

Taxonomic remarks. Heller (1865) reported *Pi. scabricula* (= *Pe. scabriculus*) from the Nicobar Islands. However, Haig (1965) suggested that the record needed confirmation due to possible confusion with a morphologically close *Pe. militaris* (Heller, 1862). The present specimen confirms the occurrence of *Pe.*

scabriculus from India. The Indian specimen largely agrees with the description and illustrations of *Pe. scabriculus* provided by Osawa and Chan (2010). *Petrolisthes scabriculus* is immediately distinguishable from *Pe. militaris* and its closely similar species *Petrolisthes holthuisi* Hiller and Werding, 2010, by a distinct spine on the anterolateral margin of the carapace front, which is absent in the latter two species.

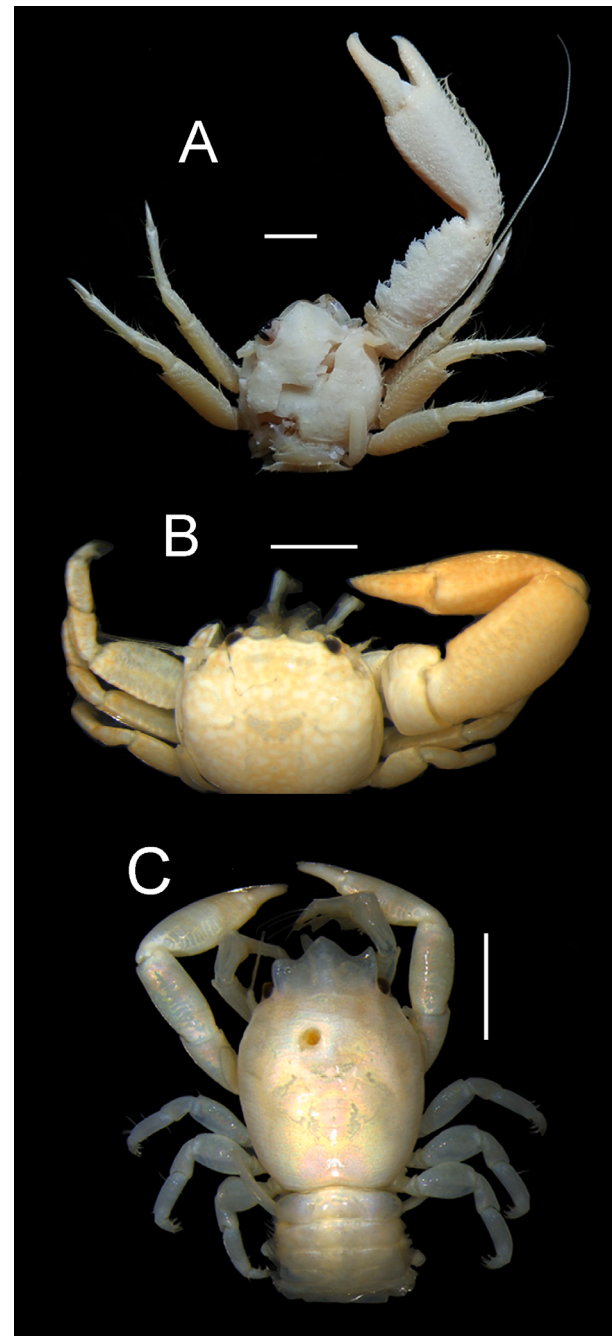


Figure 2. Dorsal habitus. **A**, *Petrolisthes scabriculus* (Dana, 1852) (male, IO/SS/ANO/00176); **B**, *Polyonyx biunguiculatus* (Dana, 1852) (male, IO/SS/ANO/00178); **C**, *Porcellanella haigae* Sankaranakutty, 1963 (ovigerous female, IO/SS/ANO/00157). Scale bars: A, C = 2 mm; B = 1 mm.

