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A new species of *Polyonyx* Stimpson, 1858 (Crustacea: Decapoda: Anomura: Porcellanidae) from the PANGLAO 2004 Marine Biodiversity Project in the Philippines

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Abstract. A new porcellanid crab from the Philippines, *Polyonyx similis*, is described from material collected through the PANGLAO 2004 Marine Biodiversity Project in the Philippines. The new species is morphologically allied to *P. biunguiculatus* (Dana, 1852) and has been confused with the latter species in previous studies. However, *Polyonyx similis*, new species, can be distinguished from *P. biunguiculatus* by the shape of the rostrum, the palm of the cheliped bearing flattened tubercles on the distal dorso-anterior surface, and the lack of male gonopods. The size-related changes of armatures on the carapace and appendages in the new species are provided. Of interest is that young specimens of *P. similis* have spines on the lateral margins of the carapace, the armature is known as a character of the genus *Aliaporcellana* Nakasone & Miyake, 1969 rather than *Polyonyx* Stimpson, 1858. Although the close relationship between the species of the *P. biunguiculatus* group and *Aliaporcellana* are suggested, the *Polyonyx* species group is still distinguishable from the latter genus by the blunt outer orbital angle, the unarmed third article of the antennal peduncle, and the usually elongate carpus of the cheliped.

Key words. Crustacea, Porcellanidae, *Polyonyx*, new species, PANGLAO, Philippines

INTRODUCTION

The PANGLAO 2004 Marine Biodiversity Project (May–July 2004) was an international survey of marine fauna, with emphasis on crustaceans and mollusks, conducted around the island of Panglao located southwest off Bohol in the central Philippines (Bouchet et al., 2009). Osawa (2007a) described a new species, *Polyonyx spina*, on the basis of the specimens from this project and the Loyalty Islands. Subsequently, Osawa (2007b) designated a neotype of *Polyonyx biunguiculatus* (Dana, 1852) for a male specimen from the Loyalty Islands to fix its specific identity because the holotype is apparently lost. This action has helped to clarify the identity of an undescribed species of the genus *Polyonyx* Stimpson, 1858, from the PANGLAO material, which closely resembles *P. biunguiculatus* and has been confused with the latter species in previous studies. The Philippine specimens differ from the true *P. biunguiculatus* in the shape of the rostrum, the possession of flattened tubercles on the distal dorso-anterior surface of the palm of the cheliped, and the lack of male gonopods. This species is herein described as new to science, and size-related intraspecific variations are also discussed.

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MATERIAL AND METHODS

The holotype and one paratype are deposited in the Crustacean Reference Collection (NMCR) of the National Museum of the Philippines, Manila, and other paratypes are located in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (formerly Raffles Museum of Biodiversity Research), National University of Singapore. Non-type specimens of the present new species, which were previously reported as *P. biunguiculatus* by Haig (1964), are deposited in the Zoological Museum (ZMUC), Natural History Museum of Denmark, University of Copenhagen.

Carapace length (cl) was measured from the anterior median tip of the rostrum to the posteromedian margin of the carapace. Measurements of chelipeds were made as follows: length of carpus, along posterior margin and breadth, on dorsal transverse midline (excluding the anterior teeth, if present); length of chela, along anterior margin and height, along dorsodistal transverse line of palm; and length of dactylus, along posterior margin. Measurements of ambulatory legs were made as follows: length of merus, along dorsal margin and height, on lateral transverse midline; length of propodus, along dorsal margin and height, on lateral transverse line at base of distal round projection; and length of dactylus, along dorsal margin. Description of the chelipeds and ambulatory legs is based on specimens with carapace lengths larger than 2.3 mm (see **Variations**). Terminology mainly follows that of Osawa & Chan (2010), except for the uses of "dorsal" and "ventral" for "extensor" and "flexor" margins in the third maxilliped and ambulatory legs and "anterior" and "posterior" for "flexor" and "extensor" margins or surfaces in the chelipeds.

TAXONOMIC ACCOUNT

Family Porcellanidae Haworth, 1825

Genus *Polyonyx* Stimpson, 1858

Polyonyx similis, new species
(Figs. 1–5)

Polyonyx biunguiculatus: Gordon, 1935: 10, fig. 5b, d. — Miyake, 1942: 371, pl. I, fig. 1, text-figs. 30–32. — Johnson, 1958: 105, fig. 3. — Haig, 1964: 377 (in part); 1965: 112; 1979: 130, figs. 16–19. — Yang & Naiyanetr, 1997: 7, fig. 4A–E [not *Polyonyx biunguiculatus* (Dana, 1852)].

