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Three new species of the pagurid hermit crab genus *Catapagurus* A. Milne-Edwards, 1880 (Decapoda: Anomura: Paguroidea) from the Bohol Sea, the Philippines

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Abstract. Three new species of the pagurid hermit crab genus *Catapagurus* A. Milne-Edwards, 1880 are described and illustrated on the basis of material from the Bohol Sea, Philippines, collected by the PANGLAO 2004 Marine Biodiversity Project. *Catapagurus exilidigitus*, new species, appears closest to *C. tanimbarensis* McLaughlin, 1997 within the *C. misakiensis* Terao, 1914 species group, but it is readily distinguished from the latter by the wide U-shaped median cleft of the telson. *Catapagurus fimbriatus*, new species, is notable in having a characteristic fringe of setae on the mesial surfaces of the ambulatory dactyli and propodi of the pereopods 3. *Catapagurus latus*, new species, appears closest to *C. haigae* (Asakura, 2001) in the general shape and armature of the ambulatory dactyli within the *C. ensifer* Henderson, 1888 species group, but might be unique within the group in having a setal cluster on the distoventral portion of each ambulatory propodus. The number of species of *Catapagurus* known from the Philippines increases to seven.

Key words. Paguridae, *exilidigitus*, *fimbriatus*, *latus*, PANGLAO 2004 Marine Biodiversity Project

INTRODUCTION

The pagurid hermit crab genus *Catapagurus* A. Milne-Edwards, 1880, is currently represented by 22 species worldwide (McLaughlin et al., 2010; Nucci & Melo, 2012; WoRMS Editorial Board, 2020), of which 19 species are known from the Indo-West Pacific region, and three species from the western Atlantic. In his extensive revision of *Catapagurus*, Asakura (2001) resurrected *Hemipagurus* Smith, 1881, a genus long considered to be a junior subjective synonym of *Catapagurus*, but his action was rejected by McLaughlin (2004), who showed that the characters employed by Asakura (2001) to differentiate *Hemipagurus* from *Catapagurus* reflected only intrageneric and ontogenetic variability. The synonymy of *Hemipagurus* has since been followed by subsequent taxonomists studying *Catapagurus* (Komai & Takeda, 2006; Komai & Osawa, 2009; McLaughlin et al., 2010; Nucci & Melo, 2012). McLaughlin et al. (2010) noted that *Hemipagurus maclaughlinae* Asakura, 2001 was conspecific with *Catapagurus alcocki* McLaughlin in Hogarth, Gherardi & McLaughlin, 1998, and that suggested synonymy is followed in this article. In addition, the authors listed five undescribed species in the genus, but the publication of these new species was postponed due to the death of Dr. P. A. McLaughlin in 2011 (Lemaitre, 2012). *Catapagurus* is characterised by the gill formula consisting of 11 pairs of biserial gills, the somewhat reduced crista dentata on the maxilliped 3 ischium, the presence of a prominent preungual process on the pereopods 4 dactyli, and the possession of a medium to long sexual tube arising from the right pereopod 5 coxa, curving toward exterior over the lateral side of the body in males (McLaughlin, 2003, 2004). From the Philippines, four species of the genus have been recorded, viz., *C. albatrossae* (Asakura, 2001), *C. alcocki*, *C. haigae* (Asakura, 2001), and *C. holthuisi* McLaughlin, 1997 (Asakura, 2001).

In this article, three new species of *Catapagurus* are described on the basis of material from the Bohol Sea, in the central Philippines, collected by the PANGLAO 2004 Marine Biodiversity Project (Bouchet et al., 2009). Studies on the hermit crab collections made by this expedition have resulted in significant findings of new taxa and new records (McLaughlin & Rahayu, 2007; McLaughlin, 2008; McLaughlin & Lemaitre, 2009; Rahayu & Forest, 2009; Asakura, 2010; Malay et al., 2012, 2017; Komai, 2013; Komai & Rahayu, 2013a–d, 2014; Rahayu & Komai, 2013a, b). *Catapagurus* is divided for practical reasons into two informal species groups based on the shape of the ambulatory dactyli (Asakura, 2001), viz., the *C. ensifer* Henderson, 1888 group characterised by the blade-shaped dactyli and the *C. misakiensis* (Terao, 1914) group [as *C. japonicus* Yokoya, 1933 group in Asakura (2001)] characterised by slender, non-

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blade shaped dactyli. *Catapagurus exilidigitus*, new species, is herein assigned to the *C. misakiensis* species group, and appears close to *C. tanimbarensis* McLaughlin, 1997, while *C. latus*, new species, is assigned to the *C. ensifer* species group. *Catapagurus fimbriatus*, new species, cannot be satisfactorily assigned to either group, because the structure of the ambulatory dactyli seems intermediate between the two species groups. It is not possible to determine if any of the three new taxa described herein correspond to any of the five undescribed species listed by McLaughlin et al. (2010).

The specimens examined are deposited in the following institutions: National Museum of the Philippines, Manila (NMCR); Zoological Reference Collection (ZRC), the Lee Kong Chian Natural History Museum, National University of Singapore; and Natural History Museum and Institute, Chiba (CBM), Japan. General terminology follows McLaughlin (2003) and McLaughlin et al. (2007), except for the use of "article" for "segment", "occlusal margin" for "cutting edge", and the numbering of thoracomeres, appendages, and articles of appendages. The shield length (sl) is measured from the tip of the rostrum to the midpoint of the posterior margin of the shield.

TAXONOMIC ACCOUNT

Family Paguridae Latreille, 1802

Catapagurus A. Milne-Edwards, 1880

Catapagurus exilidigitus, new species
(Figs. 1–4)

Material examined. Holotype: male (sl 1.7 mm), NMCR 50801, PANGLAO 2004, stn T39, Bohol Sea, west of Pamilacan Island, Cervera shoal, 9°30.1′N, 123°50.4′E, 100–138 m, muddy sand, trawl, 6 July 2004.

Paratypes: 2 males (sl 1.5, 1.8 mm), ZRC 2021.0413, same data as holotype.

Description. Shield (Fig. 1A) approximately as long as broad; anterior margin between rostral lobe and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface with longitudinal rows of tufts of short setae posterior to lateral projections; carapace lateral lobes very narrow, well calcified. Rostral lobe rounded, produced as far as lateral projections. Lateral projections broadly triangular, each with terminal, submarginal spinule. Posterior carapace 0.6 length of shield; posterolateral plates moderately wide anteriorly, drawn out into relatively thin bands reaching to posterior margins, posterior median plate short, only weakly calcified.

Ocular peduncles (Fig. 1A) moderately short (0.8 times as long as shield), stout, widened distally; corneal width 0.6 of peduncular length. Ocular acicles narrow, spike-like, slender, reaching 0.4 length of ocular peduncles, terminating acutely; widely separated basally.

Antennular peduncle (Fig. 1A, B) overreaching distal corneal margin by full length of ultimate article. Ultimate article 0.9 times as long as shield, 5.3 times as long as distal height, with tuft of 7 long setae at dorsodistal lateral margin and with row of some short setae on dorsal surface. Penultimate article almost glabrous. Basal article with slightly produced, acute ventrodistal margin; statocyst lobe weakly inflated in proximal half of article.

Antennal peduncle (Fig. 1A) overreaching distal corneal margin by 0.2–0.3 length of article 5. Articles 5 and 4 with few setae. Article 3 with few setae on unarmed ventromesial distal angle. Article 2 with produced, spiniform dorsolateral distal angle reaching midlength of article 4; dorsomesial distal angle with small spine. Article 1 with small spine at dorsolateral distal angle. Antennal acicle reaching midlength of article 5 and overreaching corneal base, terminating in spine. Flagella broken off and not preserved.

Maxilliped 3 endopod moderately stout; merus with small dorsodistal spine; ischium with crista dentata consisting of 6 small teeth; accessory tooth small, subdistal in position (Fig. 1C).

Right cheliped (Fig. 2A–D) long, moderately stout. Chela (Fig. 2A) elongate subovate, 2.6 times as long as wide. Dactylus 0.7 length of palm; weakly convex dorsal surface almost smooth and with tufts of setae dorsomesially; dorsomesial margin not delimited, rounded; mesial face with scattered granules; ventral surface with some tufts of long setae; occlusal margin with 2 obtuse calcareous teeth, slightly overlapped by fixed finger. Palm subequal in length to carpus, 1.6 times as long as wide; dorsomesial and dorsolateral margins not delimited, convex dorsal surface almost smooth except for granulate dorsolateral part; lateral and mesial faces granulate; ventral surface gently convex, with scattered tufts of moderately long setae; fixed finger with 2 rows of short setae on dorsal surface, occlusal margin with low, broad calcareous tooth proximal to midlength, unarmed in distal half. Carpus (Fig. 2D) subequal in length to merus, widened distally, 2.2 times as long as distal width; dorsomesial and dorsolateral margins each delimited with row of tiny spines, strongest distally, and with few bristle-like setae proximally, dorsal surface almost smooth with few granules; lateral surface with scattered granules; mesial face almost smooth except for some granules adjacent to dorsal margin, ventromesial distal angle with tiny spine; ventral surface gently convex, smooth. Merus subtriangular in cross section; dorsodistal margin without spine, but with few bristle-like setae; dorsal surface with widely spaced stiff setae; lateral surface with sparse granules, gently convex ventrolateral margin without conspicuous spines; mesial surface almost glabrous except for few short stiff setae, weakly convex ventromesial margin with small distal spine; ventral surface with sparse granules. Ischium unarmed. Coxa unarmed on ventromesial angle.

Left cheliped (Fig. 3A–D) slender, shorter than right cheliped; dactyl and fixed finger slightly curved ventrally. Chela (Fig. 3A) 5.0 times as long as wide. Dactylus 1.5 times as long as