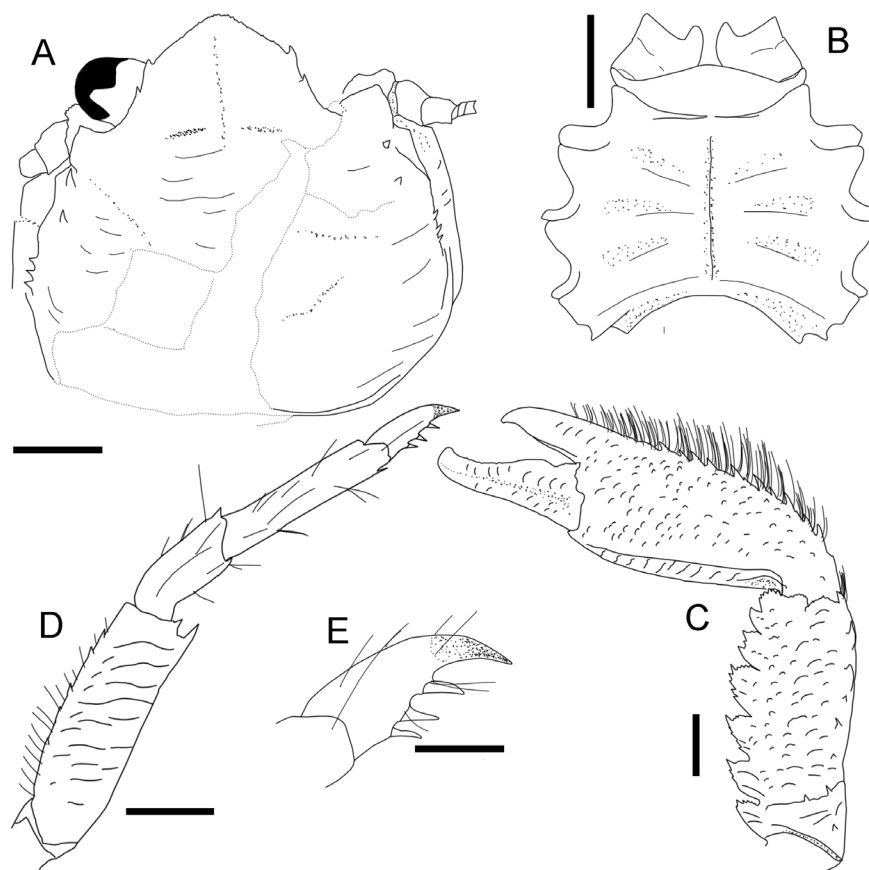


Figure 3. *Petrolisthes scabriculus* (Dana, 1852). Male, (6.18 × 6.17 mm) (IO/SS/ANO/00176). **A**, carapace, dorsal view; **B**, thoracic sternum, ventral view; **C**, right cheliped, dorsal view; **D**, right P2, lateral view; **E**, same, dactylus, lateral view. Scale bars: A–D = 1 mm; E = 0.5 mm.

Distribution. Andaman and Nicobar Islands, Gulf of Thailand, Christmas Island, Indonesia, New Guinea, western and eastern Australia, New Caledonia, Loyalty Islands, Chesterfield Islands, Philippines, Nansha Islands in South China Sea, Taiwan, Japan; 1–55 m in bathymetric range (Haig, 1979; Osawa, 2007; 2014; Osawa and Chan, 2010; present study) (Fig 1).

Genus *Polyonyx* Stimpson, 1858

Polyonyx biunguiculatus (Dana, 1852) (Figs. 2B, 4)

Porcellana biunguiculata Dana, 1852: 411 [type locality: Lifou Island, Loyalty Islands, by neotype selection (Osawa, 2007)]. — Dana, 1855: pl. 26, fig. 1a–d.

Polyonyx biunguiculatus: Stimpson, 1858: 229 — Miers, 1884: 559 (in part). — Johnson, 1970: 34. — Osawa, 2007: 31, figs. 9, 10. — Poupin et al., 2013: 24, fig 11A. — Prakash et al., 2013b: 1517 (checklist).

Polyonyx parabiunguiculatus Yang, 1996: 262, 268, fig. 5. [type locality: Nansha Islands, South China Sea].

?*Porcellana biunguiculata*: Haswell, 1882: 147.