Type material. Holotype: male (cl 5.0 mm) (NMCR 27071), Philippines, Pamilacan Island, stn B24, 9°29.4' N, 123°56.0' E, 38 m, floor of cave, coll. PANGLAO 2004, 25 June 2004. Paratypes: 1 ovigerous female (cl 5.3 mm) (NMCR 27072), same data as holotype. 7 males (cl 2.4–5.1 mm), 2 ovigerous females (cl 2.5, 3.0 mm) (ZRC 2007.0678), Panglao Island, Alona reef, stn B2, 9°33.0' N, 123°46.5' E, 5 m, reef slope, 31 May 2004. 1 male (cl 3.6 mm), 1 female (cl 2.7 mm), 1 ovigerous female (cl 4.2 mm) (ZRC 2007.0679), Panglao Island, Arco Point, stn B3, 9°33.5' N, 123°48.6' E, 8 m, base of reef slope, 31 May 2004. 2 males (cl 3.2, 4.2 mm), 2 ovigerous females (cl 3.3, 4.2 mm) (ZRC 2007.0680), Panglao Island, BBC Point, stn B4, 9°33.2' N, 123°48.3' E, 24 m, reef slope with overhangs, 1 June 2004. 2 males (cl 2.6, 4.2 mm), 1 ovigerous female (cl 3.5 mm) (ZRC 2007.0681), Panglao Island, Biking, stn B5, 9°35.2' N, 123°50.4' E, 4 m, reef slope with overhangs, 2 June 2004. 2 males (cl 2.5, 4.2 mm), 3 ovigerous females (cl 3.0–4.3 mm) (ZRC 2007.0682), Balicasag Island, Black Forest, stn B6, 9°31.1' N, 123°41.3' E, 12–14 m, coral patches, 4 June 2004. 5 males (cl 2.3–4.3 mm), 1 ovigerous female (cl 3.4 mm) (ZRC 2007.0683), Panglao Island, Catarman, stn B7, 9°35.9' N, 123°51.8' E, 4–30 m, reef slope with caves, 5 June 2004. 1 female (cl 2.3 mm) (ZRC 2007.0684), Panglao Island, Napaling, stn B8, 9°37.1' N, 123°46.1' E, 3 m, subtidal reef platform, 7 June 2004. 1 male (cl 3.1 mm) (ZRC 2007.0685), Pamilacan Island, stn B11, 9°29.4' N, 123°56.0' E, 2–4 m, coral rubble, 11 June 2004. 3 males (cl 2.1–4.3 mm), 2 ovigerous females (cl 3.1, 4.2 mm) (ZRC 2007.0686), Bohol Island, Baclayon Takot, stn B13, 9°37.1' N, 123°52.6' E, 3–5 m, coral rubble, 15 June 2004. 2 males (cl 1.9, 2.4 mm) (ZRC 2007.0687), Panglao Island, Bingag, stn B16, 9°37.6' N, 123°47.3' E, 20 m, coral rubble on sand and gravel, 17 June 2004. 1 male (cl 3.8 mm), 1 ovigerous female (cl 4.2 mm) (ZRC 2007.0688), Panglao Island, Bingag, stn B17, 9°37.5' N, 123°46.9' E, 3–21 m, reef wall with small caves, 19 June 2004. 4 males (cl 3.5–4.3 mm), 2 ovigerous females (cl 2.6, 3.3 mm) (ZRC 2007.0689), Pamilacan Island, stn B19, 9°29.4' N, 123°56.0' E, 17 m, reef slope with cave, 21 June 2004. 2 males (3.8, 3.9 mm) (ZRC 2007.0690), Bohol Island, Ubajan, stn B20, 9°41.5' N, 123°51.0' E, 2–8 m, rocks and corals on sand and mud, 23 June 2004. 1 ovigerous female (cl 3.5 mm) (ZRC 2007.0691), Balicasag Island, Black Forest, stn B23, 9°31.1' N, 123°41.3' E, 20–25 m, rubble on sand, 25 June 2004. 2 males (cl 4.5, 4.8 mm), 1 ovigerous female (cl 4.5 mm) (ZRC 2007.0692), Pamilacan Island, stn B24, 9°29.4' N, 123°56.0' E, 38 m, floor of cave, 25 June 2004. 1 male (cl 3.8 mm), 1 female (cl 1.9 mm) (ZRC 2007.0693), Pamilacan Island, stn B25, 9°29.4' N, 123°56.1' E, 16 m, reef slope, 25 June 2004. 1 male (cl 2.7 mm) (ZRC 2007.0694), Panglao Island, north of Doljo, stn B36, 9°35.9' N, 123°44.5' E, 24 m, reef wall, 1 June 2004. 4 males (cl 2.1–2.7 mm), 2 females (cl 2.2, 2.6 mm) (ZRC 2007.0695), Panglao Island, Pontod Lagoon, stn B39, 9°32.8' N, 123°42.1' E, 17–25 m, reef wall with small caves, 2 July 2004. 1 male (cl 3.0 mm) (ZRC 2007.0696), Balicasag Island, stn B41, 9°30.9' N, 123°40.8' E, 17–19 m, floor of large cave, 4 July 2004. 1 male (cl 3.4 mm) (ZRC 2007.0697), Pamilacan Island, stn R31, 9°29.4' N, 123°56.0' E, 10–41 m, reef slope with caves, 8 July 2004. 3 males (cl 3.1–3.1 mm), 1 female (cl 2.9 mm), 1 ovigerous female (cl 3.0 mm) (ZRC 2007.0698), Panglao Island, Bolod, stn T1, 9°32.4' N, 123°47.3' E, 83–102 m, mud and many sponges, 30 May 2004. 1 male (cl 3.7 mm) (ZRC 2007.0699), Panglao Island, Bolod, stn T2, 9°32.4' N, 123°47.8' E, 152 m, coarse sand, 31 May 2004. 2 ovigerous females (cl 3.4, 3.9 mm) (ZRC 2007.0700), Balicasag Island, stn T38, 9°32.3' N, 123°42.3' E, 80–140 m, sponge bed, 4 July 2004. All paratypes collected by PANGLAO 2004 from the Philippines.

Other material examined. Philippines: 1 female (cl 4.3 mm) (ZMUC), 6 miles north-northeast of Sacol Island, Zamboanga, Mindanao, 64 m (= 35 fathoms), coral bottom, 6 March 1914, collected by Th. Mortensen. Singapore: 1 ovigerous female (cl 4.0 mm) (ZMUC), Shore at low tide, 12 December 1906, Consul Sv. Gad. Thailand: 1 male (cl 5.2 mm), 1 female (cl 3.1 mm), 1 ovigerous female (cl 4.8 mm) (ZMUC), Between Koh Mesan and Koh Chuen, Gulf of Thailand, 27 m (= 15 fathoms), stones, 6 February 1900, collected by Th. Mortensen.

Description. Carapace (Figs. 1A, 4A–C) transversely subrectangular, 1.1–1.3 (males) and 1.1–1.4 (females) times longer than broad (in only 2 small male specimens of cl 1.9 and 2.1 mm, as long as broad). Dorsal surface convex, with scattered, very short striae. Rostrum (Fig. 1B, C) broad, bent ventrally, trilobate in frontal view, with shallow transverse groove along anterior margin; median lobe low, subtriangular, weakly concave along dorsal midline, exceeding lateral lobes, with narrow or broad apex; lateral lobes narrow, each with rounded apex. Orbits shallow, supra-orbital margins oblique; outer orbital angles obtuse. Hepatic margins each with indistinct or low projection in large specimens, or with small spine or subacute projection in small specimens. Protogastric ridges not marked. Cervical grooves faintly demarcated. Branchial margins usually subparallel, somewhat constricted medially; anterior margins each with 1–4 small spines or crenulated (small specimens) or unarmed (large specimens); posterior margins and adjacent regions with long oblique rugae; anterior branchial regions each with broad, rounded convexity in small specimens.

Third thoracic sternite (Fig. 1D) with anterior margin trilobate and bearing sparse short setae (males) or row of longer setae (females); median lobe low, rounded subtriangular;

