



The identity of *Pilumnus dofleini* Balss, 1933 (Crustacea: Decapoda: Brachyura: Pilumnidae), with descriptions of three new species from the Western Pacific

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Abstract

The identity of the pilumnid crab, *Pilumnus dofleini* Balss, 1933, is reassessed based on the female holotype and additional male specimens from Sagami Bay and the Sea of Japan, Japan. Three new species allied to *P. dofleini* are described and illustrated: *P. curvipenis* **n. sp.** from the Izu Islands, Japan; and *P. armatus* **n. sp.** and *P. bohol* **n. sp.** from the Bohol Sea, the Philippines. These four species are diagnosed, compared and differentiated from the related *P. acanthosoma* Ng, 2000.

Key words: Crustacea, Decapoda, Brachyura, Pilumnidae, *Pilumnus*, redescription, new species, Japan, Philippines

Introduction

The pilumnid crab *Pilumnus dofleini* was originally described by Balss (1933) on the basis of a single female specimen from off Boshu (= Boso Peninsula), Sagami Sea, Japan. Since the original description, it has been reported from the Pacific coast of the Japanese mainland, including Sagami Bay, Izu Islands, Shima Peninsula in Mie Prefecture, and Tosa Bay (Sakai 1939, 1965, 1976; Miyake 1983; Ng 2000; Marumura & Kosaka 2003), as well as from the Bohol Sea in the Philippines (Takeda & Manuel 2000; Ng *et al.* 2008). Ng (2000) provided a detailed description of specimens from the Izu Islands, just south to the type locality, which he had referred to *P. dofleini*.

This study was originally initiated to identify a single male specimen of a pilumnid crab collected from off Hashidate, Ishikawa Prefecture, Sea of Japan. It soon became apparent that the identities of *Pilumnus dofleini* and *P. acanthosoma* Ng, 2000, known from southwestern Taiwan and the South China Sea, are central to the task. These two species are characteristic for the genus in having numerous distinct, small spines or spiniform tubercles on the dorsal surface of the carapace and row(s) of prominent spines on the dorsal or extensor surfaces of the ambulatory meri, carpi and propodi. However, careful comparison with photographs of the holotype kindly provided by Stephan Friedrich of the Zoologische Staatssammlung, München, has showed that the present specimen from the Sea of Japan is the true *P. dofleini* Balss, 1933; and the material referred to this species by Ng (2000) actually belong instead to an unnamed species. Furthermore, specimens from the central Philippines sent to the authors from the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC), revealed the presence of two other undescribed species closely related to *P. dofleini*. A new diagnosis for *P. dofleini* s. str. and descriptions of three new species, *P. curvipenis* **n. sp.** from the Izu Islands, Japan, as well as *P. armatus* **n. sp.** and *P. bohol* **n. sp.** from the Bohol Sea, the Philippines, are given herein. Morphological differences for species recognition among *P. dofleini*, *P. acanthosoma* and the three new species are discussed.

The material used in this study is deposited in the National Museum, Manila (NMCR), National Museum of Nature and Science, Tokyo (NSMT), Natural History Museum and Institute, Chiba (CBM), the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC), and the Zoologische Staatssammlung, München (ZSM). Measurements provided are of carapace length and width. Although full descriptions are available for *Pilumnus acanthosoma* and *P. curvipenis* **n. sp.** (as *P. dofleini*) in Ng (2000), abbreviated descriptions are provided for these two species for comparison with the other three species treated herein.

Taxonomy

Family Pilumnidae

Genus *Pilumnus* Leach, 1815

Pilumnus dofleini Balss, 1933

(Figs 1–5)

Pilumnus dofleini Balss, 1933: 29, pl. 6, fig. 29. — Sakai 1939: 538; 1965: 169, pl. 70, fig. 1; 1976: 489 (English text), pl. 175, fig. 2. — Takeda & Manuel 2000: 157 (part); Marumura & Kosaka 2003: 57. — Takeda *et al.* 2006: 204.

Not *Pilumnus dofleini*. — Miyake 1983: 134, pl. 45, fig. 5. [see Discussion].

Not *Pilumnus dofleini*. — Ng 2000: 301, figs 1, 2. [= *Pilumnus curvipennis* n. sp.]

Not *Pilumnus dofleini*. — Ng *et al.* 2008: fig. 112. [= *Pilumnus bohol* n. sp.]

Not *Pilumnus dofleini*. — Takeda & Manuel 2000: 157 (part), figs 3F, 5. [= *Pilumnus armatus* n. sp.]

Material examined. Holotype: female (13.0 x 15.0 mm), ZSM A20110199, off Boshu (= Boso Peninsula), Sagami Sea, Japan, 180 m, 10 September 1904, coll. F. Doflein. Photographs provided by S. Friedrich examined.

Additional material: 1 male (10.2 x 12.5 mm), NSMT-CrR 2507, Kan'non-zuka-dashi, Sagami Bay, Japan, 60–80 m, 18 July 1957; 1 male (12.5 x 15.3 mm), CBM-ZC 10621, off Hashidate, Ishikawa Prefecture, Sea of Japan, 68 m, sandy mud, 17 October 2008, commercial gill net.

Description. Carapace (Figs 1A, B, 3A–D, 5A) fairly vaulted, transversely ovoid, surface covered with numerous short setae; greatest width across fourth anterolateral spines, 1.2 times of length; dorsal surface somewhat convex longitudinally, slightly convex transversely; regions well defined, surface of regions with several conical spines or spiniform tubercles; cardiac region slightly elevated, with about 10 spiniform tubercles; grooves between regions smooth, glabrous. Frontal margin not markedly produced, separated medially by wide, V-shaped notch; each frontal lobe divided in 2 parts by broad hiatus, mesial lobe with 7 small tubercles (innermost tubercle minute), lateral lobes each consisting of single conical spine slightly larger than spines on mesial lobe; inner supraorbital angle with small spine; supraorbital margin with row of small spines, with 2 shallow cleft (one at middle, one near external orbital angle). Anterolateral margin markedly spinose, with 4 main spines (including spinose external orbital angle), second to fourth anterolateral spines subequal in size, obliquely erect, each bearing several accessory spines or spinules. Posterolateral margin almost straight, converging towards posterior margin. Posterior part of carapace with submarginal row of distinct tubercles; posterior margin slightly convex. Suborbital region with covering of numerous spinules or spinulose granules; pterygostomial groove lined with granular rows dorsally and ventrally. Dorsolateral portion of buccal frame with cluster of spines.

Orbits (Fig. 3A, D) moderately large, slightly obliquely transversal in dorsal view, transversal in anterior view; eyes filling entire orbits; suborbital margin with row of small spines, innermost spine largest.

Basal segment of antennular peduncle (Fig. 3D) with 2 obliquely transversal ridges on outer surface. Antennal peduncle just entering orbital hiatus; second segment with 1 small tubercle distally on outer surface.

Epistome (Fig. 3D) divided into 4 crested lobes. Endostomal ridges indistinct.

Third maxillipeds (Fig. 3E) completely covering buccal cavity when closed; outer surfaces of ischium, merus exopods granular. Ischium subrectangular, longer than wide, with shallow oblique median sulcus, mesial margin weakly denticulate. Merus subrectangular, wider than long, margins granular, mesial margin somewhat produced in rounded lobe. Carpus to dactylus smooth on surfaces. Exopod moderately stout, distal margin just reaching distal margin of merus, inner subdistal spine prominent.

Chelipeds (Figs 1A, 2A, 4A–E; 5C, D) slightly unequal, slightly dissimilar with right larger than left; outer surfaces with covering of short setae. Anterior margin of fused basis-ischium with row of small tubercles. Merus nearly as long as high; posterodorsal margin crested, with row of spines (2 distal spines prominent); outer (posterior) surface granular adjacent to margins, otherwise nearly smooth; lower surface bluntly carinate, with rows of acute, minute to small spines. Carpus numerous, small, occasionally curved spines on dorsal to outer (lateral) surface, inner distal angle with prominent spine. Palm with numerous spines on outer surface, arranged in irregular longitudinal rows (ventral rows extending onto fixed finger), inner dorsal margin bluntly carinate, with row of small tubercles or spinules; ventral surface spinulose, bluntly carinate; inner surface nearly smooth. Fixed finger of major cheliped not deflexed, with row of rounded teeth on cutting edge; outer surface flat medially. Fixed finger of

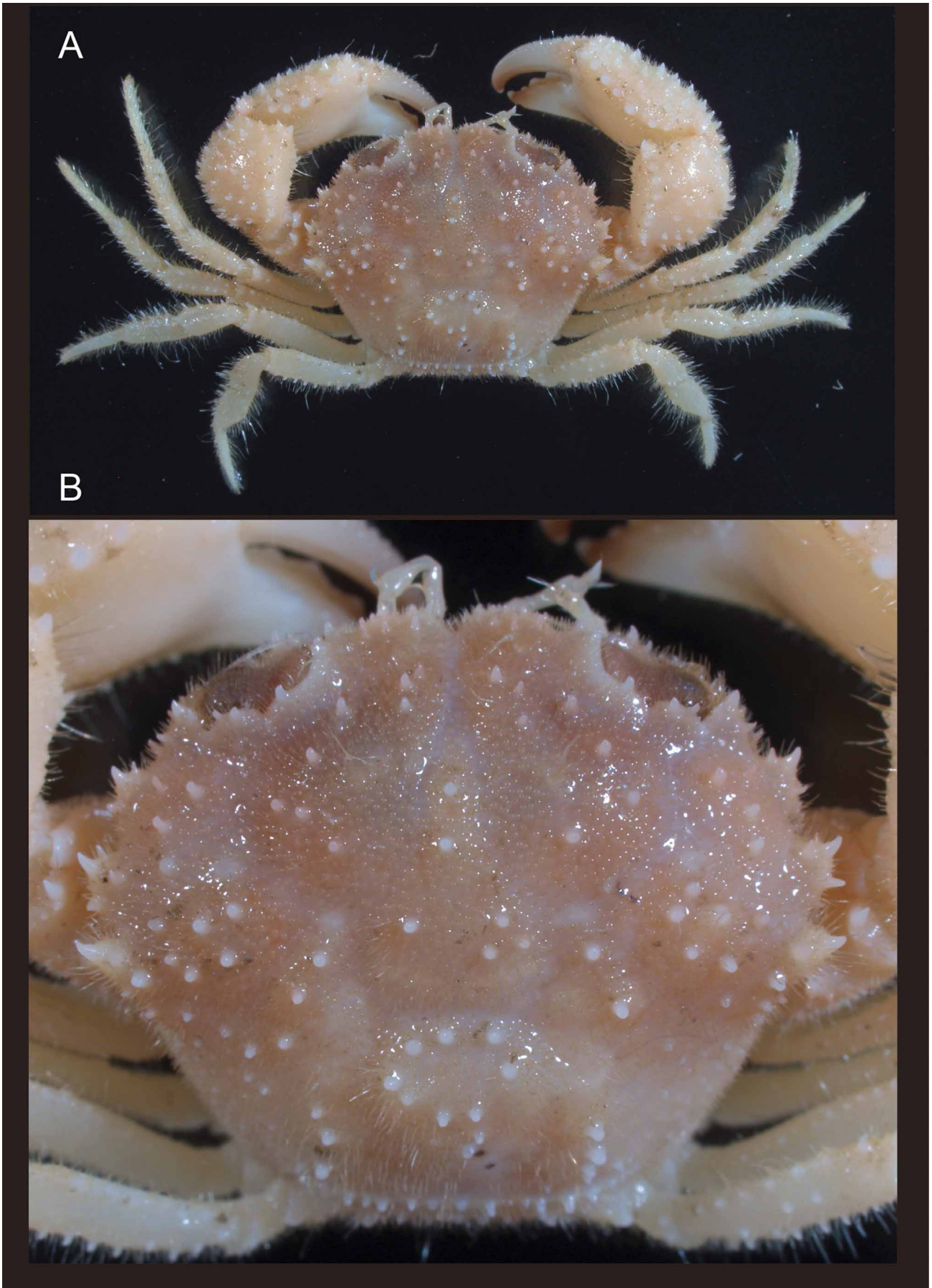


FIGURE 1. *Pilumnus dofleini* Balss, 1933, male (12.5 x 15.3 mm), CBM-ZC 10621. A, entire animal, dorsal view; B, carapace, dorsal view.

minor cheliped slightly deflexed, with row of broadly triangular, sharply edged teeth on cutting edge. Dactylus with multiple rows of small spines or spinulose tubercles on dorsal surface extending beyond midlength, with 1 (right) or 2 (left) distinct longitudinal grooves on outer surfaces.

