RAFFLES BULLETIN OF ZOOLOGY Supplement No. **36**: 162–180
Date of publication: 6 August 2021
DOI: 10.26107/RBZ-2021-0036
http://zoobank.org/urn:lsid:zoobank.org:pub:2923BC8A-B8A1-45C1-A46B-C2191CEEF154

Hermit crabs of the family Diogenidae (Crustacea: Decapoda: Anomura) collected during the South Java Deep-Sea 2018 biodiversity cruise in Indonesia, with description of two new species

Dwi Listyo **Rahayu**

Abstract. A total of 11 species of hermit crabs of the family Diogenidae, of which two are new, was collected during the South Java Deep-Sea (SJADES) Biodiversity Expedition in Indonesia in 2018. *Diogenes berduri*, new species, resembles *D. heteropsammicola* Igawa & Kato, 2017, in that both species inhabit solitary coral species of the genus *Heteropsammia*, but the new species differs in having a row of spines on the upper margin of the dactyl, palm, and carpus of the chelipeds, as well as in their living colouration. *Paguristes rectus*, new species, differs from its congeners in having a straight abdomen with a symmetrical telson. *Paguristes triton* McLaughlin, 2008, is reported for the first time after its description from Australian waters. *Paguristes calvus* Alcock, 1905, *P. miyakei* Forest & McLaughlin, 1998, and *Pseudopaguristes bicolor* Asakura & Kosuge, 2004, are new records for Indonesian waters, while the distributions of five other species are extended to the Indian Ocean off the coast of southern Java. Full descriptions are given for the two new species.

Key words. hermit crab, new species, *Diogenes*, *Paguristes*, Diogenidae, Indonesia

INTRODUCTION

Deep-sea hermit crabs of Indonesian waters are relatively well studied, exclusively or together with other materials from different places (Balss, 1912; de Saint Laurent, 1972; Forest, 1987, 1992, 1995; Lemaitre, 1996, 1997, 1999, 2004, 2014; McLaughlin, 1997; Rahayu, 2005, 2006). Recently, a deep-sea expedition to the Sunda Strait and southern Java obtained, among other organisms, a diverse collection of hermit crabs. Eleven species belonging to the family Diogenidae were obtained from depths ranging from 163–727 m, including a new species of *Diogenes*, one and two species of the genera *Areopaguristes* and *Pseudopaguristes* respectively, and eight species of the genus *Paguristes*, of which one is new. *Diogenes berduri*, new species, described below, is the first species of the genus found in the deep sea, and is only the second species that inhabits solitary corals of the genus *Heteropsammia*. *Paguristes rectus*, new species, also described herein, inhabits scaphopod shells, has a straight abdomen and symmetrical telson. The living colouration of *Areopaguristes micheleae* Rahayu, 2005, and *Paguristes triton* McLaughlin, 2008, is recorded for the first time. After including the hermit crabs in this study, the number of species of *Diogenes* recorded from Indonesia is 21 (Rahayu & Forest, 1995; Rahayu & Hortle, 2002; Rahayu, 2012), while the genus *Areopaguristes* is represented by four species (Rahayu, 2005), *Paguristes* by 13 species (Rahayu, 2006), and *Pseudopaguristes* by six species (Rahayu, 2005; McLaughlin, 2008).

MATERIAL AND METHODS

Specimens for this study came from the South Java Deep-Sea (SJADES) Biodiversity Expedition carried out in 2018 in Indonesia. This was a collaborative study between the Indonesian Institute of Sciences and National University of Singapore. General morphological terminology for the description of hermit crabs follows that of McLaughlin (2008) and McLaughlin et al. (2007). Animal size, as indicated by shield length (sl), was measured from the midpoint of the rostrum to the midpoint of the posterior margin of the shield. Abbreviations used are P2, P3 for the second and third pereopods respectively, st. for station, CP for "chalut à perche" (beam trawl), and DW for Warèn Dredge. The synonymies for species are restricted to the original description, record(s) from Indonesia, illustrated work(s), synonym(s), clarifications of systematic problems, and incorrect identification(s). The genera and species are arranged in alphabetical order. Holotypes of the new taxa are deposited in the Museum Zoologicum Bogor (MZB), Indonesian Institute of Sciences, Cibinong; paratypes are deposited in the Zoological Reference Collection (ZRC) of Lee Kong Chian Natural History Museum, National University of Singapore and the Museum Zoologicum Bogor (MZB); all other specimens studied are deposited in these two museums.

Marine Bioindustry Division, Research Center for Oceanography, Indonesian Institute of Sciences Dusun Teluk Kodek, Pemenang, Lombok Utara, Nusa Tenggara Barat; Email: dwilistyo07@gmail.com

ISSN 2345-7600 (electronic) | ISSN 0217-2445 (print)

TAXONOMY

Diogenidae Ortmann, 1892

Diogenes Dana, 1851

Diogenes berduri, new species
(Figs. 1, 2)

Material Examined. Holotype: ovigerous female, 1.3 mm (MZB Cru 5153), DW17, 6°07.333′S 105°00.762′E–6°07.221′S 105°00.865′E, Sunda Strait, 448–469 m, 26 March 2018.

Description. Shield (Figs. 1A, 2B, C) about 1.3 times as long as broad; rostrum broadly rounded; anterior margin between rostrum and lateral projections somewhat concave; lateral projections triangular, markedly exceeding tip of rostral lobe, each terminating in strong spine; anterolateral angle rounded, with row of 4 or 5 small spines; lateral margins also with small spines posteriorly and sparse setae; posterior margin truncate; dorsal surface laterally with few small spines and tufts of sparse setae. Dorsal margins of branchiostegites unarmed.

Ocular peduncles (Fig. 1A) cylindrical, about 0.8 times as long as shield, slightly inflated basally, corneas slightly tapering distally, corneal diameter about 0.2 times as long as ocular peduncular. Ocular acicles broad, subtriangular, basally separated by approximately 0.2 or less width of one acicle, with row of spinules on mesial half of terminal margin, mesialmost spine largest. Intercalary rostriform process stout, simple at tip, not reaching tips of mesial spines of ocular acicles, with few short setae; no ventral spine.

Antennular peduncles (Fig. 1A) when fully extended, overreaching corneas by whole length of ultimate segments. Ultimate and penultimate segments unarmed, but with few short setae. Basal segment with few long setae. Antennal peduncles (Fig. 1A) stout, each overreaching distal corneal margin by 0.7 length of fifth segment; fifth segment with row of long setae laterally; fourth segment with triangular dorsodistal margin, few short setae ventrodistally; third segment long, unarmed; second segment with dorsolateral distal angle produced into prominent spine, dorsomesial distal angle with small spine, mesial and lateral margins with few setae; first segment unarmed. Antennal acicle short, with spine each on dorsodistal and mesiodistal margins, and with long setae. Antennal flagella long (Figs. 1B, 2B), about 2.5 times as long as shield; each article with 3 or 4 long setae, rendering the flagellum as a cast-net structure.
Maxilliped 3 crista dentata with few, tiny teeth; merus, carpus, and propodus approximately same length to each other, with numerous long setae on mesial margin, lateral margin with fewer setae; dactyl slightly shorter than propodus, with denser setae ventrally.

Left cheliped (Figs. 1C, 2B, C) much larger than right, no hiatus between dactyl and fixed finger. Dactyl 0.8 times as long as palm measured along upper margin, slightly arched; cutting edge with row of calcareous teeth bearing few tufts of short setae, terminating in calcareous claw, overlapped by claw of fixed finger; outer surface with sparse tubercles; upper margin with row of strong spines decreasing in size distally, second row of strong spines proximally; inner surface smooth but with sparse short setae. Fixed finger with sparse tubercles on outer surface; lower margin delimited by two rows of strong spines sparsely interspersed with short setae and forming straight line with lower margin of palm; inner surface with row of sparse short setae on midline; cutting edge with row of calcareous teeth; upper margin of palm with row of prominent spines, lower margin sparsely armed with small spines; outer surface with moderately long sparse setae, irregular longitudinal row of moderately small, broad tubercles medially, row of smaller tubercles between midline and upper margin; inner surface with row of sparse setae. Carpus equal in length to palm; upper surface with row of spines, becoming more prominent distally, and sparse long setae; outer surface convex, smooth, lower margin straight, armed with 2 small spines subdistally and subproximally. Merus as long as carpus; dorsodistal margin with few small spines; lateral and mesial faces, and ventrolateral and ventromesial margins smooth; ventral surface with few small tubercles. Ischium unarmed but with long setae.

Right cheliped (Figs. 1D, 2C) reaching proximal third length of palm of left cheliped; no hiatus between dactyl and fixed finger. Dactyl shorter than palm; upper margin with row of small spines and numerous long setae; outer surface with sparse, moderately long setae; cutting edge with row of low calcareous teeth, terminating in calcareous claw overlapped by fixed finger. Palm with row of small spines and tufts of long setae on upper margin; outer surface unarmed but with mixture of long and short, simple setae; outer surface of fixed finger with sparse tiny tubercles and short, simple setae; cutting edge with row of small calcareous teeth, terminating in calcareous claw. Carpus with row of spines on upper margin and long setae; outer face smooth, lower margin not delimited; inner and lower surfaces with sparse long setae. Merus with numerous long, simple or plumose setae on dorsal margin; ventromesial and ventrolateral margins each with long, simple, and plumose setae. Ischium unarmed, but with few long setae.

P2 and P3 slender, dorsal and ventral margins each with sparse, short, and long simple setae; dactyls somewhat curved ventrally, but not twisted in dorsal view, terminating in corneous claw; meri and ischia unarmed. P2 (Fig. 1E) dactyl approximately 1.1 times as long as propodus, mesial surfaces with row of sparse setae near dorsal margin; propodus 1.5 times as long as carpus; carpus 0.8 times as long as merus, dorsal margin with small distal spine; ventral margins unarmed. P3 (Fig. 1F) slightly longer than P2; dactyl 1.2 times as long as propodus; propodus 1.4 times as long as carpus; carpus 0.9 times as long as merus, unarmed. Pereopod 4 (Fig. 1G) semichelate. Anterior lobe of sternite of P3 entire, oval. Female with paired gonopores and 4 unpaired left pleopods. Eggs attached to first 3 pairs of biramous pleopods, pleopod 4 uniramous.