?*Polyonyx biunguiculatus*: Ortmann, 1894: 30. — Southwell, 1906: 219. — Haig, 1983: 286. — Haig, 1992: 320, fig. 16.

Polyonyx tuberculosus: Zehntner, 1894: 184.

?*Polyonyx tuberculosus*: Rathbun, 1924: 31, pl. 1, fig. 7.

Not *Polyonyx biunguiculatus*: Gordon, 1935: 10, fig. 5b, d. — Miyake, 1942: 371, figs. 30–32. — Miyake, 1943: 144, fig. 60. — Johnson, 1958: 105, fig. 3. — Haig, 1964: 377 (in part). — Haig, 1965: 112. — Haig, 1979: 130, figs. 16–19. — Yang and Naiyanetr, 1997: 7, fig. 4A–E. [= *Polyonyx similis* Osawa, 2015].

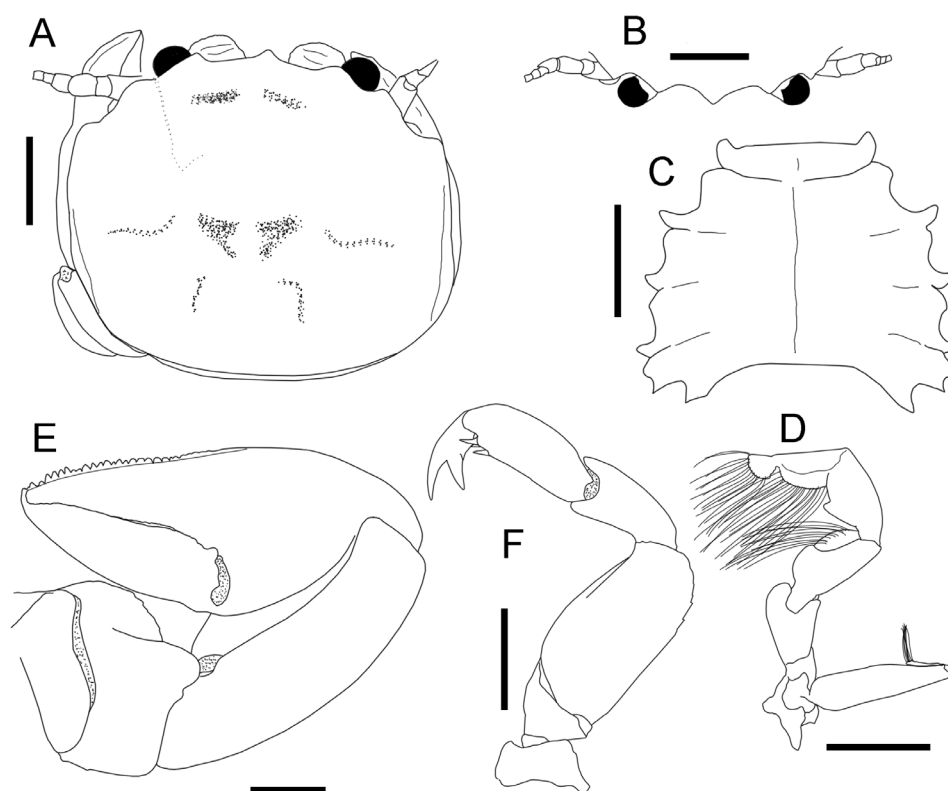


Figure 4. *Polyonyx biunguiculatus* (Dana, 1852). Male, (2.4 × 2.8 mm) (IO/SS/ANO/00178). **A**, carapace, dorsal view; **B**, carapace frontal margin, frontal view; **C**, thoracic sternum, ventral view; **D**, left Mxp3, lateral view; **E**, right larger cheliped, dorsal view; **F**, left P4, lateral view. Scale bars: A, E = 1 mm; B–D, F = 0.5 mm.

Material examined. 4 males (2.1–2.4 × 2.5–2.8 mm) (IO/SS/ANO/00178), Andaman Sea, off Little Andaman Island, India, FOR/V “Sagar Sampada” station 38806, 10.72°N 92.72°E, 53 m, chain dredge, 10.viii.2019, coll. V.P. Padate. 1 male (3.3 × 3.6 mm) (IO/SS/ANO/00179), Andaman Sea, off Great Nicobar Island, India, FOR/V “Sagar Sampada” station 38818, 6.64°N 93.82°E, 56 m, chain dredge, 16.viii.2019, coll. V.P. Padate.