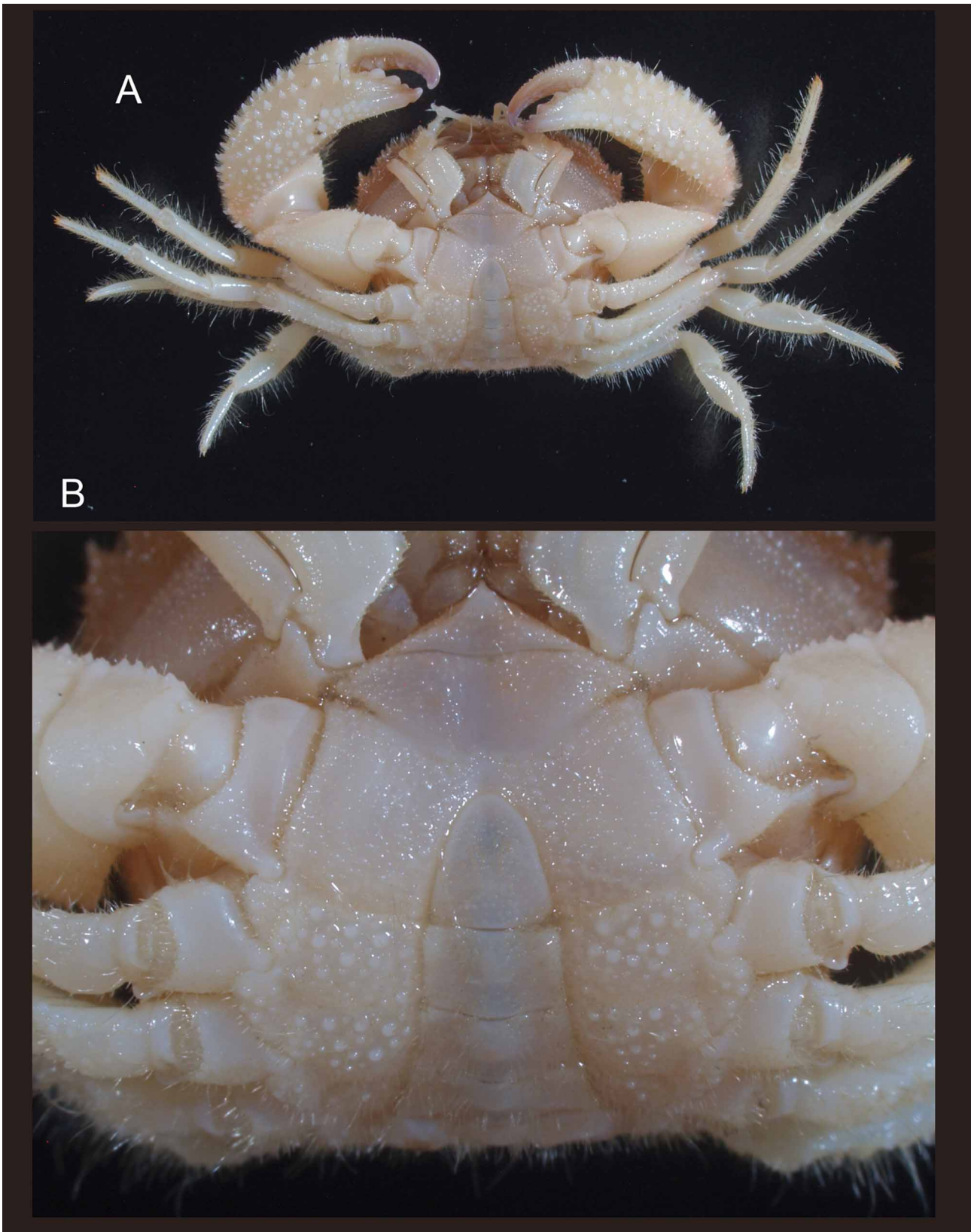


FIGURE 2. *Pilumnus dofleini* Balss, 1933, male (12.5 x 15.3 mm), CBM-ZC 10621. A, entire animal, ventral view; B, thoracic sternum and abdomen, ventral view.

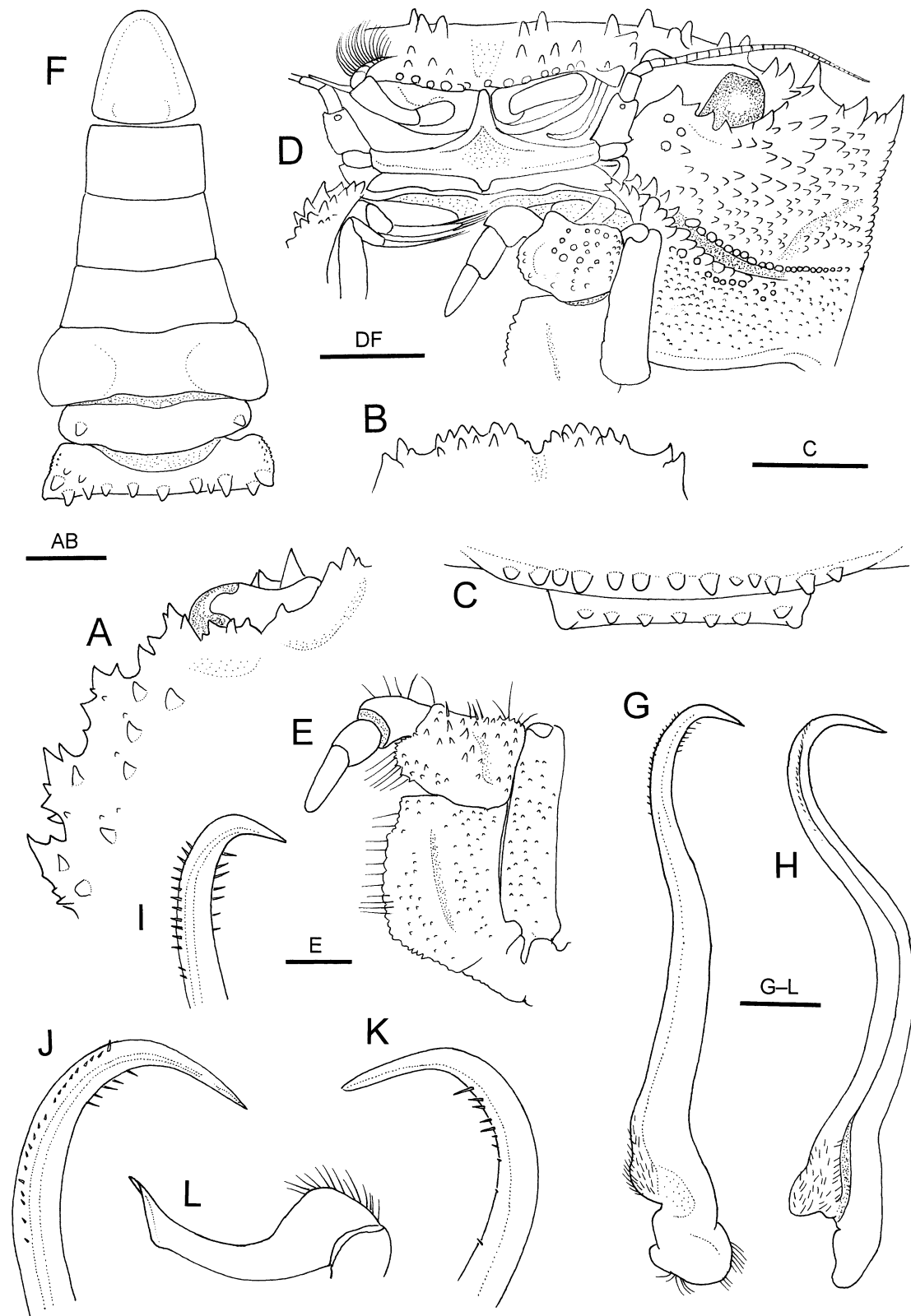


FIGURE 3. *Pilumnus dofleini* Balss, 1933, male (12.5 x 15.3 mm), CBM-ZC 10621. A, left upper orbital and anterolateral margins, dorsal view (setae omitted); B, frontal margin, anterodorsal view (setae omitted); C, posterior margin of carapace and first abdominal somite, posterodorsal view (setae omitted); D, left anterior part of carapace and cephalic appendages, anterior view (setae omitted); E, left third maxilliped, ventral (outer view; setae partially omitted); F, abdomen and telson, ventral view (setae omitted); G, left first gonopod, ventral view; H, same, mesial view; I, same, distal part, ventral view; J, same, mesial view; K, same, lateral view; L, left second gonopod. Scale bars: 2 mm for A, B, D, F; 1 mm for C, E, G, H; 0.5 mm for I-L.

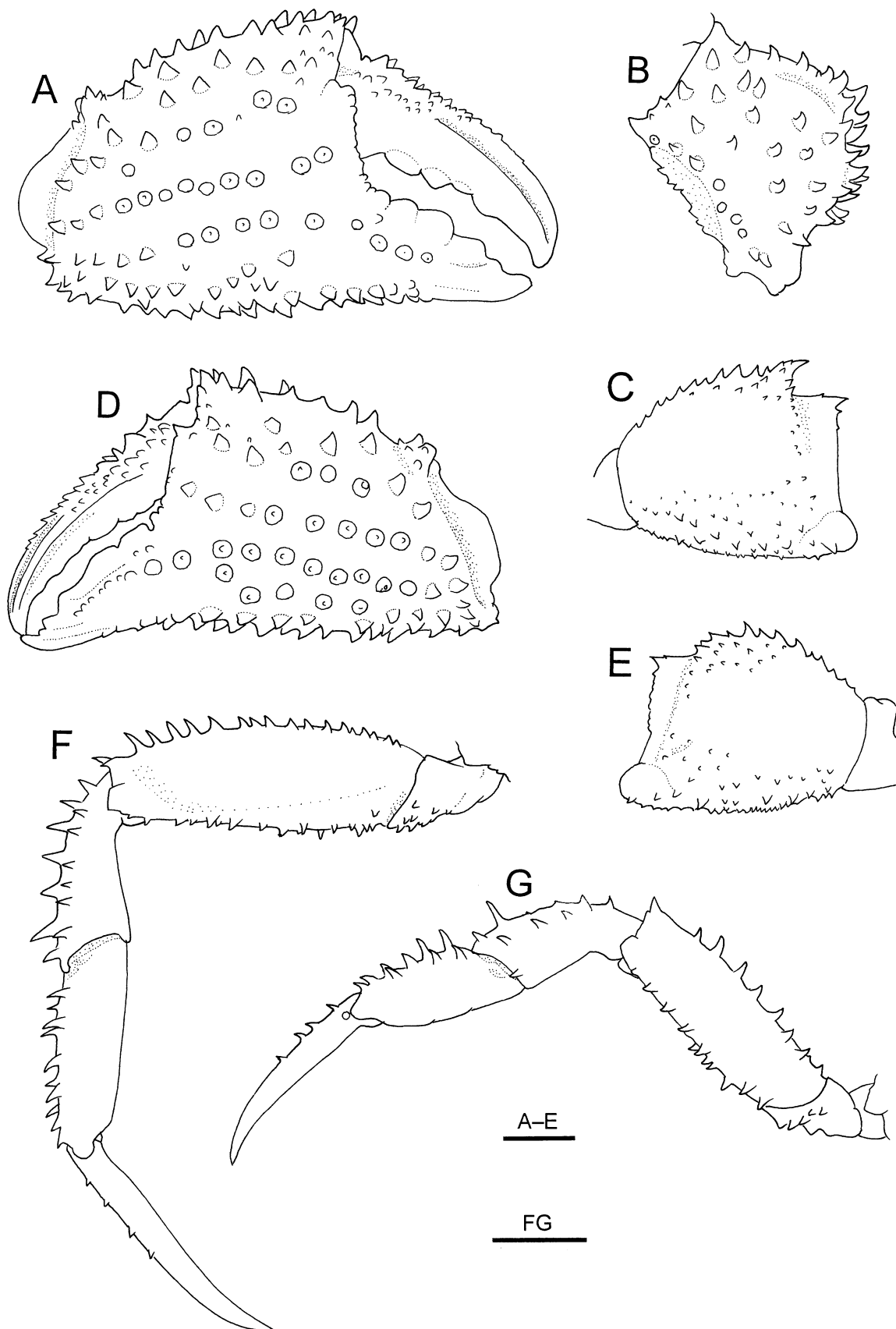


FIGURE 4. *Pilumnus dofleini* Balss, 1933, male (12.5 x 15.3 mm), CBM-ZC 10621. A, right major chela, outer view; B, carpus of right major cheliped, dorsal view; C, merus of right major cheliped, outer view; D, left minor chela, outer view; E, merus of left minor cheliped, outer view; F, left third ambulatory leg (fourth pereopod), posterior view; G, left fourth ambulatory leg (fifth pereopod), posterior view). Setae omitted. Scale bars: 2 mm.

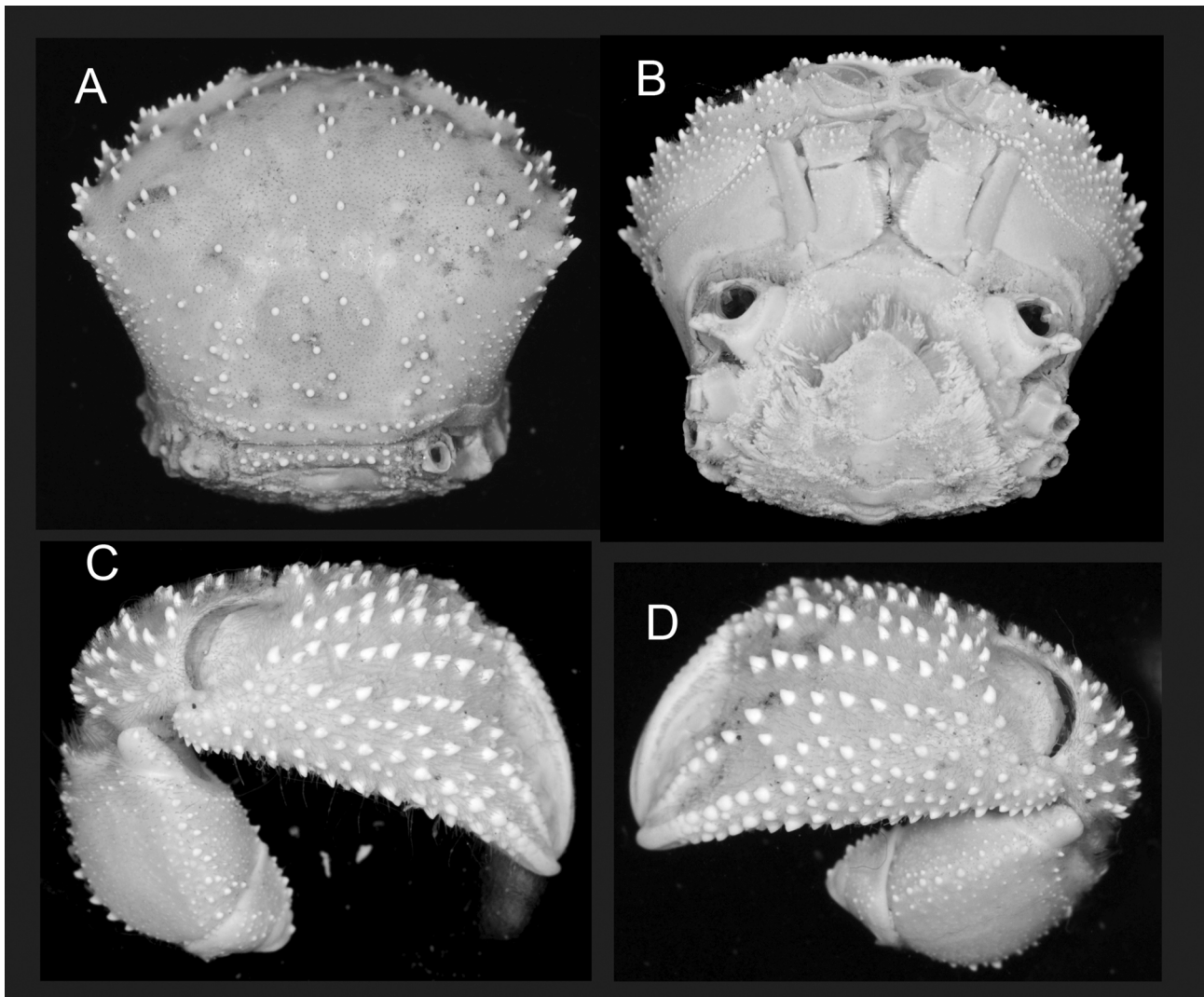


FIGURE 5. *Pilumnus dofleini* Balss, 1933, holotype, female (13.0 x 15.0 mm), ZSM A20110199 (photography: Stefan Friedrich, ZSM). A, cephalothorax, dorsal view; B, cephalothorax, ventral view; C, right minor cheliped, ventral view; D, left major cheliped, ventral view.