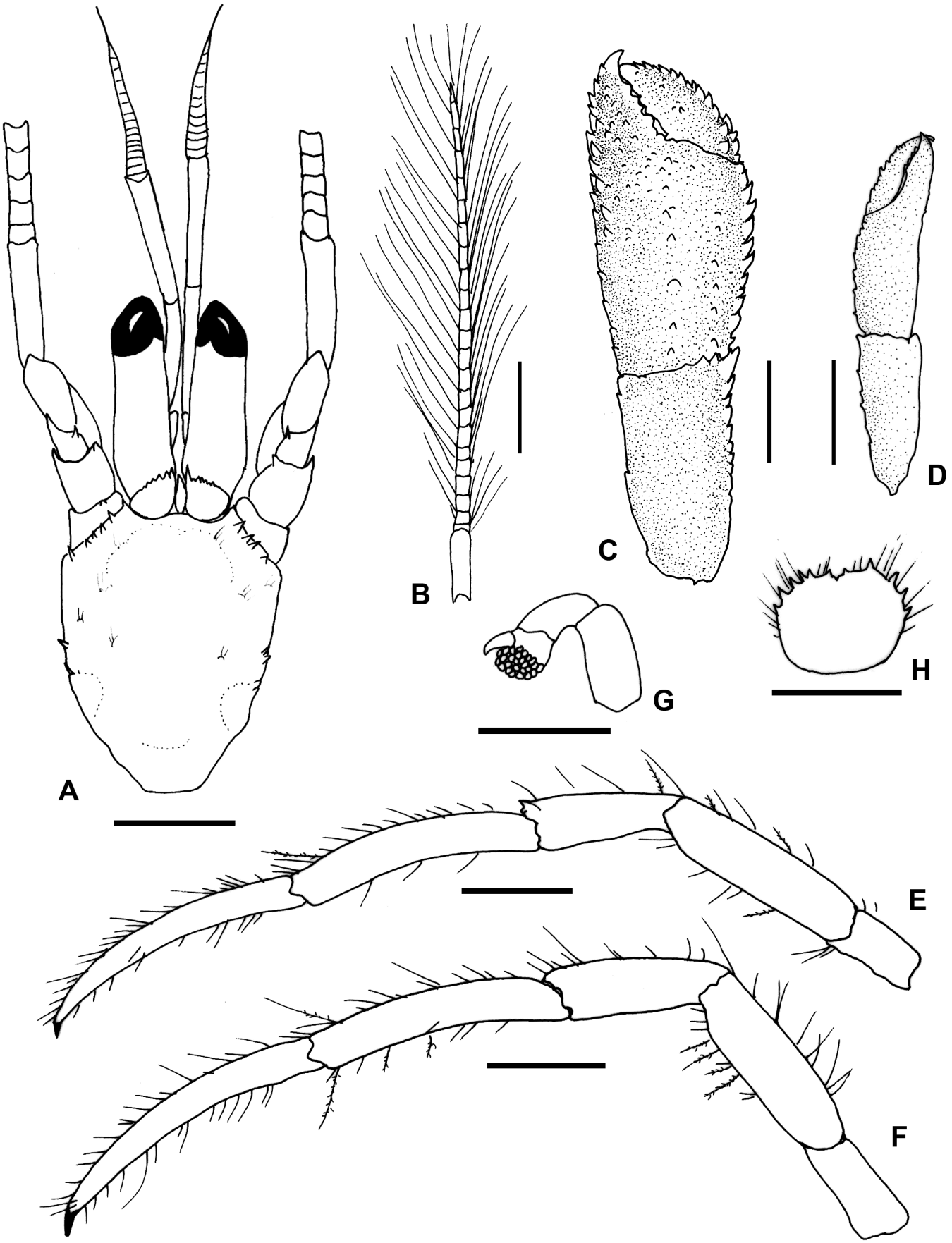

Fig. 1. *Diogenes berduri*, new species. Holotype, ovigerous female, sl 1.3 mm (MZB Cru 5153). A, shield and cephalic appendages; B, fifth segment and flagella of antennal peduncle; C, chela and carpus of left cheliped, dorsolateral view; D, chela and carpus of right cheliped, dorsolateral view; E, left P2, lateral view; F, left P3, lateral view; G, left pereopod 4, lateral view; H, telson. Scales = 0.5 mm. Setae partially omitted.

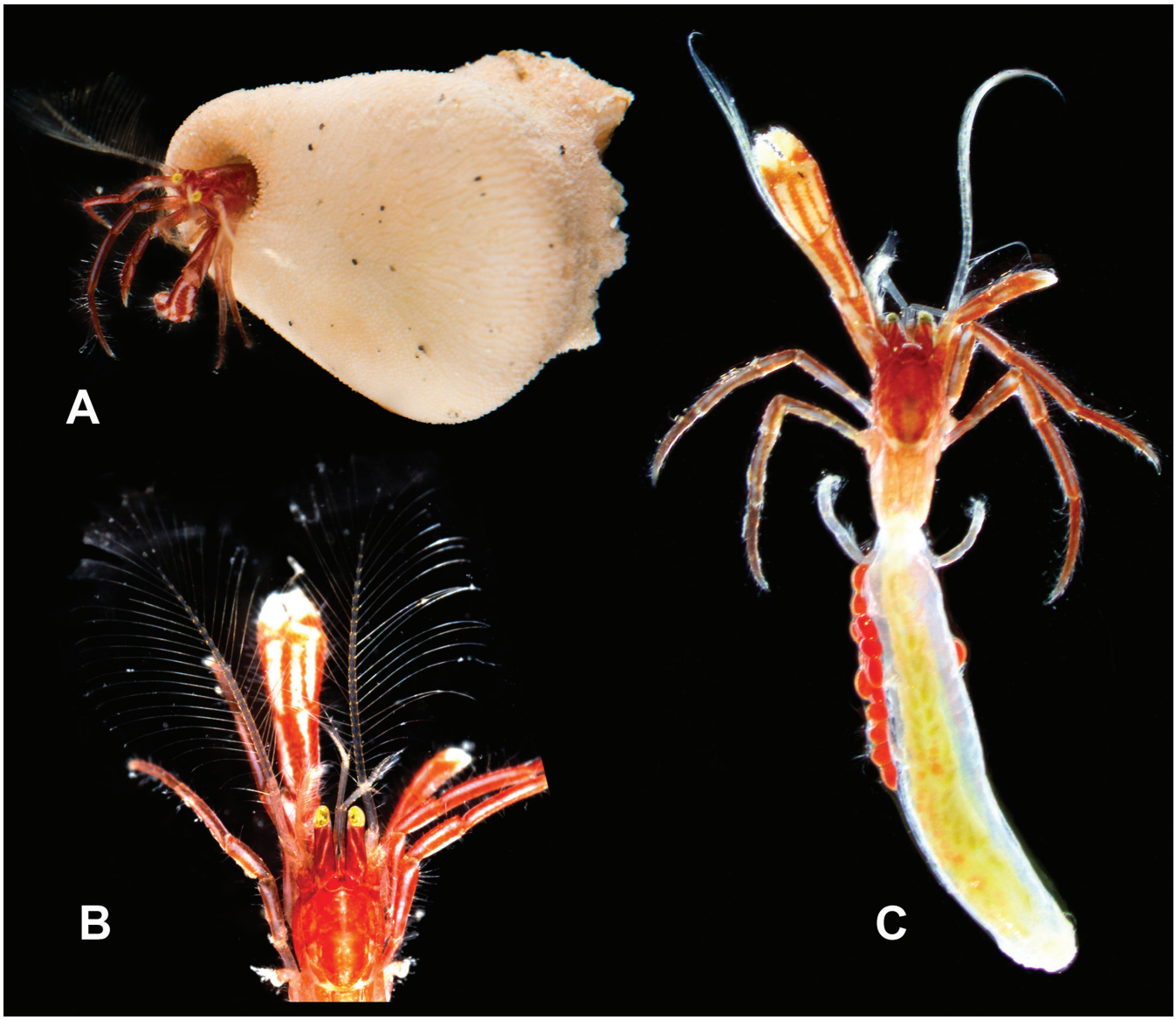

Fig. 2. *Diogenes berduri*, new species. Holotype, ovigerous female, sl 1.3 mm (MZB Cru 5153). A, individual carrying coral as shelter; B, shield and cephalic appendages, chelipeds and pereopods; C, individual removed from its shelter.

Telson (Fig. 1H) with shallow median cleft; left and right lobes symmetrical; terminal margins each with long setae and row of 5 (left) and 6 (right) small spines, spines continued onto lateral margins.

Colour in life. In general body and appendages red with white stripes (Fig. 2). Shield orangish red with median whitish-red streak, and mottled with whitish red and light brown dorsolaterally and on posterior margin. Ocular peduncles red with two oblique orangish-white stripes extending from base of cornea to base of peduncle; corneas greenish yellow; ocular acicles dark red. Antennular peduncles with basal and penultimate segments transparent light brown, ultimate segment transparent white. Antennal peduncles with first and second segments dark red; third, fourth, fifth peduncular segments, and flagellum white. Left and right chelipeds with dactyls and fixed fingers white, red spot proximally, palms white with 4 red longitudinal stripes, carpi white with 3 longitudinal stripes, meri white with red band distally, longitudinal red streak dorsally. Dactyls of P2 and P3 red, white spot distally, propodi, carpi, and meri red with white longitudinal stripes on lateral and mesial surfaces. Pleon semitransparent. Telson white. Eggs orange-red.

Etymology. 'Berduri' means spiny in Bahasa Indonesia, alluding to the strong spines on the left cheliped, which serve to differentiate the new species from the closely related *D. heteropsammicola*; used as a noun in apposition.

Remarks. This new species inhabits *Heteropsammia* sp., a solitary hexacoralline coral. Hitherto only one species of the genus *Diogenes*, *D. heteropsammicola* Igawa & Kato, 2017, was known to use solitary corals as shelter. The two *Diogenes* species share some morphological characters, such as short antennal acicles, non-dilated corneas, thick antennal flagella with long setae (forming a cast-net like structure), blunt tubercles along midline of the outer surface of the palm of the left cheliped, and a symmetrical telson. However, *D. berduri*, new species, differs from the latter in having a row of conspicuous spines on the upper margin of the dactyl, palm,

and carpus of both chelipeds, a row of small tubercles along midline and a shorter row of smaller spines between midline and upper margin of the outer surface of the palm of the left cheliped, no hiatus between the fingers on both chela, and unarmed outer surface of the right cheliped palm (Fig. 1C, D). In *D. heteropsammicola* the palm of the left cheliped is armed with very few spines on the upper margin distally, and the outer surface has two rows of blunt spines along the dorsomidline; the right cheliped is armed with a row of spines on the outer surface of the dactyl, and broad hiatus between fingers (Igawa & Kato, 2017: figs. 2, 3). In general the living colouration is red in both species, but the colour pattern is different. In the new species the shield is orangish red with a whitish streak medially, and mottled with whitish red and light brown dorsolaterally; the ocular peduncles are red with two orangish-white oblique stripes; the chelipeds, P2 and P3 are white with orangish-red longitudinal stripes (Fig. 2). In contrast, in *D. heteropsammicola* the shield is uniformly white; the ocular peduncles are marron red without any stripe; the chelipeds are white with a tinge of reddish brown, and the P2 and P3 are marron red, without longitudinal stripes (Igawa & Kato, 2017: fig. 6). Furthermore, this new species inhabits deep water, about 450 m in depth, whereas *D. heteropsammicola* occurs at sublittoral depths of 40–77 m (Igawa & Kato, 2017).

In the *Diogenes edwardsi* group as diagnosed by Asakura & Tachikawa (2010), *D. berduri*, new species, is comparable with species characterised by having small and short antennal acicles, i.e., *Diogenes guttatus* Henderson, 1888, *D. dorotheae* Morgan & Forest, 1991, *D. tirmiziae* Siddiqui & McLaughlin, 2003, *D. hothuisi* Asakura & Tachikawa, 2010, *D. takedai* Rahayu, 2012, *D. albimaculatus* Landschoff & Rahayu, 2018, and *D. minimus* Komai & Yoshida, 2020. *Diogenes berduri*, new species, most closely resembles *D. holthuisi* and *D. takedai* in having a thick antennal peduncle and short, bifid antennal acicle, but differs in the shape of the shield, chelipeds, and telson. In *D. holthuisi* the shield is as long as broad; the cheliped palm is usually furnished with a row of spines or tubercles or granules on the outer face; and the telson bears one to five spines of various sizes in each terminal margin (Asakura & Tachikawa, 2010). In *D. takedai* the shield is very slightly longer than broad; the palm of the left cheliped is covered with drop-like tubercles, with a longitudinal row of stronger spine-like tubercles on the midline; and the telson is asymmetrical, with minute spines on each terminal margin (Rahayu, 2012). As mentioned above, in *Diogenes berduri*, new species, the shield is clearly longer than broad; the chelipeds are armed with a row of spines on the upper margin of the dactyl, lower margin of the fixed finger, and the upper and lower margins of the palm; and the telson is symmetrical, with several spines on each terminal margin, extending onto the lateral margin.