Diagnosis. Carapace transversely subrectangular in general outline; dorsal surface gently convex from side to side, glabrous, pitted; rostrum moderately broad, trilobate in frontal view, median lobe bluntly triangular, overreaching triangular lateral lobes (Fig. 4A, B). Thoracic sternite 3 anterior margin nearly straight, lateral lobes bluntly produced; sternite 4 with anterior margin gently concave (Fig. 4C). Cheliped carpus slightly convex on dorsal surface, extensor margin convex, dorso-flexor margin gently concave, smooth; palm inflated, smooth on dorsal

surface, flexor margin blunt, extensor margin with low tuberculate ridge extending from distal half of palm to distal tip of fixed finger; dactylus with longitudinal ridge composed of small tubercles along posterior margin of dorsal surface (Fig. 4E). Dactyli of ambulatory legs each terminating in weakly curved, bifurcate claw, flexor claw stouter and shorter than extensor claw; flexor margin with 2 small corneous spines (Fig. 4F).

Taxonomic remarks. Based on the present specimens, a short diagnosis of *Po. biunguiculatus* is provided above because the species is recorded from Indian waters for the first time. *Polyonyx biunguiculatus* is distinguished from its closest congener *Po. similis* by the narrower median rostral lobe, absence of flattened tubercles on the distal dorso-anterior surface of the cheliped palms and dense tuft of plumose setae on the ventroproximal cutting region of the dactylus of male larger cheliped, and the presence of a pair of gonopods on the male second abdominal segment (Osawa, 2015).

In live coloration, the present specimens resembled the material of *Po. biunguiculatus* from Mayotte, southwestern Indian Ocean, provided by Poupin et al. (2013, fig. 11A).

Distribution. Red Sea, eastern coast of Africa, Madagascar and neighboring islands, Mayotte and Glorioso Islands, Réunion, Seychelles, Moluccas, Australia, Hong Kong, Nansha Islands in the South China Sea, New Caledonia, Loyalty Islands; 12–120 m in bathymetric range (Haig, 1964; 1983; Osawa, 2007; Poupin et al., 2013; present study) (Fig. 1). This is the first record of *P. biunguiculatus* from Indian waters.

Genus *Porcellanella* White, 1851

Porcellanella haigae Sankarankutty, 1963 (Figs. 2C, 5)

Porcellanella triloba: Miyake, 1943: 134, fig. 53 — Lieske and Myers, 2004: 338 (color photograph), fig. 9.

Porcellanella haigae Sankarankutty, 1963: 273, fig. 1a–e [type locality: Off Tuticorin in the Gulf of Mannar, intertidal and associated to sea pen]. — Haig, 1966: 61 — Nakasone and Miyake, 1972: 142, fig. 3A–H. — Haig, 1981: 288. — Haig, 1983: 287. — Haig, 1989: 99. — Werding and Hiller, 2007: 19, fig. 18a–c. — Prakash et al., 2013b: 1517 (checklist). — Patel et al., 2022: 38 (checklist), 80 (checklist).

Material examined. 1 ovigerous female (4.5 × 3.4 mm) (IO/SS/ANO/00157), Andaman Sea, off Great Nicobar Island, India, FOR/V “Sagar Sampada” station 38818, 6.64°N 93.82°E, 56 m, chain dredge, 16.viii.2019, coll. V.P. Padate.

Taxonomic remarks. *Porcellanella haigae* was originally described on the basis of one male and one female from the Gulf of Mannar and distinguished from *Porcellanella triloba* White, 1851 by the form of the carapace and cheliped merus and nature of the spines

on the ambulatory dactyli (Sankarankutty, 1963). The present specimen represents the second record of the species from India and the first record from the Andaman Sea. It agrees with the original description and a subsequent account by Nakasone and Miyake (1972) of *P. haigae* in the absence of mesiodistal lobe on the cheliped merus and the ambulatory dactyli each with third spine from the proximal end being largest among the flexor marginal spines.