Ambulatory legs (Figs 1A, 2A, 4F, G) moderately long, relatively slender for genus; surfaces with covering of short setae, dorsal (extensor) and ventral (flexor) surfaces numerous moderately short to moderately long, stiff setae; first leg (second pereopod) longest, about 1.5 times of carapace width. Coxa with minutely granular ventro-distal margin. Basis-ischium fused segment each with sharp granules on ventral surface, that of fourth leg (fifth pereopod) with small spinulose tubercles on outer surface along distal margin. Merus with single row of slender, weakly curved spines on dorsal (extensor) margin; flexor surface flanked by distinctly delimited margins each bearing row of small acute spines or tubercles; outer (posterior) surface unarmed (first to third legs) or with some small spines (fourth leg). Carpus with row of long spines on extensor margin; outer (posterior) surface with median row of spines plus few additional spines. Propodus with 2 or 3 rows of spines on extensor surface; flexor margin unarmed (first to third legs) or with 1 or 2 small spines (fourth leg). Dactylus slender, slightly curved distally, terminating in small corneous claw, longer than respective propodus; extensor margin with 0–4 spinules or tiny tubercles.

Thoracic sternum (Fig. 2B) with covering of granules; these granules becoming more conspicuous in posterior sternites. Sternites 2/3 separated by distinct, straight groove; sternites 3/4 separated by suture sloping just anterior to abdominal cavity, suture becoming obsolete medially.

Male abdomen (Fig. 3F) moderately narrow, somites 1 and 3 widest. Somite 1 transversely trapezoidal, armed with transversal row of small tubercles. Somite 2 subtrapezoidal, narrower than flanking somites, with paired tubercles laterally. Somites 3–6 unarmed; somite 3 broadly trapezoidal, narrowed distally, lateral margin gently

convex, unarmed; somite 4 trapezoidal, lateral margins slightly concave; somites 5 and 6 subrectangular, with straight lateral margins. Telson (Fig. 3F) triangular with rounded tip, 1.1 times longer than wide, lateral margins nearly straight.

Female abdomen (Fig. 5B) moderately broad. Somite 1 with several tubercles on outer surface. Somite 2 with pair of tiny tubercle laterally on outer surface.

First gonopod (Fig. 3G–K) sinuous; distal 0.2 noticeably arcuate in lateral or mesial view, slightly directed laterally in ventral view, gradually tapering, bearing 2 rows of minute stiff setae not extending to apex. Second gonopod (Fig. 3L) short, sigmoidal, distal part spatulate, tip slightly recurved, sharply pointed.

Coloration. Carapace generally brown, whitish grooves between regions, cardiac and posterolateral regions. Chelipeds light brown on dorsal surface; outer surface of palm white. Ambulatory legs whitish with brown tinge on basal parts of dactyli, propodi, carpi and distal parts of meri. Thoracic sternum generally white.

Distribution. Presently known only from Japan (Sagami Sea and Ishikawa Prefecture, Sea of Japan); 60–180 m.

Remarks. The identity of *Pilumnus dofleini* is here established. The present male specimens, including one specimen studied by Sakai (1965; 1976), agree well with the holotype female in every non-sexual diagnostic character, including the presence of a submarginal row of distinct tubercles along the posterior margin of the carapace and spines arranged in irregular rows on the outer surfaces of the chelae. These male specimens enable us to provide male diagnostic characters.

The material referred to *Pilumnus dofleini* by Ng (2000) is here described as *P. curvipenis* **n. sp.** *Pilumnus dofleini* is readily distinguished from this new species by the following characters: spines or tubercles on the dorsal surface and margins on the carapace are more conspicuous in *P. dofleini* than in *P. curvipenis* **n. sp.**, in particular, the cardiac region is armed with about 10 distinct spines or tubercles in *P. dofleini*, whereas there are only a few indistinct tubercles on that region in *P. curvipenis* **n. sp.** (Fig. 1B versus Fig. 12A); grooves defining the regions on the dorsal surface of the carapace are more distinctly marked in *P. dofleini* than in *P. curvipenis* **n. sp.** (Fig. 1B versus Fig. 12A); there is a submarginal row of conspicuous tubercles adjacent to the posterior margin of the carapace in *P. dofleini*, but such tubercles are absent in *P. curvipenis* **n. sp.** (Fig. 3C versus Fig. 12A); the upper orbital margin has two small clefts in *P. dofleini*, whereas no distinct clefts are discernible in *P. curvipenis* **n. sp.** (Fig. 3A versus Fig. 12B); the pterygostomial groove of the carapace is flanked by rows of distinct tubercles in *P. dofleini*, whereas such rows of tubercles are absent or poorly developed in *P. curvipenis* **n. sp.** (Fig. 3D versus Fig. 12D); spines on the palms of the chelae are relatively less numerous and stronger in *P. dofleini* than in *P. curvipenis* **n. sp.**, with those on the median area are arranged in irregular rows in *P. dofleini* rather than scattered in *P. curvipenis* **n. sp.** (Fig. 4 A, D versus Fig. 13A, C); the ambulatory legs are relatively more slender in *P. dofleini* than in *P. curvipenis* **n. sp.** (Fig. 4F, G versus Fig. 13D, E); the extensor margins of the dactyli of the ambulatory legs are armed with small spines or tubercles in *P. dofleini*, but unarmed in *P. curvipenis* **n. sp.** (Fig. 4F, G versus Fig. 13D, E); the thoracic sternum is distinctly granular in *P. dofleini*, rather than nearly smooth in *P. curvipenis* **n. sp.** (Fig. 2B versus Fig. 1g of Ng 2000); the first abdominal somite is armed with several distinct tubercles in *P. dofleini*, but is unarmed in *P. curvipenis* **n. sp.** (Fig. 3C, F versus Fig. 12F); the first gonopod is more strongly sinuous in *P. dofleini* than in *P. curvipenis* **n. sp.**, with its distal part arcuate in the distal 0.2 in *P. dofleini*, but strongly curved near the apex in *P. curvipenis* **n. sp.** (Fig. 3G–K versus Fig. 13F–I).

Sakai (1965; 1976) reported *P. dofleini* on the basis of material from Sagami Bay made by the Showa Emperor of Japan (now housed in the collection of the Showa Memorial Institute of Tsukuba Research Center, National Science Museum, Tokyo). Takeda & Manuel (2000) presented a precise list of those specimens, in which the presence of ten lots was clarified. During this study, a single lot (NSMT-Cr R2507) was reexamined, of which the identification has been verified.

Miyake (1983) reported *P. dofleini* based on a single male specimen from Tosa Bay, Kochi Prefecture, Japan. However, this specimen seems to be different from the present specimens of *P. dofleini* in the dorsally naked carapace, the weaker armature on the cheliped, the lack of long dorsal or extensor spines on the ambulatory meri to propodi, and the purplish body color. There is little doubt that the specimen used by Miyake (1983) does not represent *P. dofleini*. Our efforts to locate Miyake's specimen has not been successful, and the determination of the specific identity of Miyake's (1983) specimen is not possible at this time.

Takeda & Manuel (2000) identified one female specimen from Balicasag Island, the Philippines, with *P. dofleini*. Although this specimen was not reexamined, it is assumed that it actually represents *P. armatus* **n. sp.** based on examination of the given photograph (Takeda & Manuel 2000: Fig. 3F). The photograph clearly shows

the absence of tubercles on the cardiac region of the carapace and the presence of a row of conspicuous tubercles along the posterior margin of the carapace and on the first abdominal somite, representing diagnostic features of *P. armatus* **n. sp.**

The record of *P. dofleini* by Marumura & Kosaka (2003) based on two specimens from Tosa Bay needs to be verified. Ng *et al.* (2008) published a color photograph of an ovigerous female specimen from the Philippines, referred to as *P. dofleini*, although *P. dofleini* was inadvertently omitted from their species list (Ng *et al.* 2008: 141–142). This specimen is referred to *P. bohol* **n. sp.** because of the weak armature on the carapace, although it was not available for this study.

***Pilumnus acanthosoma* Ng, 2000**

(Figs 6, 7)

Pilumnus acanthosoma Ng, 2000: 303, figs 3–6; Ng *et al.* 2008: (list).

Material examined. Paratypes: 1 male (11.6 x 12.6 mm), 1 female (12.9 x 14.9 mm), ZRC 1997.701, Tung-Kang, Kaohsiung County, Taiwan, 100–400 m, commercial trawlers, 5 August 1996, coll. P. K. L. Ng. Non-type: 2 males (12.0 x 13.3, 16.3 x 18.1 mm), ZRC 2001.0100, similar locality, 6 November 2000, coll. P. K. L. Ng; 2 females (12.7 x 14.6, 13.8 x 16.0 mm), CBM-ZC 2860, same locality, 5 August 1996, coll. T. Komai.

Diagnosis. Carapace (Fig. 6A, B) transversely subovoid, surface with sparse, relatively long stiff setae, but without covering of very short setae; greatest width across fourth anterolateral spines, about 1.1 times of length; regions clearly defined, slightly elevated, armed with small sharp conical spines, grooves defining regions relatively deep, naked; cardiac region with more than 10 conspicuous spines or tubercles; frontal margin slightly produced, weakly deflexed, separated medially by distinct V-shaped notch; each frontal lobe not markedly divided, with row of unequal spines (most lateral, mesial spines longer than others); inner supraorbital angle with distinct spine directed anterolaterally; supraorbital margin with row of sharp spines, with trace of 2 clefts; anterolateral margin spinose, with 4 principal spines (including spiniform external orbital angle), these anterolateral spines elongated, increasing in size posteriorly, obliquely erect, each with 1 or 2 accessory spinules basally; posterolateral margin almost straight, converging towards posterior margin; posterior part with submarginal row of conspicuous, conical spines; suborbital margin bordered with row of sharp spines, innermost spine prominent, visible in dorsal view; suborbital region with covering of numerous sharp granules; pterygostomial groove smooth, bordered dorsally by row of minute granules; dorsolateral portion of buccal frame with several granules.

Third maxilliped with ischium granular on outer surface; outer surface of merus coarsely granular; outer surface of exopod granular entirely.

Chelipeds (Figs 6A, 7A) slightly unequal, slightly dissimilar with right larger than left; surfaces of carpi, chelae bearing sparse longish setae; anterior margins of fused basis-ischium segment with row of sharp granules; merus with 2 distal spines and row of small spines on crested posterodorsal margin; carpus with scattered long spines on dorsal to outer surface (these spines slightly curving forward), inner distal angle produced in prominent spine; palm with relatively strong, acute spines, arranged in 5 or 6 irregular rows on outer surface, inner dorsal margin bluntly carinate with row of spines, ventral surface rounded, having rows of spines; fingers slightly longer than palm, with row of blunt teeth on cutting edges (major) or row of sharply edged, triangular teeth (minor); dactylus with row of tiny spines or sharp granules on dorsal margin extending nearly to tip; outer surface of dactylus with median carina bearing spinules accompanied by shallow sulcus.

Ambulatory legs (Figs 6A, 7A) moderately long, relatively slender for genus, bearing sparse short to long stiff setae on margins and surfaces, but lacking covering of short setae; coxa with few acute granules on ventral surfaces; basis-ischium fused segment with some acute granules or spinules on ventral surfaces; merus with single row of acute spines on dorsal margin; ventral margin also each with row of acute spines; outer (posterior) surface smooth in first to third legs, with few spinules in fourth leg; carpus with 2 rows of slender, acute spines on extensor surface; propodus with 2 rows of slender, acute spines on dorsal margin, flexor margin unarmed; dactylus slender, distinctly longer than propodus, unarmed on extensor margin, relatively sparsely setose.

Thoracic sternum (Fig. 7B) with scattered stiff setae; fused sternites 1–3 weakly granular; sternites 4–8 with scattered, sometimes spiniform tubercles.