The new species is the first representative of the genus known from the deep sea below 200 m.

Distribution. So far known only from the Sunda Strait, at depths of 448–469 m, on substrate mixed with gravel, dead coral, and small rock.

Areopaguristes Rahayu & McLaughlin, 2010

Areopaguristes micheleae (Rahayu, 2005)
(Figs. 3, 4A, B)

Stratiotes micheleae Rahayu, 2005: 16, figs. 6, 7; Rahayu, 2007: 528.

Material examined. 15 males, 2.6–6.8 mm, 5 females, 3.2–5.0 mm, 6 ovigerous females, 4.0–4.2 mm (MZB Cru 5154); 15 males, 2.6–6.6 mm, 9 females, 3.0–5.4 mm, 3 ovigerous females, 3.6–5.0 mm (ZRC 2020.0571), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait, between Tabuhan Island and Sumatra, 379–409 m, 25 March 2018; 6 males, 4.2–6.8 mm, 1 female, 5.6 mm (MZB Cru 5155), 5 males, 3.2–6.8 mm, 2 females, 4.2–5.0 mm (ZRC 2020.0572), CP08, 5°45.126′S 104°51.080′E–5°45.225′S 104°51.710′E, Sunda Strait, between Tabuhan Island and Sumatra, 425–422 m, 25 March 2018.

Colour in life. In general, body and appendages red-orange (Fig. 4A, B). Shield generally red-orange, median part lighter, anterior margin including rostrum white; ocular peduncles orange with white streak proximal to corneas, corneas dark brown. Antennular and antennal peduncles orange, antennal flagella alternately orange and white, antennal acicle orange. Chelipeds generally orange, chela and palm whitish orange, merus with white transverse band distally. P2 and P3 with dactyls and propodi whitish orange, carpi and meri orange, white transverse broad band on meri distally.

Remarks. Rahayu's (2005) original description of *Areopaguristes micheleae* (as *Stratiotes*) was based on six specimens, and morphological variation was seen only in the male pleopod 1, i.e., in the small paratype (sl = 3.5 mm) the inferior lamella of the male pleopod is devoid of row of hook-like spines, while in the holotype and other paratype (sl = 4.6 mm and 6.5 mm) the inferior lamella is armed with a row of hook-like spines. However, examination of newly collected specimens has shown that all male individuals (sl = 2.6–6.8 mm) possess a row of hook-like spines on the inferior lamella of pleopod 1 (Fig. 3F). Furthermore, other variations that appear to be a function of animal size were observed on the ratio of ocular peduncle and antennal flagella length to shield length; the corneal diameter to ocular peduncle length; the intensity of setae on the antennal flagella, chelipeds, and P2, P3; the shape of female brood pouch. In full grown specimens (sl > 6.1 mm) the ocular peduncles are proportionally longer, about 0.6 times as long as the shield, and the corneas are proportionally smaller, about 0.2 times as long as the ocular peduncles (Fig. 3A). In small specimens (sl < 3.5 mm), the ocular peduncle is 0.5 times as long as the shield and the corneal diameter is 0.3 times as long as the ocular peduncle. The antennal flagella is much shorter with only sparse setae in the small individual; chelipeds, and P2, P3 have more setae in the larger individual (Fig. 3D, E). Female brood pouch is subquadrangular, moderately large in the females with sl > 5 mm (Fig. 3G), while in the small females (sl < 4.5 mm) the brood pouch is in the form of a small triangular flap. Additionally, the shape of the telson is also variable, the posterior lobes are almost symmetrical

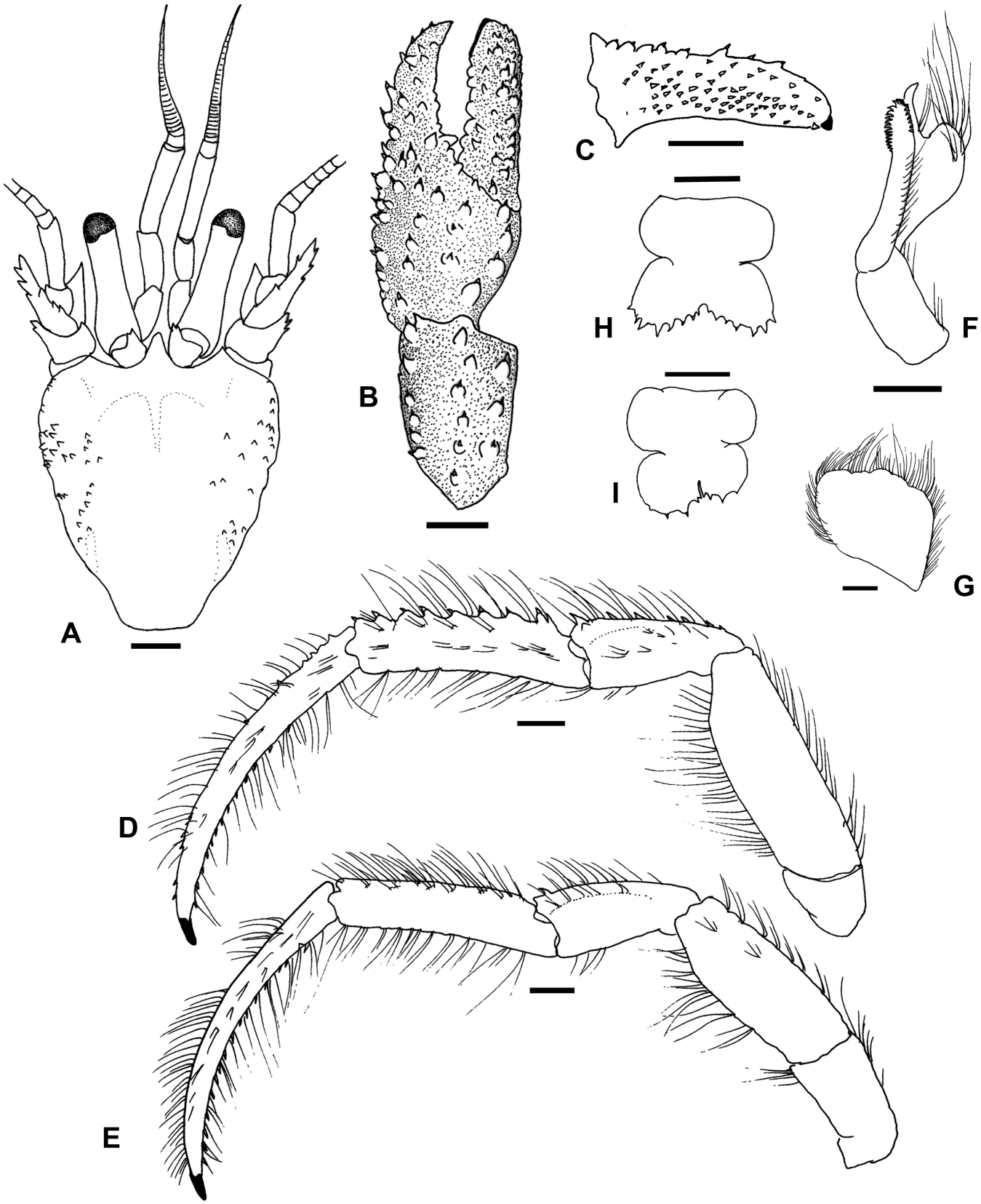

Fig. 3. *Areopaguristes micheleae* (Rahayu, 2005), A–F, H, male, sl 6.1 mm (MZB Cru 5154); G, female, sl 4.4 mm (MZB Cru 5154); I, male, sl 6.0 mm (MZB Cru 5154). A, shield and cephalic appendages; B, chela and carpus of left cheliped, dorsolateral view; C, dactyl of left cheliped, mesial view; D, left P2, lateral view; E, left P3, lateral view; F, left male first gonopod; G, female brood pouch; H, I, telson. Scales = 1.0 mm. Setae partially omitted.

in some specimens, with a shallow, broad median incision, and armed with more numerous and prominent spines on the terminal margin (Fig. 3H), while in some other individuals they are clearly asymmetrical with a deep, narrow incision, with few and relatively small spines on the terminal margins (Fig. 3I); this variation seems to be independent of the size or sex of individuals.

Areopaguristes micheleae is superficially similar to *Paguristes miyakei*. Both species have relatively stout ocular peduncles, which are 0.5 to 0.6 length of the shield, presence of long, dense setae on the chelipeds and pereopods, and the telson has spinous terminal margins. Other than differences in gill numbers, the two species are differentiated from one another by the antennal flagella that is relatively long and thick with dense, long stiff setae in *P. miyakei* (relatively short and slender, with fewer setae in *A. micheleae*); and that the chelipeds are armed with large and numerous spines in *P. miyakei* (relatively small and fewer spines in *A. micheleae*; see Fig. 3B, C). Living colouration is also different in the two species. In general, the colour in life of *P. miyakei* is white speckled with orange and light brown (Fig. 4E, F), while in *A. micheleae* it is deep orange with a white transverse band distally on the meri of the chelipeds and pereopods (Fig. 4A, B).

Distribution. The species is now known from Madagascar and Indonesia (southeast of Sulawesi, Makassar Strait, and Sunda Strait), at depths of 350–585 m, on coarse sand, gravel, and rubble.

Paguristes Dana, 1851

Paguristes antennarius Rahayu, 2006

Paguristes antennarius Rahayu, 2006: 365, figs. 13–15; Rahayu, 2007: 517.

Material examined. 2 males, 4.8–7.6 mm, 1 female, 5.0 mm, 3 ovigerous females, 5.2–6.0 mm (MZB Cru 5156), 2 males, 5.2–6.2 mm, 2 females, 4.4–4.2 mm, 3 ovigerous females, 5.0–6.2 mm (ZRC 2020.0573), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait, between Tabuan Island and Sumatra, 379–409 m, 25 March 2018; 3 males, 4.4–6.6 mm, 3 females, 3.4–4.8 mm (MZB Cru 5157), 4 males, 4.8–6.4 mm, 2 females, 4.6–5.0 mm, 1 ovigerous female, 4.7 mm (ZRC 2020.0574), CP08, 5°45.126′S 104°51.080′E–5°45.225′S 104°51.710′E, Sunda Strait, between Tabuan Island and Sumatra, 425–442 m, 25 March 2018; 3 males, 6.6–8.4 mm (MZB Cru 5158), 4 males, 3.9–8.0 mm (ZRC 2020.0575), CP10, 5°45.399′S 104°56.098′E–5°46.183′S 104°56.565′E, Sunda Strait, South of Umbar Bay, Sumatra, 429–446 m, 25 March 2018.