Distribution. Red Sea, Seychelles, India, Philippines, Japan, Palau Islands; 18–60 m in bathymetric range (Haig, 1989; Werding and Hiller, 2007; present study) (Fig. 1).

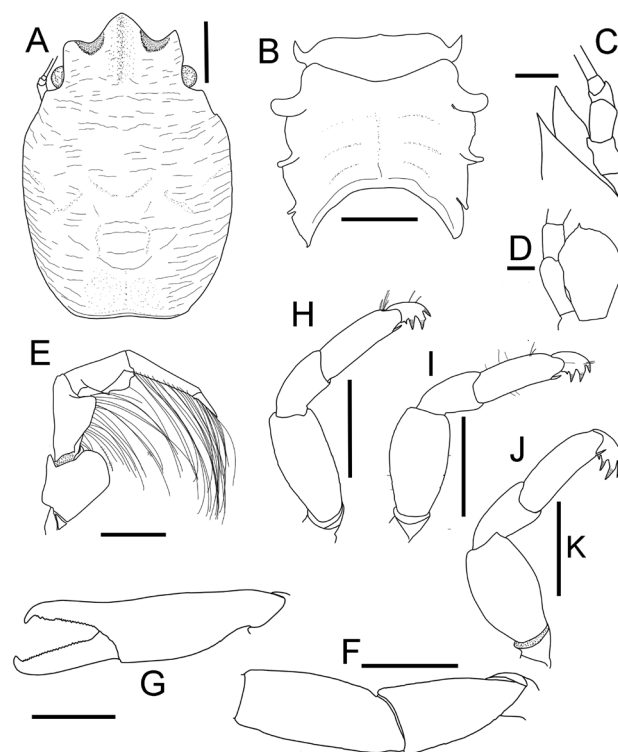


Figure 5. *Porcellanella haigae* Sankarankutty, 1963. Ovigerous female (4.5 × 3.4 mm) (IO/SS/ANO/00157). **A**, carapace, dorsal view; **B**, thoracic sternum, ventral view; **C**, left antenna, ventral view; **D**, left antennule, ventral view; **E**, right Mxp3, lateral view; **F**, right cheliped, merus and carpus, dorsal view; **G**, same, chela, dorsal view; **H–J**, right P2–4, lateral view. Scale bars: **A**, **E–K** = 1 mm; **B** = 0.5 mm; **C**, **D** = 0.2 mm.

Identification key to all the porcellanids known in the Indian EEZ

1. Chelipeds straight, directed anteriorly; carpus wider than long. Ambulatory dactyli triunguiculate
..... Genus *Pseudoporcellanella* Sankarankutty, 1962; monotypic, *P. manoliensis* Sankarankutty, 1962
– Chelipeds strongly bent at propodus-carpus articulation 2
2. Antennal peduncle with articles 2–4 freely accessible to orbit 3
– Antennal peduncle with articles 2–4 excluded from orbit by projection of article 1 appressed to anterior carapace margin 20
3. Pterygostomian flap with posterior portion composed of 2 or more pieces separated from anterior portion by membranous interspaces (Genus *Pachycheles* Stimpson, 1858) 4
– Pterygostomian flap composed of single, undivided plate 7
4. Carapace without setae 5
– Carapace distinctly setose 6
5. Males with pair of gonopods on abdominal somite 2 *Pa. natalensis* (Krauss, 1843)
– Males without gonopods *Pa. sculptus* (H. Milne Edwards, 1837)
6. Frontal margin of carapace without setal tufts, regions behind frontal margin with scattered setae. Rostrum broad, nearly transverse in dorsal view *Pa. pisoides* (Heller, 1865)
– Frontal margin of carapace with tufts of short plumose setae and long, scattered, simple setae. Rostrum relatively narrow, bluntly triangular in dorsal view *Pa. tomentosus* Henderson, 1893
7. Carapace gastric region strongly elevated. Ambulatory legs subcylindrical (Genus *Neopetrolisthes* Miyake, 1937) 8
– Carapace with evenly flattish or weakly convex dorsal surface. Ambulatory legs flattened laterally (Genus *Petrolisthes* Stimpson, 1858) 9
8. Carapace with strongly elevated protogastric ridges; supra-ocular spine present
..... *N. spinatus* Osawa and Fujita, 2001
– Carapace without elevated protogastric ridges; supra-ocular spine absent *N. maculatus* (H. Milne Edwards, 1837)
9. Frontal margin of carapace tridentate, dorsal surface and extremities uneven, tuberculate. Cheliped carpus with 1 proximal tooth on flexor margin *Pe. ornatus* Paulson, 1875
– Frontal margin of carapace sinuously triangular or trilobate, dorsal surface and extremities with faint or distinct, short and long transverse ridges. Cheliped carpus usually with 2 or more teeth on flexor margin 10
10. Carapace epibranchial spine present on each side 11
– Carapace epibranchial spine absent on each side 18
11. Inner orbital angles of carapace each produced into small spine *Pe. scabriculus* (Dana, 1852)
– Inner orbital angles of carapace unarmed 12