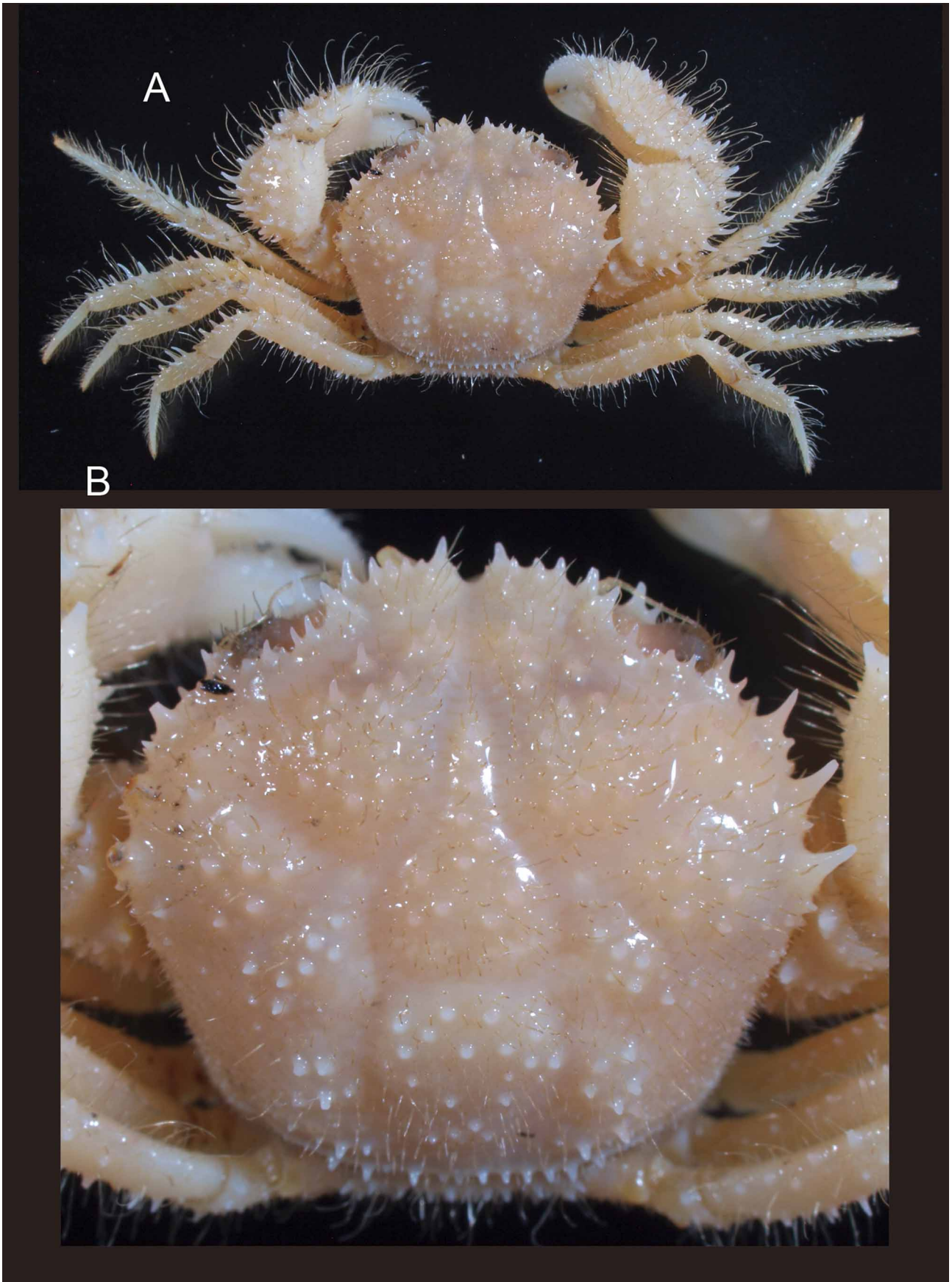


FIGURE 6. *Pilumnus acanthosoma* Ng, 2000, male (11.6 x 12.6 mm), ZRC 1997.701. A, entire animal, dorsal view; B, carapace, dorsal view.



FIGURE 7. *Pilumnus acanthosoma* Ng, 2000, male (11.6 x 12.6 mm), ZRC 1997.701. A, entire animal, ventral view; B, thoracic sternum and abdomen, ventral view.

Male abdomen (Fig. 7B) with tiny spiniform tubercles on all somites, although becoming less numerous toward sixth somite.

First gonopod sinuous; distal 0.2 noticeably arcuate in lateral or mesial view, slightly directed laterally in ventral view, gradually tapering, bearing row of minute setae not extending to apex (see Ng 2000; fig. 4h–k).

Coloration. Carapace reddish brown to orange in anterior part, posterior part and grooves separating regions whitish. Outer surfaces of chelipeds and ambulatory legs generally reddish brown with scattered white patches. Thoracic sternum and abdomen white. Setae on carapace and appendages golden brown.

Distribution. So far known only from southwestern Taiwan; 100–400 m.

Remarks. *Pilumnus acanthosoma* is readily recognizable by the possession of sparse, short to moderately short stiff setae on the surfaces of the carapace and on the outer surfaces of the chelipeds, instead of a covering of very short setae, the strong armature on the carapace, thoracic sternum, abdomen and appendages, and the deep grooves defining regions on the carapace. The ambulatory legs are relatively the most slender among the five species discussed in this study. The male first gonopod of this species is similar in the general shape to those of *P. dofleini* and *P. armatus* n. sp.

***Pilumnus armatus* n. sp.**

(Figs 8–11)

Pilumnus dofleini. — Takeda & Manuel 2000: 157 (part), figs 3F, 5.

Material examined. Holotype: male (15.4 x 18.4 mm), NMCR 39035, Visayas, off Panglao, Bohol Sea, Philippines, steep slope of outer reef edge, depth unknown, 2004, tangle net, coll. local fisherman.

Description. Carapace (Fig. 8A, B, 10A–D) fairly vaulted, subovoid in general, surface covered with numerous short, stiff setae; greatest width across fourth anterolateral spines, 1.2 times of length; dorsal surface somewhat convex longitudinally, slightly convex transversely, regions weakly defined, surface of regions with several conical spines or spinulose tubercles; cardiac region not particularly elevated, only with few, low tubercles partially obscured by setae; grooves between regions also with short setae. Frontal margin slightly produced, separated medially by wide, V-shaped notch; each frontal lobe divided in two parts by broad hiatus, mesial lobe with 7 subequal minute tubercles, lateral lobes each consisting of small conical spine slightly larger than spines on mesial lobe; inner supraorbital angle with minute tubercle; supraorbital margin with row of small spines, with 2 narrow cleft (one at middle, one near external orbital angle). Anterolateral margin with 4 principal spines (including spinose external orbital angle), these anterolateral spines subequal in size, obliquely erect, each bearing some accessory spines or spinules. Posterolateral margin almost straight, converging towards posterior margin. Posterior part with submarginal row of small but conspicuous tubercles, posterior margin nearly straight. Suborbital margin sinuous with mesial angle weakly produced, with row of small spines. Suborbital region with covering of numerous spinules or spinulose granules; pterygostomial groove lined with distinct granular row along dorsal side. Dorsolateral portion of buccal frame with cluster of spinules.

Orbits (Fig. 10A, D) moderately large, slightly obliquely transversal in dorsal view, transverse in anterior view; eyes filling entire orbits. Basal segment of antennular peduncle with 1 obliquely transversal ridge on outer surface, bordering fossa. Antennal peduncle just entering orbital hiatus; second segment with minute tubercle distally on outer surface.

Epistome divided into 4 crested lobes. Endostomal ridges indistinct.

Third maxilliped (Fig. 10E) similar to that of *P. dofleini*. Ischium with mesial margin bearing row of tiny rounded teeth; outer surface finely granular in most part, but mesial part coarsely granular. Merus coarsely granular on outer surface. Carpus with few coarse granules on outer surface. Propodus, dactylus surfaces smooth. Exopod with inner subdistal tooth prominent.

Chelipeds (Figs 8A, 9A, 11A–E) slightly unequal, slightly dissimilar with right stouter than left. Anterodorsal margin of basis-ischium fused segment with row of small tubercles. Merus nearly as long as high; upper surface concave to fit lateral surface of carapace; posterodorsal margins crested, each with 2 prominent spines distally and row of much smaller spines; outer (posterior) distal margins each with few minute spinules, ventrolateral outer angle with minute spine; outer (posterior) surfaces with covering of short setae, with spinules along ventral margin; anterior (inner) surface slightly convex, with minute granules along distal margin; ventral margin bluntly carinate, with rows of spinules or minute spiniform tubercles. Carpus with scattered, numerous, conical spines on dorsal surface, inner distal angle with prominent spine. Palm with numerous scattered spines, short setae covering outer surface, inner dorsal margin bluntly carinate with row of spines; ventral surface bluntly carinate, spinulose; inner

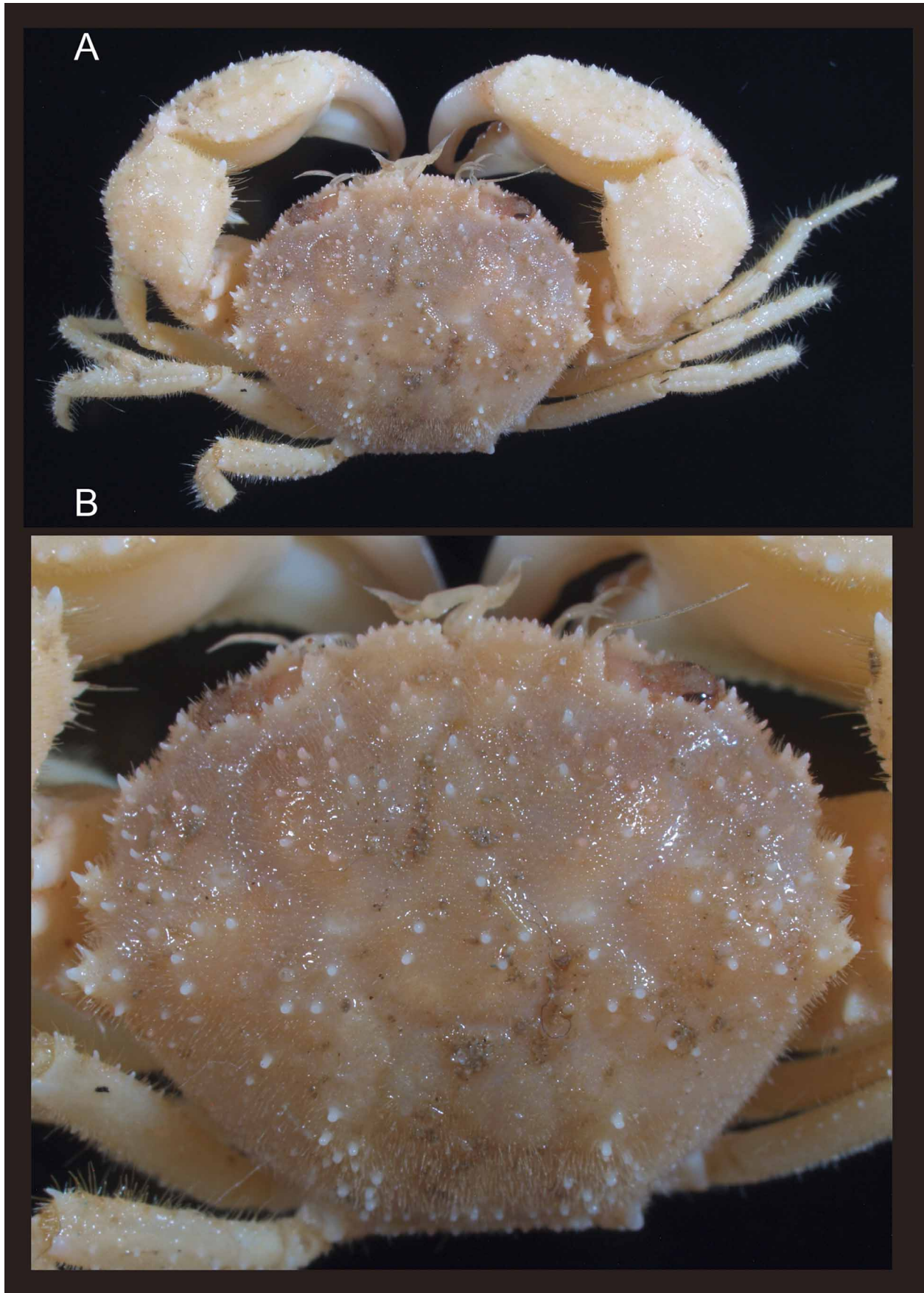


FIGURE 8. *Pilumnus armatus* n. sp., holotype, male (15.4 x 18.4 mm), NMRC 39035. A, entire animal, dorsal view; B, carapace, dorsal view.

surface nearly smooth. Fingers crossing at tips. Fixed finger of major cheliped slightly deflexed, curved inward, with row of low, rounded teeth on cutting edge; outer surface shallowly concave medially. Fixed finger of minor cheliped more strongly deflexed than that of major cheliped, with sharply edged, faintly dentate cutting edge. Dactylus weakly curved, with numerous small tubercles or granules proximally; outer surface with blunt median carina flanked by deep longitudinal sulci.

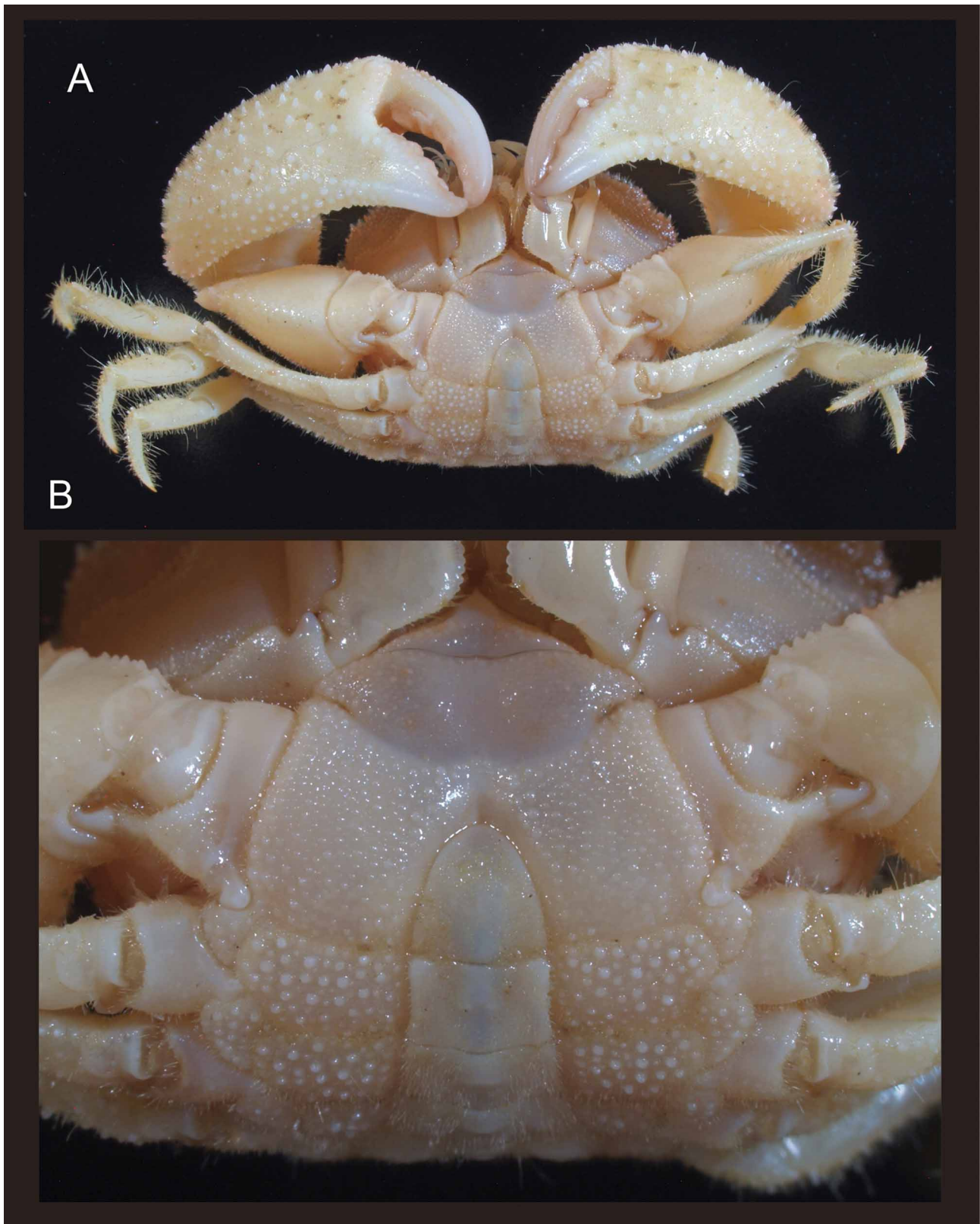


FIGURE 9. *Pilumnus armatus* n. sp., holotype, male (15.4 x 18.4 mm), NMRC 39035. A, entire animal, ventral view; B, thoracic sternum and abdomen, ventral view.