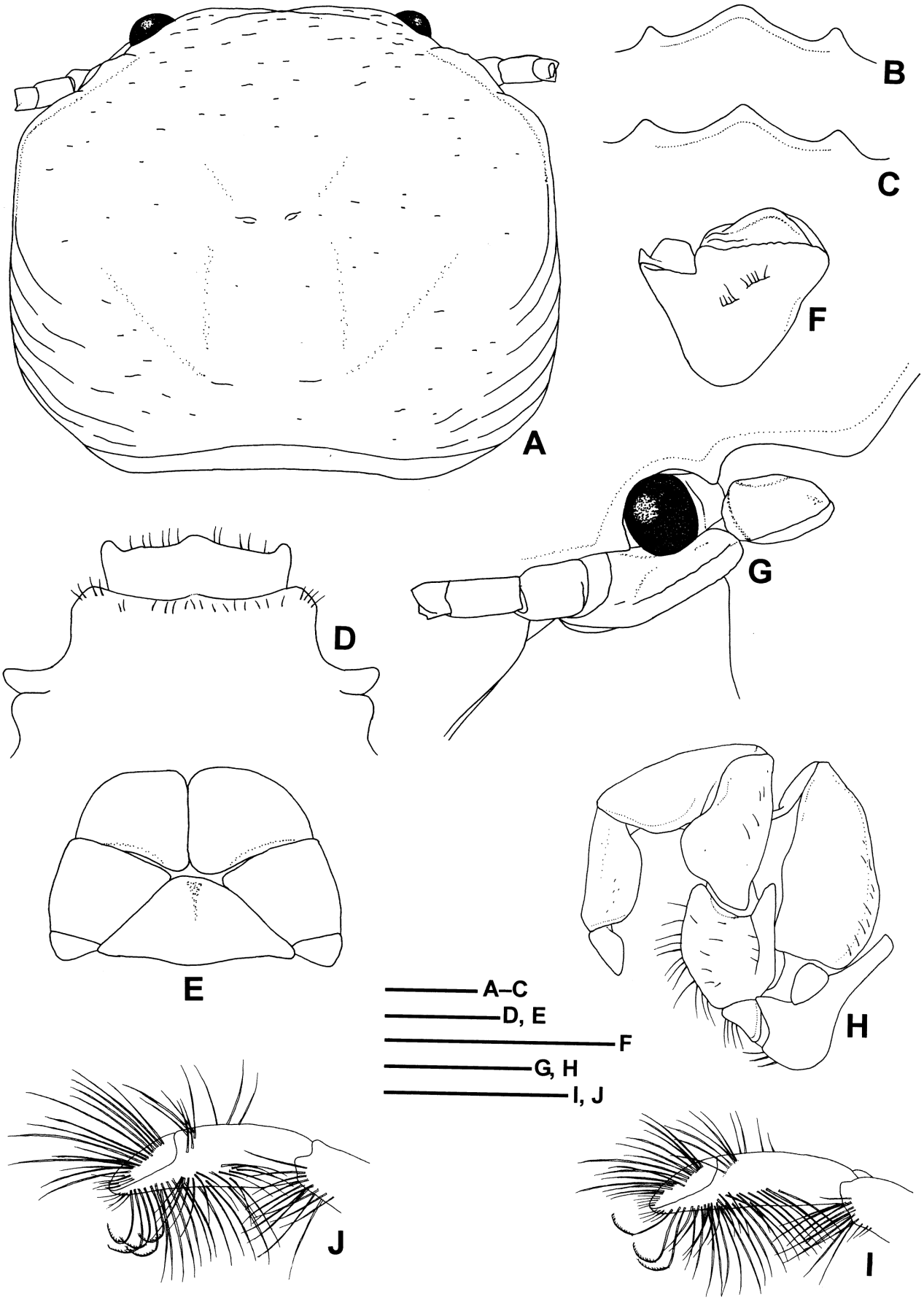

Fig. 1. *Polyonyx similis*, new species. A, B, D–H, holotype, male (cl 5.0 mm), stn B24, NMCR 27071; C, I, J, paratype, ovigerous female (cl 5.5 mm), stn B24, NMCR 27072. A, carapace and ocular and antennal peduncles, dorsal view; B, C, rostrum, anterior view; D, third and forth thoracic sternites, ventral view; E, telson, external view; F, basal segment of left antennular peduncle, ventral view; G, right anterior part of carapace and ocular and antennal peduncles, anterolateral view; H, left third maxilliped, lateral view (long setae on ventral margin omitted); I, J, left fifth pereopod, chela and distal part of carpus, dorsal view. Scale bars = 1.0 mm.

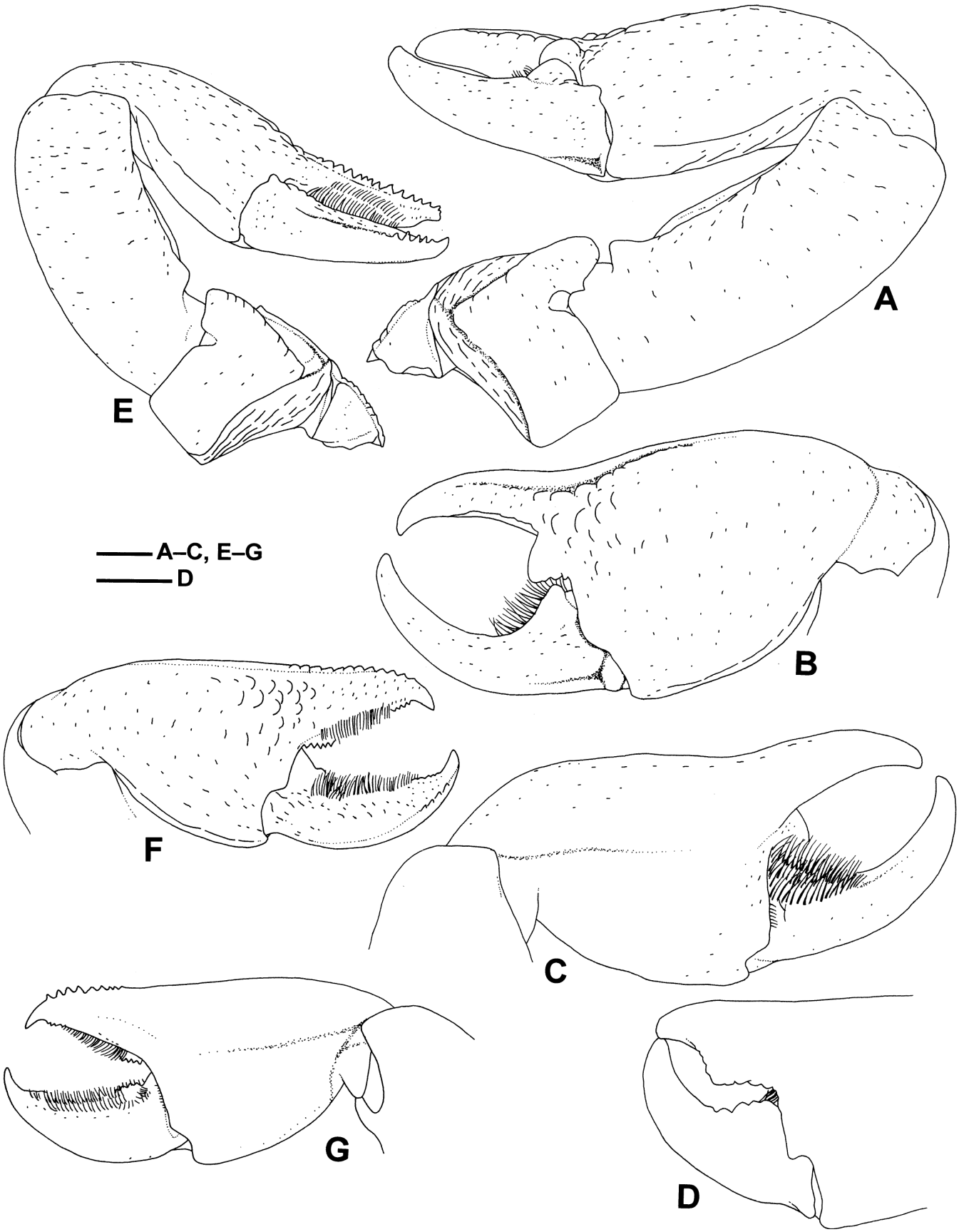

Fig. 2. *Polyonyx similis*, new species. A–C, E–G, holotype, male (cl 5.0 mm), stn B24, NMCR 27071; D, paratype, male (cl 4.2 mm), stn B6, ZRC 2007.0682. A, larger cheliped, dorsal view; B, same, chela, dorso-anterior view; C, same, chela, ventro-posterior view; D, same, distal part of chela, dorso-anterior view; E, smaller cheliped, dorsal view; F, same, chela, dorso-anterior view; G, same, chela, ventro-posterior view. Scale bars = 1.0 mm.

lateral lobes not exceeding median lobe, each with rounded apex. Fourth thoracic sternite with transverse series of short (males) or long (females) setae along slightly concave, anterior margin.