Remarks. Rahayu (2007) discussed the differences between *Paguristes antennarius* and *P. miyakei* in the armament of P2 and P3, and the mesial face of the dactyl of the chelipeds. McLaughlin (2008) stated that although the armament of the mesial faces of the dactyls of the cheliped is somewhat variable, this character has still proved useful in distinguishing certain taxa of *Paguristes*. In the case of *P. antennarius* this armament varies considerably, in some specimens spines on the mesial face of the dactyls of the cheliped are arranged longitudinally and in other specimens they are arranged in an oblique row, or scattered. Therefore, the spine arrangement on the mesial face of dactyls of the chelipeds are not reliable in differentiating the two species. Nevertheless, the shape of the rostrum and the armament of P2 and P3 are quite constant in *P. antennarius*, and they are different from those of *P. miyakei*. In *P. antennarius* the rostrum is broadly triangular, terminating acutely; P2 and P3 ventral margins dactyls each with 16–19 corneous spines, P2 mesial surface dactyl is armed with subdistal row of few spines, while on P3 the row of spines is along entire length medially. In *P. miyakei* the rostrum is also broadly triangular but terminating bluntly, the ventral margins of the dactyl of P2 and P3 each with 20–28 of corneous spines, and the mesial surfaces are unarmed. Additionally the chelipeds of *P. antennarius* have relatively fewer spines and sparser setae, whereas in *P. miyakei* the spines on the chelipeds are more numerous and prominent with relatively denser setae.

Distribution. Previously known only from Maluku (Moluccas, Indonesia) and Madagascar, at depths of 448–720 m; now recorded from Sunda Strait, at depths of 379–446 m, on coarse sand, rubble, and wood.

Paguristes calvus Alcock, 1905
(Fig. 4C, D)

Paguristes calvus Alcock, 1905: 135, pl. 1, fig. 4; Rahayu & McLaughlin, 2006: 875, figs. 4, 5; McLaughlin et al., 2007: 44–46, unnumbered fig.; Rahayu & Forest, 2009: 1311.

Material examined. 2 males, 4.8–6.4 mm (MZB Cru 5159), 1 male, 5.0 mm (ZRC 2020.0576), CP37, 8°07.462′S 109°05.639′E–8°07.864′S 109°06.470′E, South of Cilacap, 163–166 m, 30 March 2018.

Comparative material: male, 9.6 mm, Panglao Stn P3, Balicasag, Philippines, 9°31.1′N 123°41.5′E, 100 m, 11 June 2004.

Colour in life. Shield mottled white and red; ocular peduncles red-orange with white streak on dorsomesial surface, corneas dark green. Antennular peduncles orange transparent, antennal peduncles red, antennal acicles orange. Chelipeds white with red transverse band on dactyls, fixed fingers, and proximal part of palms; carpi red with white streak medially, meri mottled red and white. P2 and P3 red with distal white band on dactyls and propodi, band of lighter red medially on dactyl, carpi with white spot on dorsodistal, meri with white band subdistally (Fig. 4C).

Remarks. The specimens examined in this study agree well with the description of *P. calvus* on the basis of the topotypic material from the Andaman Sea by Rahayu & McLaughlin (2006). However, wider morphological variations were observed in the relative length of the ocular peduncles and the corneal diameter. In the two females from the Andaman

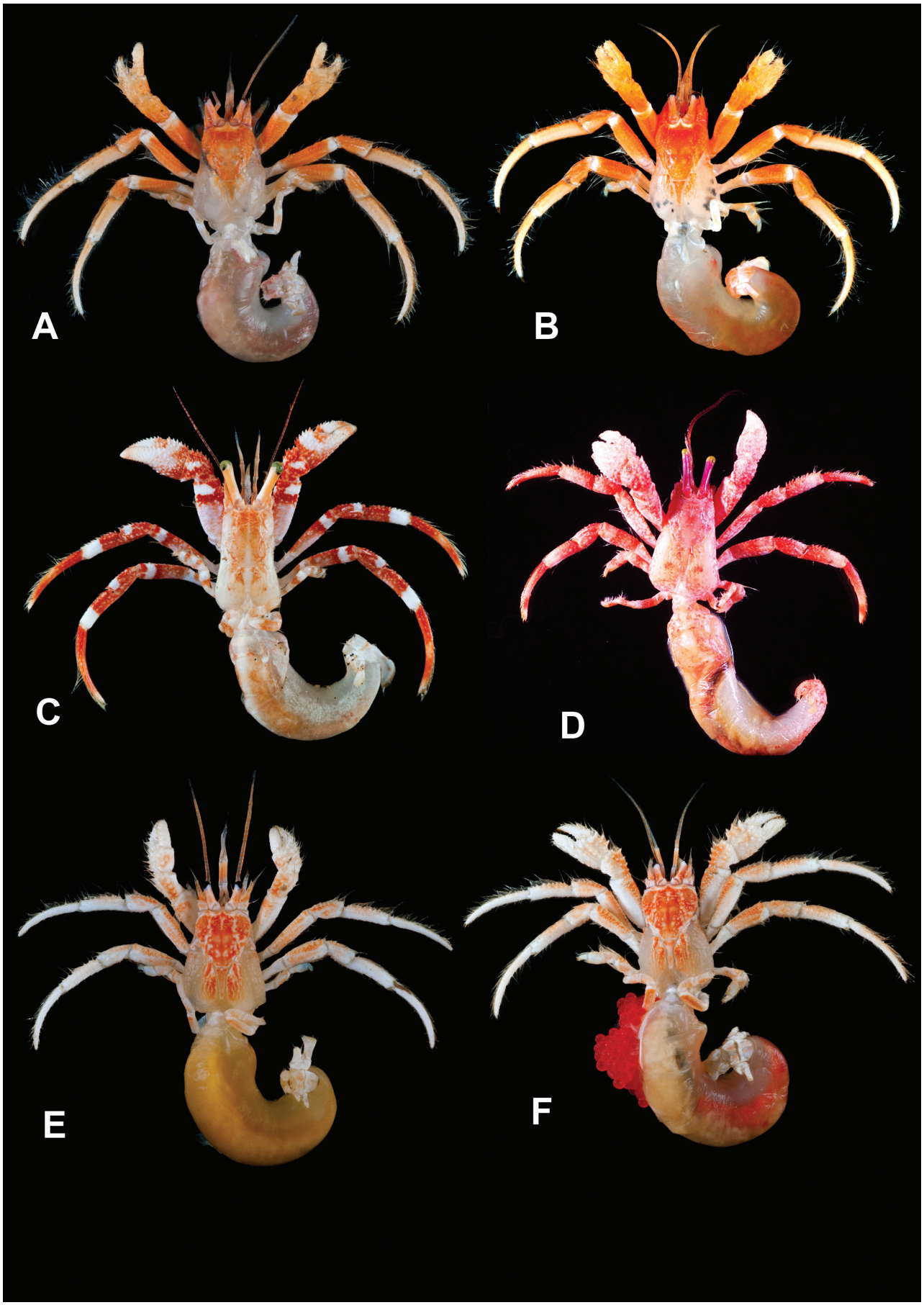

Fig. 4. A, B, *Areopaguristes micheleae* (Rahayu, 2005). A, male, sl 6.4 mm (MZB Cru 5154); B, male, sl 5.4 mm (MZB Cru 5155); C, D, *Paguristes calvus* Alcock, 1905. C, male, sl 4.8 mm (MZB Cru 5159); D, male, sl 9.6 mm (ZRC), Stn P3, Balicasag, Philippines, 11 June 2004; E, F, *Paguristes miyakei* Forest & McLaughlin, 1998. E, male, sl 5.0 mm (MZB Cru 5160); F, ovigerous female, sl 6.0 mm (ZRC 2020.0581).

Sea, the ocular peduncles are 0.7 times as long as the shield, with the corneal diameter being 0.3 times of the peduncular length. In the present specimens, which consist of three males comparable in size to the females from the Andaman Sea, the ocular peduncles are relatively longer, slightly more than 0.9 times as long as the shield, with the corneal diameter being 0.2 times the ocular peduncle length. The males seem to have longer ocular peduncles than the females in this species, and similar sex-related variation was also seen in *P. puniceus* Henderson, 1896 (cf. McLaughlin, 2004). Furthermore, the spines on the chelipeds are more numerous and stronger in the present male specimens than in the female specimens from the Andaman Sea; dorsal spines on the propodi of P3 are stronger in the present male specimens than in the topotypic female specimens. The living colour of the specimens from the Philippines (Fig. 4D) recorded by Rahayu & Forest (2009) was less bright compared to the present Indonesian specimens, but the colour pattern is the same. Althought the corneas of the specimens from the Philippines and those of the present study are both dark green in colour, the ocular peduncles are pinkish red in the former while it is red-orange in the present specimens.

Distribution. Known from the Indo-West Pacific region including the Red Sea, Indian Ocean, Philippines, and Taiwan, at depths 100–804 m. The present specimens are from within the known geographical range of the species; found on fine mud mixed with small pieces of wood branches.

Paguristes miyakei Forest & McLaughlin, 1998
(Fig. 4E, F)

Paguristes miyakei Forest & McLaughlin, 1998: 191, figs. 2, 3; McLaughlin, 2008: 247, fig. 22.

Material examined. 1 ovigerous female, 4.3 mm (MZB Cru 5174), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait (between Tabuhan Island and Sumatra), 379–409 m, 25 March 2018; 1 male, 4.5 mm, 2 females, 3.6–5.0 mm (ZRC 2020.0577), CP08, 5°45.126′S 104°51.080′E–5°45.225′S 104°51.710′E, Sunda Strait (between Tabuhan Island and Sumatra), 425–422 m, 25 March 2018; 3 males, 3.0–5.8 mm, 2 females, 3.4–4.2 mm, 1 ovigerous female, 5.5 mm (MZB Cru 5160), 4 males, 2.8–6.0 mm, 1 female, 4.6 mm, 1 ovigerous female, 4.8 mm (ZRC 2020.0578), CP10, 5°45.399′S 104°56.098′E–5°46.183′S 104°56.565′E, Sunda Strait, South of Umbar Bay, Sumatra, 429–446 m, 25 March 2018; 1 male, 5.7 mm, 3 females, 4.5–6.5 mm (ZRC 2020.0579), CP12, 5°52.252′S 104°66.786′E–5°52.728′S 104°56.422′E, Sunda Strait, Southeast of Tabuan Island, 615–698 m, 25 March 2018; 9 males, 3.7–7.4 mm, 1 ovigerous female, 5.6 mm (MZB Cru 5161); 7 males, 2.8–5.2 mm, 3 females, 3.4–6.6 mm, 1 ovigerous female, 4.8 mm (ZRC 2020.0580), CP23, 6°46.739′S 105°09.239′E–6°45.924′S 105°08.360′E, Sunda Strait, South of Panaitan Island, 571–559 m, 27 March 2018; 1 male, 5.7 mm, 1 female, 5.6 mm, 2 ovigerous females, 5.6–6.8 mm (MZB Cru 5162), 1 male, 6.2 mm, 1 female, 4.7 mm, 4 ovigerous females, 5.2–6.2 mm (ZRC 2020.0581), CP26, 6°57.221′S 105°54.754′E–6°56.664′S 105°55.315′E, East of Tinjil Island, 517–727 m, 28 March 2018; 2 males, 5.0–8.2 mm, 3 females, 6.2–6.6 mm, 2 ovigerous females, 6.8–7.4 mm (MZB Cru 5163), CP27, 6°58.642′S 105°53.745′E–6°58.937′S 105°53.363′E, East of Tinjil Island, 481–557 m, 28 March 2018.

Colour in life. Shield orange speckled with white; ocular peduncles mottled orange and white, streak of bluish white just proximal to corneas, corneas black. Antennular peduncles with ultimate segment orange, with white band distally and proximally, penultimate segment white distally, orange transparent proximally. Antennal peduncle mottled orange and white, antennal acicle orange, antennal flagella alternately orange and white. Chelipeds orangish white; palm carpi and meri with darker orange dorsally. P2 and P3 white or orangish white, propodi, carpi, and meri with orange streak dorsally and laterally (Fig. 4E, F).