12. Lateral margin of carapace with some spines behind epibranchial spine *Pe. militaris* (Heller, 1862)
 – Lateral margin of carapace unarmed 13
13. Supra-ocular spine of carapace present on each side *Pe. coccineus* (Owen, 1839)
 – Supra-ocular spine of carapace absent on each side 14
14. Meri of ambulatory legs each with row of spines on extensor margin 15
 – Meri of ambulatory legs without spines on extensor margins 16
15. Carapace covered with numerous transverse ridges *Pe. moluccensis* (De Man, 1888)
 – Carapace covered with numerous, short plumose setae *Pe. tomentosus* (Dana, 1852)
16. Cheliped carpus and chela with numerous, distinct transverse and oblique ridges
 *Pe. boscii* (Audouin, 1826)
 – Cheliped carpus and chela without distinct transverse and oblique ridges 17
17. Cheliped carpus with 3 broad teeth on dorso-flexor margin. P2 merus with small blunt distal spine on the lateral flexor margin; P2 carpus unarmed on extensor margin
 *Pe. shanyingi* Fang, Dong, Yang and Li, 2024
 – Cheliped carpus usually with 4 or 5 broad teeth on dorso-flexor margin. P2 merus with acute distal spine on the lateral flexor margin; P2 carpus with acute disto-extensor spine *Pe. lamarckii* (Leach, 1821)
18. Cheliped carpus with only 1 proximal tooth on dorso-flexor margin *Pe. teres* Melin, 1939
 – Cheliped carpus usually with more than 3 teeth on dorso-flexor margin 19
19. Gape of cheliped fingers with distinct tufts of plumose setae *Pe. inermis* (Heller, 1862)
 – Gape of cheliped fingers without distinct pubescence ventrally *Pe. rufescens* (Heller, 1861)
20. Carapace distinctly longer than wide (Genus *Porcellanella* White, 1851) 21
 – Carapace wider than long or slightly longer than wide 22
21. Cheliped merus armed with distinct, subtriangular lobe on dorso-flexor margin distally. Dactyli of ambulatory legs each with proximal second tooth largest *Pc. triloba* White, 1851
 – Cheliped merus armed with indistinct lobe on dorso-flexor margin distally. Dactyli of ambulatory legs each with proximal third tooth largest *Pc. haigae* Sankarankutty, 1963
22. Dactyli of ambulatory legs straight, slender; flexor margins without spines (Genus *Raphidopus* Stimpson, 1858) 23
 – Dactyli of ambulatory legs curved, stout; flexor margins with spines 24
23. Carapace branchial margins without spines. Cheliped carpus unarmed on extensor margin
 *R. indicus* Henderson, 1893
 – Carapace branchial margins with spines. Cheliped carpus armed with spines on extensor margin
 *R. dhritiae* Mitra, Chowdhury and Bose, 2024