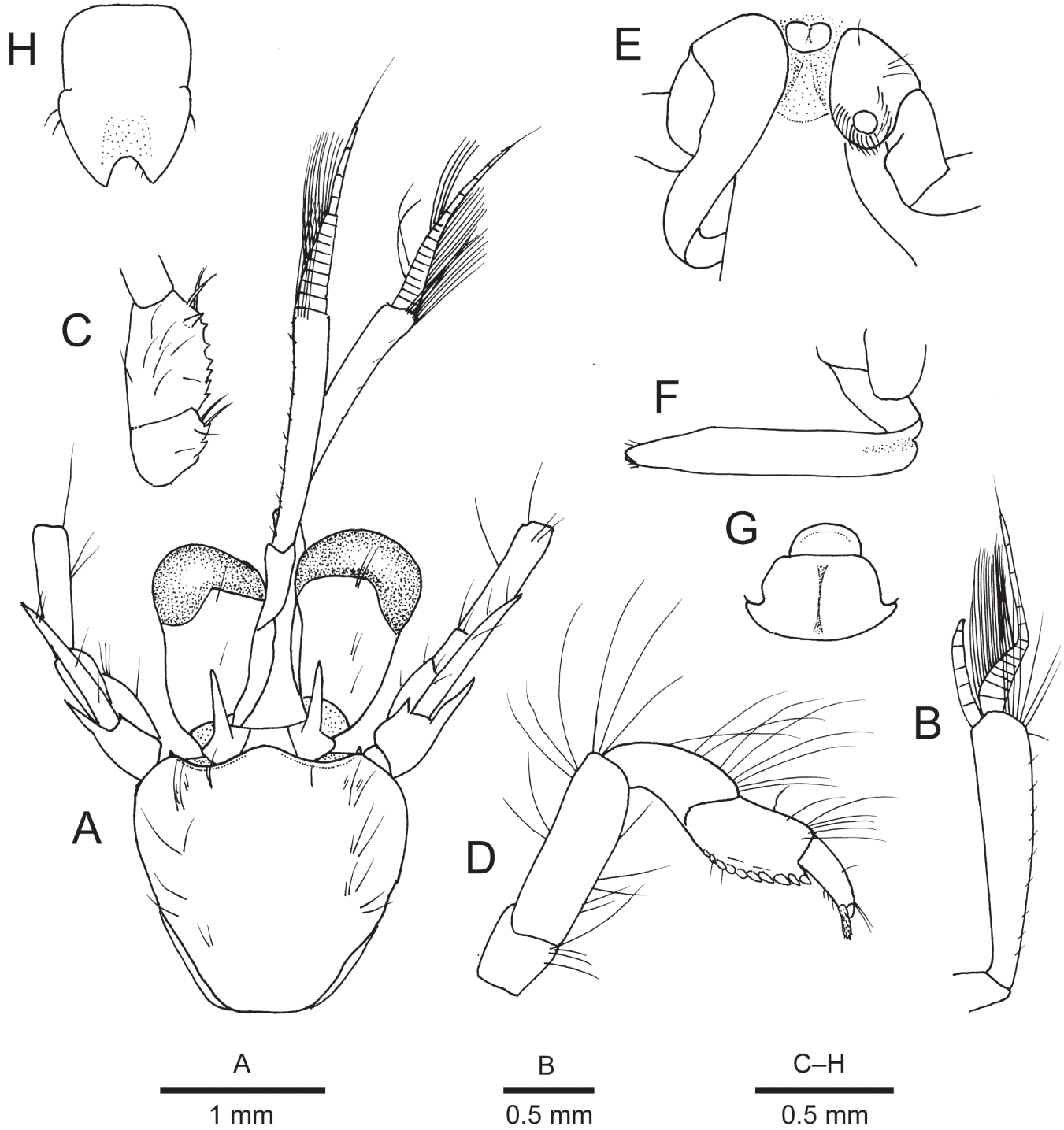

Fig. 1. *Catapagurus exilidigitus*, new species, holotype, male (sl 1.7 mm), NMCR 50801. A, shield, carapace lateral lobes and cephalic appendages, dorsal view; B, left antennule, ultimate article of peduncle and flagella, lateral view; C, left maxilliped 3, ischium and basis, ventral view; D, right pereopod 4, lateral view; E, coxae of pereopods 5 and thoracic sternite 8, ventral view; F, distal part of right sexual tube, dorsal view; G, thoracic sternite 6, ventral view; H, telson, dorsal view.

palm, terminating in small, curved corneous claw; surfaces almost smooth, with sparse setae; dorsomesial margin not delimited; occlusal margin with row of minute corneous teeth almost over entire length. Palm 0.5 length of carpus, 2.0 times as long as wide; dorsomesial and dorsolateral margins not delimited, transversely convex dorsal surface with sparse granules; ventral surface slightly convex, smooth; fixed finger smooth on surfaces, terminating in small, curved corneous claw, with sparse short setae; occlusal margin with row of minute corneous teeth. Carpus (Fig. 3D) slightly longer than merus; dorsomesial and dorsolateral margins each with row of tiny spines, strongest distally, dorsal surface almost smooth; lateral surface with sparse granules; mesial surface nearly smooth except for granulate ventral part, granules extending onto slightly convex ventral surface. Merus dorsodistal margin unarmed; dorsal surface with several setae; lateral surface with sparse granules, particularly on ventral part, gently convex ventral margin unarmed; mesial surface almost smooth, with row of stiff setae adjacent to ventromesial margin, gently convex ventromesial margin with

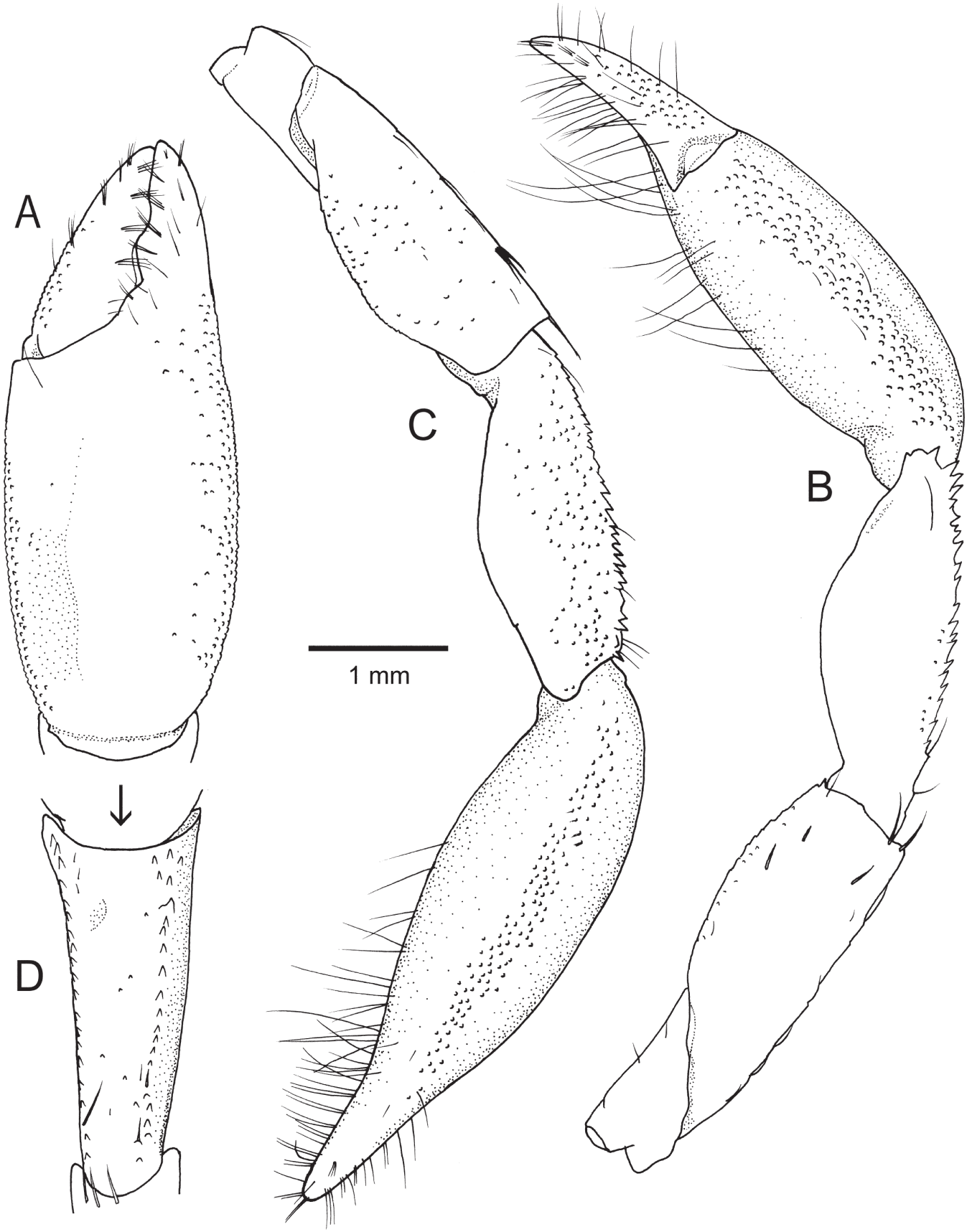

Fig. 2. *Catapagurus exilidigitus*, new species, holotype, male (sl 1.7 mm), NMCR 50801. A, chela of right cheliped, dorsal view; B, right cheliped, mesial view; C, same, lateral view; D, carpus of right cheliped, dorsal view.

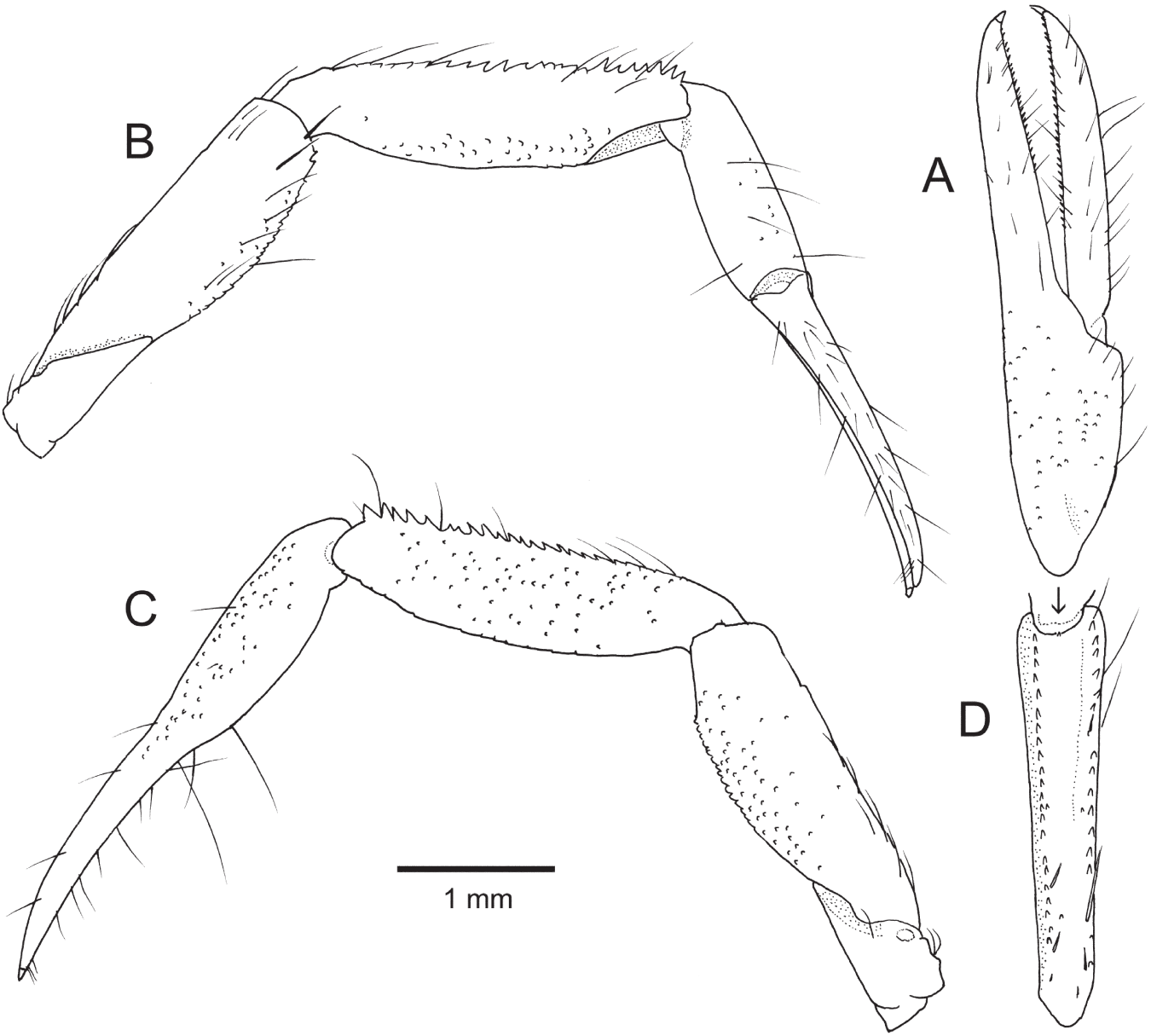

Fig. 3. *Catapagurus exilidigitus*, new species, holotype, male (sl 1.7 mm), NMCR 50801. A, chela of left cheliped, dorsal view; B, left cheliped, mesial view; C, same, lateral view; D, carpus of left cheliped, dorsal view.

