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FURTHER RECORDS OF DEEP-SEA SHRIMPS OF THE GENUS *GLYPHOCRANGON* A. MILNE-EDWARDS, 1881 (CRUSTACEA: DECAPODA: CARIDEA) FROM THE PHILIPPINES, WITH DESCRIPTIONS OF THREE NEW SPECIES

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***ABSTRACT*. –** The deep-water shrimps of the genus *Glyphocrangon* A. Milne-Edwards, 1881, collected from recent deep-sea expeditions in the Philippines, i.e., the 1995 FAO Western Central Pacific Species Identification Guide Workshop (east of Luzon), PANGLAO 2005 (around the Bohol Sea) and AURORA 2007 (east of Luzon), contains 13 species: *G. chacei* Komai, 2004; *G. faxoni* De Man, 1918; *G. formosana* Komai, 2004; *G. grandis*, new species; *G. hakuhoae* Takeda & Hanamura, 1994; *G. isos*, new species; *G. panglao*, new species; *G. proxima* Komai, 2004; *G. pugnax* De Man, 1918; *G. richeri* Komai, 2004; *G. robusta* Komai, 2004; *G. spinossisima* Brand & Takeda, 1996; and *G. unguiculata* Wood-Mason, 1891. Four species, *G. faxoni*, *G. formosana*, *G. hakuhoae* and *G. richeri*, are recorded for the first time from the Philippines. Affinities of the three new species are discussed and colour photographs are provided for all the 13 species.

***KEY WORDS*. –** Crustacea, Decapoda, Caridea, Glyphocrangonidae, *Glyphocrangon*, Philippines, new species, new records, endemism.

INTRODUCTION

The regional fauna of the deep-sea shrimp genus *Glyphocrangon* A. Milne-Edwards, 1881 in the Philippines is fairly well documented (Chace, 1984; Brand & Takeda, 1996; Komai, 2004). The following 12 species are known from the region: *G. albatrossae* Komai, 2004, *G. caecescens* Wood-Mason & Alcock, 1891, *G. chacei* Komai, 2004, *G. indonesiensis* Komai, 2004, *G. longipes* Komai, 2004, *G. parva* Komai, 2004, *G. proxima* Komai, 2004, *G. pugnax* De Man, 1918, *G. punctata* Komai, 2004, *G. robusta* Komai, 2004, *G. spinossisima* Brand & Takeda, 1996, and *G. unguiculata* Wood-Mason, 1891. Additionally, Komai (2004) noted that the paratype of *G. stenolepis* Chace, 1984 might represent an undescribed species, because it differs from the holotype from the South China Sea and other additional specimens from the South China Sea and Taiwan in some morphological details. Of them, seven named species are heretofore known only from the Philippines. The real identity of the western Pacific population referred to *G. unguiculata* remains uncertain (Komai, 2004). It was suggested that the glyphocrangonid fauna of the Philippines was characterized by a high degree of endemism.

From recent deep-sea cruises to the Philippines participated by the second author (TYC) in the 1995 FAO Western Central Pacific Species Identification Guide Workshop (only one station with *Glyphocrangon* collected, off Lagonoy Gulf, east of Luzon), and the PANGLAO 2005 (around the Bohol Sea) and AURORA 2007 (east of Luzon) expeditions organized by the Muséum national d'Histoire naturelle, Paris, abundant material of *Glyphocrangon* was obtained. Thirteen species are present in this collection. Surprisingly, even though the Philippine glyphocrangonid fauna was thought to be well sampled by the great "Albatross" and MUSORTOM expeditions, three new species and four new Philippine records are found. These 13 species are: *G. chacei* Komai, 2004, *G. faxoni* De Man, 1918 (new record), *G. formosana* Komai, 2004 (new record), *G. grandis*, new species, *G. hakuhoae* Takeda & Hanamura, 1994 (new record), *G. isos*, new species, *G. panglao*, new species, *G. proxima*, *G. pugnax*, *G. richeri* Komai, 2004 (new record), *G. robusta*, *G. spinossisima* and *G. unguiculata*. All of them have colour photographs of fresh specimens, and therefore, all but *G. formosana* and *G. pugnax* have their colouration known for the first time.

Specimens examined in this study are deposited in the following institutions: National Museum, Manila (NMCR), National Taiwan Ocean University, Keelung (NTOU) and Natural History Museum and Institute, Chiba (CBM). In the lists of material examined the capital letters preceding the station numbers refer to the gear used: CC, otter trawl; and CP, beam trawl. Other abbreviations used are: cl, postorbital carapace length; and ovig., ovigerous. Terminology and measurements generally follow Komai (2004). A pointed projection not articulated basally is referred to as a tooth, whereas a pointed rigid projection movably attached with a distinct basal suture is referred to as a spine.

SYSTEMATIC ACCOUNT

Glyphocrangon spinicauda species group

Glyphocrangon chacei Komai, 2004
(Fig. 12A1, A2)

Glyphocrangon faxoni – Chace, 1984: 10 (in part); Brand & Takeda, 1996: 276, Fig. 5A.
Glyphocrangon chacei Komai, 2004: 534, Figs. 73, 74, 119 (type locality: between Bohol and Siquijor Island, Mindanao Sea, 719 m).

Material examined. – PANGLAO 2005 Expedition – NTOU, 1 male (cl 8.7 mm), 8°49.9'N 123°34.9'E, PANGLAO 2005, stn CP 2359, 437–443 m, 26 May 2005.

Colouration. – Body and appendages generally pink, darker tint on pleon, particularly conspicuous on posterodorsal margins of fifth and sixth pleonal somite. Cornea pale brown.

Distribution. – So far known only from the Philippines, Sulu Sea, Mindanao Sea, and Bohol Sea, at depths of 437–719 m.

Remarks. – This species closely resembles *G. faxoni*, now recorded also from the Philippines. Komai (2004) argued that there were morphological differences between the two species. The present male specimen closely agrees *G. chacei*, particularly in the rostrum being longer than the carapace and the acuminate posterior division of the anterior fourth carina on the carapace. It is confirmed that the colouration in life also differs between the two species. In *G. chacei*, the body is generally pink without distinct markings, while in *G. faxoni*, the body is generally light brown, with the third pleonal somite being distinctly darker.

Glyphocrangon faxoni De Man, 1918
(Fig. 12B1–B3)

Glyphocrangon (*Plastacrangon*) *faxoni* De Man, 1918: 298 (in part) (type locality: SE of Selat Roti, Indonesia, 520 m); 1920: 243 (in part), Pl. 20, Fig. 62a–c.
Glyphocrangon faxoni – Chace, 1984: 10 (in part); Komai, 2004: 530, Figs. 71, 72, 119.
Not *Glyphocrangon faxoni* – Brand & Takeda, 1996: 276, Fig. 5A.
= *Glyphocrangon chacei* Komai, 2004.