Telson (Fig. 1E) composed of 7 plates; posterior plates broad.

Ocular peduncles (Fig. 1A) comparatively small in large specimens; dorsal extension onto cornea weakly produced (hardly visible in dorsal view).

Basal article of antennular peduncles (Fig. 1F) unarmed; anterior surface slightly concave, rugose; dorsal margin with broad, rounded lobe; ventral margin weakly tuberculate, mesial angle slightly produced.

Antennal peduncles (Fig. 1G) short, slender, nearly smooth. First article largest, strongly produced forward in lateral view, broadly in contact with lower orbital margin, with longitudinal ridge along ventral margin; lateral surface slightly concave; anterior margin rounded. Second, third, and fourth articles roundly subrectangular; second article with small spine on anterodistal margin (small specimens) or unarmed (large specimens); third article elongate; fourth article short.

Third maxilliped (Fig. 1H) with coxa bearing rounded projection on ventrodistal margin; mediodistal projection not articulated. Basis articulating with ischium, roundly subtriangular. Ischium moderately broad, nearly smooth on lateral surface, with longitudinal ridge along dorsal margin; dorsodistal projection rounded. Merus with laminate, broad, rounded lobe on ventral margin; lateral surface nearly smooth. Carpus with subtriangular projection on median part of ventral margin. Propodus relatively long. Dactylus short, roundly subtriangular. Merus to dactylus with long setae on ventral margin. Exopod with proximal article small, roundly subtriangular; distal article laminate, robust, nearly reaching to distal margin of merus, with distal flagellum, proximal part inflated.

Chelipeds (first pereopods) (Figs. 2A–G, 3A–H) unequal in size, subcylindrical, inflated, with scattered, short or very short striae and small pits on dorsal surface; striae most numerous on palm, showing rugose or corrugated appearance; ventral surface with fewer striae and pits. In larger cheliped of male (Fig. 2A–D), merus with rounded, transverse crest submedially on dorsal surface; dorso-anterior margin with distal round lobe unarmed (large specimens) or with small spines (small specimens); ventro-anterior margin also unarmed (large specimens) or with small spines (small specimens). Carpus 2.1–2.7 times as long as broad; dorso-anterior margin weakly concave or transverse, smooth or weakly crenulate, with rounded proximal angle; posterior margin rounded, smooth or weakly crenulated. Chela relatively broad, ovate, 1.1–1.4 times as long as carpus, 2.2–2.6 times as long as high; anterior margin delimited by blunt ridge, smooth (large specimens) or with row of small tubercles on fixed finger (small specimens), slightly concave at base of fixed finger; dorsal surface with longitudinal blunt ridge of flattened tubercles and short corrugations along distal 0.5–0.7 of anterior margin. Palm with dorsal surface convex, no distinct dorso-median longitudinal ridge; dorso-anterior distal surface with flattened tubercles usually extending onto fixed finger; dorsoposterior margin with longitudinal rugose ridge; ventral surface with low longitudinal ridge proximally along midline, disto-posterior margin with short plumose setae. Fixed finger with distal claw elongate and curved or short and nearly straight; dorsal surface convex; cutting edge with large, proximal or median tooth and small rounded teeth on proximal 0.7 (small teeth usually obsolete in large specimens); ventral surface smooth. Dactylus 0.4–0.5 length of chela, opening at oblique angle, with strongly curved distal claw; dorsal surface convex; dorsoposterior margin rounded; cutting edge concave, with large, blunt proximal tooth or row of small rounded teeth on proximal 0.4–0.7 (distal small teeth of row usually obsolete); ventral surface with usually well-developed tuft of plumose setae on proximal part of cutting region.

Larger cheliped of female (Fig. 3A–D, G) generally similar shape to that of male. Carpus 1.7–2.2 times as long as broad; dorso-anterior margin transverse or slightly convex, weakly crenulate or with low projections (large specimens) or with small acute or blunt teeth (small specimens). Chela 1.1–1.3 times as long as carpus, 1.9–2.5 times as long as high; anterior margin with row of small subacute and blunt tubercles and some short setae on distal 0.3–0.5. Fixed finger with distal claw nearly straight and short; dorso-anterior surface with upstanding subacute or blunt tubercles in small specimens; cutting edge with row of small, rounded and subtriangular teeth, median margin produced. Dactylus 0.4–0.5 length of chela, with curved distal claw; dorsoposterior margin rounded, or with longitudinal crest unarmed or bearing distal short row of small subacute tubercles; cutting edge with row of small, rounded or subacute teeth; ventral surface with sparse, short setae along cutting edge.

Smaller cheliped (Figs. 2E–G, 3E, F, H) generally similar to larger cheliped in shape, smaller cheliped of male also allied to that of female. Carpus 1.6–2.5 times as long as broad; dorso-anterior margin slightly concave to weakly convex, nearly smooth or slightly crenulate (large specimens) or with small acute or blunt teeth (small specimens). Chela with row of small, acute and blunt tubercles on distal 0.3–0.7 of anterior margin; fingers each with row of small, acute or subacute teeth on cutting edge; in males, dorsal and ventral surfaces adjacent to cutting edges with or without tufts of dense, short plumose setae, in females, such tufts of setae always absent. Fixed finger usually with upstanding subacute tubercles on dorso-anterior surface in females and small males, numbers of tubercles usually reduced in large specimens. Dactylus with dorsoposterior margin bluntly or sharply crested and bearing row of small acute or subacute tubercles on distal 0.3–0.6; dorsodistal surface occasionally with small acute tubercles.

Ambulatory legs (second to fourth pereopods) (Fig. 3I–L) stout, subcylindrical, with scattered, simple setae marginally, most numerous on propodi and dactyli; lateral surfaces nearly smooth. Meri somewhat compressed laterally, elongated

ovate, 1.8–2.0 times as long as broad, decreasing in size posteriorly; dorsal margin unarmed, slightly crenulated, weakly convex; ventrodistal margins of lateral and mesial surfaces without lobes or spines. Carpi moderately elongate; lateral surface with longitudinal row of short striae along dorsal margin; dorso-distal and ventrodistal margins unarmed, narrowly rounded. Propodi 1.4–1.6 times as long as dactyli, 2.7–3.2 times as long as high; dorsal margin nearly smooth; ventral margin with 3–5 (usually 4) corneous spines, distal paired spines subequal in size. Dactyli each terminating in weakly curved, bifurcate claw, ventral claw stouter but equal in length to dorsal claw; ventral margin with 2 or 3 (usually 2) small corneous spines, distal spine largest.