Remarks. *Pagurises miyakei* is readily recognised by the thick antennal flagella with dense setae, becoming longer and denser distally, the unarmed mesial face of the dactyls of P2 and P3, and the asymmetrical posterior lobes of the telson, separated by broad median cleft, the terminal margin of each lobes rounded, with widely spaced, small spines. These characters are consistent in the small and large sized individual. The colour in life is lighter than conspecific from Japan which is reddish brown (cf. Forest & McLaughlin, 1998: 195); in the material studied here it is more whitish orange (Fig. 4E, F).

Distribution. Japan, Taiwan, northern Western Australia. In Indonesia it is recorded from south of Java, at depths of 429–727 m, on coarse sand, gravel and mud.

Paguristes palythophilus Ortmann, 1892
(Fig. 9A)

Paguristes palythophilus Ortmann, 1892: 277, pl. 12, figs. 5, 5p, q; Komai, 2001: 359, figs. 3–6; Rahayu, 2006: 359; McLaughlin, 2008: 213, fig. 10.

Material examined. 3 males, 6.1–7.5 mm, 1 ovigerous female, 5.1 mm (ZRC 2020.0582), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait (between Tabuhan Island and Sumatra), 379–409 m, 25 March 2018; 1 male, 6 mm, CP08, 5°45.126′S 104°51.080′E–5°45.225′S 104°51.710′E, Sunda Strait, between Tabuan Island and Sumatra, 425–442 m, 25 March 2018; 3 males, 6.7–10.2 mm, 20 ovigerous females, 4.4–7.3 mm, 7 individuals in shell, not measured (MZB Cru 5164), CP37, 8°07.462′S 109°05.639′E–8°07.864′S 109°06.470′E, South of Cilacap, 163–166 m, 30 March 2018.

Colour in life. In general reddish orange (Fig. 9A). Shield orange with several white spots, dark orange dorsodistal medially; ocular peduncles orange with white longitudinal stripes on lateral and mesial faces; chelipeds orange, tubercles whites; P2 and P3 orange with white spots.

Remarks. In life, this species is easily distinguished from its congeners in local waters by the colouration, which is red-orange, the chelipeds with white tubercles, and the ocular peduncles with longitudinal white stripes.

Distribution. This is a very common species that is widely distributed in the Indo-West Pacific, from Madagascar and Mozambique Channel in the Indian Ocean to Indonesia, Philippines, Taiwan, and Japan, at depths of 80–442 m; found on coarse sand, gravel, and fine mud.

Paguristes puniceus Henderson, 1896

Paguristes puniceus Henderson, 1896: 527; McLaughlin, 2004: 15, figs. 1, 2; 2008: 253, fig. 24; Rahayu, 2006: 365.
Paguristes puniceus var. *unispinosa* Balss, 1912: 92.
Not *Paguristes puniceus* – Miyake, 1978: 38, fig. 13.

Material examined. 2 males, 2.8–5.5 mm, 2 females, 3.0–3.6 mm (MZB Cru 5165); 2 males, 4.6–5.8 mm, 2 females, 3.6–3.8 mm, 2 ovigerous females, 4.0–4.4 mm (ZRC 2020.0582), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait, between Tabuan Island and Sumatra, 379–409 m, 25 March 2018; 2 males, 4.8–5.6 mm (MZB Cru 5166), CP08, 5°45.126′S 104°51.080′E–5°45.225′S 104°51.710′E, Sunda Strait (between Tabuhan Island and Sumatra), 425–422 m, 25 March 2018.

Remarks. In her observations of morphological variation in *Paguristes puniceus*, McLaughlin (2004: 10) stated that the length of ocular peduncles increased with body size. The size of the specimens examined during this study ranged from 2.3 mm to 5.7 mm in shield length, all being smaller than those studied by McLaughlin (2004), but having long, slender ocular peduncles with small corneas (the ocular peduncles were 0.6–0.8 times as long as the shield with the corneal diameter 0.1–0.2 times peduncular length). While the material from Indian Ocean examined by McLaughlin (2004) ranged from 3.7 mm to 10.1 mm, the ocular peduncles were 0.4–0.7 times as long as the shield, with the corneal diameter 0.1–0.3 of peduncular length. However, as the shape of the ocular peduncles is known to be variable intraspecifically in species of *Paguristes*, and all other morphological characters agree very well with the description of McLaughlin (2004), there is no doubt on the identity of the material examined in this study.

Distribution. Indian Ocean, from Bay of Bengal to Sumatra and south of Java, Indonesia, and Queensland, Australia, at depths of 243–766 m; found on coarse sand and gravel.

Paguristes rectus, new species
(Figs. 5–7)

Material examined. Holotype: male, 10.3 mm (MZB Cru 5167), CP47, 7°47.972′S 107°45.298′E–7°48.257′S 107°45.706′E, Indian Ocean, South of Pamengpeuk, 476–530 m, 1 April 2018; Paratypes: 2 males, 7.2–7.6 mm, 1 female, 8.1 mm (MZB Cru 5168), 3 males, 5.2–9.2 mm (ZRC 2020.0584), same locality as holotype; 1 male, 8.0 mm (MZB Cru 5169), 2 males, 5.8–7.8 mm, 1 female, 5.2 mm (ZRC 2020.0585), CP10, 5°45.399′S 104°56.098′E–5°46.183′S 104°56.5658′E, Sunda Strait, South of Umbar Bay, 429–446 m, 25 March 2018; 1 male, 3.1 mm, 1 female, 3.3 mm (MZB Cru 5170), CP23, 6°46.739′S 105°09.239′E–6°45.924′S 105°08.360′E, West of Tanjung Layar, Indian Ocean, 559–571 m, 27 March 2018.

Description. Gills biserial. Shield (Figs. 5A, 7B, D) 1.2 times as long as broad; anterolateral margin sloping; dorsal surface with scattered small spines and rows of moderately long setae laterally, few scattered tufts of shorter setae medially; posterior margin roundly truncate. Rostrum triangular, extending well beyond level of lateral projections, reaching more than half length of ocular acicles, terminating bluntly or acutely, margins each with row of long setae; anterior margin between rostrum and lateral projections concave, lateral projections triangular, unarmed. Branchiostegites each with few spinules on distal margin and dorsal margin distally, partially concealed by moderately long, dense setae.

Ocular peduncles short, 0.5 times as long as shield, slender, dilated proximally, slightly so distally, each with longitudinal row of tufts of long setae on half proximal of dorsal surface; corneal diameter 0.2 of peduncular length. Ocular acicles short, only weakly calcified in basal halves, acicular projections narrowly triangular, with simple or small bifid terminal spines.

Antennular peduncles, when fully extended, overreaching distal corneal margins by 0.4 to nearly entire length of ultimate segment; ultimate and penultimate segments glabrous; basal segment with slender spine on lateral face of statocyst lobe and small spine at ventrodistal margin. Antennal peduncles reaching midlength of corneas to overreaching distal corneal margins by approximately 0.2 length of fifth segment. Fifth and fourth segments glabrous. Third segment with few long setae; ventrodistal margin drawn out and terminating in small spine. Second segment with dorsolateral distal angle produced, terminating in 3 or 4 strong spines and with long setae; dorsomesial distal angle with 1 or 2 strong spines; mesial margin with setae; ventral surface practically obscured by dense, long setae. First segment with ventrolateral distal margin drawn out into prominent spine partially concealed by long setae. Antennal acicles broad, reaching to proximal 0.6 of fifth peduncular segments, each terminating in prominent bifid spine; dorsal surface with 2 or 4 spines, 4 or 6 spines on lateral margin, 5 or 6 spines on mesial margin, both margins and surface with abundance of long setae not concealing armature. Antennal flagella as long or slightly longer than shields, thick; articles each with 1 or 2 long setae.

Maxilliped 3 coxae with 1 acute spine on ventromesial margin distally. Ischia each with well developed crista dentata and small distal spine ventrally. Merus with 5 or 6 spines on ventral margin; dorsodistal margin with small spine.

Chelipeds (Figs. 5B, C, 7B, C) slightly unequal (left slightly larger), but similar in armament, partially concealed by long

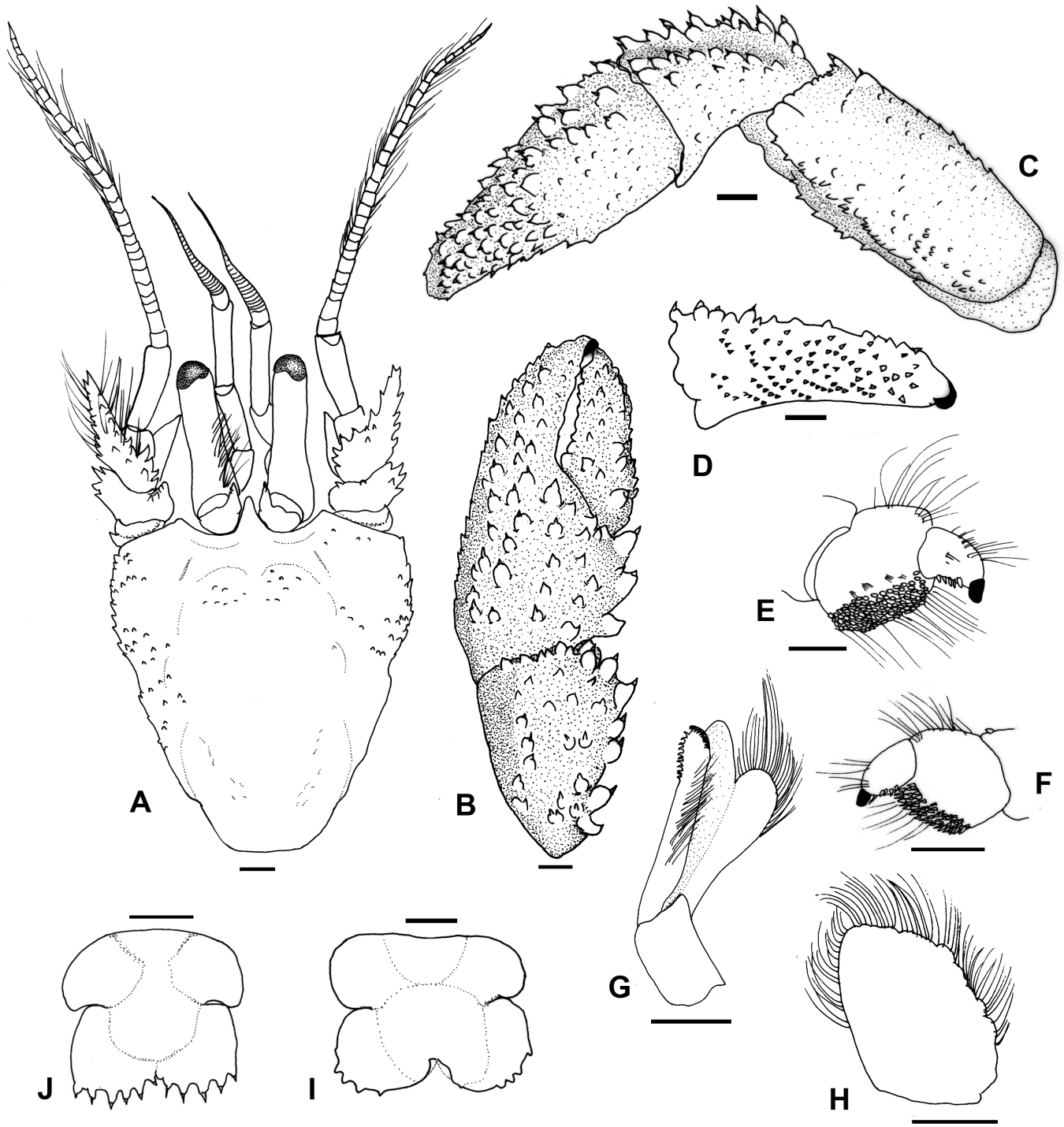

Fig. 5. *Paguristes rectus*, new species. A–E, G, I, holotype, male, sl 10.3 mm (MZB Cru 5167); F, H, J, paratypes; F, male, sl 7.8 mm (ZRC 2020.0585); H, female, 8.1 mm (MZB Cru 5168); J, male, sl 7.8 mm (ZRC 2020.0584). A, shield and cephalic appendages; B, chela and carpus of left cheliped, dorsolateral view; C, chela, carpus and merus of left cheliped; D, dactyl of left cheliped, mesial view; E, right pereopod 4; F, left pereopod 4; G, left male first gonopod, ventral view; H, female brood pouch. C, E, F, lateral view. Scales = 0.5 mm. Setae partially omitted.