Material examined. – AURORA 2007 Expedition – NTOU, 17 females (cl 10.0–14.3 mm), 4 ovig. females (cl 12.6–13.3 mm), 13 males (cl 9.8–13.7 mm), 15°59'N 121°51'E, 431–422 m, stn CP 2658, 20 May 2007; NTOU, 1 female (cl 10.4 mm), 1 male (cl 10.1 mm), 15°57'N 121°50'E, 480–460 m, stn CP 2659, 20 May 2007; NTOU, 1 female (cl 10.9 mm), 14°50'N 121°48'E, 218–209 m, stn CP 2669, 22 May 2007; NTOU, 2 ovig. females (cl 12.3, 13.2 mm), 2 males (cl 12.7, 14.0 mm), 14°47'N 123°10'E, 507–540 m, stn CP 2678, 23 May 2007; NTOU, 1 female (cl 10.3 mm), 5 ovig. females (cl 12.9–14.2 mm), 15°46'N 121°11'E, 500–524 m, stn CC 2700, 27 May 2007; NTOU, 1 female (cl 10.4 mm), 15°59'N 121°50'E, 456–418 m, stn CC 2744, 2 Jun.2007; NTOU, 1 male (cl 12.4 mm), 15°58'N 121°51'E, 469–364 m, stn CC 2745, 2 Jun.2007.

Colouration. – Generally light brown; cluster of white dots often present on postorbital, hepatic and branchial regions, and three large white patches occasionally also present on posterior part of carapace immediately behind cervical groove. Tips of rostrum and antennal scale reddish. Third and sometimes also second pleonal somites tinged with reddish brown on terga, middorsal carina and posterodorsal margin on third dark reddish-brown; pleuron of fourth somite also tinged with reddish-brown; carinae and tubercles on fifth and sixth somites also reddish-brown. Cornea pale brown. Third maxilliped to fifth pereopod generally whitish translucent. Eggs blue.

Distribution. – Previously known from Indonesia and Northwestern Australia, 364–551 m (Komai, 2004). The present material extends the known geographical range of this species to the Philippines.

Remarks. – The present specimens from off eastern coast of Luzon agree very well with specimens from Indonesia and Northwestern Australia reported by Komai (2004).

Glyphocrangon formosana Komai, 2004
(Fig. 12C1, C2)

Glyphocrangon formosana Komai, 2004: 594, Figs. 108, 109E–H, 122 (type locality: Yilan County, NE Taiwan).

Material examined. RV "Fisheries Researcher 1" – NTOU, 1 ovig. female (cl 25.0 mm), 13°21.32'N 124°12.26'E, 1037–1100 m, stn PH1-05-95, 30 m otter trawl, 24 Sep.1995. – AURORA Expedition – NTOU, 1 ovig. female (cl 23.3 mm), 14°47'N 123°10'E, 507–540 m, stn CP 2678, 23 May 2007; NTOU, 1 female (cl 11.0 mm) 1 female (cl 11.0 mm), 15°58'N 121°51'E, 469–364 m, stn CC 2745, 2 Jun.2007; NTOU, 1 male (cl 21.9 mm), 15°54'N 121°52'E, 538–518 m, stn CP 2750, 2 Jun.2007.

Colouration. – Generally agreeing with description of Komai (2004).

Distribution. – Previously known from Okinawa Trough in the East China Sea and northeastern Taiwan, 300–540 m (Komai, 2004). The present specimen extends the geographical range of this species to the northern part of the Philippines.

***Remarks*. –** Four species assigned to the *Glyphocrangon holthuisi* species complex, i.e., *G. confusa* Komai, 2004 from Indonesia and Northwestern Australian Shelf, *G. formosana* Komai, 2004 from the East China Sea and Taiwan, *G. similior* Komai, 2004 from the southwestern Pacific, and *G. rubricinctuta* Komai, 2004 from Wallis and Futuna Islands, are very similar with each other. These four species can be distinguished by subtle, sometimes variable, morphological characters and colouration in life (Komai, 2004). The present specimen agrees with *G. formosana* in the following features: the intercarinal tubercles on the carapace are relatively large and clearly delineated; the posterior third carina of the carapace terminates anteriorly in a small acute tooth; the dorsolateral carina on the first pleonal somite is sharply pointed; and the antennal scale is devoid of short pubescence on the dorsal surface. The fresh colouration also agrees with the type series from Taiwan.

The small female specimen from AURORA stn CC 2745 (cl 11.0 mm) differs from adult specimens in less conspicuous, less numerous intercarinal tubercles on the carapace and the more conspicuous anterior tooth of the posterior third carina of the carapace. These differences could be attributed to ontogenetic change, like in other congenerics.

***Glyphocrangon grandis,* new species**
(Figs. 1–5, 12D)

***Material examined*. –** Holotype: NMCR 27060, ovig. female (cl 43.0 mm), 13°21.32'N 124°12.26'E, 1037–1100 m, RV "Fisheries Researcher 1", stn PH1-05-95, 30 m otter trawl, 24 Sep.1995.

Description. **–** Body (Fig. 1) relatively robust. Integument of carapace and abdomen naked on surface.

Rostrum (Fig. 2A, B) relatively broad, tip broken, preserved part 0.52 of carapace length, slightly upturned distally, deepest at base; armed with 2 pairs of relatively large, sharp teeth on strongly raised dorsolateral ridges; middorsal carina obsolete in posterior half, becoming distinct in anterior half; dorsal surface smooth; dorsolateral ridge between lateral teeth not sharply edged; ventral surface (Fig. 4A) with shallow median groove becoming narrower and deeper posteriorly, flanked by ventrolateral carinae; midventral carina apparently absent.

Carapace (Figs. 2A, B) with greatest width across tips of anterior division of anterior fourth (lateral) carinae; carinae and tubercles finely eroded on margins or surfaces; prominent tubercles present on intercarinal spaces, most tubercles bluntly or subacutely pointed, strongly compressed, also with few mixed conical or spiniform tubercles. First (submedian) carina (Fig. 4B) composed of high, forwardly directed,