Fifth pereopod (Fig. 1I, J) slender; carpus with tuft of simple setae on ventrodistal margin; chela elongate, with dense, long simple setae on ventral surface of palm and 2–5 scythe-like setae on fixed finger; dactylus also with dense, long simple setae.

Males without pair of pleopods modified as gonopods on second abdominal segment. Females with pairs of well developed pleopods on third to fifth abdominal segments.

Variations. The ratio of the carapace width relative to the carapace length generally increases in accordance with growth and is usually larger in females than males when the specimens of same or approximate sizes are compared. The elongation of the carpus of the larger cheliped is usually more distinct in males than females. On the distal dorso-anterior surface of the palm of the cheliped, the tuberculate or corrugated condition is more distinct in females than males and in smaller cheliped than larger cheliped.

As mentioned below, small specimens examined (Fig. 4A–E) have small but distinct spines or teeth on the margins of the carapace, antennular and antennal peduncles, and chelipeds, which are reduced or absent in large specimens. The crenulations on the margins of the ambulatory legs are also generally stronger in small specimens than in large specimens. In specimens smaller than cl 2.3 mm (e.g., ZRC 2007.0684, 2007.0686; Fig. 4A, B, E), the carapace is armed with one to four small spines or crenulated on the anterior branchial margin and usually with a broad, rounded convexity on the anterior branchial region; the basal article of the antennular peduncle usually bears a tooth on the anterior mesial margin; and the carpus of the smaller cheliped has a row of acute teeth or serration on the dorso-anterior margin. In specimens smaller than cl 2.7 mm, the hepatic margin possesses a sharp spine or subacute projection, the second article of the antennal peduncle has a distal spine on the anterior margin, and the ambulatory legs are sometimes armed with several small or very small spines on the dorsal margin of each merus and a subdistal spinule on the dorsal margin of each carpus. Specimens smaller than cl 3.1 mm usually have some spines on the ventro-anterior margin of the merus and two to four acute small teeth on the dorso-anterior margin of the carpus of the one or two chelipeds. The size of spines or teeth on the lateral margins of the carapace gradually reduces in general as increase of the specimen size. The armature is regarded as a character in young specimens because most specimens of larger sizes have unarmed lateral margins as known for other species of *Polyonyx*.

In males, the fingers of the smaller cheliped have or lack tufts of dense plumose setae on the cutting regions (Fig. 2F, G). The development of setal tufts is not related to specimen size. The tufts are present in specimens ranging from cl 3.1 to 5.1 mm. In this size range, even a large specimen of cl 4.8 mm (ZRC 2007.0692) lacks the setal tufts. In the case that the fixed finger of the larger cheliped has a large tooth on the proximal part of the cutting edge (Fig. 2B), the tufts on the fingers of the smaller cheliped are present except for two specimens (ZRC 2007.0678, cl 2.9 mm; and ZRC 2007.0681, cl 4.2 mm) which lack such tufts. The cutting edges of the fingers of the smaller cheliped always lack tufts of plumose setae when the fixed finger of the larger cheliped has a large tooth with marginal small tubercles on the median part of the cutting edge (Fig. 2D). The median position of the tooth also accompanies with a short claw of the fixed finger of the larger cheliped, the character is similar to that of females (Fig. 3C).

Size. Male cl 1.9–5.1 mm, non-ovigerous female cl 1.9–2.7 mm, ovigerous female cl 2.5–5.3 mm.

Colouration (Fig. 5). Carapace brown, with scattered small white or pale brown spots on median part; anterior and lateral parts white or pale brown, occasionally with irregular brown marks. Chelipeds with mottled patterns of brown and white or pale brown on dorsal surface. Ambulatory legs also brown, with scattered small white spots; distal parts of meri, carpi, and propodi whitish.

This colouration can be observed even in young specimens of cl 2.7 mm as well as large specimens.

Distribution. Thailand, Singapore, Philippines, Palau, Indonesia, and Australia (Gordon, 1935; Miyake, 1942; Johnson, 1958; Haig, 1965, 1979; Yang & Naiyanetr, 1997, all as *P. biunguiculatus*; present study). The specimens examined from the Philippines are collected at depths between 2–152 m.

Etymology. The specific name is derived from the Latin, *similis* (similar), in reference to the close morphological resemblance between the new species and *P. biunguiculatus*.

Remarks. The new species is morphologically allied to *P. biunguiculatus* and has been frequently confused with the latter species in the previous studies (see the synonymy of the new species). The characters and possible synonymy of *P. biunguiculatus* are discussed by Osawa (2007b). *Polyonyx similis*, new species, is distinguished from *P. biunguiculatus* by the low and much broader, median lobe of the rostrum, palms of the chelipeds with flattened tubercles on the distal dorso-anterior surface, dactylus of the male larger cheliped with a usually well-developed tuft of plumose setae on the ventroproximal cutting region, and lack of the male gonopods