3 tiny spines on distal margin; ventral surface granulates. Ischium unarmed. Coxa unarmed on ventromesial angle.

Pereopods 2 (Fig. 4A, B) slender, overreaching tips of outstretched chelipeds. Dactyli (Fig. 4B) very slender (about 23 times as long as wide), 1.4 times as long as propodi; in dorsal view, straight; in lateral view, slightly curved ventrally; dorsal margins each with row of moderately spaced bristle-like or spiniform setae, becoming longer distally; mesial faces each with row of 9 moderately spaced, spiniform or bristle-like setae extending near ventral margin to midline toward distal; lateral surfaces and ventral margins unarmed. Propodi slightly more than twice length of carpi; dorsal and ventral margins granulate, former with few stiff setae subdistally; lateral and mesial surfaces smooth; ventrodistal margin with 1 spiniform seta. Carpi short, about half-length of meri; dorsal surfaces each with row of spinules, strongest distally; lateral surface with few granules, mesial and ventral surfaces almost smooth. Meri each with 1 small dorsodistal spine; dorsal surface with few low transverse ridges and moderately spaced bristle-like setae, but without spines; lateral and mesial surfaces smooth except for granulate ventral parts; ventral surfaces granulate, ventrolateral distal angle with minute spine. Ischia unarmed.

Pereopods 3 (Fig. 4C, D) generally similar to pereopods 2. Dactyli (Fig. 4D) 26 times as long as wide, 1.5 times as long as propodi; dorsal margins each with row of moderately spaced bristle-like or spiniform setae, becoming longer distally; mesial faces each with row of about 10 moderately spaced spiniform setae extending near ventral margin to midline toward distal; lateral surfaces and ventral margins unarmed. Propodi about twice length of carpi; dorsal margins faintly granulate, ventral margins nearly smooth; lateral and mesial surfaces also smooth; ventrodistal margin with 1 spiniform seta. Carpi short, about half-length of meri; dorsal surfaces each with row of spinules, strongest distally; lateral, mesial and ventral surfaces almost smooth. Meri

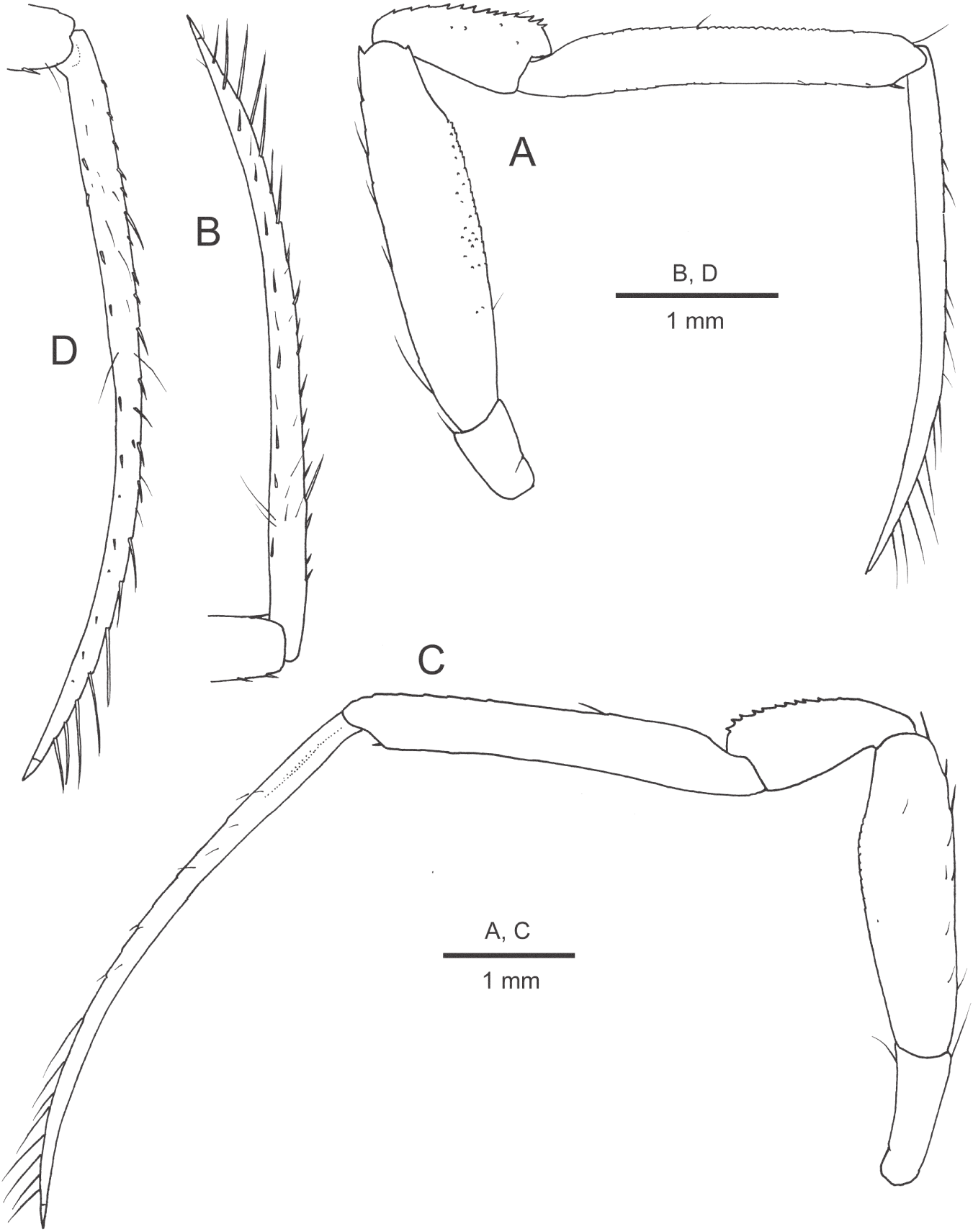

Fig. 4. *Catapagurus exilidigitus*, new species, holotype, male (sl 1.7 mm), NMCR 50801. A, right pereopod 2, lateral view; B, same, dactylus and distal part of propodus, mesial view; C, left pereopod 3, lateral view; D, same, dactylus and distal part of propodus, mesial view.

unarmed on dorsodistal margin, but with bristle-like seta; dorsal surface with 2 low transverse ridges and bristle-like setae subdistally, remainder with irregular rows of bristle-like or stiff setae; lateral and mesial surfaces smooth; ventral surfaces granulate, ventrolateral distal angle unarmed. Ischia longer than those of pereopods 2, unarmed.

Pereopods 4 (Fig. 1D) weakly semichelate; dactyli each with well developed preungual process far extending beyond tip of corneous claw; propodal rasp consisting of single row of corneous scales on distal 0.8 of ventral margin. Pereopods 5 chelate.

Males with long right sexual tube (right pereopod 5 coxa) curved dorsally over pleon and reaching pleonal midline, terminus simple, with few minute setae (Fig. 1F). Left pereopod 5 coxa with small, papilla-like protrusion from gonopore, circumscribed by short setae (Fig. 1F).

Thoracic sternite 6 (pereopods 3) (Fig. 1G) with moderately wide, subsemicircular anterior lobe, much shorter than large posterior lobe; posterior lobe distinctly longer than anterior lobe. Sternite 8 (pereopods 5) (Fig. 1E) consisting of two small rounded lobes moderately separated.

Pleon in males with small, uniramous unpaired left pleopods 3 and 4, no pleopod 5; females unknown. Uropodal protopods not protruding posteriorly.

Telson (Fig. 1H) with lateral indentations suggesting separation of anterior and posterior portions; triangular posterior lobes separated by moderately deep U-shaped median cleft, each terminating in subacute tip; oblique terminal margins unarmed, with few minute setae on right margin.

Colouration in life. Not known.

Distribution. Presently known only from the Bohol Sea, central Philippines, at depths of 100–138 m.

Remarks. There were no female specimens available for study. The present new species is assigned to *Catapagurus* without hesitation because it agrees with the generic features of *Catapagurus*, including the gill formula consisting of 11 pairs of biserial gills, the somewhat reduced crista dentata on the maxilliped 3 ischium, the presence of a prominent preungual process on the pereopod 4 dactyli, and the possession of a long sexual tube arising from the right pereopod 5 coxa in males, curving exteriorly and over the lateral side of the body (McLaughlin, 2003, 2004).

Catapagurus exilidigitus, new species, appears close to *C. tanimbarensis* McLaughlin, 1997, presently known only from the Banda Sea, Indonesia, in the general armature and slenderness of the pereopod 2 and 3 dactyli. In particular, in these two taxa, the dorsal spiniform or bristle-like setae on the mesial surfaces of the ambulatory dactyli are relatively few compared to other species in the *C. misakiensis* group (20 or less versus more than 30) (de Saint Laurent & McLaughlin, 2000; Asakura, 2001; McLaughlin, 2002; Komai & Takeda, 2006; McLaughlin & Rahayu, 2008). *Catapagurus exilidigitus*, new species, is primarily distinguished from *C. tanimbarensis* by the telson with a wide, U-shaped median cleft (Fig. 1H) (versus telson with a narrow, slit-like V-shaped median cleft; McLaughlin, 1997: fig. 18i, k, m). Other differentiating characters are: (1) the ultimate article of the antennular peduncle is relatively longer in *C. exilidigitus*, new species, than in *C. tanimbarensis* (0.9 times as long as the shield versus about 0.7 times) (Fig. 1A, B versus McLaughlin, 1997: fig. 18a, b); the meri of chelipeds are unarmed on the dorsodistal margins in *C. exilidigitus*, new species (Figs. 2, 3), whereas armed with one or more dorsodistal spine(s) in *C. tanimbarensis* (cf. McLaughlin, 1997: 499; fig. 18c); the ambulatory dactyli are more elongate and slender in *C. exilidigitus*, new species, than in *C. tanimbarensis* (1.4–1.5 times as long as the propodus; more than 20 times as long as wide in *C. exilidigitus*, new species, cf. Fig. 4; versus 1.0–1.25 times as long as the propodus and less than 15 times as long as wide in *C. tanimbarensis*, cf. McLaughlin, 1997: fig. 18d–f; Asakura, 2001: fig. 37F); the pereopod 2 meri are only armed with a dorsodistal spine in *C. exilidigitus*, new species (cf. Fig. 4A), rather than armed with subdistal spines on the dorsal surface in addition to the dorsodistal spine in *C. tanimbarensis* (cf. McLaughlin, 1997: fig. 18d).