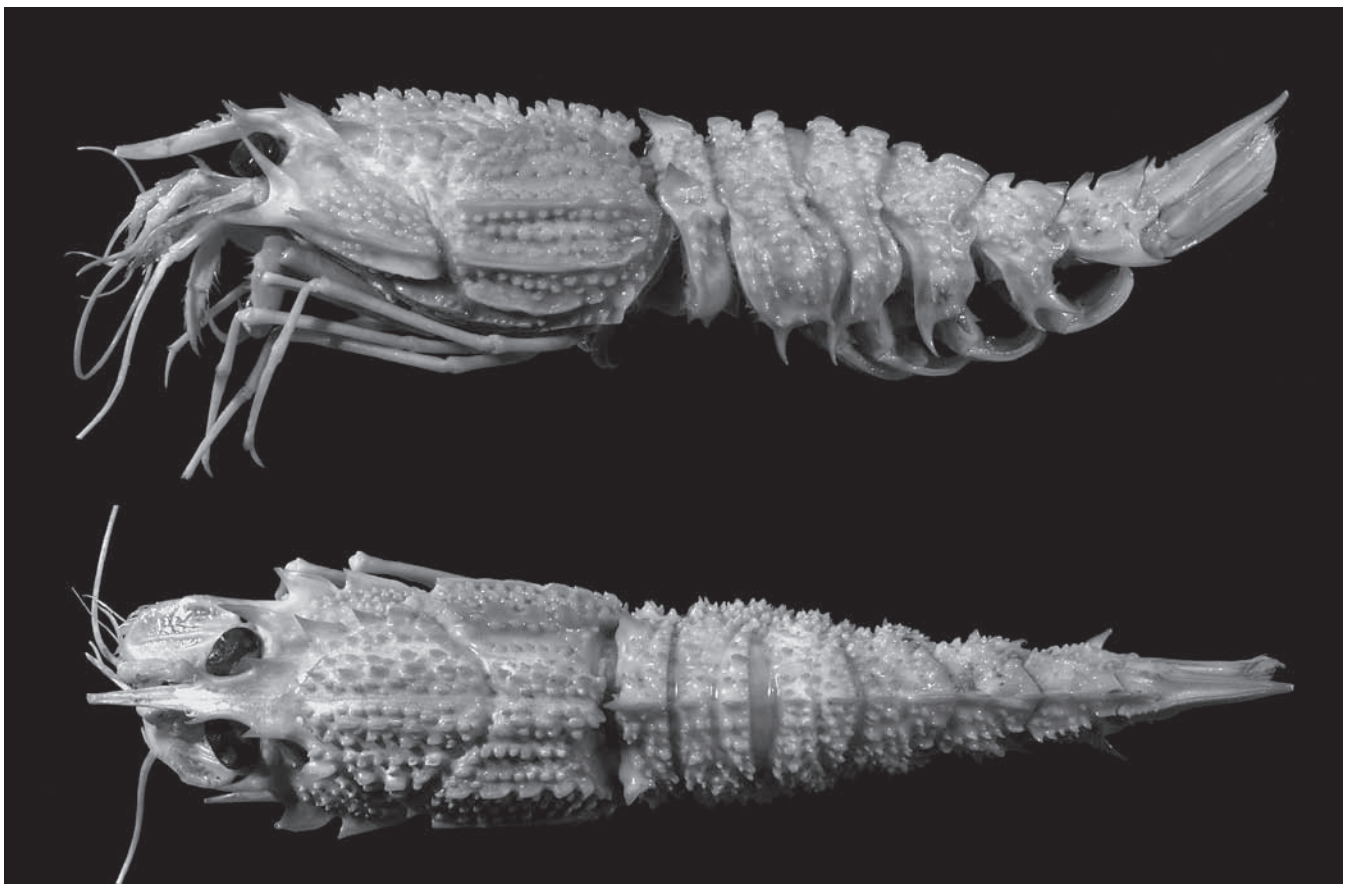

Fig. 1. *Glyphocrangon grandis*, new species. Holotype, ovig. female (cl 43.0 mm), NMCR 27060, R/V "Fisheries Researcher 1", stn PH1-05-95, habitus in dorsal and lateral views.

blunt or subacute teeth, 6 on anterior section, 5 on posterior section, posterior end of carina overhanging posterodorsal margin of carapace. Anterior second (intermediate) carina (Fig. 4C) composed of 4 compressed teeth increasing in size anteriorly, anteriormost tooth prominent, acuminate, other 3 teeth subacute or blunt; posterior second carina weakly convex in lateral view, composed of 5 large teeth, anterior 3 teeth broader but blunt, posterior 2 subacute. Anterior third (antennal) carina confined to antennal spine; posterior third carina (Fig. 4E) high, parallel to plane of dorsal margin of carapace, faintly lobed except for 1 prominent posterior tubercle; anterior end of posterior third carina angular.

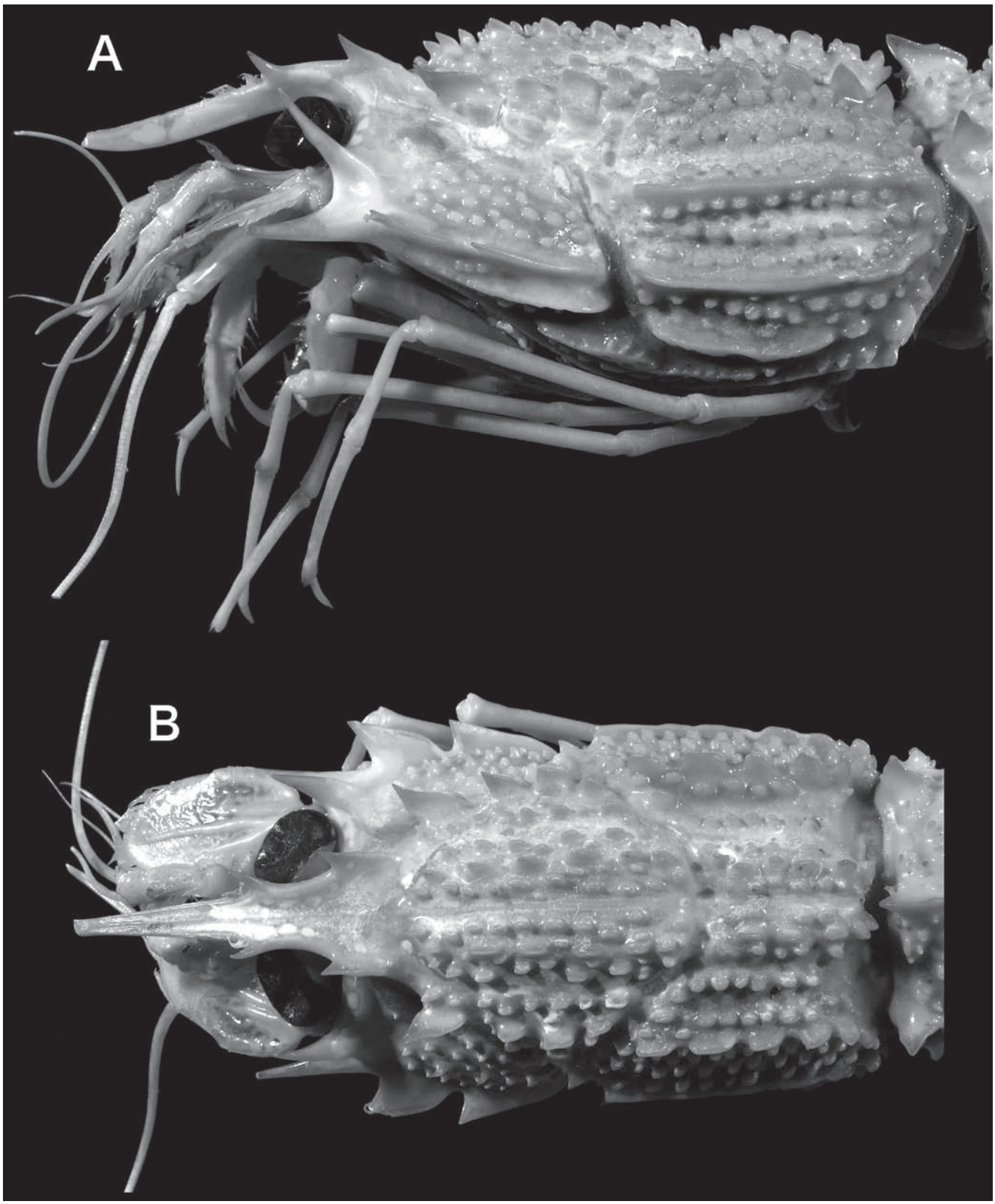

Fig. 2. *Glyphocrangon grandis*, new species. Holotype, ovig. female (cl 43.0 mm), NMCR 27060, RV "Fisheries Researcher 1", stn PH1-05-95, cephalothorax and appendages: lateral (A) and dorsal (B) views.