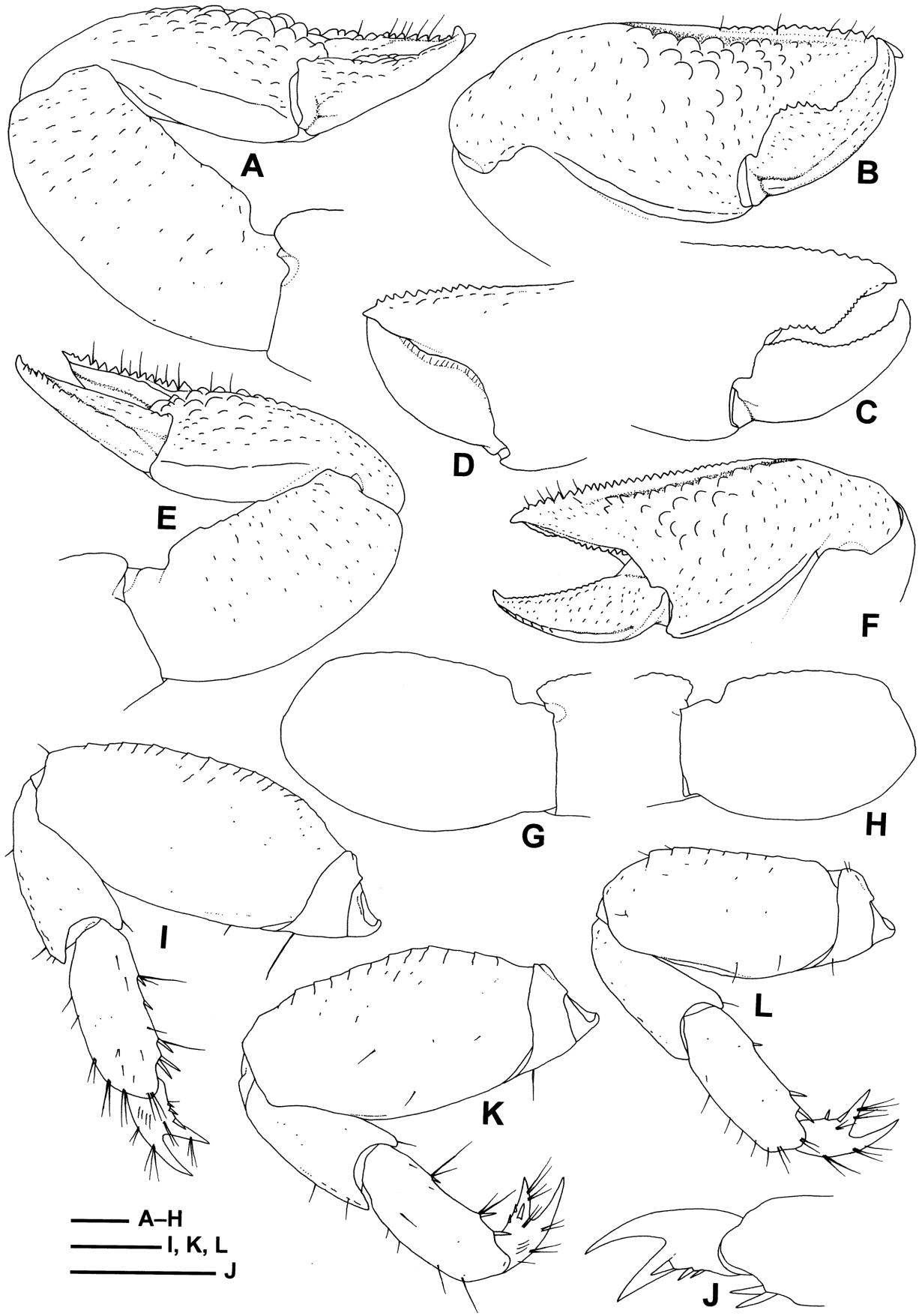

Fig. 3. *Polyonyx similis*, new species. A–F, paratype, ovigerous female (cl 5.5 mm), stn B24, NMCR 27072; G, H, paratype, ovigerous female (cl 4.2 mm), stn B13, ZRC 2007.0686; I–L, holotype, male (cl 5.0 mm), stn B24, NMCR 27071. A, larger cheliped, dorsal view; B, same, chela, dorso-anterior view; C, same, distal part of chela, dorso-anterior view; D, same, distal part of chela, ventro-posterior view; E, smaller cheliped, dorsal view; F, same, chela, dorso-anterior view; G, larger cheliped, carpus and distal part of merus, dorsal view; H, smaller cheliped, carpus and distal part of merus, dorsal view; I, left first ambulatory leg, lateral view; J, same, dactylus and distal part of propodus, lateral view; K, left second ambulatory leg, lateral view; L, left third ambulatory leg, lateral view. Scale bars = 1.0 mm.

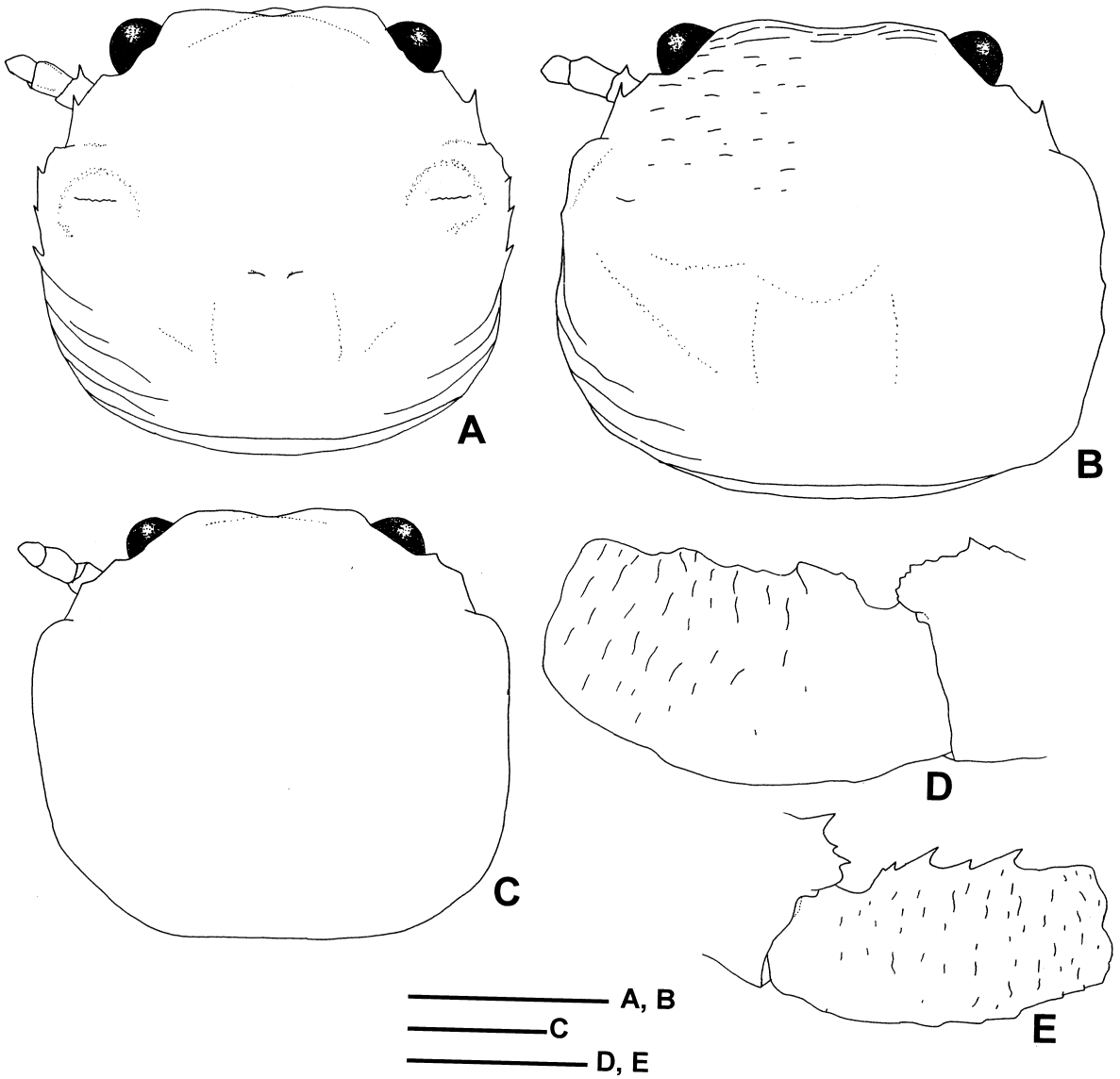

Fig. 4. *Polyonyx similis*, new species. A, paratype, male (cl 2.1 mm), stn B13, ZRC 2007.0686; B, D, E, paratype, female (cl 2.3 mm), stn B8, ZRC 2007.0684; C, paratype, male (cl 3.0 mm), stn B41, ZRC 2007.0696. A–C, carapace and ocular and antennal peduncles, dorsal view; D, larger cheliped, carpus and distal part of merus, dorsal view; E, smaller cheliped, carpus and distal part of merus, dorsal view. Scale bars = 1.0 mm.