24. Frontal margin of carapace strongly deflexed ventrally, appearing straight or weakly sinuous in dorsal view. Dactyli of ambulatory legs each terminating in bifurcate claw (Genus *Polyonyx* Stimpson, 1858) 25
 - Frontal margin of carapace horizontal or down-tilted, appearing multilobed, broadly angular, or rounded in dorsal view. Dactyli of ambulatory legs each terminating in single claw 29
25. Dactyli of ambulatory legs each with dorsal terminal claw smaller than ventral terminal claw *Po. loimicola* Sankolli, 1965
 - Dactyli of ambulatory legs each with dorsal terminal claw longer or slenderer than ventral terminal claw 26
26. Dorsal terminal claw of dactylus of each ambulatory leg subequal in length to ventral terminal claw 27
 - Dorsal terminal claw of dactylus of each ambulatory leg distinctly longer than ventral terminal claw ... 28
27. Median frontal lobe of carapace triangular. Dactyli of ambulatory legs each with 2 spines on flexor margin *Po. biunguiculatus* (Dana, 1852)
 - Median frontal lobe of carapace rounded. Dactyli of ambulatory legs each with only 1 spine on flexor margin *Po. obesulus* Miers, 1884
28. Chelae with dense plumose setae *Po. splendidus* Sankolli, 1966
 - Chelae at most with short setae *Po. hendersoni* Southwell, 1909
29. Frontal margin of carapace broadly angular or rounded (Genus *Ancylocheles* Haig, 1978) 30
 - Frontal margin of carapace multilobed 31
30. Median lobe of third thoracic sternite with strongly convex anterior margin. Third maxilliped merus with subrectangular lobe on flexor margin *A. peterngi* Trivedi, Osawa and Vachhrajani, 2017
 - Median lobe of third thoracic sternite with transverse anterior margin. Third maxilliped merus with rounded lobe on flexor margin *A. gravelei* (Sankolli, 1966)
31. Dorsal surface of carapace areolate, regions well-defined (Genus *Enosteoides* Johnson, 1970). Article 1 of antennular peduncle with sharp spines on anterior margin. Cheliped carpus with minute denticles on proximal part of dorso-flexor margin *E. ornatus* (Stimpson, 1858)
 - Dorsal surface of carapace surface smooth or bearing fine striations 32
32. Carapace without hepatic spine, branchial margin unarmed behind epibranchial angle. Chelipeds subequal (Genus *Porcellana* Lamarck, 1801). Frontal margin of carapace with shallowly bifid median tooth, lateral frontal teeth narrower than median tooth and separated by broad V-shaped notch; epibranchial angle with 2 or 3 denticles. Cheliped carpus with 2 teeth and few smaller teeth on dorso-flexor margin *Pi. persica* Haig, 1966
 - Carapace with hepatic spine, branchial margin with 1 or more spines behind epibranchial angle. Chelipeds unequal 33

33. Frontal margin of carapace with median notch. Spination of chelipeds similar in both sexes (Genus *Lissoporcellana* Haig, 1978) 34
 - Frontal margin of carapace without median notch. Spination of chelipeds more prominent in female than male (Genus *Pisidia* Leach, 1821) 35
34. Cheliped carpus with 3 spines on extensor margin *L. spinuligera* (Dana, 1853)
 - Cheliped carpus unarmed on extensor margin *L. quadrilobata* (Miers, 1884)
35. Rostrum with median lobe nearly as broad as lateral lobes. Cheliped carpus unarmed on dorso-flexor margin *Pi. dehaanii* (Krauss, 1843)
 - Rostrum with median lobe distinctly broader than lateral lobes. Cheliped carpus armed with spines on dorso-flexor margin *Pi. gordonii* (Johnson, 1970)

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Author Contributions

Conceptualization and design: ST, VPP, SSC. Performed Research: ST, VPP. Acquisition of data: SSC, ST. Analysis and interpretation of data: ST, SSC, VPP, MO. Preparation of figures/tables/maps: ST. Writing – original draft: ST, VPP, MO. Writing – critical review and editing: MO, SSC. Project administration: SSC.

Consent for publication

All authors declare that they have reviewed the content of the manuscript and gave their consent to submit the document.

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Not relevant.

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Study permits

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