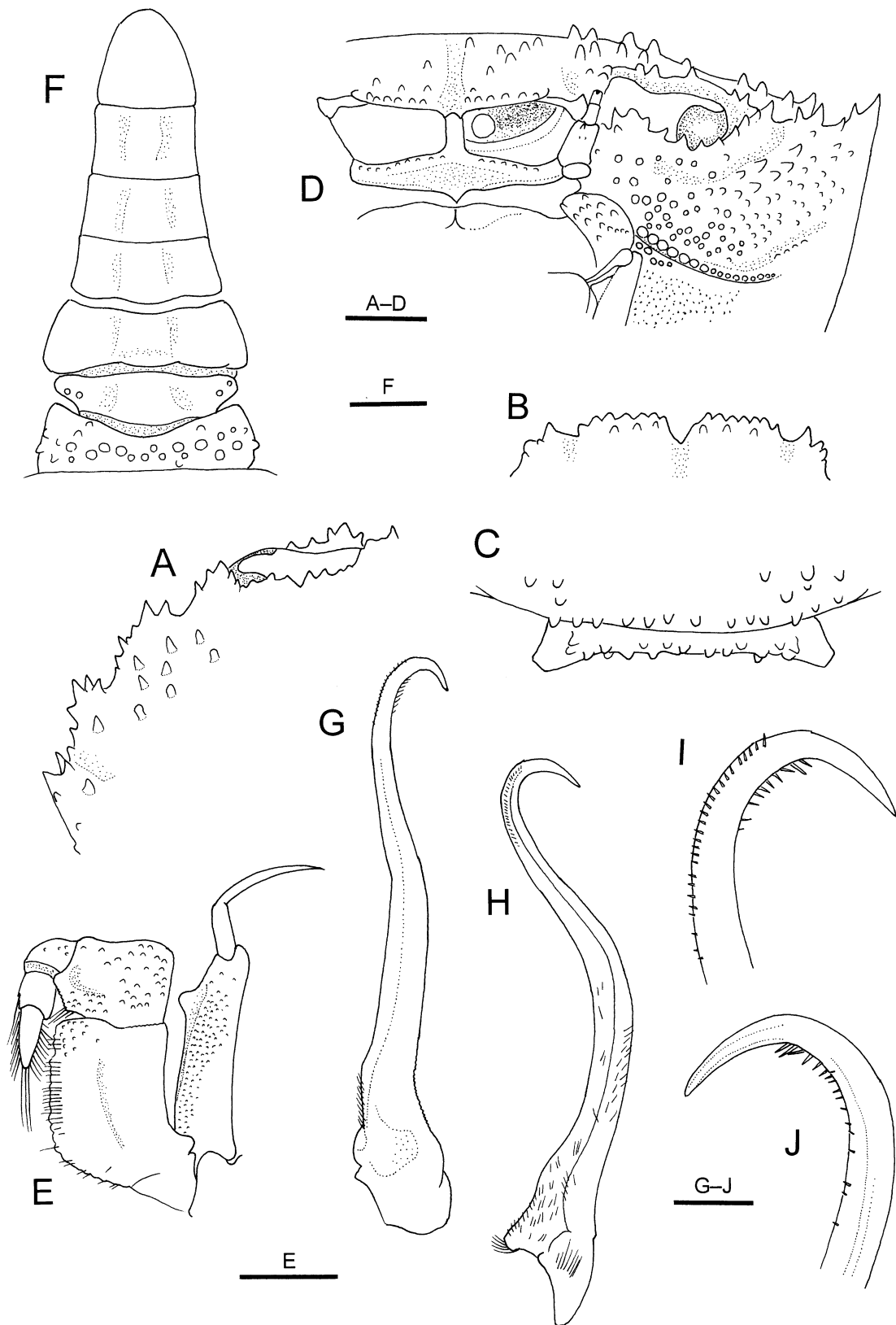


FIGURE 10. *Pilumnus armatus* n. sp., holotype, male (15.4 x 18.4 mm), NMRC 39035. A, left upper orbital and anterolateral margins, dorsal view (setae omitted); B, frontal margin, anterodorsal view (setae omitted); C, posterior margin of carapace and first abdominal somite, posterodorsal view (setae omitted); D, left anterior part of carapace and cephalic appendages, anterior view (setae omitted); E, left third maxilliped, ventral (outer) view (setae partially omitted); F, abdomen and telson, ventral view (setae omitted); G, left first gonopod, ventral view; H, same, mesial view; I, same, distal part, mesial view; J, same, lateral view. Scale bars: 2 mm for A–F; 1 mm for G, H; 0.5 mm for I, J.

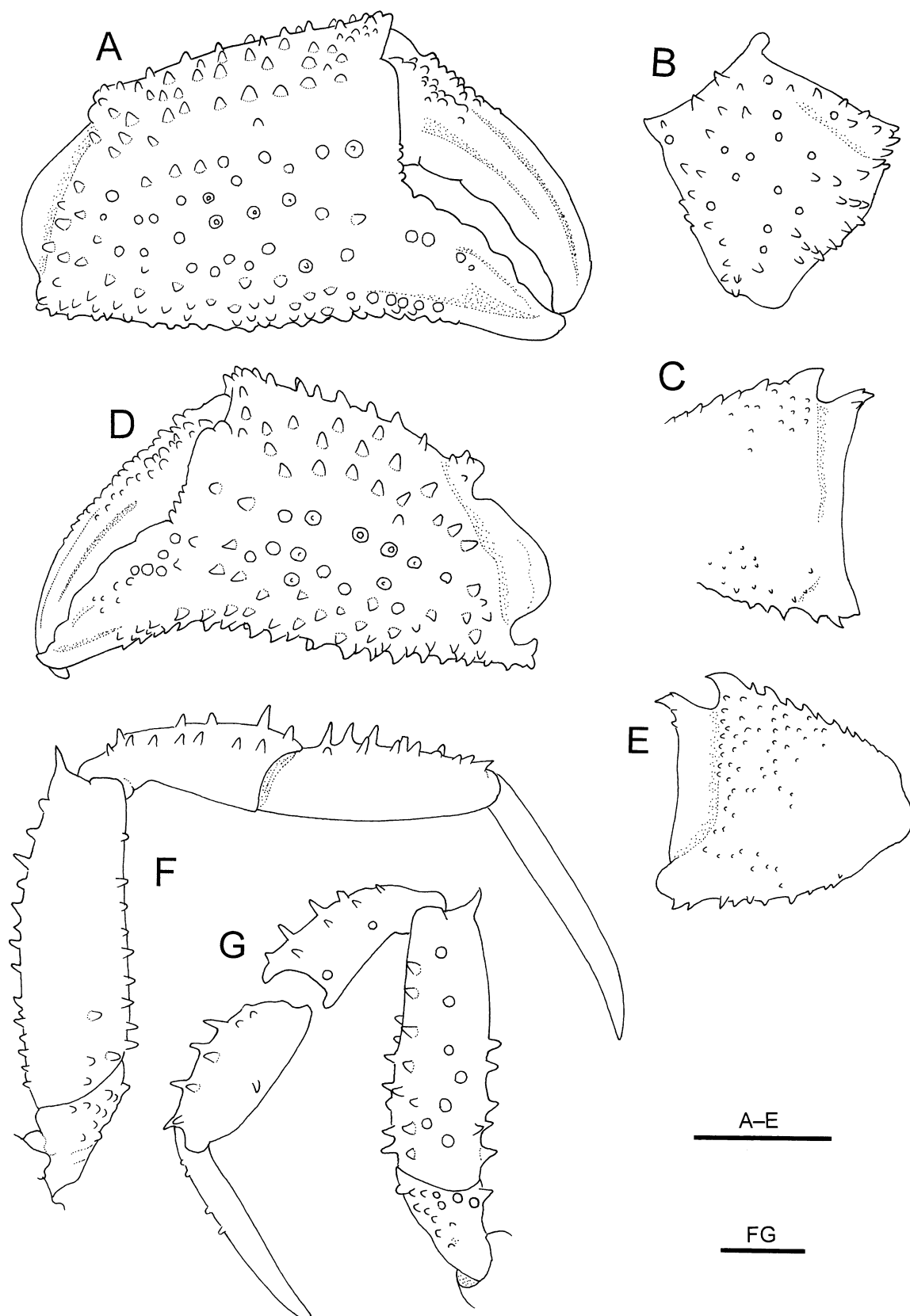


FIGURE 11. *Pilumnus armatus* n. sp., holotype, male (15.4 x 18.4 mm), NMRC 39035. A, right major chela, outer view; B, carpus of right major cheliped, dorsal view; C, merus of right major cheliped, outer view; D, left minor chela, outer view; E, merus of left minor cheliped, outer view; F, right third ambulatory leg (fourth pereopod), posterior view; G, left fourth ambulatory leg (fifth pereopod), posterior view (broken at articulation between carpus and propodus). Setae omitted. Scale bars: 5 mm for A–E; 2 mm for F, G.

Ambulatory legs (Figs 8A, 9A, 11F, G) moderately long, relatively slender for genus (merus of fourth leg about 3.0 times longer than wide); surfaces with covering of minute setae; dorsal (extensor), ventral (flexor) surfaces with sparse, moderately long to long, stiff setae, first leg (second pereopod) longest, about 1.6 times of carapace width. Coxa with low granules on ventral surface. Basis-ischium fused segment with minute tubercles on ventral surface in first to third legs, that of fourth leg (fifth pereopod) with small spinulose tubercles on outer (posterior) surface. Merus with single row of spines increasing in size distally on dorsal (extensor) margin; ventral (flexor) surface flanked by clearly delimited margin each bearing row of small spines or tubercles; outer (posterior) surface unarmed (first to third legs) or armed with many spines or spiniform tubercles arranged in 2 irregular rows (fourth leg). Carpus with single row of spines on extensor surface; outer (posterior) surface with median row of spines. Propodus with 2 or 3 rows of spines or spiniform tubercles on extensor surface; flexor margin unarmed. Dactylus moderately slender, slightly curved distally, terminating in small corneous claws, longer than respective propodus; dorsal margin with 3–6 small spiniform tubercles.

Thoracic sternum (Fig. 9B) covered with coarse granules (granules becoming more conspicuous in posterior sternites).

Male abdomen (Fig. 10F) moderately narrow, somites 1 and 3 widest. Somite 1 transversely trapezoidal, lateral margins tuberculate, outer surface with numerous small but conspicuous tubercles. Somite 2 subtrapezoidal, narrower than flanking somites, with paired minute tubercles laterally. Somites 3–6 unarmed, smooth; somite 3 broadly trapezoidal, narrowed distally, lateral margin gently convex, unarmed; somite 4 trapezoidal, lateral margins slightly concave; somites 5 and 6 subrectangular, with straight lateral margins. Telson (Fig. 10F) triangular with rounded tip, approximately as long as wide, lateral margins slightly convex.

First gonopod (Fig. 10G–J) sinuous; distal 0.2 strongly arcuate, hooked in lateral or mesial view, slightly directed laterally in ventral view, gradually tapering, bearing 2 rows of minute stiff setae not extending to apex. Second gonopod similar to that of *P. dofleini*.

Coloration in life. Not known.

Distribution. Known only from the Bohol Sea, the Philippines; bathymetric range unknown.

Remarks. *Pilumnus armatus* **n. sp.** is most similar to *P. dofleini*, particularly in the general armature of the carapace and abdomen, the shape of the ambulatory legs, armed extensor margin of the ambulatory dactyli, and noticeably arcuate distal part of the first gonopod. *Pilumnus armatus* **n. sp.** can be differentiated from *P. dofleini*, however, in the following characters: the cardiac region of the carapace is not elevated and bears only a few, very low tubercles in *P. armatus* **n. sp.**, whereas there are about 10 conspicuous spines or tubercles on the slightly elevated cardiac region in *P. dofleini* (Fig. 8B versus Fig. 1B); the outer surface of the palm of major cheliped bears spines or tubercles scattered in *P. armatus* **n. sp.**, rather than arranged in irregular rows in *P. dofleini* (Fig. 11A versus Fig. 4A); the outer (posterior) surface of the merus of the fourth ambulatory leg has several scattered spines in *P. armatus* **n. sp.**, but is unarmed in *P. dofleini* (Fig. 11G versus Fig. 4G); and the distal part of the first gonopod is more strongly arcuate in *P. armatus* **n. sp.** than in *P. dofleini* (Fig. 3H versus Fig. 10H).

As mentioned above, the record *P. dofleini* from Balicasag Island made by Takeda & Manuel (2000) is here referred to *P. armatus* **n. sp.**

Etymology. From the Latin, *armatus* (= armed), alluding to the armature on the body and thoracic appendages.

***Pilumnus curvipenis* n. sp.**

(Figs 12, 13, 18A, B)

Pilumnus dofleini. — Ng 2000: 301, figs 1, 2. Not *Pilumnus dofleini* Balss, 1933.