Anterior fourth (lateral) carina (Fig. 4F) strongly compressed vertically, divided in 2 large acute teeth separated by deep U-shaped notch; anterior tooth not reaching level of orbital margin, distance between tips greater than distance between anterior ends of posterior third carinae; posterior fourth carina (Fig. 4F) high, nearly smooth in anterior 0.75, divided in 3 tubercles in posterior 0.3, terminating anteriorly in acute tooth somewhat directed laterally. Anterior fifth (sublateral) carina (Fig. 4F) high, sharply defined, margin roughly eroded; posterior fifth carina also high, sharply defined, followed by 1 dentiform tubercle. Sixth (submarginal) carina (Fig. 4F) showing as broad elevation, surface roughly eroded. Submarginal posteroventral ridge composed of 4 tooth-like prominences. Orbital margin weakly elevated, with shallow sulcus. Postorbital region with 1 very small tubercle. Median part with small anteromedian tubercle and irregular row of tubercles along each first carina on both anterior and posterior sections. Lateral part of gastric region with 2 rows of tubercles between first and second carinae; space between second carina and lateral groove with scattered tubercles. Posterior dorsolateral region with about 20 tubercles arranged in 2 rows. Hepatic region (Fig. 4G) with upper part slightly convex, with about 30 small tubercles, some of them spiniform; lower part concave, with few tubercles. Branchial region with upper part bearing about 40 scattered tubercles (Fig. 4E); middle part with about 35 tubercles arranged in 3 longitudinal rows; lower part with about 15 tubercles. Subbranchial region (Fig. 4F) with space between anterior fifth and sixth carinae with longitudinal row of 5 tubercles; space between sixth and seventh (marginal) carinae moderately broad with crenulate longitudinal ridge. Antennal tooth long, directed anterodorsally (angle against horizontal plane of carapace about 50°), slightly curved mesially, without accessory tubercle basally. Branchiostegal tooth partially visible in dorsal view, slightly diverging, slightly exceeding antennal tooth, reaching nearly to midlength of antennal scale; lateral face with 1 faint ridge, not in contact with anterior fourth carina. Posterolateral corner produced in bluntly triangular projection.

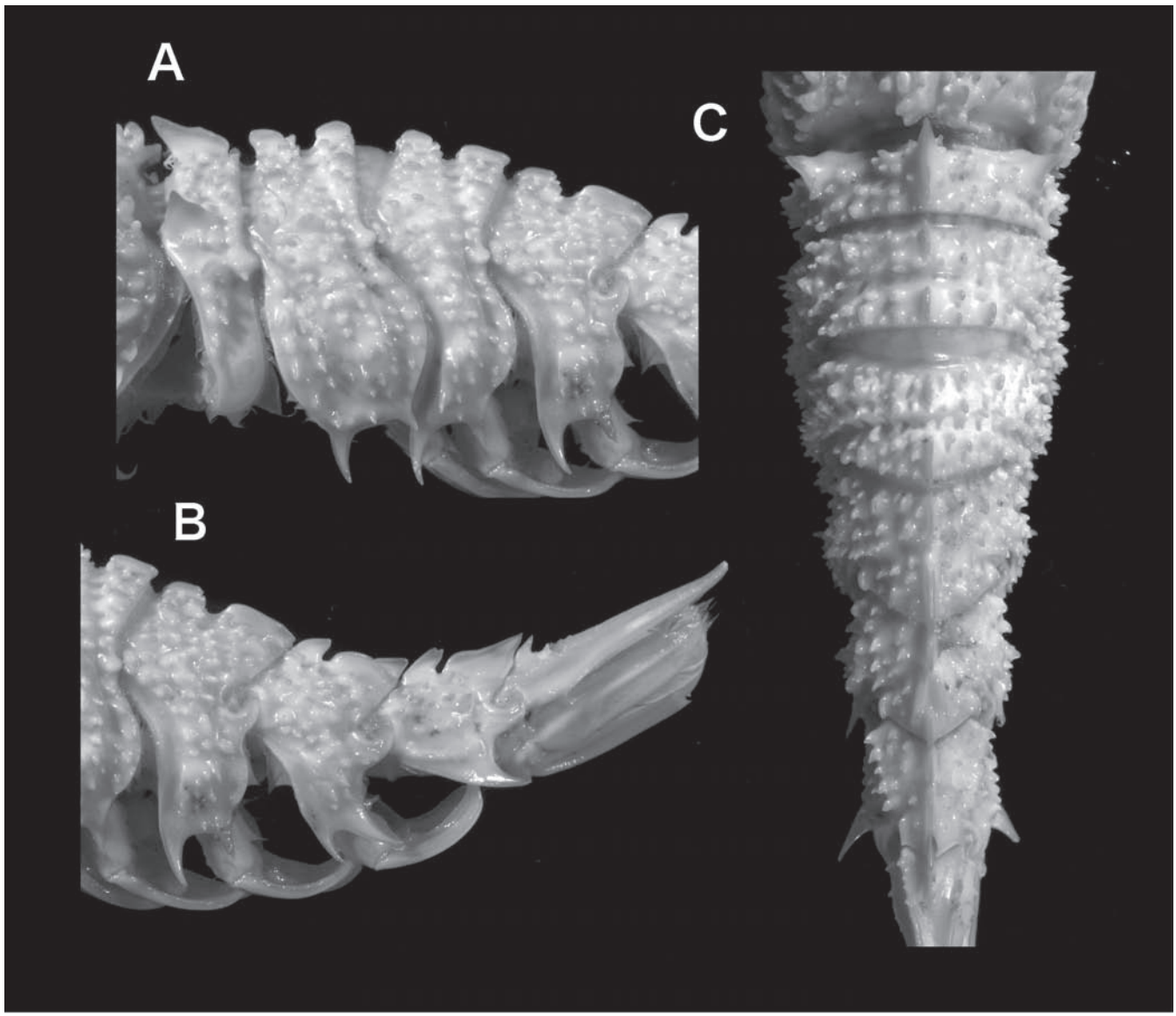

Fig. 3. *Glyphocrangon grandis*, new species. Holotype, ovig. female (cl 43.0 mm), NMCR 27060, RV "Fisheries Researcher 1", stn PH1-05-95, pleon: A, first to fourth somites, lateral view; B, fourth somite to telson, lateral view; C, entire pleon, dorsal view.