(Figs. 1B, C, 2B, C, F, 3B, F). *Polyonyx biunguiculatus* has a high and narrow, median lobe of the rostrum and a pair of gonopods on the male second abdominal segment, and lacks flattened tubercles on dorsal surface of the palms of the chelipeds (smaller cheliped with small protuberances and subacute tubercles) and a dense tuft of plumose setae on the ventroproximal cutting region of the dactylus of the male larger cheliped. The specimens reported as *P. biunguiculatus* by Gordon (1935), Miyake (1942), Johnson (1958), Haig (1965, 1979), and Yang & Naiyanetr (1997) are referred to the present new species based on the structures of the rostrum and chelipeds and lack of male pleopods, which are as described for *P. similis*. Examination of a part of the specimens reported by Haig (1964) has revealed that three lots from the Philippines, Singapore, and the Gulf of Thailand all belong to the new species, although one specimen from the Taiwan Strait (25°28’ N, 120°29’ E, 66 m, April 1897, 1 male, cl 3.7 mm, ZMUC) is referred to *P. obesulus* Miers, 1884, instead (Osawa & Chan, 2010).

Fig. 5. *Polyonyx similis*, new species. Paratype male (cl 3.1 mm), stn T1, ZRC 2007.0698. Entire animal, dorsal view.

Johnson (1958) separated the Indo-West Pacific species of the genus *Polyonyx* into three species groups and characterised the *P. biunguiculatus* group primary by having the carapace without spines on the lateral margins, palms of the chelipeds lacking dense setae on the dorso-anterior surface, and dactyli of the ambulatory legs each with usually subequal distal claws. His *P. biunguiculatus* group included *P. biunguiculatus*, *P. obesulus*, *P. parvidens* Nobili, 1905, *P. triunguiculatus* Zehntner, 1894, and with some doubts, *P. hendersoni* Southwell, 1909. Among these species, *P. parvidens* was treated as a junior synonym of *P. obesulus* by Haig (1966a). Sankolli (1963) later placed his new species *P. splendidus*, also in the *P. biunguiculatus* group. Werding (2001) stated that *P. hendersoni* is different from the typical *Polyonyx* and should be assigned to a separate genus, together with *P. splendidus*, in his forthcoming paper, although it has not been published yet. The two species are clearly distinguished from the *P. biunguiculatus* group by the two distal claws of each ambulatory dactylus being distinctly unequal with the dorsal claw longer than the ventral claw rather than being subequal (cf. Tirmizi et al., 1989; Hiller et al., 2010). Thus, the *P. biunguiculatus* group can be currently regarded as containing only four species: *P. biunguiculatus*, *P. obesulus*, *P. triunguiculatus*, and *P. similis* herein described. As mentioned above, young specimens of *P. similis* have small spines on the hepatic and branchial margins of the carapace. This armature is known as a character of species of the genus *Aliaporcellana* Nakasone & Miyake, 1969 rather than *Polyonyx*. In addition to this character, the species of the *P. biunguiculatus* group and *Aliaporcellana* recognised as the *P. denticulatus* group by Johnson (1958) share a character, the dactyli of the ambulatory legs each with a broad cleft at the base of the distal claws. Those species are also similar to each other in habitat and have been recorded from sponges or anthozoans such as scleractinian, alcyonacean, and gorgonacean corals (Haig, 1979; Ng & Goh, 1996; Osawa, 2007b). In species of the *Polyonyx sinensis* group, another species group of the genus defined by Johnson (1958), the dactylus of the ambulatory leg usually has a very narrow cleft at the base of the distal claws (in *P. pedalis* Nobili, 1906, the cleft is relatively broad; cf. Osawa & Ng, in press) and the dorsal claw being usually much smaller than the ventral claw, and most of the species have been found to be in association with tube-dwelling polychaete worms (Ng & Sasekumar, 1993; Werding, 2001). The habitat and morphology of the distal claws of the ambulatory dactylus also agree with those of *Eulenaios cometes* (Walker, 1887), originally placed in the *P. sinensis* group by Johnson (1958) but later transferred to its own genus by Ng & Nakasone (1993), and of *Hetropolyonyx biforma* Osawa, 2001. These probably suggest a close relationship between the *P. biunguiculatus* group and *Aliaporcellana*. However, the *P. biunguiculatus* group is still distinguishable from *Aliaporcellana* by the blunt outer orbital angle of the carapace, unarmed third article of the antennal peduncle, and usually elongate carpus of the cheliped. In *Aliaporcellana*, the outer orbital angle terminates acutely or in a small spine and the third antennal article has a small spine on the anterodistal margin (cf. Osawa & Chan, 2010).

The complete lack of male gonopods raises an interesting question regarding its possible influence on the structure of the fifth pereopod, which has been usually treated as a grooming appendage (Fleischer et al., 1992) but could also be used for mating. The absence of male gonopods is not rare in Anomura—it is known only in several species of the genera *Neopisosoma* Haig, 1960, *Pachycheles* Stimpson, 1858, and *Polyonyx* in Porcellanidae (cf. Haig, 1960, 1964, 1966b; Osawa & Chan, 2010). Preliminary observation has shown that there are no apparent modified structures on the coxae and chelae of the fifth pereopods in males of seven of such species: *Pachycheles sculptus* (H. Milne Edwards, 1837), *P. spinipes* (A. Milne-Edwards, 1873), *P. pedalis*, *P. similis*, and three new species which will be reported by Osawa & Ng (in press). The setation on the fifth pereopods of these species also does not seem to differ between male and female and is similar to that of usual species having a pair of male gonopods, although the scythe-like setae on the fixed finger may vary in numbers interspecifically. It will be interesting to examine the mating behavior because the above porcellanids are expected to have unusual copulations.

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LITERATURE CITED

Bouchet P, Ng PKL, Largo D & Tan SH (2009) PANGLAO 2004 – Investigation of the marine species richness in the Philippines. Raffles Bulletin of Zoology, Supplement 20: 1–19.

Dana JD (1852) Crustacea, Part 1. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 13: i–viii, 1–685. Philadelphia.

Fleischer J, Morten G, Høeg JT & Olesen J (1992) Morphology of grooming limbs in species of *Petrolisthes* and *Pachycheles* (Crustacea: Decapoda: Anomura: Porcellanidae): a scanning electron microscopy study. Marine Biology, 113: 425–435.

Gordon I (1935) Anomura (excluding Paguridea). In: Résultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. Mémoires du Musèe Royal d'Histoire naturelle de Belgique, hors série, 3(17): 1–12.

Haig J (1960) The Porcellanidae (Crustacea Anomura) of the eastern Pacific. Allan Hancock Pacific Expedition, 24: i–viii, 1–440, frontispiece, pls. 1–41.