setae, particularly long and dense on lateral halves of palms and fixed fingers. Dactyl 1.8 times as long as palm, with row of prominent spines accompanied by tufts of long, stiff setae on dorsomesial margin proximally, smaller spines distally; dorsal surface with moderately large spines and tufts of stiff, long setae not concealing armature; mesial face (Fig. 5D) with covering of small, corneous-tipped spines, and sparse setae; cutting edge with row of small calcareous teeth, terminating in small corneous claw overlapped by fixed finger; narrow hiatus between fingers. Palm 0.5 times as long as carpus, dorsomesial margin with 3 or 4 prominent, corneous-tipped spines; convex dorsal surface with 4 or 5 irregular rows of prominent, corneous-tipped spines, extending onto fixed finger, partially concealed by tufts of long setae, dorsolateral margin delimited by row of corneous-tipped spines; mesial surface with sparse spines and tubercles; lateral surface (Fig. 5C) with covering of strong spines on fixed finger, sparse small spines on palm, ventrolateral and ventromesial margins

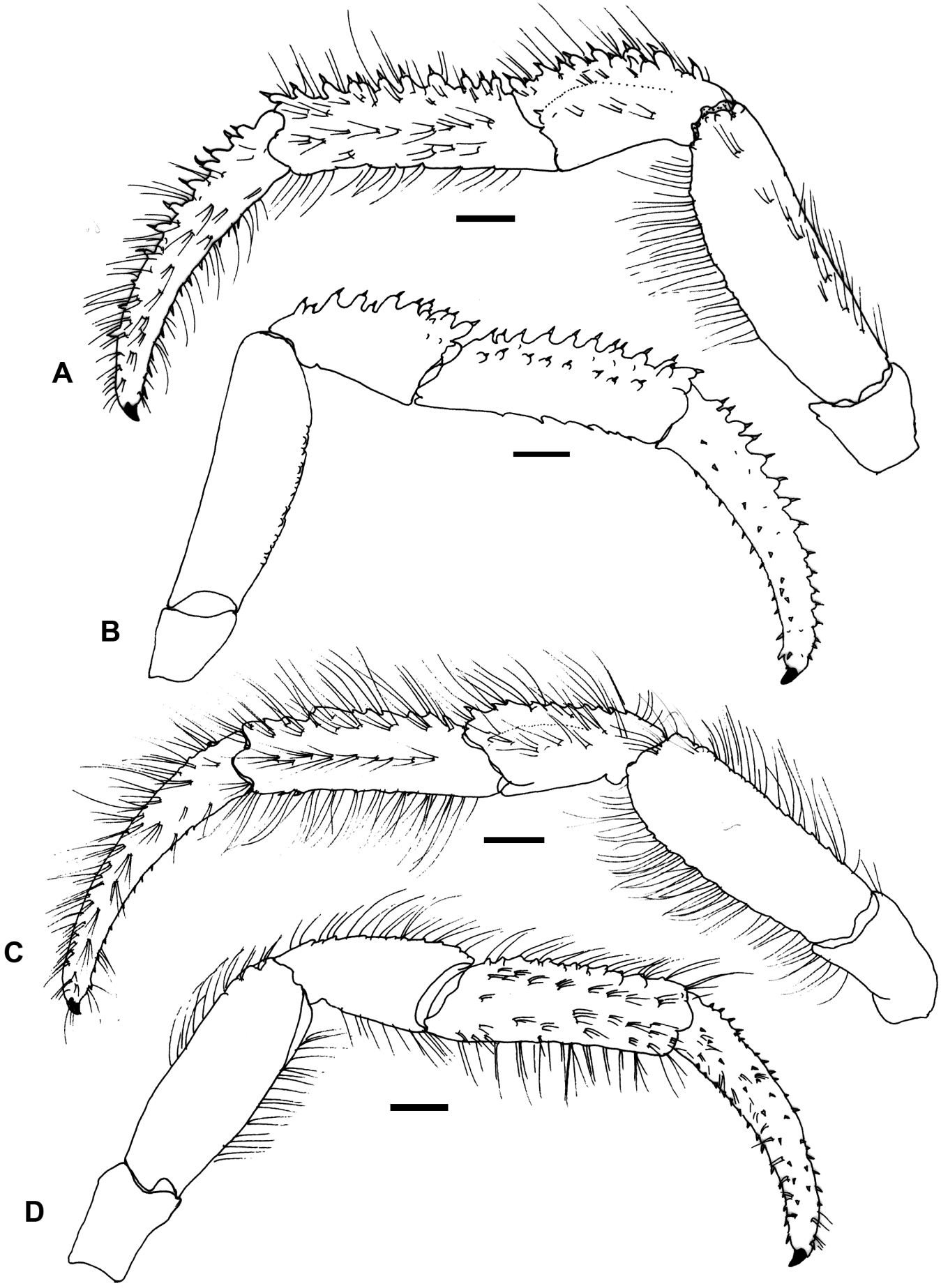

Fig. 6. *Paguristes rectus*, new species. Holotype, male, sl 10.3 mm (MZB Cru 5167). A, B, left P2; C, D, left P3. A, C, lateral view; B, D, mesial view. Scales = 0.5 mm. Setae partially omitted.

rounded. Carpus with row of strong spines dorsomesially, dorsolateral margin delimited by row of large spines, dorsal surface with scattered small spines, long setae covering carpus but not concealing armature. Merus with row of spines on dorsal surface, subdistal transverse row of small spines extending onto lateral and mesial faces, remainder of lateral face sparsely tuberculate, tubercles denser ventrolaterally; ventrolateral and ventromesial margins each with row of small spines.

P2 and P3 (Fig. 6A–D) stout, left and right similar, dorsal and ventral margins with numerous tufts of long setae, armament partially concealed; dactyls somewhat curved ventrally, slightly twisted in dorsal view, terminating in moderately small corneous claw. P2 (Fig. 6A, B) dactyl approximately 1.4 times as long as propodus; dorsal margin with row of strong, corneous-tipped spines; ventral margin with row of 12–14 corneous spines; lateral face with median row of tufts of long setae, fewer setae proximally; mesial face with median row of small corneous spines, and with dorsolateral and ventrolateral rows of tufts of long setae. Propodus about 1.1 times as long as carpus, dorsal surface with row of 11–12 prominent, corneous-tipped spines, also usually with second row of 3 or 4 smaller corneous-tipped spines on dorsomesial distally; ventral margins with row of small spines; lateral surface with row of transverse protuberances or tuberculate scutes adjacent to dorsal margin, accompanied by tufts of long setae, and with row of tufts of setae medially and ventrolaterally; mesial surface with row of corneous-tipped spines adjacent to dorsal margin partially obscured by tufts of long setae, and row of long setae ventromesially. Carpus 0.8 times as long as merus; dorsal margin with double row of prominent, corneous-tipped spines, lateral face with small spine and shallow longitudinal sulcus accompanied by row of tufts of setae; mesial face smooth. Merus with dorsal margin unarmed, ventral margin with row of tubercles, and with tufts of long setae dorsally and ventrally.

P3 (Fig. 6C, D) dactyl approximately 1.5 times as long as propodi, dorsal margin with row of small corneous-tipped spines proximally, low protuberances distally; ventral margin with row of 13–17 corneous spines; lateral face with median row of tufts of long setae; mesial face with row of corneous spines medially and shorter row dorsomesially, and with dorsolateral and ventrolateral rows of tufts of long setae. Propodus about 1.1 times as long as carpus, dorsal surface with row of protuberances, some accompanied by small corneous spine; ventral margin with row of protuberances and 1–2 small spines distally; lateral surface with row of transverse protuberances or tuberculate scutes adjacent to dorsal margin, accompanied by tufts of long setae, and with rows of tufts of setae medially and ventrally; mesial surface with dorsal, median, and ventral rows of tufts of long setae. Carpus 0.8 length of merus; dorsal margin with row of small spines, becoming larger distally; lateral face with small spine and shallow longitudinal sulcus accompanied by row of tufts of setae, mesial face smooth. Merus dorsal and ventral margins unarmed but with row of tufts of long setae.

Pereopod 4 usually without preungual process at base of claw (Fig. 5E), but in one paratype small preungual process present at base of claw (Fig. 5F); propodal rasp well developed, consisting of 5–7 corneous scales, partially obscured by numerous setae.

Male first pleopod (Fig. 5G) with row of hooked spines on distal margin of inferior lamella; external lobe broad, overreaching inferior lamella; internal lobe shorter than inferior lamella, with long setae on distal margin and inner surface. Female brood pouch (Fig. 5H) subquadrate in outline, margin slightly scalloped, fringed with dense, long plumose setae. Telson (Fig. 5I, J) symmetrical; posterior lobes separated by broad or narrow median incision, terminal margin each with blunt spines extending slightly onto lateral margin or with corneous-tipped spines not extending to lateral margins.

Etymology. From the Latin *rectus*, meaning straight, alluding to the straight abdomen; used as a noun in apposition.

Colour in life. Body and appendages generally light brown or orange and white (Fig. 7). Shield white with tint of orangish brown dorsolaterally; ocular peduncles orangish brown, white proximally and just proximal to corneas; antennular peduncles orangish white; antennal peduncles orangish white, antennal acicles whitish orange. Chelipeds generally white with orange tint on dorsal surface of carpi and meri; P2 and P3 white with shading of orange or light brown.

Remarks. The telson in the holotype seems to have been damaged, resulting in a broad median cleft that separated the symmetrical posterior lobes, of which the terminal margins are armed with blunt, well spaced spines, extending slightly onto the lateral margins (Fig. 5I). In the paratypes, the posterior lobes of the telson are separated by a deep, narrow cleft, of which the terminal margins are armed with strong, corneous spines not extending onto the lateral margins (Fig. 5J). This is apparently the usual shape of the telson. Except for one paratype specimen with sl 7.8 mm (Fig. 5F), all other specimens examined are devoid of a preungual process at the base of the claw of pereopod 4.