Etymology. The Latin *exilidigitus* (*exilis* = thin; *digitus* = digit, toe) refers to the very slender dactyli of the ambulatory legs of the new species.

Catapagurus fimbriatus, new species

(Figs. 5–8)

Material examined. Holotype: male (sl 1.5 mm), NMCR 50802, PANGLAO 2004, stn T27, Bohol Sea, between Panglao and Pamilacan islands, 09°33.4′N, 123°51.0′E, 106–137 m, fine sand and mud with echinoderms, trawl, 25 June 2004.

Paratype: 1 male (sl 1.4 mm), ZRC 2021.0414, PANGLAO 2004, same data as holotype.

Description. Shield (Fig. 5A) 1.2 times broader than long; anterior margin between rostral lobe and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with longitudinal rows of tufts of short setae on midline and posterior to lateral projections; carapace lateral lobes narrow, well calcified. Rostral lobe broadly and roundly triangular, usually produced as far as lateral projections. Lateral projections broadly and roundly triangular, each usually with terminal, submarginal spinule. Posterior carapace 0.5 length of shield; posterolateral plates moderately wide anteriorly, drawn out into relatively thin bands reaching to posterior margins, posterior median plate short, only weakly calcified.

Ocular peduncles (Fig. 5A) short (0.7 times as long as shield), stout, widened distally; corneal width 0.7 peduncular length. Ocular acicles narrowly triangular, slender, reaching 0.3 length of ocular peduncle, terminating acutely; widely separated.

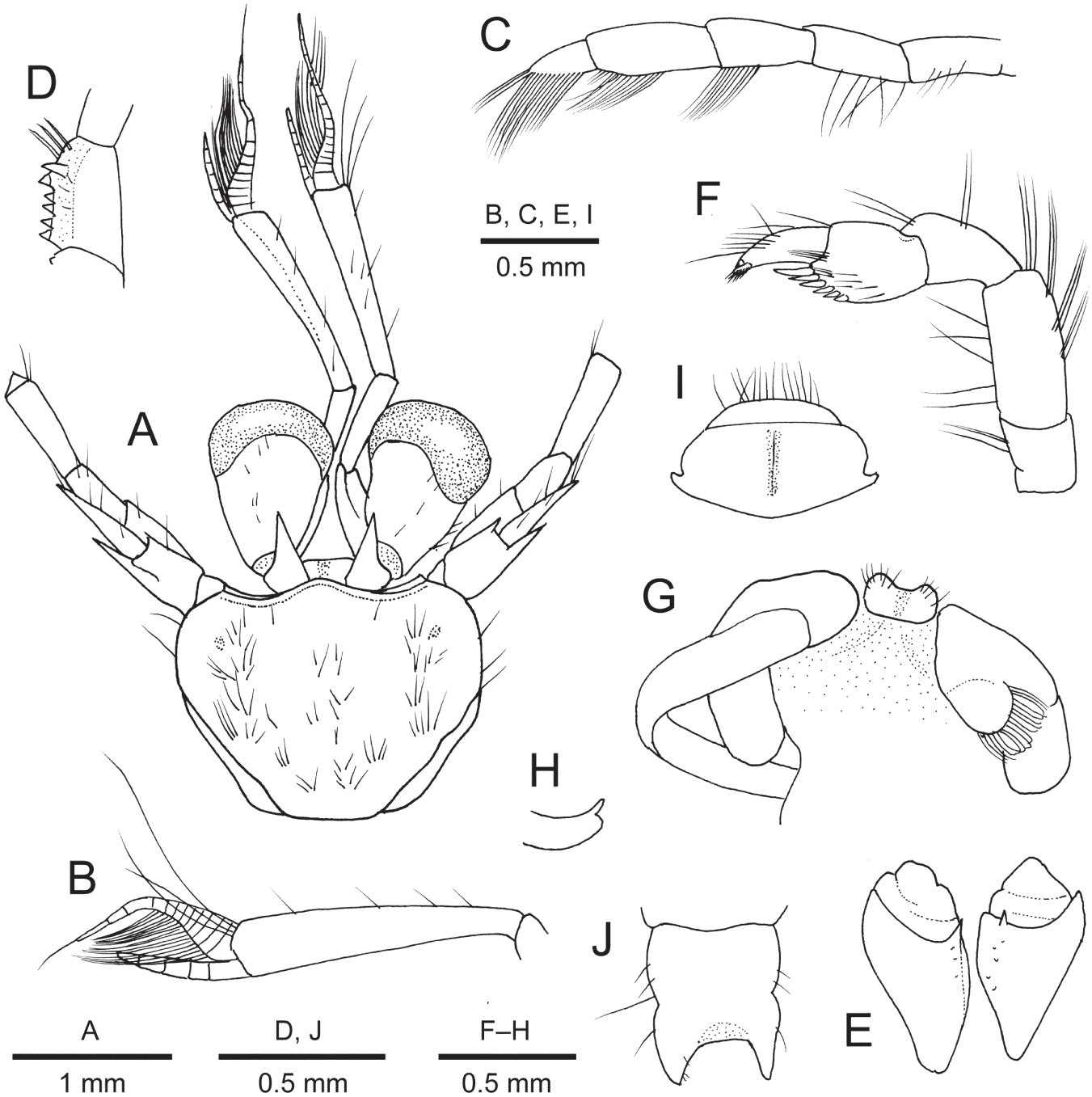

Fig. 5. *Catapagurus fimbriatus*, new species. A–I, holotype, male (sl 1.5 mm), NMCR 50802; J, paratype, male (1.4 mm), ZRC 2021.0414. A, shield, carapace lateral lobes and cephalic appendages, dorsal view; B, left antennule, ultimate article of peduncle and flagella, lateral view; C, left maxilliped 3, endopod, lateral view; D, ischium, ventral view; E, coxae of chelipeds, ventral view; F, left pereopod 4, lateral view; G, coxae of pereopods 5 and thoracic sternite 8, ventral view; H, distal part of right sexual tube, dorsal view; I, thoracic sternite 6, ventral view; J, telson, dorsal view.

Antennular peduncle (Fig. 5A, B) overreaching distal corneal margin by full length of ultimate article. Ultimate article 0.8 times as long as shield, 5.3 times as long as distal height, with tuft of long setae at dorsodistal margin and some short setae on dorsal surface. Penultimate article with few short setae. Basal article with very slightly produced, subacute ventrodistal margin; statocyst lobe gently inflated in proximal half of lateral margin.

Antennal peduncle (Fig. 5A) overreaching distal corneal margin by 0.7 length of ultimate article. Articles 5 and 4 with few, scattered short setae. Article 3 with few setae on unarmed ventrodistal angle. Article 2 with produced dorsolateral distal angle reaching to or beyond base of article 4, terminating in spine; dorsomesial distal angle with prominent spine. Article 1 with small spine at dorsolateral distal angle. Antennal acicle reaching distal margin of article 4 and reaching corneal base, terminating in spine. Flagella missing.

Maxilliped 3 endopod (Fig. 5C) moderately stout; merus with small dorsodistal spine; ischium with crista dentata consisting of 5 small teeth; accessory tooth prominent (Fig. 5D).

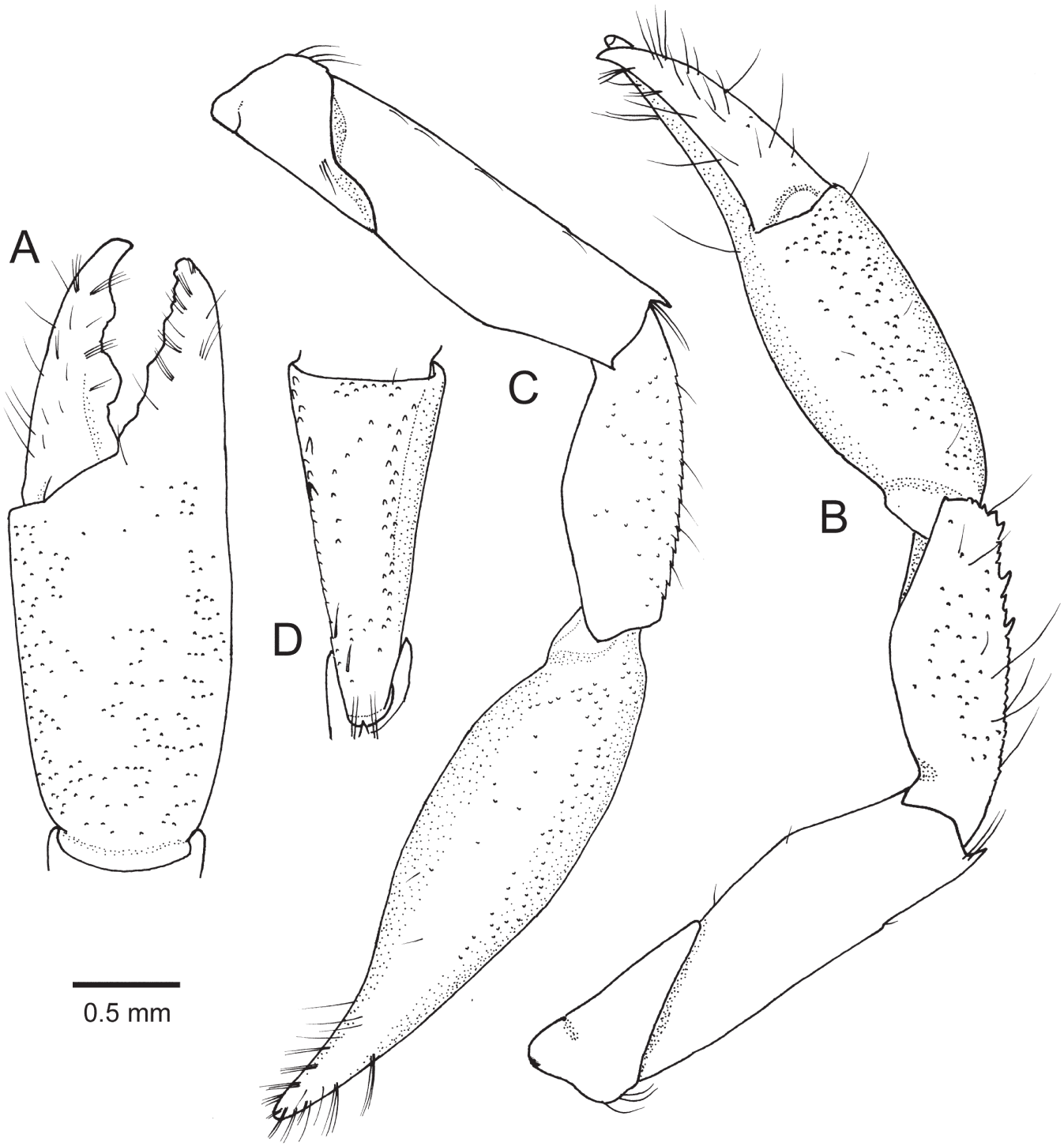

Fig. 6. *Catapagurus fimbriatus*, new species, holotype, male (sl 1.5 mm), NMCR 50802. A, chela of right cheliped, dorsal view; B, right cheliped, mesial view; C, same, lateral view; D, carpus of right cheliped, dorsal view.