Haig J (1964) Papers from Dr. Th. Mortensen's Pacific Expedition 1914–1916. 81. Porcellanid crabs from the Indo-West Pacific, Part I. Videnskabelige Meddelelser Dansk Naturhistrisk Forening i Kjøbenhavn, 126: 355–386.

Haig J (1965) The Porcellanidae (Crustacea, Anomura) of Western Australia with description of four new Australian species. Journal of the Royal Society of Western Australia, 48: 97–117.

Haig J (1966a) The Porcellanidae (Crustacea Anomura) of the Iranian Gulf and Gulf of Oman. Videnskabelige Meddelelser Dansk Naturhistrisk Forening i Kjøbenhavn, 129: 49–65.

Haig J (1966b) A review of the Indo-West Pacific species of genus *Pachycheles* (Porcellanidae, Anomura). In: Proceedings of the Symposium on Crustacea held at Ernakulam from January 12 to 15, 1965, Part I, Marine Biological Association of India. Pp. 285–294

Haig J (1979) Expèdition Rumphius II (1975) Crustacès parasites, commensaux, etc. (Th. Monod et R. Serène, éd.). V. Porcellanidae (Crustacea, Decapoda, Anomura). Bulletin du Musèum National d'Histoire Naturelle, Paris, 4e, section A, 1: 119–135.

Haworth AH (1825) A new binary arrangement of the brachyurous Crustacea. The Philosophical Magazine and Journal, 65: 105–106, 183–184.

Hiller A, Harkantra S & Werding B (2010) Porcellanid crabs from Goa, eastern Arabian Sea (Crustacea: Decapoda: Porcellanidae). Journal of the Bombay Natural History Society, 107: 201–210.

Johnson DS (1958) The Indo-West Pacific species of the genus *Polyonyx* (Crustacea, Decapoda, Porcellanidae). The Annals of Zoology, the Academy of Zoology, 2: 95–118.

Miers EJ (1884) Crustacea. In: Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. 'Alert' 1881–2. London, British Museum. Pp. 178–322, 513–575.

Milne-Edwards A (1873) Description de quelques crustacés nouveaux ou peu connus provenant du Musée de M. C. Godeffroy. Journal des Museum Godeffroy, 4: 253–264.

Milne Edwards H (1837) Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux, 2: 1–532.

Miyake S (1942) Studies on the decapod crustaceans of Micronesia. III. Porcellanidae. The Palau Tropical Biological Station Studies, 2: 329–379.

Nakasone Y & Miyake S (1969) A new porcellanid crab (Anomura: Porcellanidae) from Japan (*Aliaporcellana kikuchii* gen. et sp. nov.), with description of two species of the new genus. Publications of the Amakusa Marine Biological Laboratory, 2: 17–32.

Ng PKL & Goh NKC (1996) Notes on the taxonomy and ecology of *Aliaporcellana telestophila* (Johnson, 1958) (Decapoda, Anomura, Porcellanidae), a crab commensal on the gorgonian *Solenocaulon*. Crustaceana, 69: 652–661.

Ng PKL & Nakasone Y (1993) Taxonomy and ecology of the porcellanid crab *Polyonyx cometes* Walker, 1887 (Crustacea: Decapoda), with description of a new genus. Journal of Natural History, 27: 1103–1117.

Ng PKL & Sasekumar A (1993) A new species of *Polyonyx* Stimpson, 1858, of the *P. sinensis* group (Crustacea: Anomura: Porcellanidae) commensal with a chaetopterid worm from Peninsular Malaysia. Zoologische Mededelingen, 67: 466–472.

Nobili G (1905) Décapodes nouveaux des côtes d'Arabie et du Golfe Persique (diagnoses préliminaires). Bulletin du Muséum national d'Histoire naturelle, Paris, 11: 158–164.

Nobili G (1906) Diagnoses préliminaires de 34 espèces et variétés nouvelles, et de 2 genres nouveaux de décapodes de la Mer Rouge. Bulletin du Muséum National d'Histoire, Paris, 11: 393–411, figs. 1, 2.

Osawa M (2001) *Heteropolyonyx biforma*, new genus and new species, from Japan, with a redescription of *Polyonyx utinomii* (Decapoda: Porcellanidae). Journal of Crustacean Biology, 21: 505–520.

Osawa M (2007a) A new species of *Polyonyx* Stimpson, 1858 (Crustacea: Decapoda: Anomura: Porcellanidae) from the Philippines and Loyalty Islands. Zootaxa, 1450: 21–29.

Osawa M (2007b) Porcellanidae (Crustacea: Decapoda: Anomura) from New Caledonia and the Loyalty Islands. Zootaxa, 1548: 1–49.

Osawa M & Chan T-Y (2010) Part III. Porcellanidae (porcelain crabs). In: Chan T-Y (ed.) Crustacean Fauna of Taiwan: Crab-like Anomurans (Hippoidea, Lithodoidea and Porcellanidae). National Taiwan Ocean University, Keelung. Pp. 67–181.

Osawa M & Ng PKL (in press) Revision of *Polyonyx pedalis* Nobili, 1906 (Crustacea: Decapoda: Anomura: Porcellanidae), with descriptions of three new species. Raffles Bulletin of Zoology, Supplement.

Sankolli KN (1963) On a new species of porcellanid crab (Decapoda, Anomura) from India. Journal of the Zoological Society of India, 15: 79–84.

Southwell T (1909) Report on the Anomura collected by Mr. James Hornell at Okhamandal in Kattiawar in 1905–6. In: Hornell J (ed.) Report to the government of Baroda on the marine ecology of Okhamandal in Kattiawar. Part I. London, Williams & Norgate. Pp. 105–123.

Stimpson W (1858) Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars VII. Crustacea Anomura. [Preprint (December 1858)]. Proceedings of the Academy of Natural Sciences of Philadelphia, 1858: 225–252.

Tirmizi NM, Yaqoob M & Siddiqui FA (1989) Marine Fauna of Pakistan: 3 Porcellanid Crabs (Crustacea, Anomura). Centre of Excellence, Marine Biology, University of Karachi, Karachi, 46 pp.

Walker AO (1887) Notes on a collection of Crustacea from Singapore. Journal of the Linnean Society of London, Zoology, 20: 107–117.

Werding B (2001) Description of two new species of *Polyonyx* Stimpson, 1858 from the Indo-West Pacific, with a key to the species of the *Polyonyx sinensis* group (Crustacea: Decapoda: Porcellanidae). Proceedings of the Biological Society of Washington, 114: 109–119.

Yang S & Naiyanetr P (1997) Thailand's porcellanid crabs (Crustacea: Decapoda: Anomura). Memoirs of Beijing Natural History Museum, 56: 1–13.

Zehntner L (1894) Crustacés de l'Archipel Malais. Voyage de MM. M. Bedot et C. Pictet dans l'Archipel Malais. Revue Suisse de Zoologie et Annales du Musée d'Histoire Naturelle de Genève, 2: 135–214, pls. 7–9.