Among the species in the genus *Paguristes* that have prominent spines and dense setae on the chelipeds and pereopods, and with a spinous telson, this new species most closely resembles *P. sulcatus* Baker, 1905, in the propodal rasp of the pereopod 4 being well developed, consisting of several rows of corneous scales and the symmetrical telson. However, these two species can be separated by the following characteristics: the shield is slightly longer than broad in *P. rectus*, new species, whereas it is considerably longer than broad in *P. sulcatus*; the antennal acicles are relatively broad and strongly spinous in *P. rectus*, but are relatively narrow with only one or two spines on the mesial margins in *P. sulcatus*. Additionally, the antennular peduncles of the new species, when fully extended, overreach distal corneal margins by the entire length of the ultimate segment, while in *P. sulcatus* they slightly overreach the distal corneal margins. All these characters are constant in the new species, which

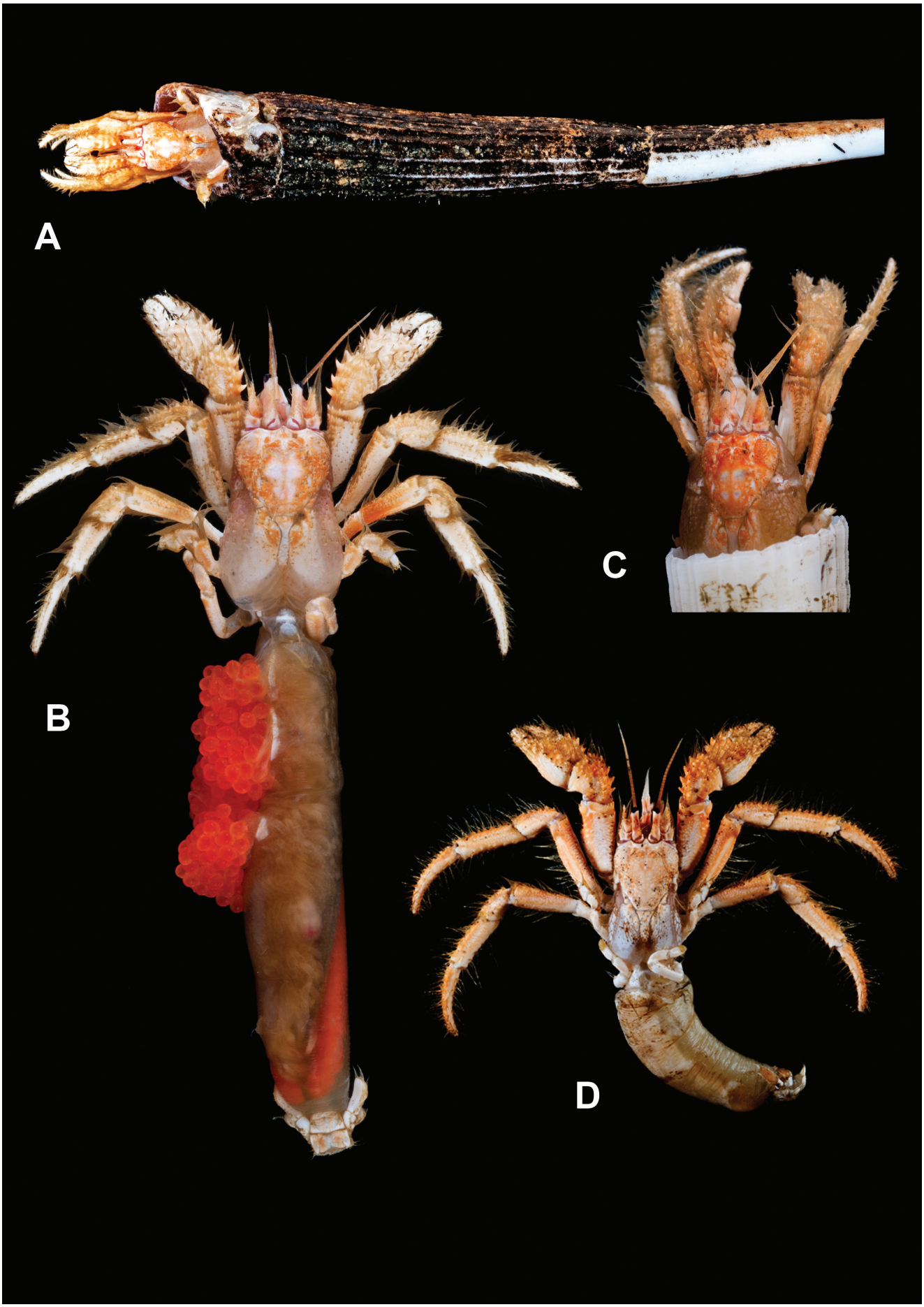

Fig. 7. *Paguristes rectus*, new species. A, B, ovigerous female, not measured, CP07, Sunda Strait, 379–409 m, 25 March 2018; C, male paratype, sl 7.0 mm (MZB Cru 5169); D, paratype, male, sl 8.6 mm (ZRC 2020.0584).

are not influenced by the size or sex of individuals. The colouration in life is not significantly different between the two species, but Morgan (1989) mentioned that the living colouration of *P. sulcatus* is generally mottled cream and brown, with brown setae. *Paguristes rectus*, new species, is more whitish and mottled orangish light brown, with brown setae. Furthermore, *P. sulcatus* occurs in littoral and sublittoral depths to 25 m, while *P. rectus* inhabits deep water, at depths of 429–570 m.

In having a broad antennal acicle, spinous and setose chelipeds and pereopods, *P. rectus*, new species, also superficially resembles *P. antennarius*. However, the unarmed upper margin of the dactyls, the unarmed mesial faces of the propodi of P2, the propodal rasp of the pereopod 4 consisting only one or two rows of corneous scales, and the markedly asymmetrical telson with a row of tiny spinules on the terminal margin of the posterior lobes, distinguish *P. antennarius* from this new species.

All the specimens of this new species live in scaphopod shells. Most of the known deep-sea species of *Paguristes* in this study occupy empty gastropod shells, or shells created by colonies of zoanthids forming a carcinoecium. This is the only species of *Paguristes* that is known to inhabit scaphopod shells and have a straight pleon.

Distribution. At present known only from Sunda Strait and Pamengpeuk, in the south of Java, at 429–571 m; on coarse sand and gravel.

Paguristes triton McLaughlin, 2008
(Figs. 8, 9C, D)

Paguristes triton McLaughlin, 2008: 210, fig. 9.

Material examined. 1 male, 6.1 mm, 1 ovigerous female, 5.1 mm (MZB Cru 5171), 1 male, 4.5 mm (ZRC 2020.0586), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait, between Tabuan Island and Sumatra, 379–409 m, 25 March 2018.

Colour in life. Shield reddish orange with some white spots on anterolateral part, ocular peduncles white with reddish-orange longitudinal stripe on dorsal surface medially, corneas black, ocular acicle reddish orange. Antennular peduncles with penultimate segment white, ultimate segment light orange; antennal peduncle light orange. Antennal peduncles light orange, flagellum whitish orange; antennal acicles orange. Chelipeds light orange with white spines and tubercles; dactyl and fixed finger white with shade of orange. P2 and P3 whitish orange, distal area of dactyls, propodi, carpi, and meri white (Fig. 9C, D).

Remarks. The present specimens from Indonesia agree well with the original description of *P. triton* from Western Australia by McLaughlin (2008). However, some minor differences were observed. In the present specimens, the dorsal surface of the shield is more strongly tuberculated (Fig. 8A); left cheliped is clearly more stout but not longer than the right (Fig. 8B, D), with the mesial face of the dactyl of the cheliped covered with large, corneous-tipped spines (Fig. 8C), and the cutting edges of the dactyl and fixed fingers armed each with very low or obtuse calcareous teeth. In the holotype and paratypes of *P. triton*, the shield has sparsely distributed small spines on dorsal surface, the left cheliped is only slightly larger than the right, the mesial face of dactyl of the cheliped is covered with very small, sometimes corneous-tipped spines, and there are 3–6 moderately small calcareous teeth on cutting edges of the dactyl and fixed finger. Furthermore, the dactyls of P2 and P3 of the specimens studied here are relatively longer, 1.9 times as long as the propodi (Fig. 8E–H), whereas in the the specimens from Western Australia the dactyls of P2 and P3 are 1.6–1.8 times as long as propodi. These differences may fall within the morphological variation of the species that is related to size, since the specimens studied here are smaller than the holotype and paratypes.

Additionally, the female brood pouch in the material from Western Australia is only a narrow subtriangular flap of tissue with marginal long, dense, plumose setae not covering the eggs (McLaughlin, 2008: 213, fig. 9h). In the material studied here, the female brood pouch is relatively large with long, dense, plumose setae on the margin (Fig. 8I), but also not covering the eggs (Fig. 9D). The eggs are attached on the thickening of the pleonal wall above the acetabula of second and third appendages of the abdomen and protected by fringe of long, dense plumose setae, similar with the female holotype described by McLaughlin (2008: 213).

McLaughlin (2008) compared her new species with *P. calvus*, but at that time the living colouration of *P. triton* was not known. The newly collected specimens reveal that the living colouration is considerably different between the two species. In *P. triton* the ocular peduncle has a longitudinal red stripe on the dorsal surface, the cornea is black, the P2 and P3 are whitish orange with distal white bands on dactyls, propodi, carpi, and meri (Fig. 9C, D). On the other hand in *P. calvus* the ocular peduncle is red-orange or pinkish, the cornea is green with some small white spots, and the P2 and P3 have transverse red and white bands (Fig. 4C, D).

Distribution. Previously known from northwestern Australia, at depths of 42–404 m. The present specimens extend the geographic range of the species northwards into the Sunda Strait, Indonesia; trawl at depths of 379–409 m, on coarse sand and gravel.

Pseudopaguristes McLaughlin, 2002

Pseudopaguristes bicolor Asakura & Kosuge, 2004
(Fig. 9B)

Pseudopaguristes bicolor Asakura & Kosuge, 2004: 57, figs. 1–8; Rahayu & Osawa, 2012: 180.

Material examined. 1 male, 1.2 mm (MZB Cru 5172), DW16, 6°09.803′S 104°57.976′E–6°09.606′S 104°58.208′E, Sunda Strait, 92–103m, 26 March 2018.