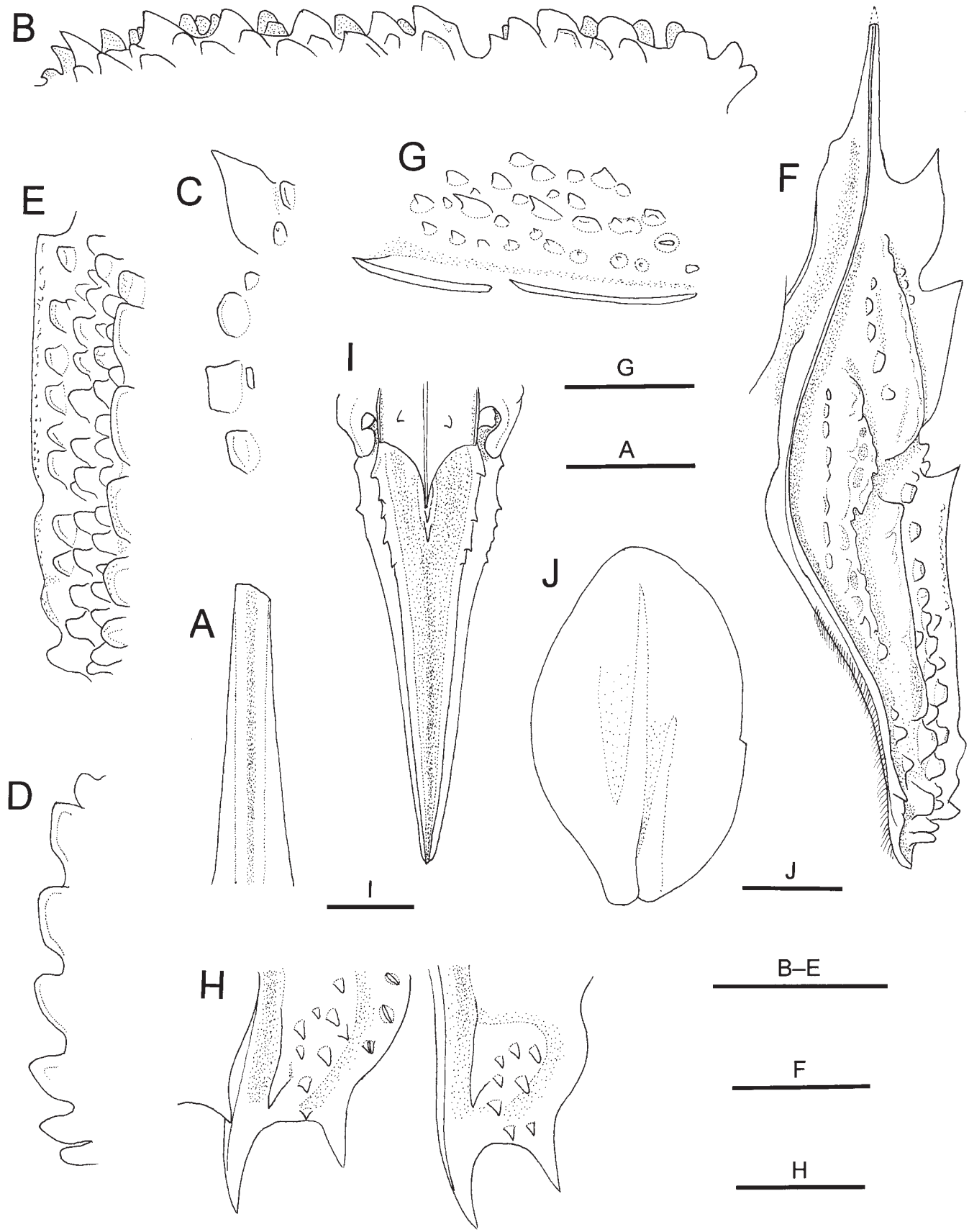

Fig. 4. *Glyphocrangon grandis*, new species. Holotype, ovig. female (cl 43.0 mm), NMCR 27060, R/V "Fisheries Researcher 1", stn PH1-05-95: A. distal part of rostrum, ventral view; B, first carina and adjacent tubercles on carapace, lateral view; C, anterior second carina, dorsal view; D, posterior second carina, obliquely dorsal view; E, intercarinal tubercles between posterior second and third carinae, dorsal view; F, ventrolateral part of carapace, obliquely ventral view; G, tubercles on upper part of hepatic region, lateral view; H, pleura of third and fourth pleonal somites, lateral view; I, telson, dorsal view; J, right antennal scale, dorsal view. Scale bars: F = 10 mm; A–E, G–J = 5 mm.