Right cheliped (Fig. 6A–D) long, moderately slender. Chela elongate subovate (Fig. 6A), 2.7 times as long as wide. Dactylus 0.9 length of palm; weakly convex dorsal surface almost smooth and with sparse tufts of setae; dorsomesial margin not delimited, rounded; occlusal margin with 2 blunt calcareous teeth, slightly overlapped by fixed finger. Palm subequal in length to carpus, 1.6 times as long as wide; dorsomesial and dorsolateral margins not delimited, dorsal and mesial surfaces minutely granular; ventral surface nearly smooth; fixed finger with sparse tufts of setae in distal half, occlusal margin with row of low, blunt calcareous teeth over entire length. Carpus (Fig. 6D) slightly shorter than merus, 2.7 times as long as distal width; dorsal surface with sparse granules, dorsomesial margin delimited with row of tiny spines in distal 0.3 and of minute granules proximally, and with few setae, dorsodistal margin unarmed; dorsolateral margin delimited with irregular row of spinules, and with few setae; lateral and mesial surfaces with sparse minute granules, ventral surface nearly smooth; all with covering of tiny or minute spinules, tubercles or granules. Merus subtriangular in cross section; dorsodistal margin with small spine; dorsal surface with widely spaced short setae;

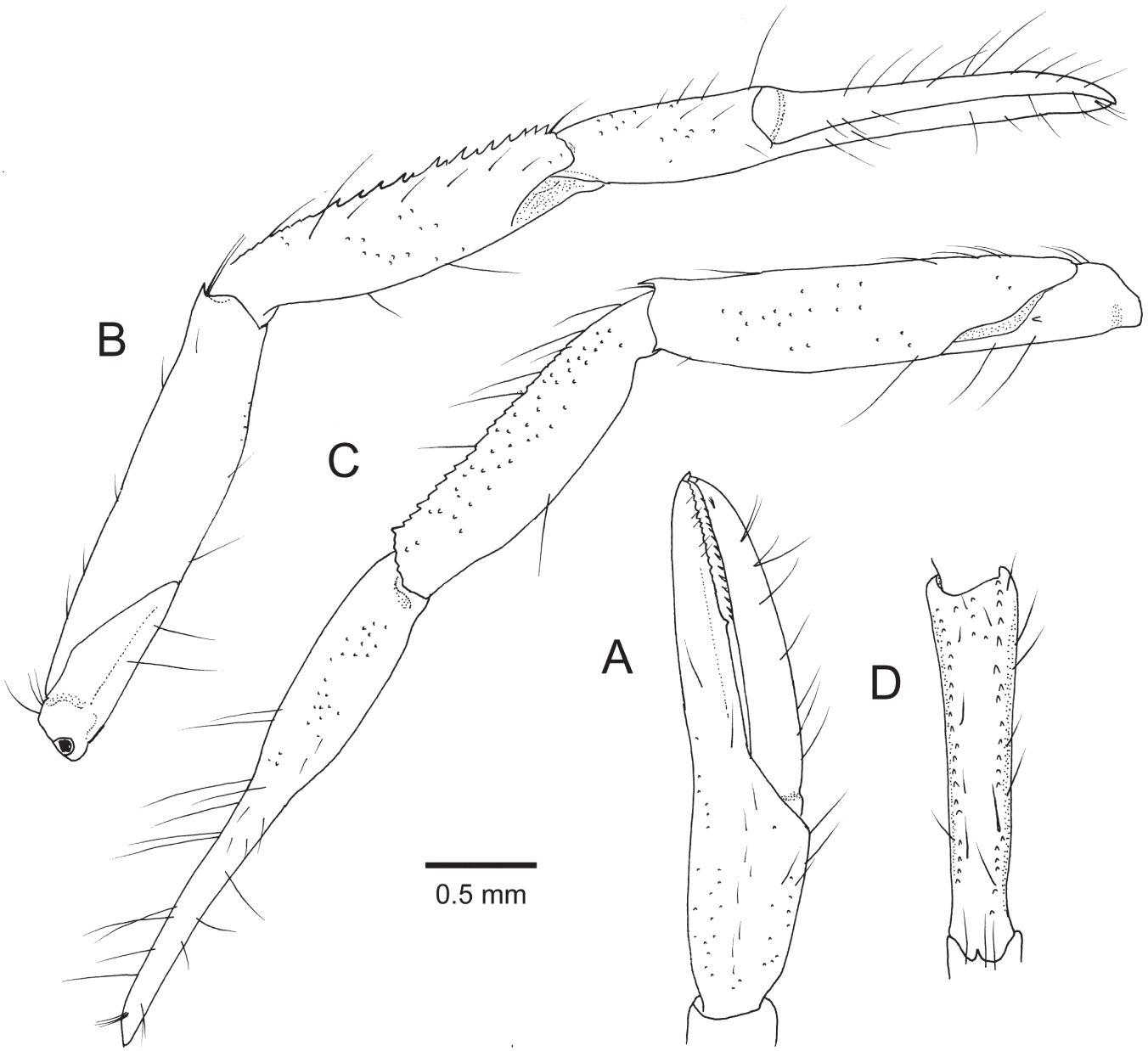

Fig. 7. *Catapagurus fimbriatus*, new species, holotype, male (sl 1.5 mm), NMCR 50802. A, chela of left cheliped, dorsal view; B, left cheliped, mesial view; C, same, lateral view; D, carpus of left cheliped, dorsal view.

mesial and lateral faces almost smooth; ventrolateral and ventromesial margins each with small distal spine; ventral surface smooth, only with few short setae. Ischium unarmed on distolateral margin. Coxa with small ventromesial distal spine (Fig. 1E).

Left cheliped (Fig. 7A–D) slender, subequal in length to right cheliped; dactyl and fixed finger nearly straight. Chela (Fig. 7A) 4.8 times as long as wide. Dactylus 1.8 times as long as palm; surfaces almost smooth, with sparse tufts of setae; dorsomesial margin not delimited; occlusal margin with row of tiny corneous teeth in distal half, otherwise unarmed. Palm 0.5 length of carpus, 1.8 times as long as wide; dorsomesial and dorsolateral margins not delimited, dorsal, lateral and mesial surfaces with few setae and sparse minute granules; ventral surface slightly convex, smooth; fixed finger with smooth surfaces, few scattered long setae; occlusal margin with row of minute calcareous teeth in distal half, unarmed in proximal half. Carpus (Fig. 7D) slightly shorter than merus, 4.0 times as long as distal width; dorsomesial margin with row of spinules and few setae, dorsolateral margin with row of granules, becoming spinulose distally, dorsal surface with few granules distally, otherwise smooth; mesial and lateral surfaces with sparse granules, ventral surface smooth. Merus with small spine on dorsodistal margin, dorsal surface with row of widely spaced setae; lateral surface with sparse granules, mesial and ventral surfaces almost smooth, ventromesial and ventrolateral distal angles each with small spine. Ischium with small spine distolaterally. Coxa with small ventromesial distal spine (Fig. 1E).

Pereopods 2 (Fig. 8A–C) considerably overreaching tips of outstretched chelipeds. Dactyli narrowly blade-shaped, 1.1 times as long as propodi; in dorsal view, straight; in lateral view, gently curved ventrally; dorsal margins each with row of moderately spaced setae, becoming longer and more stiff

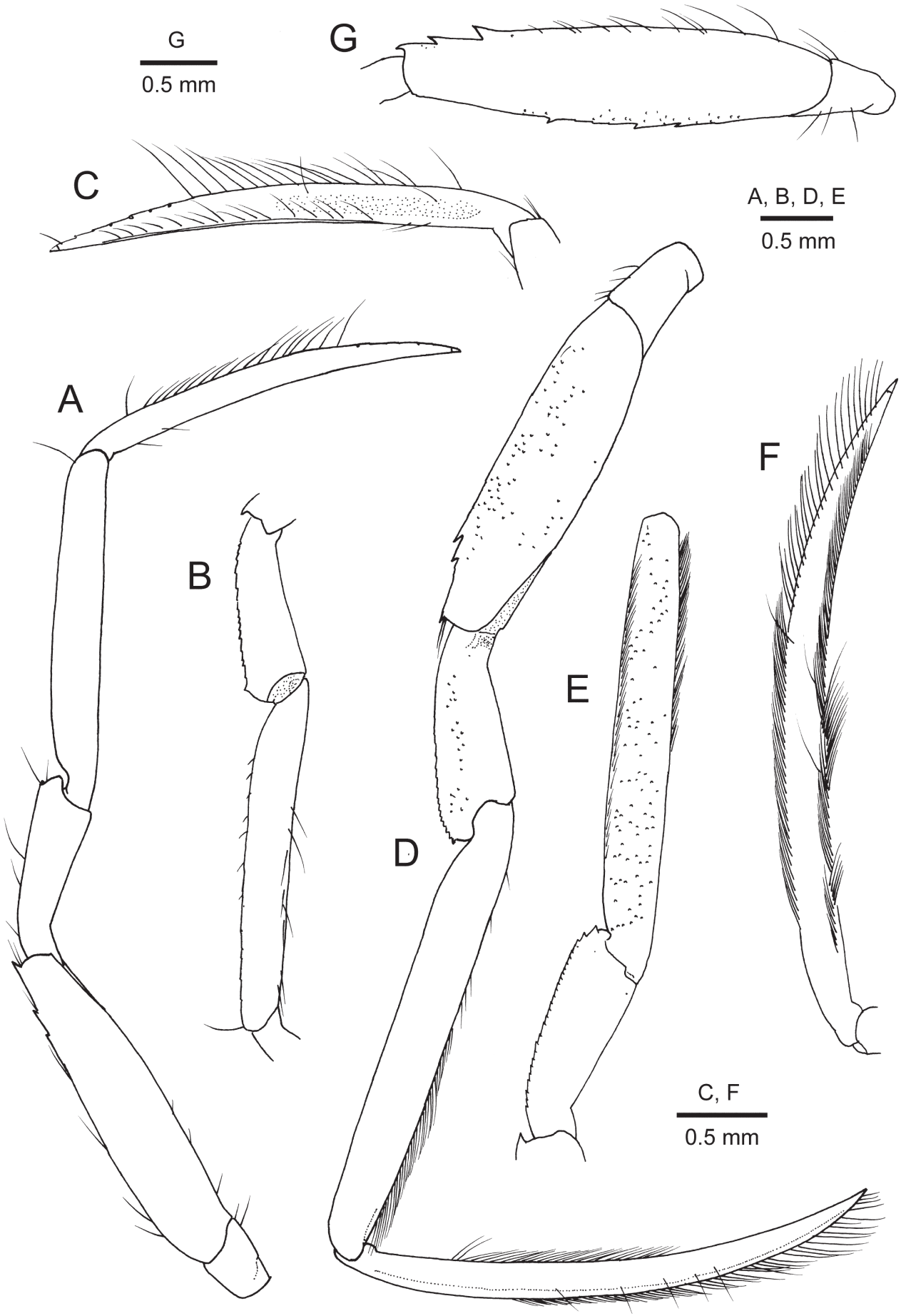

Fig. 8. *Catapagurus fimbriatus*, new species. A–F, holotype, male (sl 1.5 mm), NMCR 50802; G, paratype, male (sl 1.4 mm), ZRC 2021.0414. A, right pereopod 2, lateral view; B, same, propodus and carpus, mesial view; C, same, dactylus, mesial view; D, left pereopod 3, lateral view; E, same, propodus and carpus, mesial view; F, same, dactylus, mesial view. G, left pereopod 3, merus, lateral view.

distally; mesial faces (Fig. 8C) slightly concave, each with row of about 20 moderately spaced, stiff setae adjacent to ventral margin; lateral faces and ventral margins unarmed. Propodi approximately twice length of carpi; dorsal margins and lateral surface smooth, almost glabrous; mesial surfaces each with longitudinal rows of setae adjacent to dorsal and ventral margins. Carpi 0.6 length of meri; dorsal surfaces each with row of very small spinules, strongest distally; lateral, mesial and ventral surfaces almost smooth. Meri each with 1 small dorsodistal spine; dorsal surface with 2 small subdistal spines and widely spaced stiff setae; lateral and mesial faces glabrous; ventral surfaces with few short setae, ventrolateral distal angle with small spine. Ischia unarmed.