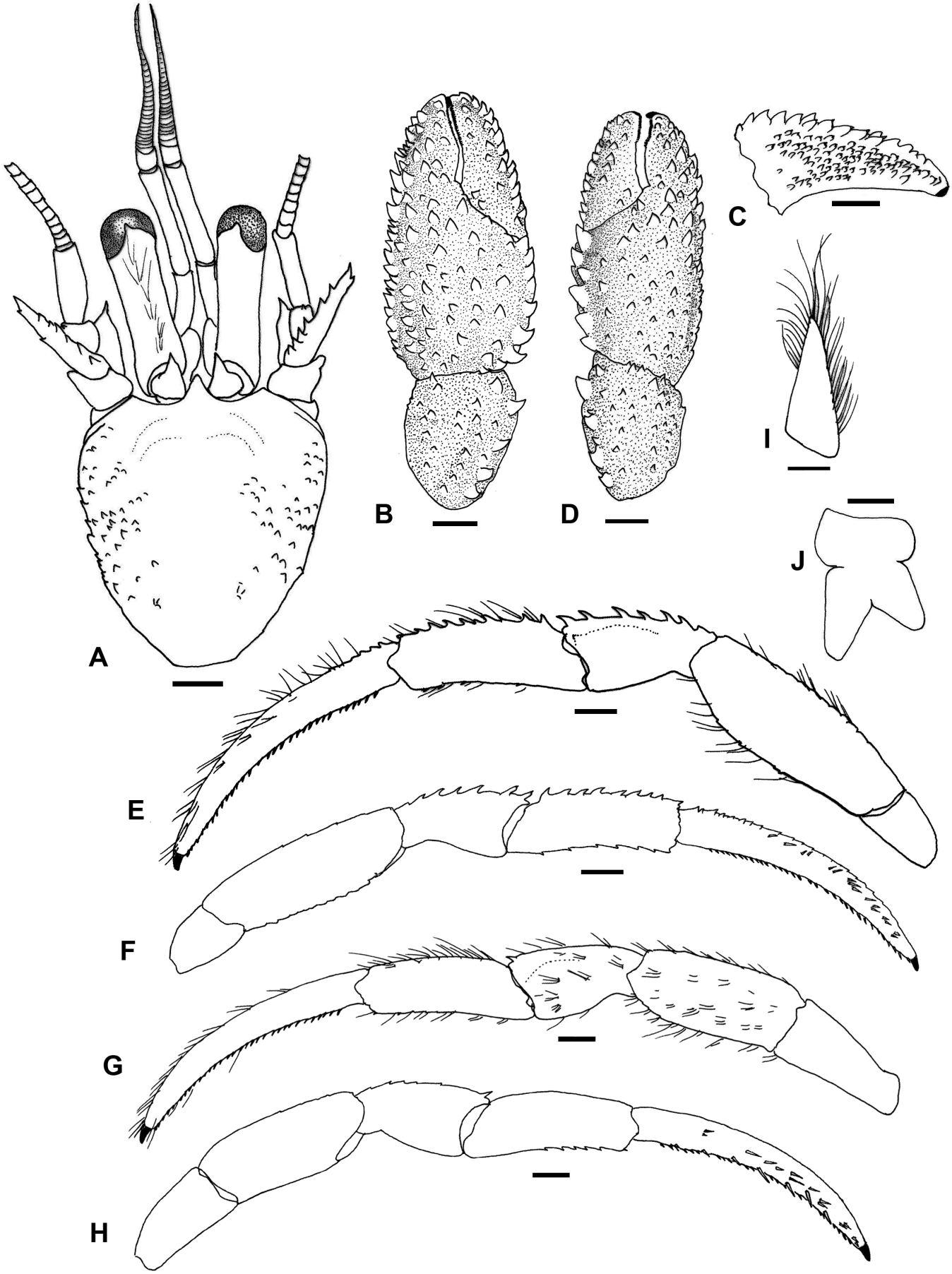

Fig. 8. *Paguristes triton* McLaughlin, 2008, A–H, J, male, 6.1 mm (MZB Cru 5171); I, ovigerous female, 5.1 mm (MZB Cru 5171). A, shield and cephalic appendages; B, chela and carpus of left cheliped; C, dactyl of left cheliped; D, chela and carpus of right cheliped; E, F, left P2; G, H, left P3; I, female brood pouch; K, telson. B, D, dorsolateral view; E, G, lateral view; C, F, H, mesial view. Scales = 1.0 mm. Setae partially omitted.

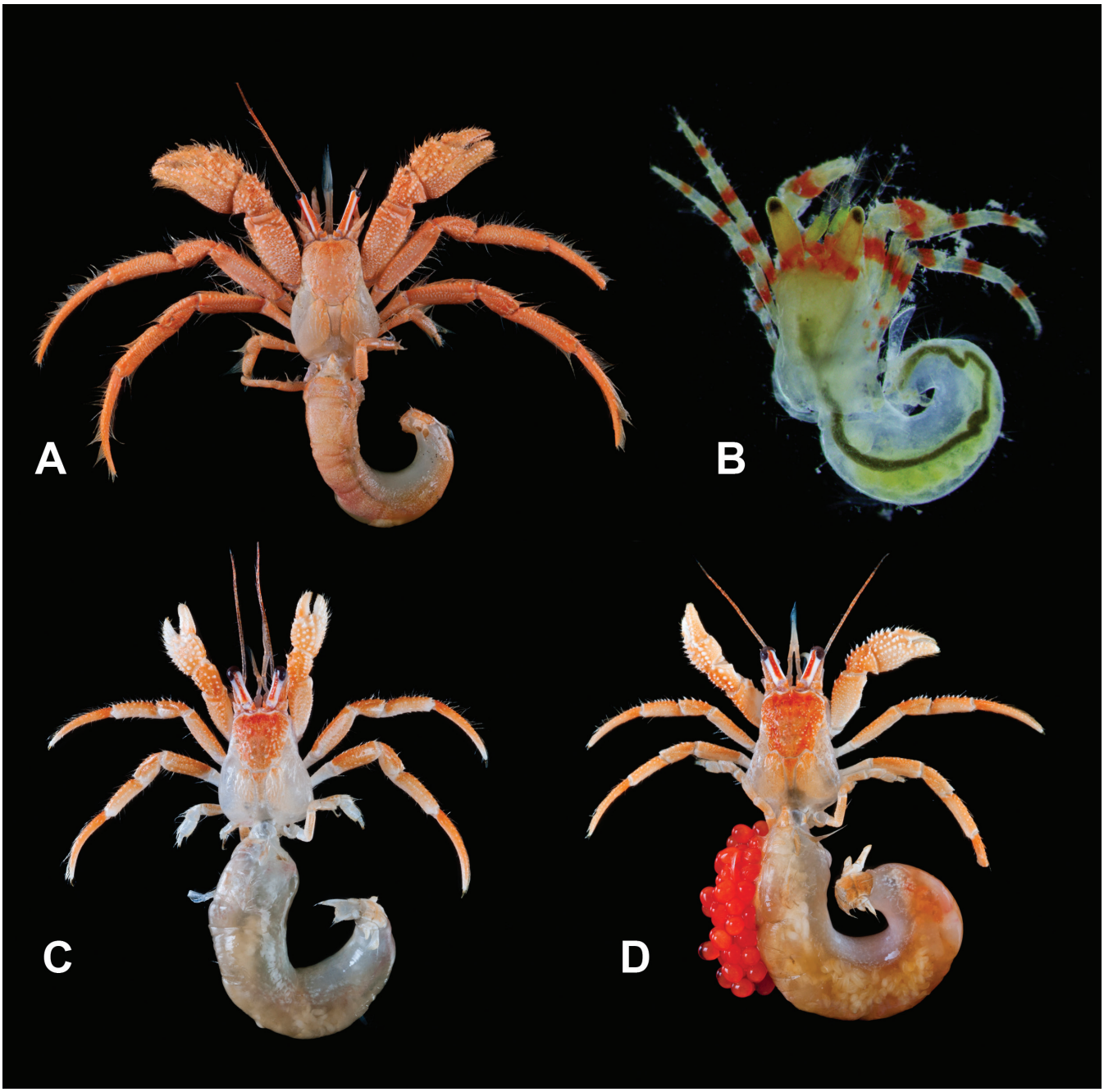

Fig. 9. A, *Paguristes palythophilus* Ortmann, 1892, male, sl 10.2 mm (MZB Cru 5164); B, *Pseudopaguristes bicolor* Asakura & Kosuge, 2004, male, sl 1.2 mm (MZB Cru 5172); C, D, *Paguristes triton* McLaughlin, 2008, C, male, sl 6.1 mm (MZB Cru 5171), D, ovigerous female, sl 5.1 mm (MZB Cru 5171).

Colour in life. Shield cream, ocular peduncles yellowish orange with red band proximally, corneas black. Antennular peduncles with basal and penultimate segments bright red, ultimate segment yellowish orange, antennular flagellum transparent white. Antennal peduncles yellowish white, first segment bright red, antennal flagellum alternating red and transparent white. Chelipeds white, broad bright red band proximally on palm and medially on merus. P2 and P3 white with broad bright red band medially on each of the dactyls, propodi, carpi, and meri (Fig. 9B).

Remarks. The ocular peduncles that are stout and thick with tapering corneas, the spines on the chelipeds and pereopods very well spaced, and the first male gonopod being not yet developed (gonopods only appeared as a small protuberance on the first pleomere), indicate that the material in this study is obviously a juvenile. However, the colour and colour pattern confirmed the identity of this species.

Distribution. Reported from Ishigaki-jima and Kume Island, Japan, at depths of 67–96 m. The known range of this species is now extended southwards to the Sunda Strait, Indonesia, at depths of 92–103 m; on gravel, sand, and mud.

Pseudopaguristes laurentae (Morgan & Forest, 1991)
(Fig. 15)

Paguristes laurentae Morgan & Forest, 1991: 678, figs. 12, 13.

Paguristes brachytes Komai, 1999: 3, figs. 1–4.
Pseudopaguristes laurentae Rahayu, 2005: 25; McLaughlin, 2008: 261, fig. 26.
Pseudopaguristes gracilis Rahayu, 2005: 28, figs. 10, 11.

Material examined. 1 female, 3.3 mm (MZB Cru 5173), 2 females, 3.0–3.2 mm (ZRC 2020.0587), CP07, 5°44.678′S 104°51.151′E–5°44.917′S 104°52.061′E, Sunda Strait, between Tabuan Island and Sumatra, 379–409 m, 25 March 2018.

Remarks. Comparison with the amended description of this species by McLaughlin (2008) showed that the shield of the specimens in this study is more spinose, the ocular peduncles are shorter (half length of the shield), the ocular acicles are relatively broader, and the telson has smaller spines on its margin. However, these differences may fall within the morphological variation of the species. Comparison with the original description of *Paguristes brachytes* Komai, 1999 (junior subjective synonym of *Pseudopaguristes laurentae*), supports this observation. Furthermore, the Indonesian specimens differ from the Japanese specimens referred to *P. brachytes* in the less spinose dorsal surface of cheliped dactyl, the absence of a spine on the dorsal margin of pereopod 4 propodus, and the less developed propodal rasp of pereopod 4. Careful reassessment in future studies would be necessary in order to conclude that geographically separated populations are one and the same species.

Distribution. Madagascar, Mozambique channel and La Reunion, Indian Ocean; Eastern and western Australia; Sunda Strait, South Sulawesi, and Kei Island in Indonesia; Izu Island and Kii Peninsula, in Japan, at depths of 121–675 m.

ACKNOWLEDGEMENTS

This study would not have been possible without the endorsement and support of the Indonesian Institute of Sciences (LIPI), National University of Singapore (NUS), Keppel-NUS Corporate Laboratory, National Research Foundation (Prime Minister's Office, Singapore), Embassy of Indonesia in Singapore, as well as the Foreign Affairs ministries of Indonesia and Singapore under the RISING 50 program to promote bilateral co-operation. Grateful thanks are due to Dirhamsyah (former Director, Research Centre for Oceanography, LIPI) for the support to the realisation of the South Java Deep-Sea (SJADES) Biodiversity Expedition. Bertrand Richer de Forges and Chan Tin-Yam provided critical and much-needed expertise during dredging and trawling operations. We are also grateful to the Indonesian crew of *Baruna Jaya VIII* and especially Captain Jefri Juliansyah for their hard work, to geologist Praditya Avianto (LIPI) for his invaluable help with the seabed geography, and all the participants for excellent collaboration during the cruise. The author is deeply indebted to Rafael Lemaitre and Tomoyuki Komai for the useful comments to improve the manuscript. Photographs were taken by Chan Tin-Yam and Rene Ong. Specimens were collected under the research permit RISTEKDIKTI 80/SIP/FRP/E5/Dit.KI/III/2018.

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