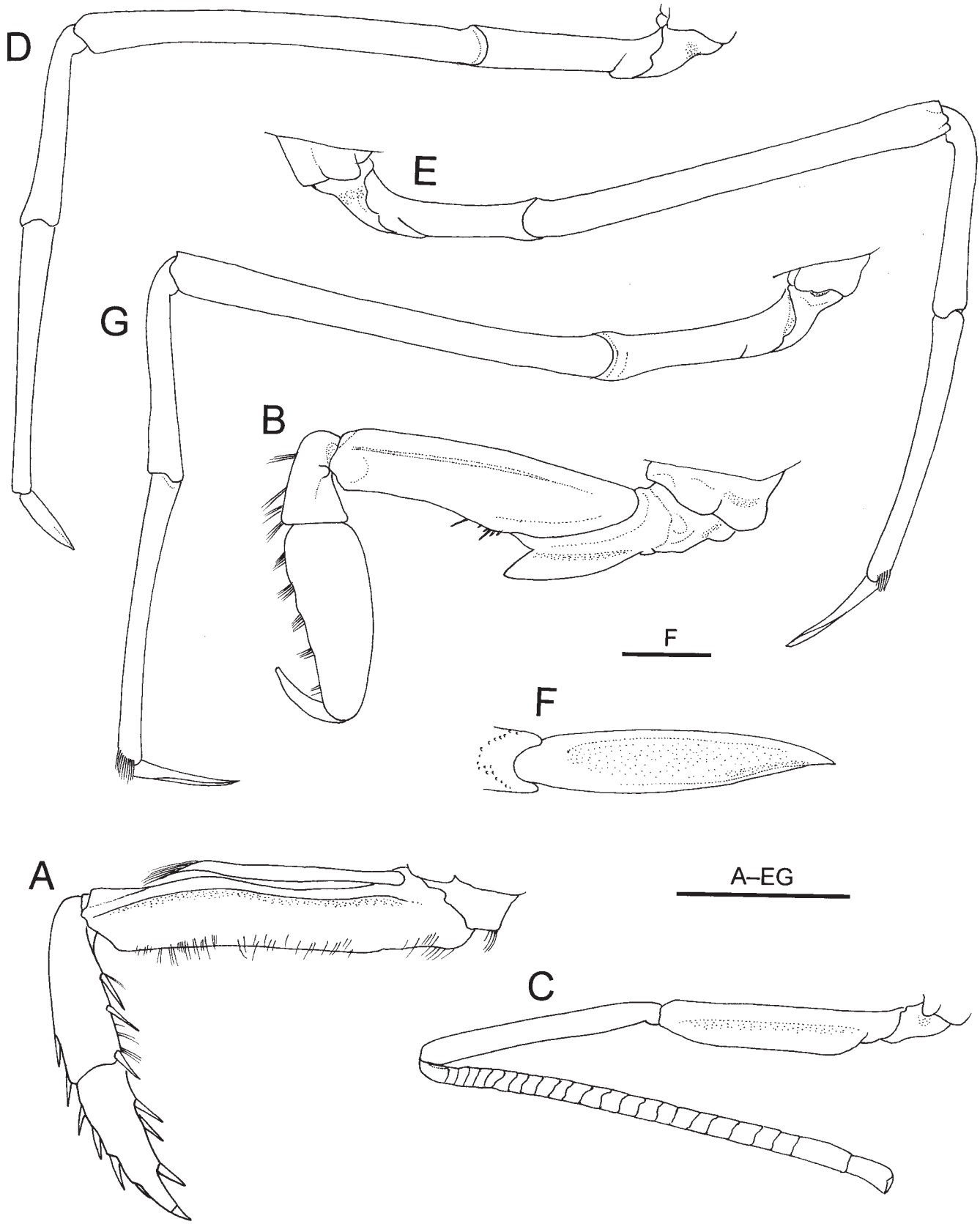

Fig. 5. *Glyphocrangon grandis*, new species. Holotype, ovig. female (cl 43.0 mm), NMCR 27060, R/V "Fisheries Researcher 1", stn PH1-05-95. A, third maxilliped, lateral view; B, first pereopod, lateral view; C, second pereopod, lateral view; D, third pereopod, lateral view; E, fourth pereopod, lateral view; F, dactylus of fourth pereopod, dorsal view; G, fifth pereopod, lateral view. Scale bars: A–E, G = 10 mm; F = 2 mm.

Pleon (Fig. 3A–C) covered with numerous prominent tubercles, most tubercles elongate subconical with blunt apices; major carinae high, strongly compressed laterally in general, with sharp edges; grooves and depressions generally deep. First pleonal somite with median elevation defined by deep surrounding groove, bearing some small tubercles on either side of median carina; median carina not reaching posterodorsal margin of somite, terminating anterodorsally in large, acute tooth; posterior end of median carina abruptly truncate. Dorsolateral carina showing strong triangular tooth directed anterodorsally; dorsal margin with minute tubercle at posterior end. Lateral carina composed of 2 subconical tubercles, both blunt at tip. Pleuron with posterior depression abruptly delimited; anteroventral corner slightly produced, bluntly pointed.

Second to fourth pleonal somites with median carinae each deeply divided in 2 sections by U-shaped notch, none of them acuminate; posterior transverse grooves on tergites deep; dorsolateral carinae high, but none acuminate. Ventral lobe of pleural elevation on second somite with small spiniform tubercles; anterior ridges of ventral lobes of pleural elevations on third and fourth somites each terminating ventrally in acute spine (Fig. 4H); ventral teeth on each somite greatly unequal (anterior teeth distinctly longer than posterior tooth), both acuminate. Anteroventral margin of second somite broadly rounded.

Fifth pleonal somite with both sections of median carina forming triangular teeth directed posterodorsally. Most tubercles laterally compressed. Anterior and posterior submedian carinae highly crested, former subrectangular, latter not reaching posterodorsal margin of somite. Pleuron with 2 long, acute ventral teeth, posterior tooth longer than anterior tooth.

Sixth pleonal somite with highly crested median carina noticeably becoming higher posteriorly, divided in 2 sections by deep, U-shaped notch; anterior section of median carina terminally bifid, with nearly straight dorsal margin; posterior section of median carina terminating posteriorly in acute triangular tooth, with faintly sinuous dorsal margin. Lateral carina composed of 5 strongly compressed, acute teeth. Pleuron generally concave; lateroventral carina tuberculate; posterolateral tooth strong, supported by distinct carina.

Telson (Figs. 3B, 4I) about 0.7 of carapace length; anterior projection strongly compressed laterally, unequally bifurcate; dorsolateral carina high, with some tiny tubercles in anterior 0.30; ventrolateral carina also with tiny tubercles in anterior 0.30.

Cornea (Fig. 2A, B) moderately large, darkly pigmented in preservative; ocular peduncle with small process anteromesially.

Antennular peduncle (Fig. 2A, B) reaching distal margin of antennal scale; second segment about 2.4 times longer than wide; aesthetasc-bearing portion of outer flagellum about 0.35 times as long as carapace. Antennal scale (Figs. 2A, B, 4J) oval, about 0.40 times as long as carapace, about 1.70 times longer than wide; dorsal surface naked, with blunt longitudinal ridges; lateral margin convex, with trace of lateral tooth arising at 0.45 of length of antennal scale. Carpocerite falling short of distal margin of scaphocerite.

Third maxilliped (Fig. 5A) overreaching distal margin of antennal scale by 0.80 length of ultimate segment; marginal spines on distal 2 segments moderately slender; antepenultimate segment with distinct dorsolateral ridge.

First pereopod (Fig. 5B) moderately stout; palm naked on lateral surface; merus with weak longitudinal ridge on lateral surface dorsally; ischium with prominent, acuminate ventral lobe. Second pereopods (Fig. 5C) subequal, both not reaching distal margin of antennal scale; left chela slightly larger than right chela; left carpus composed of 24 articles, right carpus composed of 27 articles. Posterior 3 pairs of pereopods moderately long and slender for genus. Third pereopod (Fig. 5D) overreaching distal margin of antennal scale by nearly full length of propodus; dactylus compressed laterally, 0.38 of propodal length; propodus slightly tapering distally. Fourth pereopod (Fig. 5E) overreaching distal margin of scaphocerite by 0.20 length of propodus; dactylus (Fig. 5F) depressed dorsoventrally, subspatulate, about 0.42 of propodal length, terminating in simple, acuminate unguis; dorsal surface shallowly concave, lacking short submedian groove or row of very short setae. Fifth pereopod (Fig. 5G) overreaching distal margin of antennal scale by length of dactylus; dactylus 0.28 of propodal length, generally similar to that of fourth pereopod in structure.

Gill formula typical of *Glyphocrangon spinicauda* group (cf. Komai, 2004), arthrobranchiae present above bases of first and second pereopods.

Egg size about 4.3 × 3.3 mm.

***Colouration*. –** Body and appendages generally crimson. Gastric region, upper part of hepatic region, and anterior groove on carapace, and tergites of second and third pleonal somites whitish. Cornea dark brown. Eggs in non-eyed stage are white.

***Distribution*. –** Known with certainty only from off Lagonoy Gulf, east of Luzon, the Philippines, at depths of 1,037–1,100 m.

***Remarks*. –** This new species is morphologically most similar to *Glyphocrangon major* Komai, 2004 from Indonesia. Shared characters include the presence of prominent tubercles on the intercarinal spaces on the carapace and the pleon, the deeply divided anterior fourth carina on the carapace, and the prominent median carinae on the pleonal tergites. However, *G. grandis* can be differentiated from *G. major* by the presence of a sharp anterior tooth of the posterior fourth carina on the carapace and the anterior vertical ridges on the third and fourth pleonal somites each terminating ventrally in sharp spine. In *G. major*, the posterior fourth carina terminates anteriorly in a blunt point; and the anterior vertical ridges

on the third and fourth pleonal somites terminate ventrally in blunt tubercles. Furthermore, tubercles covering the pleon are more sharply pointed in *G. grandis* than in *G. major*.