Pereopods 3 (Fig. 8D–G) distinctly longer than pereopods 2. Dactyli (Fig. 8F) narrowly blade-shaped, 1.3 times as long as propodi; in dorsal view, straight; in lateral view, gently curved ventrally; dorsal margins each with row of numerous, closely spaced setae, becoming longer and more stiff distally; mesial faces each with row of numerous setae adjacent to ventral margin; lateral surfaces and ventral margins unarmed. Propodi (Fig. 8E) approximately twice length of carpi; dorsal margins unarmed; mesial surfaces each with sparse granules and row of short setae adjacent to dorsal margins; lateral surfaces smooth; ventral margins each with row of short setae in distal 0.7. Carpi (Fig. 8E) 0.6 length of meri; dorsal surfaces each with row of very small spinules, strongest distally; lateral surface with sparse granules medially, mesial and ventral surfaces almost smooth. Meri each with 1 small dorsodistal spine; dorsal surface with 2 small subdistal spines and irregular rows of short stiff setae mesially; lateral surface with sparse granules; mesial surface smooth; ventral surfaces slightly granulate, bearing 3 spinules in paratype, no distinct spinule in holotype, ventrolateral distal angle unarmed. Ischia unarmed.

Pereopods 4 (Fig. 5F) weakly semichelate; dactyli each with well developed preungual process usually far extending beyond tip of claw; propodal rasp consisting of single row of corneous scales on distal half of ventral margin, distalmost scale longest. Pereopods 5 chelate.

Males with long right sexual tube curved dorsally over pleon and reaching pleonal midline, terminating in 2 small, unequal lobes (Fig. 5G, H). Left coxa lacking gonopore, having row of setae on ventral surface posteriorly (Fig. 5G).

Thoracic sternite 6 (pereopods 3) (Fig. 5I) with very wide, subtrapezoidal anterior lobe, much shorter than large posterior lobe; with row of short setae on anterior margin; posterior lobe much longer than anterior lobe. Sternite 8 consisting of two small rounded lobes widely separated.

Pleon in males with 3 unpaired, uniramous pleopods (pleopods 3–5); females unknown. Uropodal protopods not protruding posteriorly.

Telson (Fig. 5J) with lateral indentations suggesting separation of anterior and posterior portions; triangular posterior lobes separated by very wide, trapezoidal medial cleft, each terminating in subacute tip; oblique terminal margins unarmed.

Colouration in life. Not known.

Distribution. Presently known only from the Bohol Sea, central Philippines; at depths of 77–137 m.

Remarks. There were no female specimens available for study. None of the two types is intact: in the holotype, the entire pleon is missing; in the paratype, both chelipeds and pereopods 2 are missing. Nevertheless, the new species is assigned to *Catapagurus* without hesitation because it agrees with the generic features, including the gill formula consisting of 11 pairs of biserial gills, the somewhat reduced crista dentata on the maxilliped 3 ischium, the presence of a prominent preungual process on the pereopods 4 dactyli and the possession of a long sexual tube arising from the right pereopod 5 coxa, curving exteriorly and over the lateral side of the body (McLaughlin, 2003, 2004).

Catapagurus fimbriatus, new species, is readily distinguished from all other congeneric species in the characteristic setation of the pereopod 3 dactyli and propodi: the dactylus has a row of dense setae on the dorsal margin and on the mesial face adjacent to the ventral margin; the merus is also provided with setal rows on the mesial face adjacent to the dorsal margin and on the distal 0.7 of the ventral margin. Such setation is not seen in the 24 other species in the genus (McLaughlin, 1997, 2002, 2004; Hogarth et al., 1998; de Saint Laurent & McLaughlin, 2000; Asakura, 2001; Komai & Osawa, 2009; Nucci & Melo, 2012; this study). The shape of the ambulatory dactyli of the present new species is also notable: the dactyli are slender as in species referred to the *C. misakiensis* species group as diagnosed by Asakura (2001; as *C. japonicus* group), but in this new species the shape is similar to the blade-shaped dactyli with shallow concave mesial faces of the *C. ensifer* species of Asakura (2001). As a result, this new species appears to be intermediate between the two species groups as proposed by Asakura (2001), and cannot be satisfactorily placed in either.

Etymology. The Latin *fimbriatus* (= fringed) refers to the characteristic setation of the ambulatory dactyli of the new species.

Catapagurus latus, new species
(Figs. 9–12)

Material examined. Holotype: ovigerous female (sl 2.0 mm), NMCR 50803, PANGLAO 2004, stn T33, Bohol Sea, Bohol Island, Baclayon, 9°36.0′N, 123°53.7′E, 67–74 m, sand with sponges, trawl, 3 July 2004.

Description. Shield (Fig. 9A) 1.1 times as broad as long; anterior margin between rostral lobe and lateral projections concave; anterolateral margins sloping, rounded; posterior margin roundly truncate; dorsal surface with longitudinal rows of tufts of short setae on either side of midline and posterior to lateral projections; carapace lateral lobes narrow,

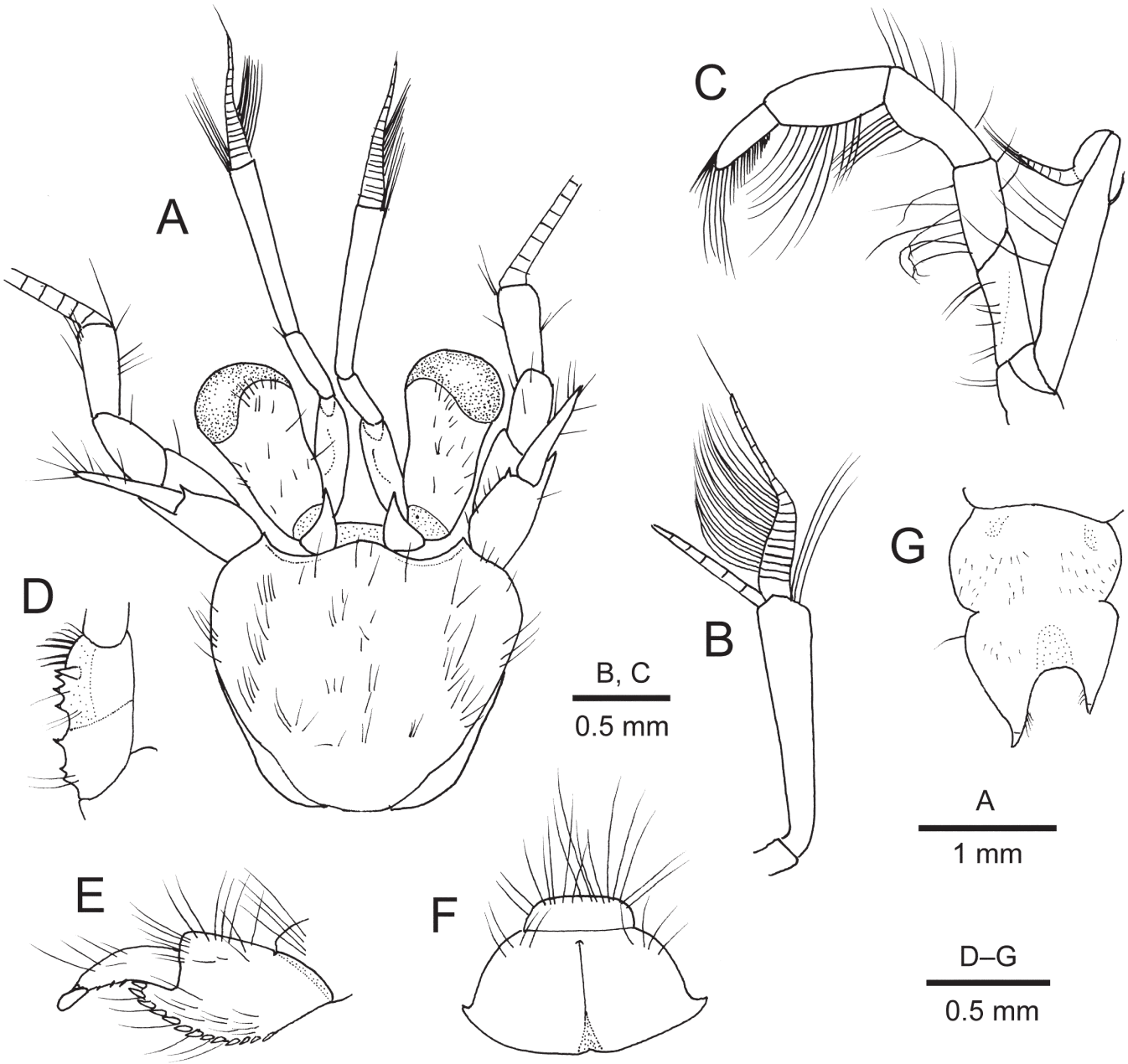

Fig. 9. *Catapagurus latus*, new species, holotype, ovigerous female (sl 2.0 mm), NMCR 50803. A, shield, carapace lateral lobes and cephalic appendages, dorsal view; B, left antennule, ultimate article of peduncle and flagella, lateral view; C, left maxilliped 3, lateral view; D, ischium and basis, ventral view; E, left pereopod 4, dactylus and propodus, lateral view; F, thoracic sternite 6, ventral view; G, telson, dorsal view.

well calcified. Rostral lobe broadly rounded, produced as far as lateral projections. Lateral projections broadly triangular, each with terminal, submarginal spine. Posterior carapace 0.8 length of shield; posterolateral plates moderately wide anteriorly, drawn out into relatively thin bands reaching to posterior margins, posterior median plate short, weakly calcified.

Ocular peduncles (Fig. 9A) moderately short (0.7 times as long as shield), moderately stout, widened distally; corneal width approximately 0.5 peduncular length. Ocular acicles narrow, short, only reaching 0.1 length of ocular peduncles, terminating acutely; widely separated basally.

Antennular peduncle (Fig. 9A, B) overreaching distal corneal margin by half-length of penultimate article. Ultimate article 0.6 times as long as shield, 5.1 times as long as distal height, with tuft of 3 long setae at dorsodistal lateral margin. Penultimate article glabrous. Basal article with gently inflated statocyst lobe proximal to midlength and weakly produced, subacute ventrodistal margin.