Material examined. Holotype: male (11.4 x 14.2 mm), NSMT-Cr 6665, Shin-Kurose Bank, Izu Islands, 230–160 m, 26 November 1974, dredge, coll. T. Okutani.

Paratypes: 2 males (8.0 x 9.5, 8.8 x 10.2 mm), 1 ovigerous female (13.4 x 16.4 mm), NSMT-Cr 22177, same data as holotype; 1 female (12.3 x 14.8 mm), NSMT-Cr 6666, Hyotan-se Bank, Izu Islands, 26 June 1973, coll. T. Okutani.

Diagnosis. Carapace (Fig. 12A–D, 18A) transversely ovoid, surface covered with dense short setae; greatest width across fourth anterolateral spines, about 1.2 times of length; regions poorly defined, grooves defining regions

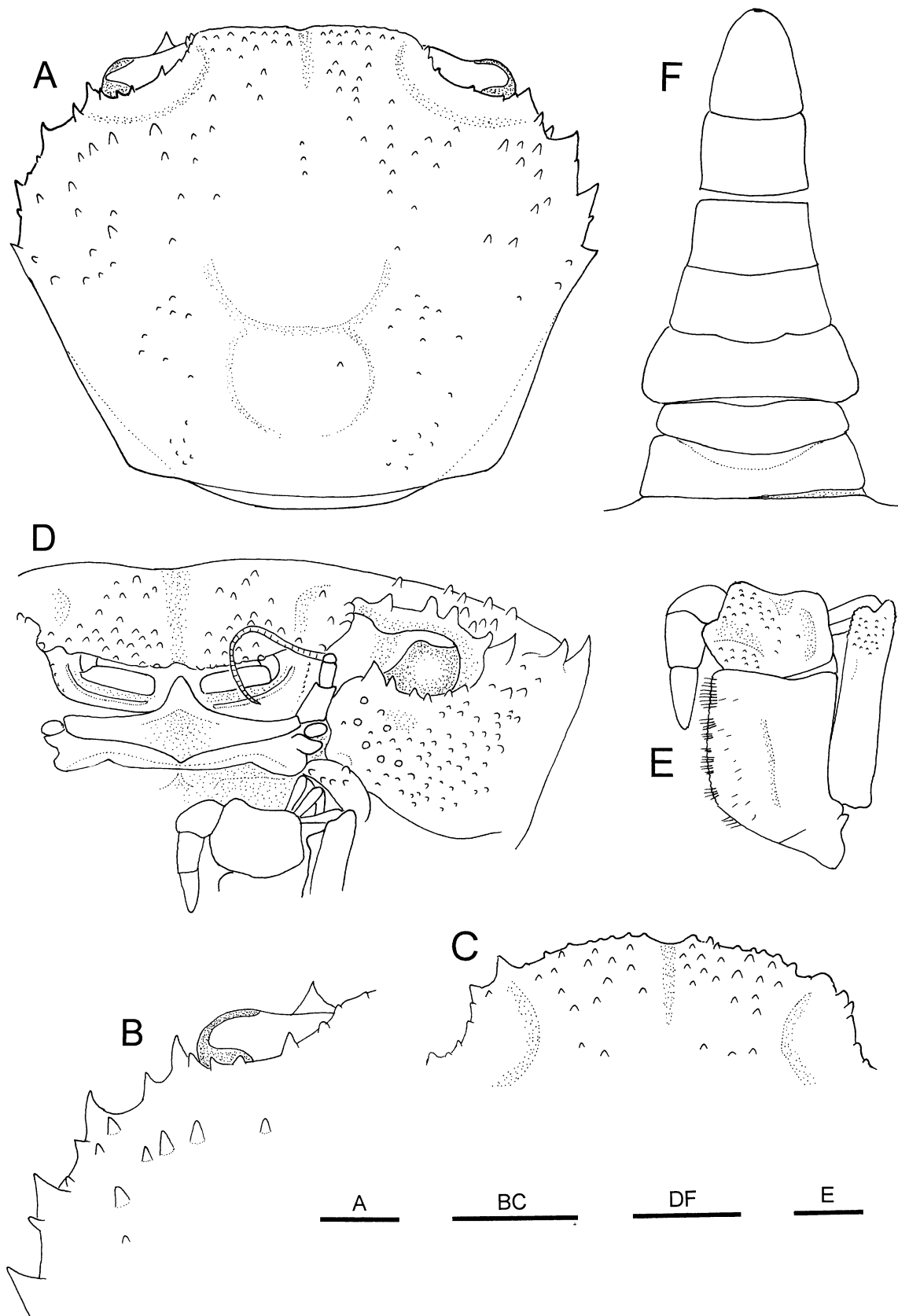


FIGURE 12. *Pilumnus curvipenis* n. sp., holotype, male (11.4 x 14.2 mm), NSMT-Cr 6665. A, carapace, dorsal view (setae omitted); B, left upper orbital and anterolateral margins, dorsal view (setae omitted); C, frontal margin, anterodorsal view (setae omitted); D, left anterior part of carapace and cephalic appendages, anterior view (setae omitted); E, left third maxilliped, ventral (outer) view (setae partially omitted); F, abdomen and telson, ventral view (setae omitted). Scale bars: 2 mm for A–D, F; 1 mm for E.

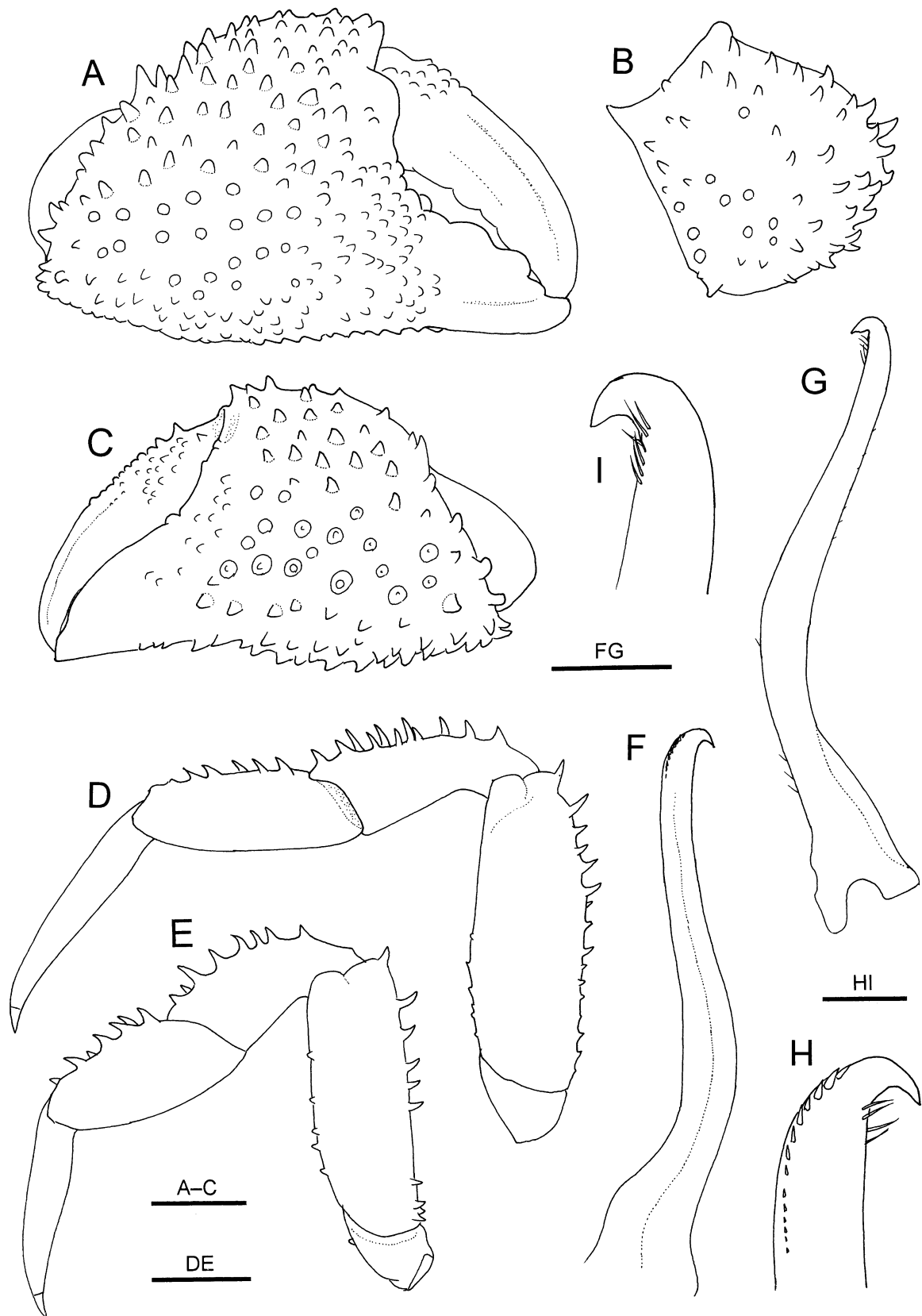


FIGURE 13. *Pilumnus curvipenis* n. sp., holotype, male (11.4 x 14.2 mm), NSMT-Cr 6665. A, right major chela, outer view; B, carpus of right major cheliped, dorsal view; C, left minor chela, outer view; D, left third ambulatory leg (fourth pereopod), posterior view; E, left fourth ambulatory leg (fifth pereopod), posterior view; F, left first gonopod, mesial view; G, same, lateral view; H, same, distal part, mesial view; I, same, lateral view. Setae omitted. Scale bars: 2 mm for A–E; 1 mm for F, G; 0.2 mm for H, I.

very shallow, indistinct; anterior part of dorsal surface with scattered small, conical spines or spinulose tubercles; cardiac region without conspicuous spines or tubercles; frontal margin nearly horizontal in dorsal view, weakly deflexed, separated medially by shallow, U-shaped notch; each frontal lobe not markedly divided, granular or tuberculate on margins, with or without small tubercle at inner supraorbital angle; supraorbital margin with row of small spines, without clefts; anterolateral margin spinose, with 4 principal spines (including spiniform external orbital angle), these anterolateral spines slightly unequal in size (first slightly smaller than others), obliquely erect; second, third each bearing 1 or 2 accessory spinules; posterolateral margin almost straight, converging towards posterior margin; posterior part without submarginal row of spines or tubercles; suborbital margin bordered with row of small spines or tubercles, innermost spine largest, visible in dorsal view; suborbital region with covering of numerous granules or small spinulose tubercles; pterygostomial groove smooth; dorsolateral portion of buccal frame with several granules.

Third maxilliped with ischium nearly smooth on outer surface; outer surface of merus and distal part of exopod coarsely granular.

Chelipeds (Fig. 13A–C) slightly unequal, slightly dissimilar with right larger than left; anterior margin of basis-ischium fused segment with row of small tubercles; merus with distal spine on crested posterodorsal margin; carpus with scattered small spines on dorsal to outer surfaces (these spines conical or subconical, sometimes curving), inner distal angle produced in prominent spine; palm with scattered numerous spines or spinulose tubercles on outer surface (most spines subacute), inner dorsal margins not carinate, ventral surface with small, blunt to subacute tubercles in right, acute or subacute spines in left; fingers slightly longer than palm, with row of low, broadly rounded teeth on cutting edges (major chela) or with faintly denticulate cutting edges (minor chela); dactylus with small, occasionally spinulose granules on dorsal surface proximally, with 1 (minor) or 2 (major) longitudinal grooves on outer surface.

Ambulatory legs (Fig. 13D, E) moderately long, moderately stout for genus (merus of fourth leg about 2.9 times longer than wide), bearing moderately long, stiff setae on margins of merus to dactylus; basis-ischium fused segment unarmed on ventral surface in first to third legs, that of fourth leg (fifth pereopod) with few small tubercles on ventral surface; merus with single row of conspicuous spines on dorsal (extensor) margin and single row of small tubercles or sharp granules on ventral (flexor) margins; outer (posterior) surface smooth; carpus with 2 rows of long spines on extensor margin and 1 or 2 additional spines on outer (posterior) surface dorsally (in fifth, outer surface unarmed); propodus with 2 rows of spines on extensor margin, flexor margin unarmed; dactylus slender, distinctly longer than propodus, unarmed on extensor margin.

Thoracic sternum nearly smooth (cf. Ng 2000: fig. 1g).

Male abdomen (Fig. 12F) with somites 1 and 2 unarmed on outer surfaces and margins. Telson (Fig. 12F) triangular with rounded tip, 1.2 times longer than wide, lateral margins nearly straight.

First gonopod (Fig. 13 F–I) sinuous; distal 0.1 strongly bent, bearing row of spinules subterminally on lateral side, these spinules increasing in size distally; apex sharply pointed.

Coloration. Not known.

Distribution. So far known only from Izu Islands at depths of 160–230 m.

Remarks. A full description of this new species was given by Ng (2000: 301) under the name *Pilumnus dofleini*. *Pilumnus curvipenis* n. sp. appears closest to *P. bohol* n. sp. Differentiating characters between *P. curvipenis* n. sp. and *P. bohol* n. sp. are discussed under the account of the latter species.

Etymology. From the Latin *curvis* (= curved), and *penis* in reference to the strongly curved distal part of the first gonopod.

***Pilumnus bohol* n. sp.**

(Figs 14–17, 18C, D)

Pilumnus dofleini. — Ng *et al.* 2008: fig. 112. Not *Pilumnus dofleini* Balss, 1933.

Material examined. Holotype: male (16.2 x 19.2 mm), AURORA Expedition, Bohol Sea, CA 2345, 09°28.7'N, 123°55.3'E to 9°28.3'N 123°54.1'E, 106–276 m, sandy/muddy bottom, 23 May 2005, NMCR 39036.