Glyphocrangon grandis is also similar to *G. ferox* Komai, 2004 from Madagascar, *G. speciosa* Komai, 2004 from New Caledonia, and *G. arduus* Komai, 2007 from the Austral Islands, French Polynesia, but the lack of a sharp tooth at the anterior end of the posterior third carina of the carapace immediately distinguish the new species from the latter three species.

One small juvenile specimen from AURORA station CC 2740 (NTOU, cl 11.8 mm; 15°04'N 123°09'E, 1,347–1,392 m, 27 May.2007) might represent the present new species, considering the proximity of the sampling locations. As Komai (2004) indicated, many important diagnostic characters remain undifferentiated in juveniles or subadult specimens of *Glyphocrangon* species, and thus definite identification without good series of specimens of various size is difficult.

Etymology. **–** From the Latin *grandis*, meaning large, in reference to the large size of this new species.

Glyphocrangon hakuhoae Takeda & Hanamura, 1994
(Fig. 13A1, A2)

Glyphocrangon (*Plastacrangon*) *faxoni* De Man, 1918: 298 (in part); De Man, 1920: 243 (in part).
Glyphocrangon hakuhoae Takeda & Hanamura, 1994: 24, Figs. 11–13 (type locality: S of Celebes, Flores Sea, Indonesia, 280 m); Brand & Takeda, 1996: 270 (in part), Fig. 5B, C.

Material examined. **–** AURORA 2007 Expedition – NTOU, 1 female (cl 11.3 mm), 16°01'N 121°53'E, 358–342 m, stn CP 2657, 20 May.2007; NTOU, 1 female (cl 11.5 mm), 11 males (cl 7.8–10.7 mm), 14°46'N 123°39'E, 367–357 m, stn CP 2695, 26 May.2007.

Colouration. **–** Body generally brownish, darker in dorsal side; numerous white dots, often forming irregular reticulate pattern. Rostrum brownish in middle part, otherwise whitish. Median part of gastric region with tint of purple; tubercles or lobes composing first and second carinae whitish; dark brown blotch on cervical groove just anterior to middle part of brachial region. Lateral tubercles on pleon whitish, posterior tip of middorsal carina of sixth somite dark reddish brown. Cornea brownish. Antennular peduncle generally light brown, with dark reddish brown spot on third segment. Antennal scale transparent, lateral margin brownish in distal to lateral tooth. Third maxilliped to fifth pereopod generally whitish, ultimate segment of third maxilliped tinged with brown, meri of fourth and fifth pereopods dark reddish brown in proximal half. Pleopods transparent. Uropods bluish white.

Distribution. **–** Previously known from Indonesia, 210–367 m (Komai, 2004). The present specimens extend the known geographical range of this species to the northern part of the Philippines.

Remarks. **–** The present specimens from off eastern coast of Luzon agree very well with the specimens from Indonesia reported by Komai (2004).

Glyphocrangon panglao, new species
(Figs. 6–8, 13B1, B2)

Glyphocrangon parva Komai, 2004: 412 (in part).

Material examined. **–** Holotype: NMCR 27061, ovig. female (cl 15.6 mm), 8°51'N 123°10'E, 982–1040 m, PANGLAO 2005 Expedition, stn CP 2385, 29 May.2005.

Paratypes: PANGLAO 2005 Expedition – NTOU, 5 females (cl 9.0–11.9 mm), 12 ovig. females (cl 11.5–15.1 mm), 5 males (cl 10.4–12.7 mm), 8°46.2'N 123°16.1'E, 647–613 m, stn CP 2384, 29 May.2005, CBM-ZC 9474, 2 ovig. females (cl 11.5, 13.9 mm), 2 males (cl 11.0, 12.8 mm), same data.

Description. **–** *Females*. Body (Fig. 6) moderately slender. Integument of carapace and abdomen naked.

Rostrum (Figs. 6, 7A, C) relatively slender, 0.80–0.96 (0.90 on average; n=15) times as long as carapace, slightly curved dorsally, deepest at about midlength; armed with 2 pairs of moderately strong teeth on moderately raised dorsolateral ridges; middorsal carina obsolete; dorsal surface smooth; dorsolateral ridge between 2 lateral teeth narrow, bluntly edged, without shallow sulcus; ventral surface (Fig. 7B) with moderately deep median groove, flanked by sharply edged lateral carinae; midventral carina absent.

Carapace (Fig. 6) about 1.5 times longer than wide (greatest point across anterior ends or middle of posterior third (antennal) carinae; carinae and tubercles eroded with small depressions; no conspicuous tubercles or spines on intercarinal spaces. Major carinae relatively low. Anterior first (submedian) carina (Fig. 7D) terminating in small acute tooth anteriorly, further armed with 1 small acute or subacute tooth subdistally, remainder nearly entire; posterior first carina thicker than anterior first carina, entire, terminating anteriorly in acute tooth, posterior end of carina not overhanging posterodorsal margin of carapace. Anterior second (intermediate) carina (Fig. 7D) composed of 3 acute teeth and 1 short, low ridge, anteriormost tooth relatively small; posterior second carina somewhat convex in lateral view, almost smooth. Anterior third (antennal) carina divided in two divisions, anterior division supporting antennal tooth sharp, extending to level of anterior end of anterior fourth (lateral) carina; posterior division short, widely separated from anterior division, terminating anteriorly in acute or subacute tooth; posterior third carina rather thick, nearly parallel to dorsal plane of carapace, entire, terminating anteriorly in obtuse point. Anterior fourth (lateral) carina (Fig. 7E) not vertically compressed or not divided, terminating anteriorly in obtuse point, profile in dorsal view slightly convex; posterior fourth carina thick, parallel to posterior third carina, terminating anteriorly in obtuse angle, followed posterodorsally by few tubercles. Anterior fifth (sublateral) carina (Fig. 7E) moderately broad, surface roughly eroded;