Antennal peduncle (Fig. 9A) overreaching distal corneal margin by half-length of article 5. Articles 5 and 4 with few short setae. Article 3 unarmed at ventromesial distal angle. Article 2 with produced, dorsolateral distal angle reaching midlength of article 4 and terminating in bifid spine; dorsomesial distal angle with small spine. Article 1 with small spine at dorsolateral distal angle. Antennal acicle

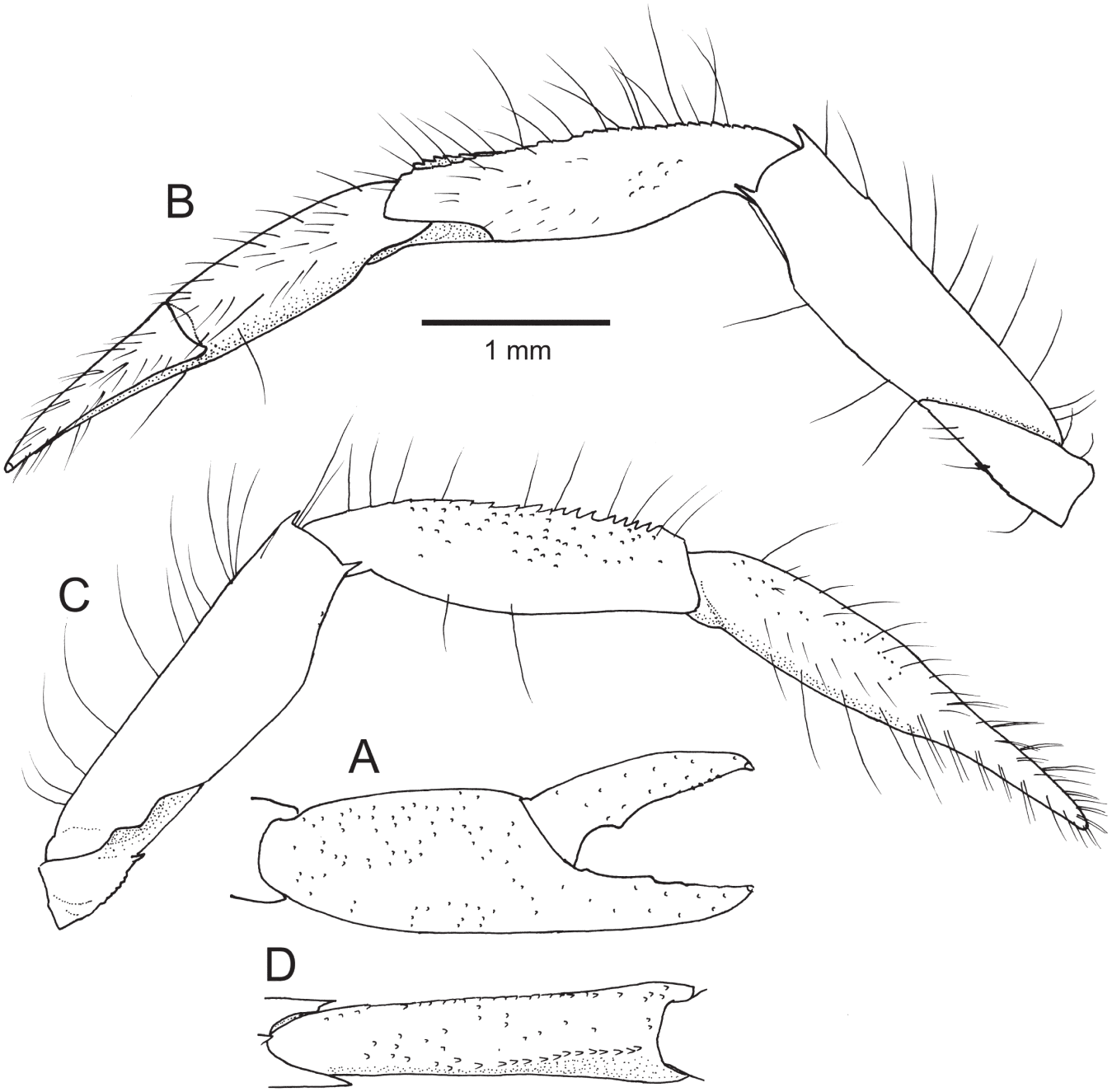

Fig. 10. *Catapagurus latus*, new species, holotype, ovigerous female (sl 2.0 mm), NMCR 50803. A, chela of right cheliped, dorsal view; B, right cheliped, mesial view; C, same, lateral view; D, carpus of right cheliped.

reaching base of article 5 and overreaching corneal base, terminating in spine. Flagella long, about 10 times as long as shield, almost glabrous.

Maxilliped 3 (Fig. 9C) endopod moderately stout; merus without dorsodistal spine; ischium with crista dentata consisting only of 3 small teeth; accessory tooth small, subdistal in position.

Right cheliped (Fig. 10A–D) short, relatively slender. Chela (Fig. 10A) elongate subovate, 2.3 times as long as wide. Dactylus 0.9 length of palm; all surfaces with scattered setae; dorsal surface weakly convex; dorsomesial margin not delimited, rounded; occlusal margin with 1 low, triangular calcareous tooth at proximal one-third, and with row of minute corneous teeth in distal half. Palm 0.7 length of carpus, 3.9 times as long as distal width; dorsomesial and dorsolateral margins not delimited, convex dorsal surface with sparse granules and short to moderately long setae; ventral surface gently convex, almost smooth, with scattered tufts of short to long setae; fixed finger with longitudinal rows of short setae, occlusal margin with low, obtuse calcareous tooth at midlength, unarmed in distal half. Carpus (Fig. 10D) subequal in length to merus, slightly widened distally, 3.9 times as long as distal width; dorsal surface with sparse granules, dorsomesial margin delimited with row of granules, dorsolateral margin delimited with row of spinules becoming obsolete proximally; sparse setae on both margins; lateral surface with scattered granules in dorsal half, smooth in ventral half; mesial surface with scattered short setae on distal

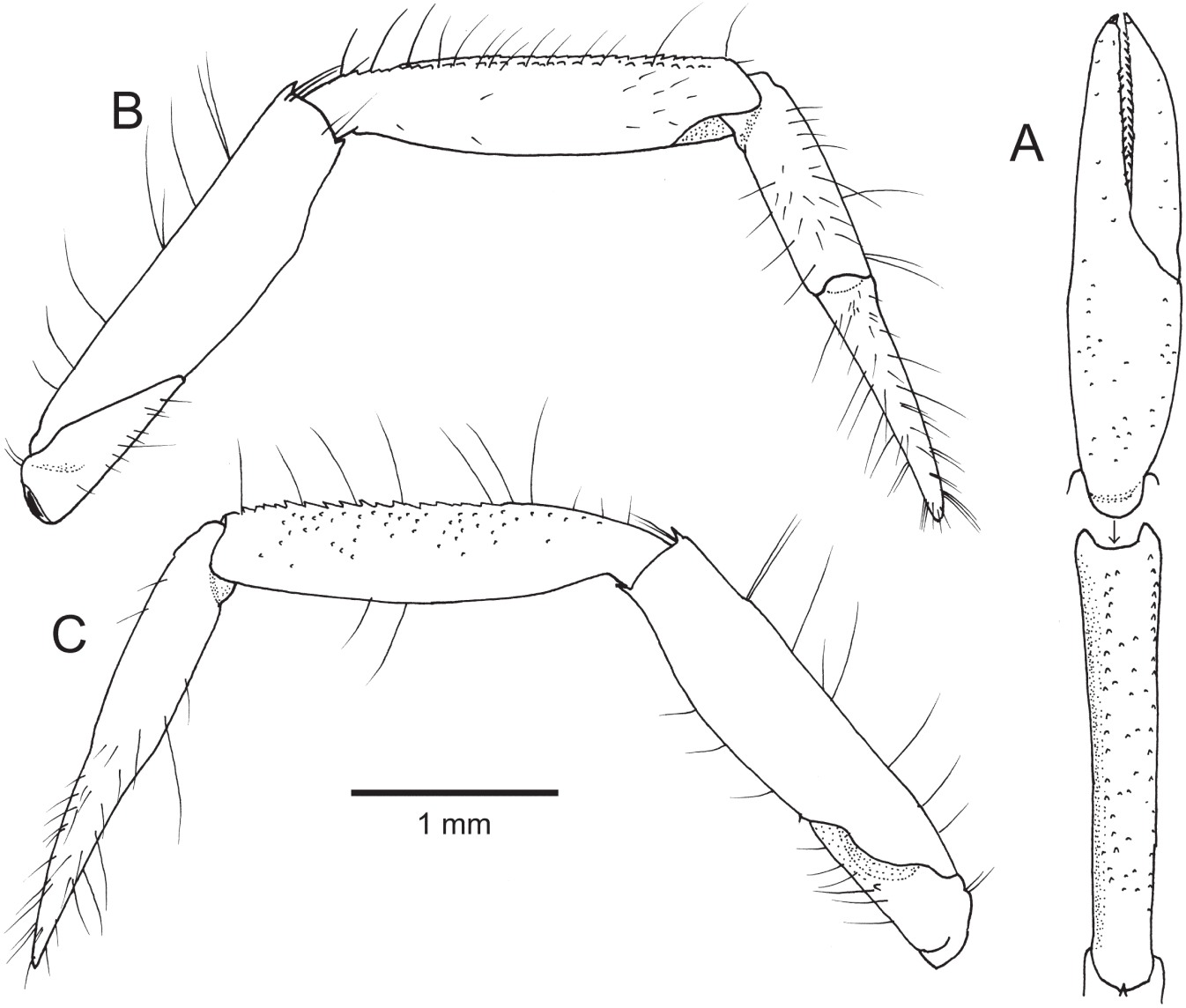

Fig. 11. *Catapagurus latus*, new species, holotype, ovigerous female (sl 2.0 mm), NMCR 50803. A, chela and carpus of left cheliped, dorsal view; B, left cheliped, mesial view; C, same, lateral view; D, carpus of left cheliped.

half, ventromesial distal angle unarmed; ventral surface gently convex, smooth, with few setae. Merus subtriangular in cross section; dorsodistal margin with small spine; dorsal surface with widely spaced long setae; lateral face smooth, gently sinuous ventrolateral margin with small distal spine; mesial face also smooth, weakly sinuous ventromesial margin with small distal spine; ventral surface smooth. Ischium armed with small spine on ventrolateral distal margin. Coxa unarmed.

Left cheliped (Fig. 11A–C) slender, subequal in length to right cheliped; dactylus and fixed finger almost straight. Chela narrowly subovate, 4.4 times as long as wide. Dactylus 1.1 times as long as palm, terminating in small, curved corneous claw; surfaces almost smooth, with sparse tufts of setae; dorsomesial margin not delimited; occlusal margin with row of moderately spaced, minute corneous teeth almost over entire length. Palm 0.7 length of carpus, 2.0 times as long as wide; dorsomesial and dorsolateral margins not delimited, transversely convex dorsal surface with sparse granules and scattered short setae; ventral surface slightly convex, smooth, with few setae; fixed finger smooth on surfaces, with sparse tufts of short setae; occlusal margin with row of minute corneous teeth, terminating in small, curved corneous claw. Carpus subequal in length to merus; dorsal surface with sparse granules, dorsomesial margin delimited with row of granules, dorsolateral margin delimited with spinules becoming obsolete proximally; dorsal surface with sparse granules; lateral surface with sparse granules on dorsal half, almost smooth on ventral half, ventrolateral distal margin unarmed; mesial surface smooth, ventromesial distal margin unarmed. Merus dorsodistal margin with small spine; dorsal surface with several widely spaced setae; lateral surface smooth, gently sinuous ventral margin with small distal spines; mesial surface almost smooth, slightly sinuous ventromesial margin with small distal spine; ventral surface smooth, with few setae. Ischium unarmed. Coxa unarmed.