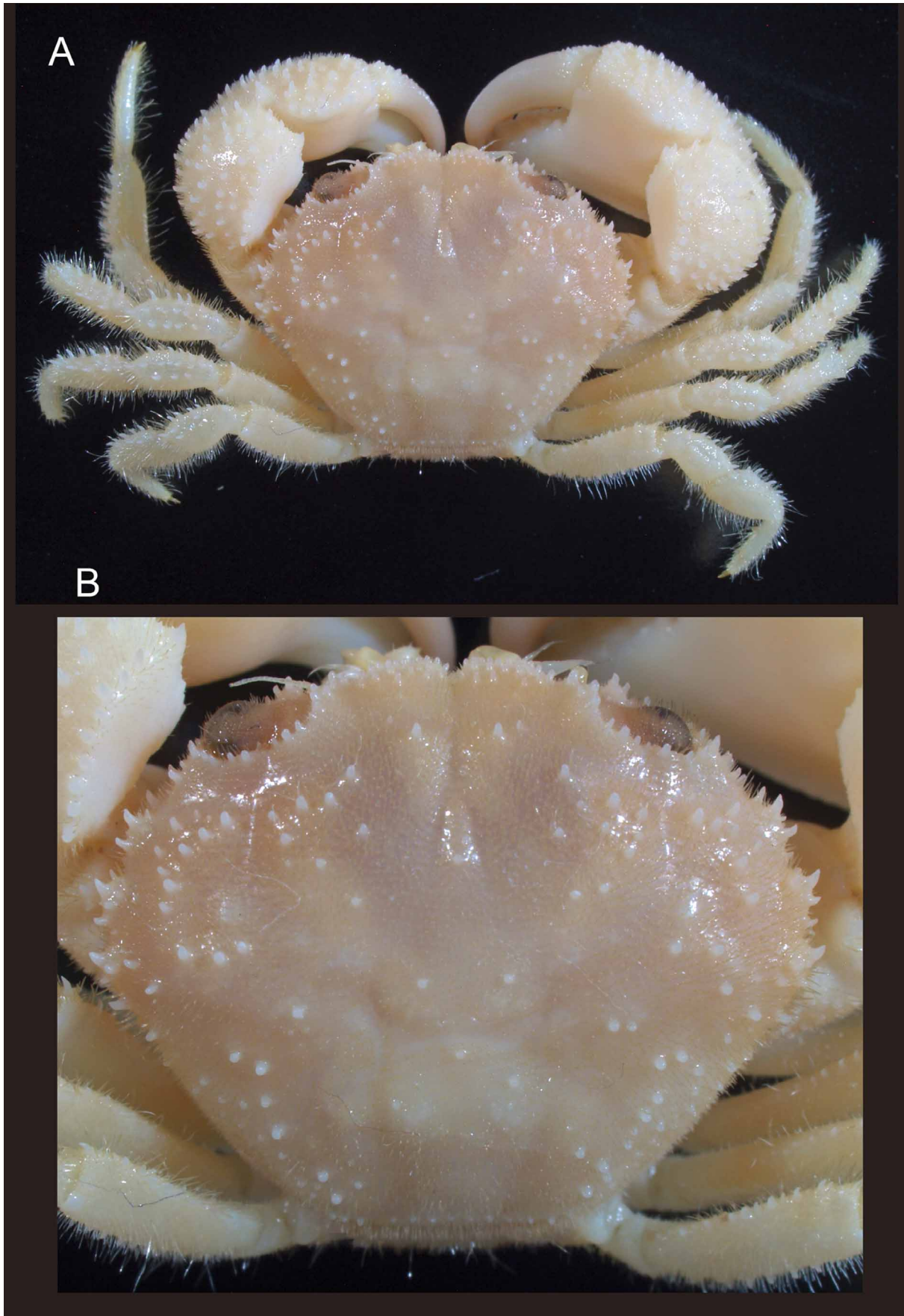


FIGURE 14. *Pilumnus bohol* n. sp., holotype, male (16.2 x 19.2 mm), NMRC 39036. A, entire animal, dorsal view; B, carapace, dorsal view.

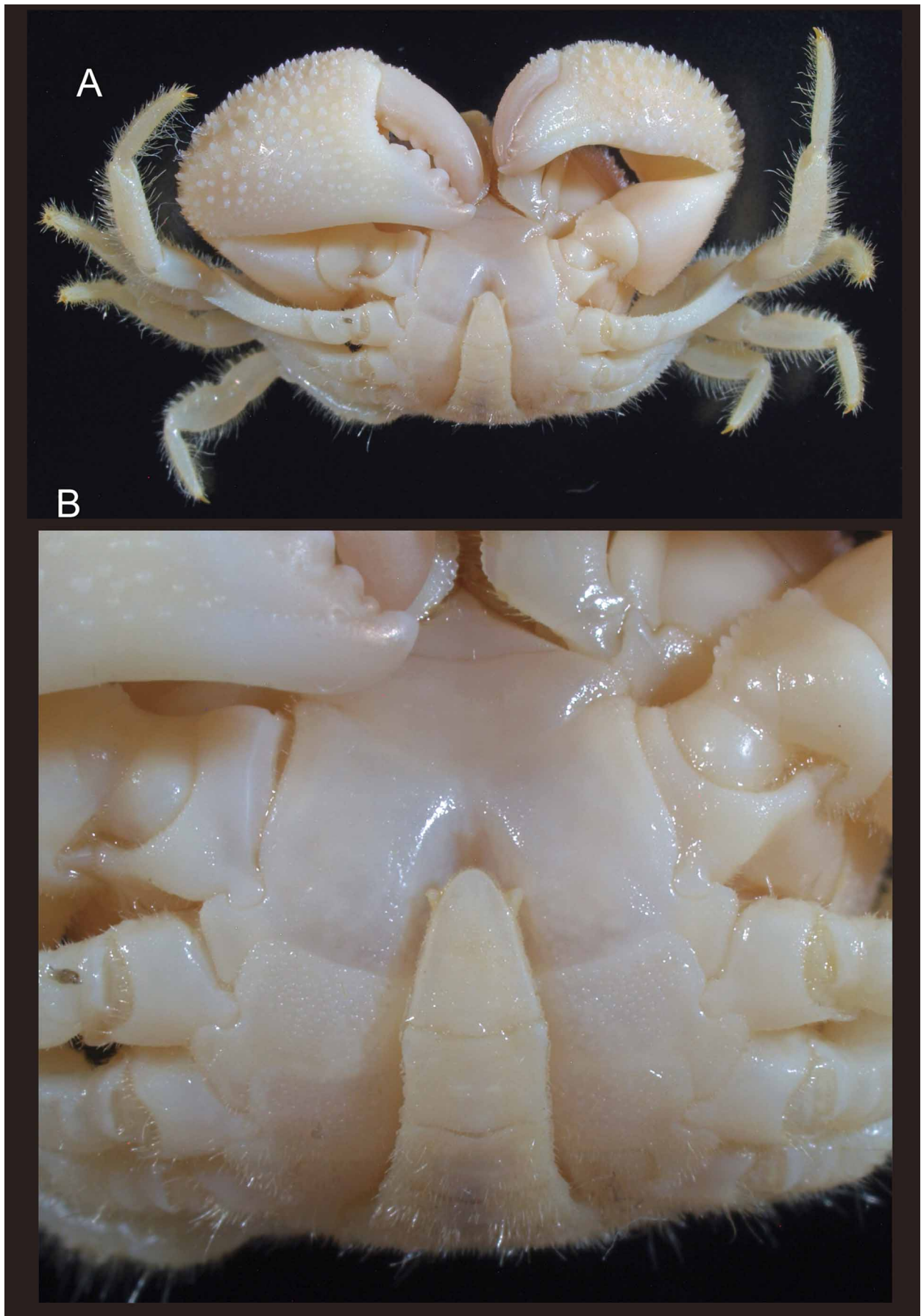


FIGURE 15. *Pilumnus bohol* n. sp., holotype, male (16.2 x 19.2 mm), NMRC 39036. A, entire animal, ventral view; B, thoracic sternum and abdomen, ventral view.

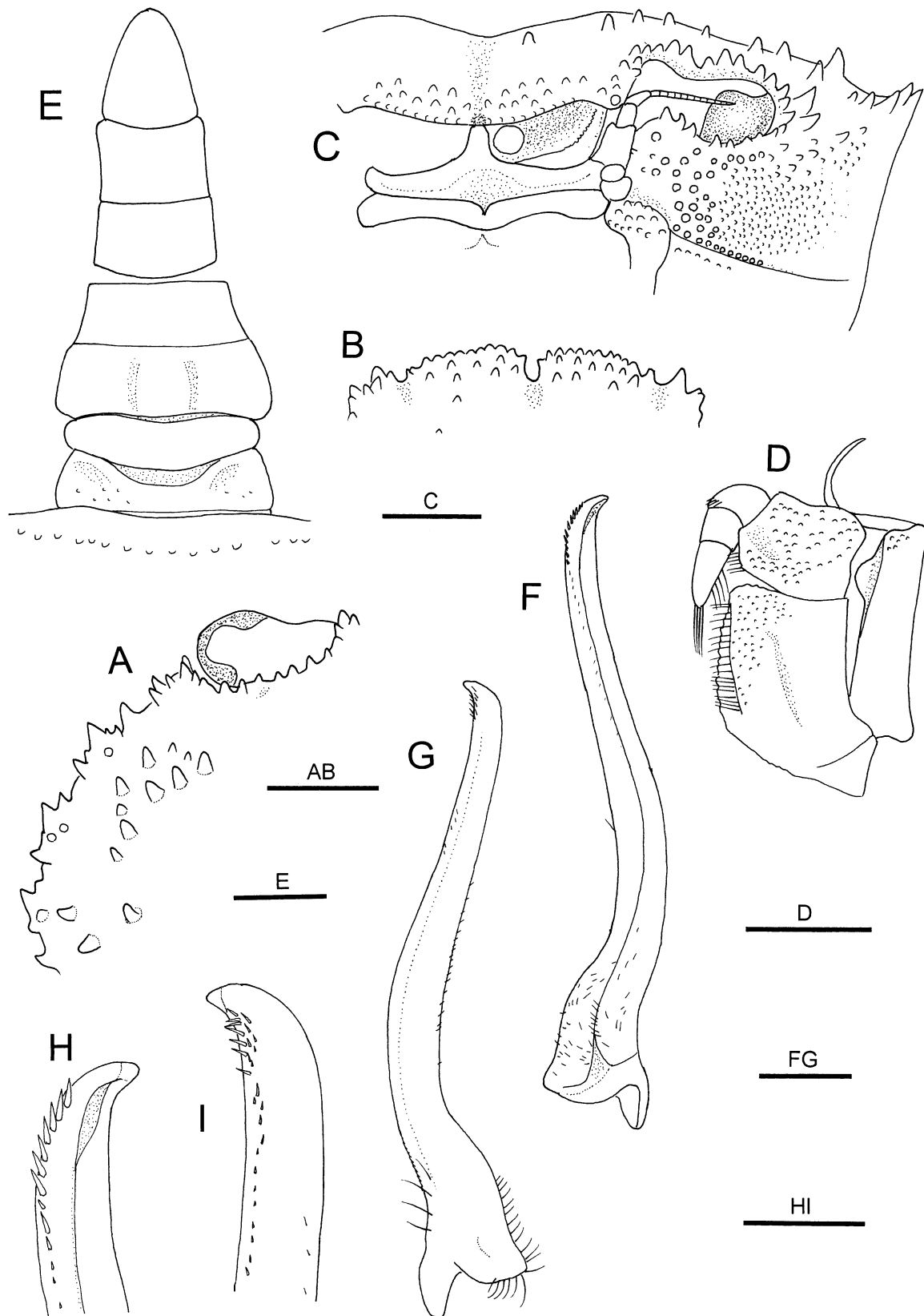


FIGURE 16. *Pilumnus bohohol* n. sp., holotype, male (16.2 x 19.2 mm), NMRC 39036. A, left upper orbital and anterolateral margins, dorsal view (setae omitted); B, frontal margin, anterodorsal view (setae omitted); C, left anterior part of carapace and cephalic appendages, anterior view (setae omitted); D, left third maxilliped, ventral (outer) view (setae partially omitted); E, abdomen and telson, ventral view (setae omitted); F, left first gonopod, mesial view; G, same, lateral view; H, same, distal part, mesial view; I, same, lateral view. Scale bars: 2 mm for A–E; 1 mm for F, G; 0.5 mm for H, I.

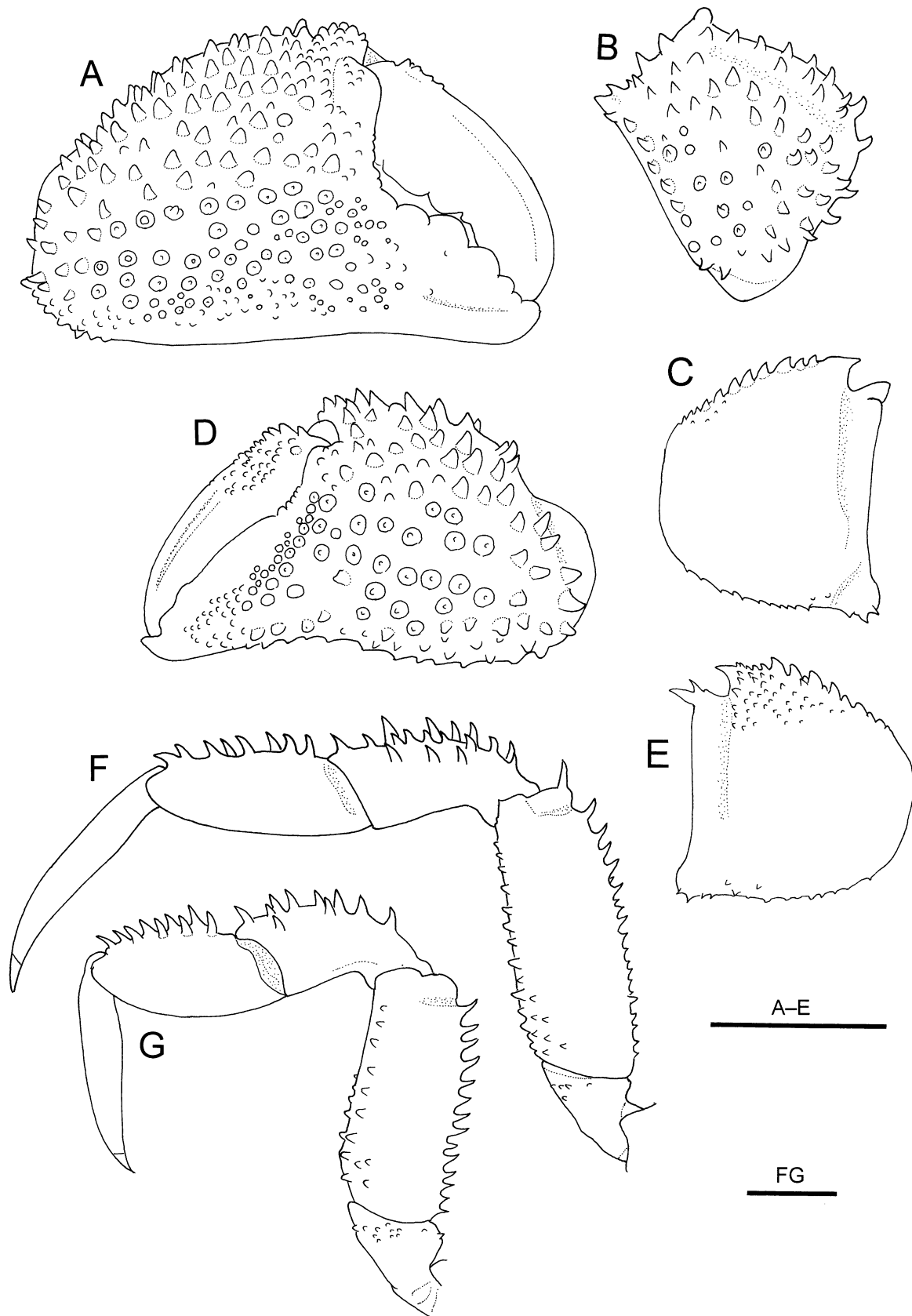


FIGURE 17. *Pilumnus bohol* n. sp., holotype, male (16.2 x 19.2 mm), NMRC 39036. A, right major chela, outer view; B, carpus of right major cheliped, dorsal view; C, merus of right major cheliped, outer view; D, left minor chela, outer view; E, merus of left minor cheliped, outer view; F, left third ambulatory leg (fourth pereopod), posterior view; G, left fourth ambulatory leg (fifth pereopod), posterior view. Setae omitted. Scale bars: 5 mm for A–E; 2 mm for F, G.