Right pereopod 2 (Fig. 12A–C) moderately stout, far overreaching tips of outstretched chelipeds, strongly twisted at articulation between carpus and propodus. Dactylus broadly blade-shaped (greatest width at midlength), 1.2 times as long as propodi, 6.0 times as long as wide; in dorsal view,

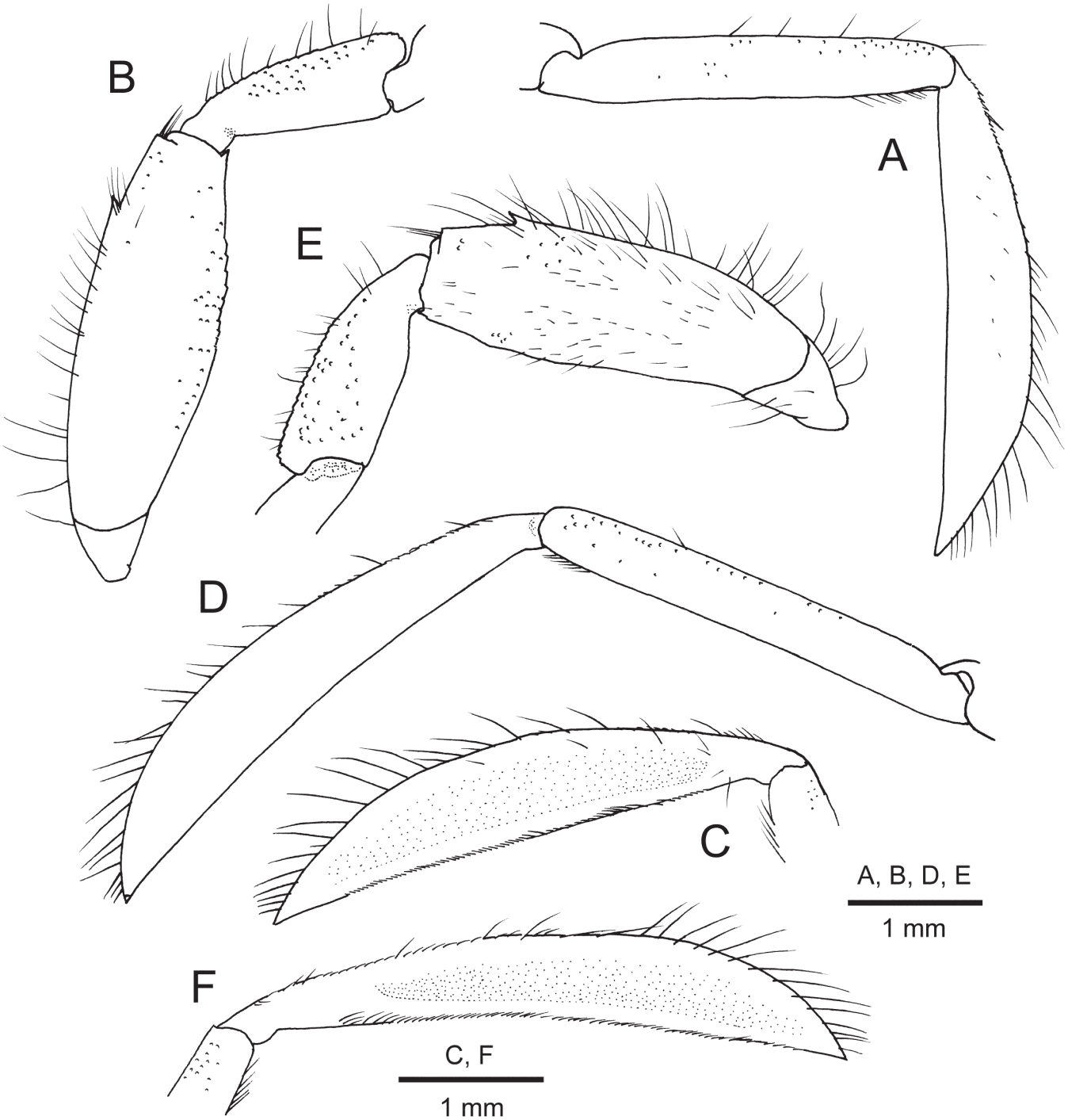

Fig. 12. *Catapagurus latus*, new species, holotype, ovigerous female (sl 2.0 mm), NMCR 50803. A, right pereopod 2, dactylus and propodus, lateral view; B, same, carpus, merus, and ischium, lateral view; C, same, dactylus, mesial view; D, left pereopod 3, dactylus and propodus, lateral view; E, same, carpus, merus, and ischium, lateral view; F, same, dactylus, mesial view.

straight; in lateral view, nearly straight; dorsal margin broadly convex, with row of numerous minute setae in proximal 0.3 and row of about 20 short to moderately long stiff setae in distal 0.7; mesial face shallowly excavate, each with row of about 60 minute stiff setae close to straight ventral margin (those setae not visible in lateral view); lateral surfaces and ventral margins unarmed. Propodus slender, 1.9 length of carpus; dorsal margin with widely spaced setae; lateral surface slightly granulate dorsodistally, otherwise nearly smooth; ventral margin with cluster of short setae in distal one-fourth, no spiniform setae on ventrodistal margin. Carpus short, about half-length of merus; dorsal surfaces granulate, with row of sparse short setae; lateral surfaces sparsely granulate, mesial and ventral surfaces almost smooth. Merus unarmed on dorsodistal margin; dorsal surface with subdistal transverse ridge, small spine located at distal 0.25 and row of sparse moderately short setae; lateral and mesial faces smooth except for granulate ventral part; ventral margin gently convex, granulate, ventrolateral distal angle with small spine. Ischium unarmed. Left pereopod 2 broken off, not preserved.

Pereopods 3 (Fig. 12D–F) generally similar to, but slightly longer than pereopods 2. Dactyli blade-shaped (greatest width at distal 0.3), 7.5 times as long as wide, 1.3 times as long as propodi; dorsal margins broadly convex, each with row of numerous minute setae in proximal half and row of about 20 short to moderately long stiff setae over entire length (more widely spaced proximally); mesial faces shallowly excavate, each with row of about 70 minute stiff setae close to straight ventral margin; lateral surfaces and ventral margins unarmed. Propodi each with cluster of short setae in distal 0.2 of ventral margin. Meri unarmed on dorsodistal margin; dorsal surface with subdistal transverse ridge, small spine located at distal 0.2 and row of sparse setae; lateral surface with scattered short setae; mesial surface glabrous; ventral margins slightly sinuous, smooth, ventrolateral distal angle with small spine. Ischia short, similar to that of pereopods 2.

Pereopods 4 semichelate (Fig. 9E); dactyli each with well developed preungual process far extending beyond tip of corneous claw; propodal rasp consisting of single row of corneous scales on distal 0.8 of ventral margin. Pereopods 5 chelate.

Thoracic sternite 6 (pereopods 3) (Fig. 9F) with wide, subrectangular anterior lobe, much shorter than large posterior lobe; posterior lobe distinctly longer than anterior lobe. Sternite 8 consisting of two small rounded lobes moderately separated.

Pleon dextrally twisted, with unequally biramous pleopods 2–5. Uropodal protopods not protruding posteriorly.

Telson (Fig. 9G) with lateral indentations suggesting separation of anterior and posterior portions; triangular posterior lobes separated by large U-shaped median cleft, each terminating in acute corneous tip; strongly oblique terminal margins unarmed, but with some minute setae subdistally on either side.

Eggs 0.5 × 0.6 mm in non-eyed stage.

Colouration in life. Not known.

Distribution. Presently known only from the Bohol Sea, central Philippines, at depth of 67–74 m.

Remarks. The ovigerous female holotype is the only representative for this new species at present. In spite of the lack of male specimens, this new species is assigned to *Catapagurus* based on the gill formula consisting of 11 pairs of biserial gills, the somewhat reduced crista dentata on the maxilliped 3 ischium, the presence of a prominent preungual process on the pereopods 4 dactyli, and the lack of paired pleopods 1 (McLaughlin, 2003, 2004). The broadly blade-shaped dactyli of the ambulatory legs suggest relationship to certain species of the *Catapagurus ensifer* species group of Asakura (2001), including *C. albatrossae* (Asakura, 2001), *C. alcocki*, *C. ensifer* Henderson, 1888, *C. haigae* (Asakura, 2001), *C. insolitus* Komai & Osawa, 2009, and *C. kosugei* (Asakura, 2001) (Asakura, 2001; Komai & Osawa, 2009).

Among the above-mentioned species, *Catapagurus latus*, new species, appears closest to *C. haigae*, known from the Arafura Sea and the Philippines, in having a ventral row of numerous (>50) minute setae on each ventromesial margin of the pereopod 2 and 3 dactyli (Asakura, 2001). This new species is readily distinguished from *C. haigae* by many characters, as outlined below: (1) the ultimate article of the antennular peduncle is more elongate in *C. latus*, new species, than in *C. haigae* (5.1 length of the distal height versus 3.6 length; Fig. 9B and Asakura, 2001: fig. 19C); (2) the crista dentata of the maxilliped 3 is less developed (consisting only of three teeth) in *C. latus*, new species (Fig. 9D), than in *C. haigae* with five to nine teeth (cf. Asakura, 2001: fig. 22C); (3) the merus of the left cheliped is armed with a dorsodistal spine in *C. latus*, new species (Fig. 11A), while unarmed in *C. haigae* (cf. Asakura, 2001: fig 31K); (4) the dorsal margin of each dactylus of the pereopods 2 and 3 is furnished with a row of closely spaced minute setae in the proximal part in *C. latus*, new species (Fig. 12A, D), but such minute setae are not seen in *C. haigae* (cf. Asakura, 2001: fig. 36C); (5) the ambulatory propodi are each provided with a short row of setae on the distal part of the ventral margin in *C. latus*, new species (Fig. 12A, D), whereas such setae are not seen on any pereopod in *C. haigae* (cf. Asakura, 2001: fig. 38C); (6) the meri of the pereopods 2 and 3 are devoid of dorsodistal spines in *C. latus*, new species (Fig. 12B, E), rather than armed each with a dorsodistal spine in *C. haigae* (cf. Asakura, 2001: fig. 40I); (7) the thoracic sternite 6 is simply subrectangular in *C. latus*, new species (Fig. 9F), whereas it is bilobed in *C. haigae* (cf. Asakura, 2001: fig. 8E). Of the above characters, the possession of the setal row on the ambulatory propodi might be unique within *Catapagurus* to *C. latus*, new species.

Etymology. The Latin *latus* (= broad) refers to the broadly blade-shaped dactyli of the ambulatory legs of the new species.

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