Paratypes: 1 ovigerous female (10.2 x 12.6 mm), Balicasag, Panglao, Philippines, 50–500 m, 28 November 2001, tangle net, ZRC 2001.0688; 1 female (9.0 x 10.5 mm), same locality, November 2005, ZRC 2012.0132; 1 male (10.7 x 12.7 mm), 1 ovigerous female (10.4 x 11.9 mm), PANGLAO 2004, stn T2, Bolod, Panglao I., 09°32.4'N 123°47.8'E, 152 m, coarse sand, 31 May 2004, ZRC 2012.0133; 1 female (10.5 x 12.2 mm), same data, ZRC 2012.0134.

Non-types: 1 female (5.5 x 6.6 mm), 1 juvenile (4.3 x 5.1 mm), PANGLAO 2004, stn T2, Bolod, Panglao I., 09°32.4'N 123°47.8'E, 152 m, coarse sand, 31 May 2004, ZRC 2012.0135; 4 juveniles (4.0 x 4.6 to 5.4 x 6.5 mm), PANGLAO 2004, stn T36, Cervera shoal, west of Pamilacan I., 09°29.3'N 123°51.5'E, 95–128 m, sand on echinoderms bed, 4 July 2004, ZRC 2012.0136.

Description. Carapace (Figs 14A, B, 16A–C, 18C) fairly vaulted, subovoid in dorsal view, surface covered with numerous short setae; greatest width across fourth anterolateral spines, 1.2 times of length; dorsal surface somewhat convex longitudinally and transversely, regions slightly defined, surface of regions with some tiny tubercles; cardiac region not elevated, only with few tubercles partially obscured by setae; grooves between regions also with short setae. Frontal margin slightly produced, separated medially by shallow V-shaped notch; each frontal lobe divided in two parts by small hiatus, mesial lobe 9–12 granules, lateral lobes each consisting of tiny conical tubercle; inner supraorbital angle with minute tubercle; supraorbital margin bordered with row of small tubercles, with or without trace of 2 clefts. Anterolateral margin with 4 principal spines (including spinose external orbital angle) interspersed by spinules or tubercles; these anterolateral spines relatively small, subequal in size, obliquely erect, first and fourth spines simple, second and third spines bearing 1–4 accessory spinules. Posterolateral margin almost straight, converging towards posterior margin. Posterior part with or without submarginal row of tubercles, if present, tubercles tiny, low, partially obscured by setae; posterior margin nearly straight. Suborbital margin sinuous with mesial angle prominent, spinose, with row of tiny spines or tubercles. Suborbital region with covering of coarse granules; pterygostomial groove lined with microscopic granular row along dorsal side. Dorsolateral portion of buccal frame with some granules.

Orbits (Fig. 16A, C) moderately large, slightly obliquely transversal in dorsal view, transverse in anterior view; eyes filling entire orbits. Basal segment of antennular peduncle with granular, obliquely transversal ridge on outer surface, bordering fossa. Antennal peduncle just entering orbital hiatus; second segment with few minute granules on outer surface.

Epistome divided into 4 crested lobes. Endostomal ridges indistinct.

Third maxilliped (Fig. 16D) similar to that of *P. dofleini*. Ischium with mesial margin irregularly denticulate; outer surface microscopically granular. Merus coarsely granular on outer surface. Carpus without distinct granules. Propodus, dactylus surfaces smooth. Exopod with inner subdistal tooth distinct; outer surface nearly smooth.

Chelipeds (Figs 14A, 15A, 17A–E) slightly unequal, slightly dissimilar with right stouter than left. Anterodorsal margin of basis-ischium fused segment with row of granules. Merus nearly as long as high; upper surface concave to fit lateral surface of carapace; posterodorsal margin crested, with 2 prominent spines distally plus row of much smaller spines; outer distal margin unarmed, lower distal angle with few minute spinules; outer (posterior) surface with covering of short setae; anterior (inner) surface nearly flat, unarmed; lower margin bluntly carinate, with minute sharp granules. Carpus with scattered, numerous, tiny spines on dorsal to outer surface, inner distal angle with small spine. Palm with scattered numerous tiny spines and covering of short setae on outer surface, inner dorsal margin not carinate with row of tiny spines; ventral surface rounded, nearly smooth (major chela) or bluntly carinate, tuberculate (minor chela); inner surface nearly smooth. Fingers meeting at tip (major chela) or crossing at tips (minor chela). Fixed finger of major cheliped faintly deflexed or straight at base, with row of prominent, rounded teeth on cutting edge; outer surface slightly convex, with very low granules. Fixed finger of minor chela slightly deflexed, with sharply edged, faintly dentate cutting edge. Dactylus of major chela weakly curved, with several granules proximally on dorsal surface; outer surfaces with trace of median sulcus, otherwise smooth; cutting edge with row of low, rounded teeth. Dactylus of minor cheliped distinctly slenderer than that of major cheliped, with patch of granules on proximal 0.3 of dorsal to outer surfaces; outer surface with shallow median sulcus; cutting edge nearly smooth.

Ambulatory legs (Figs 14A, 15A, 17F, G) moderately long, moderately stout (merus of fourth leg about 2.4 times longer than wide); surfaces with covering of very short setae, dorsal (extensor) and ventral (flexor) margins with sparse, moderately short to long, stiff setae; first leg (second pereopod) longest, about 1.5 times of carapace width. Coxa unarmed on ventral surface. Basis-ischium fused segment with coarse granules on ventral surface.

Merus with single row of spines increasing in size distally on dorsal (extensor) margin; ventral (flexor) surface flanked by clearly delimited margins each bearing row of tiny spiniform granules or tubercles; outer (posterior) surface unarmed or armed with few minute granules. Carpus with single row of spines on extensor margin; outer (posterior) surface each with 2 rows of spines in dorsal half. Propodus with 2 or 3 rows of small spines on extensor surface; flexor margin unarmed (first to third legs). Dactylus moderately slender, slightly curved distally, terminating in small corneous claw, distinctly longer than propodus; surfaces densely setose; extensor margin unarmed.

Thoracic sternites 1–4 (Fig. 15B) smooth, with very sparse short setae. Sternites 5–8 covered with microscopic granules plus numerous short setae. Female vulvae (Fig. 18D) narrower than those of *P. curvipenis* **n. sp.**, crescent-shaped.

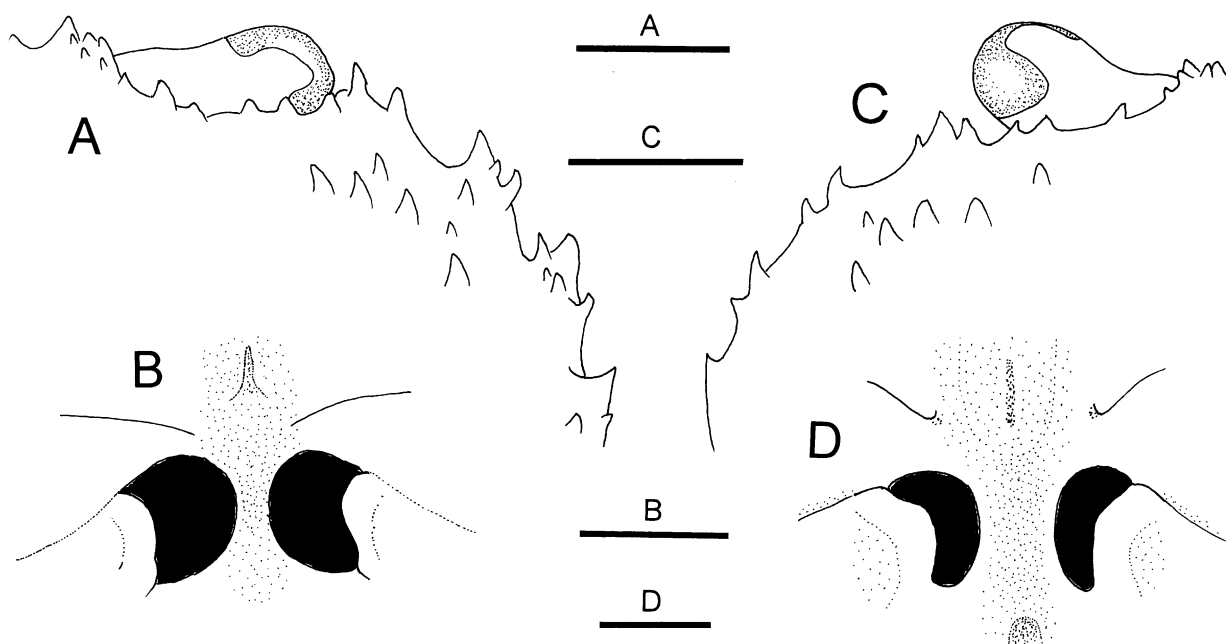


FIGURE 18. A, B, *Pilumnus curvipenis* **n. sp.**, paratype, ovigerous female (13.4 x 16.4 mm), NSMT-Cr 6666; C, D, *Pilumnus bohohol* **n. sp.**, paratype, ovigerous female (10.2 x 12.6 mm), ZRC 2001.0688. A, C, upper orbital and anterolateral margin, dorsal view; B, D, vulvae, ventral view. Scale bars: 2 mm for A, C; 1 mm for B; 0.5 mm for D.

Male abdomen (Fig. 16E) moderately narrow, surface covered with numerous short setae. Somites 1 and 3 widest. Somite 1 transversely trapezoidal, margins and surface unarmed. Somite 2 subtrapezoidal, narrower than flanking somites, without paired minute tubercles laterally. Somites 3–6 unarmed; somite 3 broadly trapezoidal, narrowed distally, lateral margin gently convex, unarmed; somite 4 trapezoidal, lateral margins slightly concave; somites 5 and 6 subrectangular, with straight lateral margins. Telson (Fig. 16E) triangular with rounded tip, 1.2 times longer than wide, lateral margins nearly straight.

Female abdomen also lacking tubercles on first and second somites.

First gonopod (Fig. 16F–I) slightly sinuous; distal 0.2 slightly arcuate in lateral or mesial view, slightly curved laterally in ventral view, gradually tapering, bearing rows of minute spiniform setae not extending to apex. Second gonopod similar to that of *P. dofleini*.

Coloration in life. Carapace generally reddish brown, mottled with white (pattern of markings fairly variable), sometimes having red spots. Chelipeds generally reddish brown on dorsal and outer surfaces, with some dark red spots. Ambulatory legs obscurely banded with reddish brown, distal part of meri to propodi with tinge of reddish brown. Eggs dark red. See Ng *et al.* (2008: fig. 112).

Distribution. So far known only from Panglao, the Philippines; 95–276 m.

Remarks. *Pilumnus bohohol* **n. sp.** is similar to *P. curvipenis* **n. sp.** Shared diagnostic characters include: the armature on the carapace is relatively weaker compared with *P. acanthosoma*, *P. dofleini* and *P. armatus* **n. sp.**, in particular, the posterior part of the carapace is provided with a row of low, indistinct tubercles or unarmed; there are no clefts on the upper orbital margin; the palms of chelipeds are armed with scattered small spines or tubercles on

the outer surfaces; the thoracic sternum is smooth or microscopically granular; the first abdominal somite is devoid of tubercles; and the distal part of the first gonopod bears a row of stout spinules. However, *P. bohol* n. sp. is distinguished from *P. curvipennis* n. sp. by the shape of the first gonopod. In *P. bohol* n. sp., the distal part of the first gonopod is only slightly curved, rather than strongly curved and hooked in *P. curvipennis* n. sp. (Fig. 16F–I versus Fig. 13F–I). In addition, the anterolateral spines of the carapace are relatively weaker in *P. bohol* n. sp. than in *P. curvipennis* n. sp. (Fig. 18C versus Fig. 18A); the fourth ambulatory leg is proportionally stouter in *P. bohol* n. sp. than in *P. curvipennis* n. sp. (the merus is about 2.4 times as long as wide in *P. bohol* n. sp. in contrast to about 2.9 times as long in *P. curvipennis* n. sp.) (Fig. 17G versus Fig. 13E); and the female vulvae are relatively narrower in *P. bohol* n. sp. than in *P. curvipennis* n. sp. (cf. Fig. 18D versus Fig. 18B).

Ng *et al.* (2008: fig. 112) showed a photograph of a female specimen that they identified as *P. dofleini*, but this specimen most probably represents *P. bohol*, as mentioned before.

Etymology. Named after the Bohol Sea, the Philippines, where the specimens of the new species were collected. Used as a noun in apposition.

Acknowledgments

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