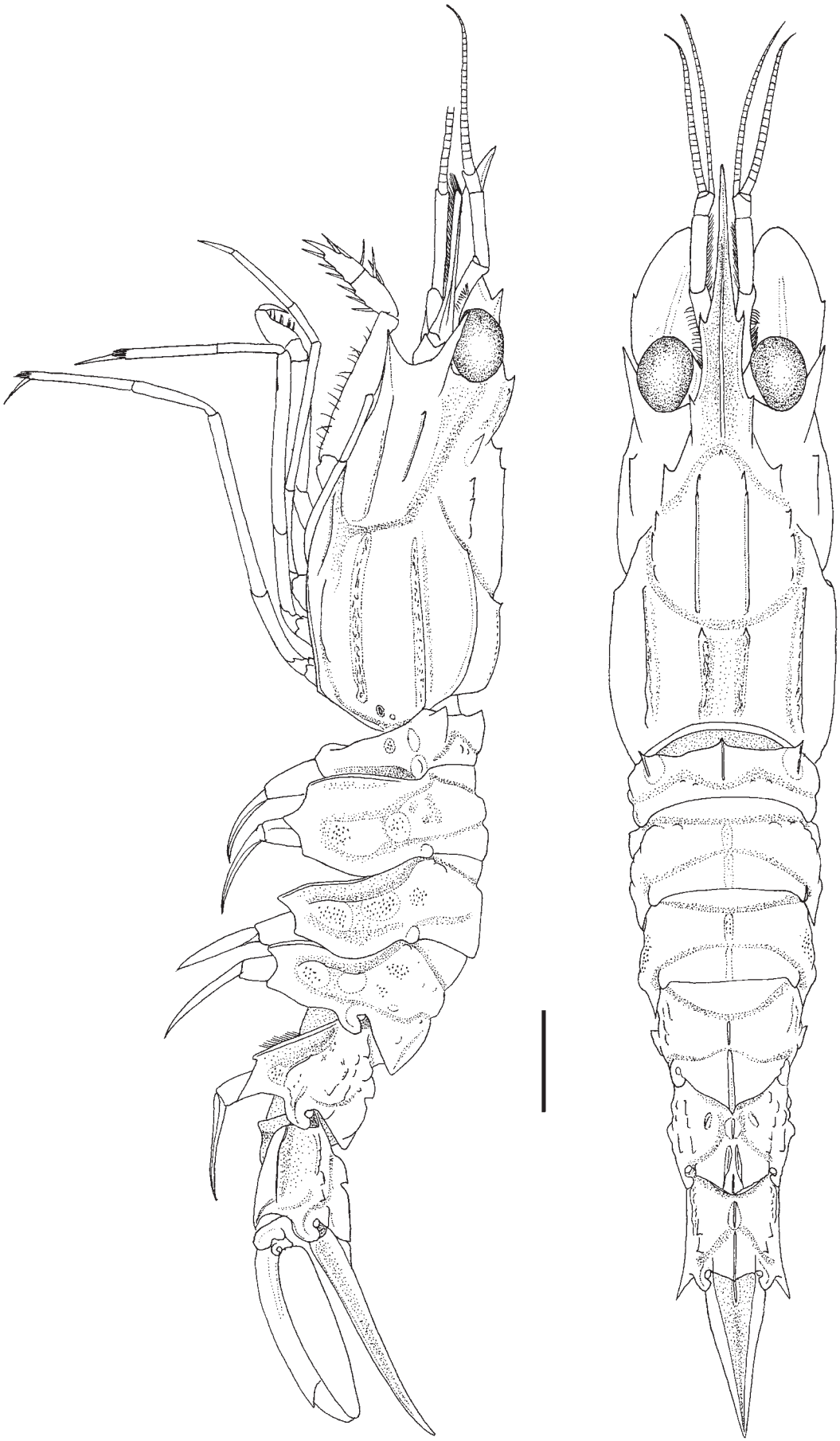

Fig. 6. *Glyphocrangon panglao*, new species. Holotype, ovig. female (cl 15.6 mm), NMCR 27061, PANGLAO 2005 Expedition, stn CP 2385, habitus in dorsal and lateral views. Scale bar = 5 mm.

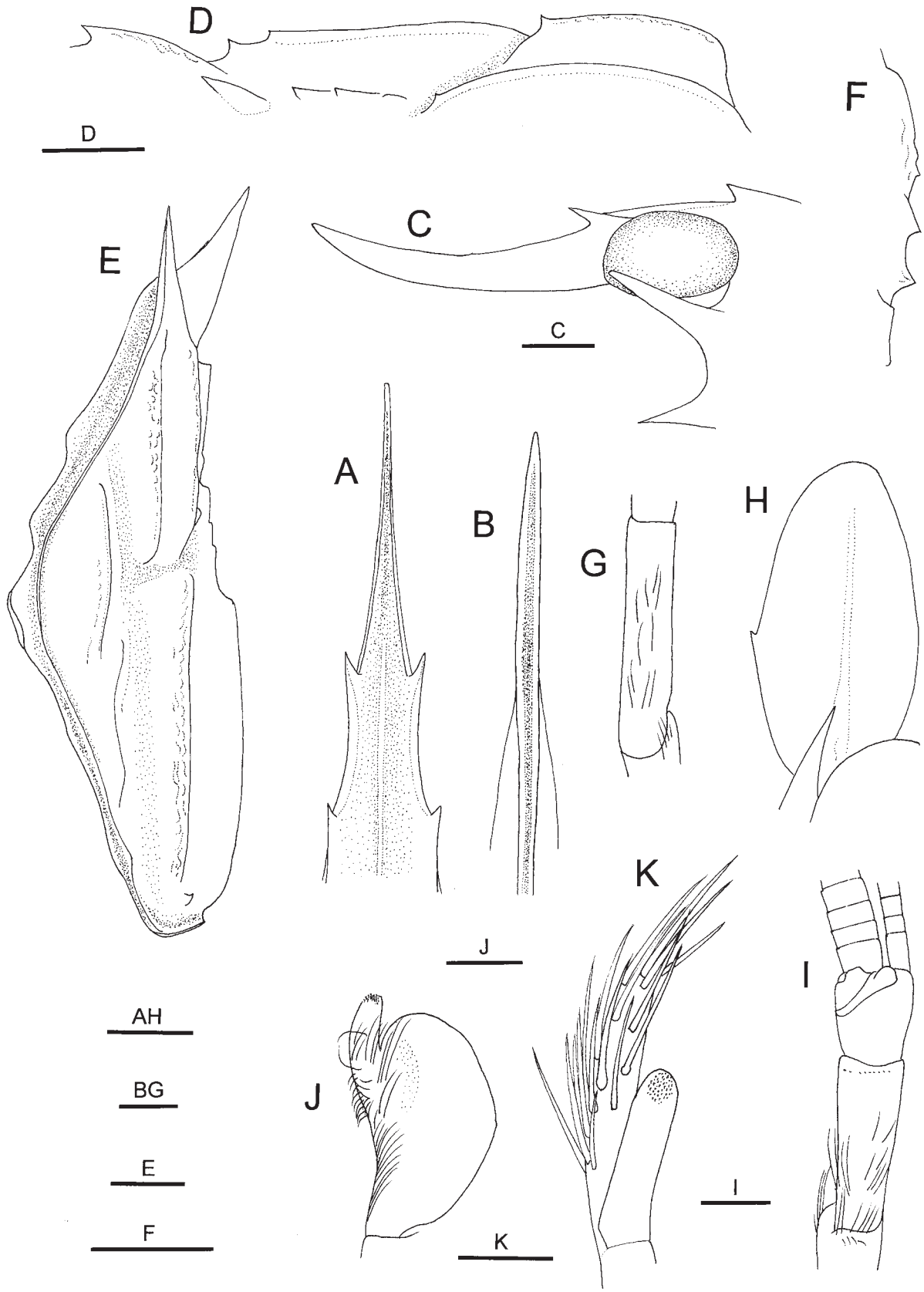

Fig. 7. *Glyphocrangon panglao*, new species. A–H, Holotype, ovig. female (cl 15.6 mm), NMCR 27061, PANGLAO 2005 Expedition, stn CP 2385; I–K, paratype, male (cl 12.8 mm), CBM-ZC 9474, PANGLAO 2005 Expedition, stn CP 2384. A, rostrum, dorsal view; B, distal part of rostrum, ventral view; C, rostrum, anterolateral part of carapace and cornea, lateral view; D, dorsal part of carapace, showing configuration of first and second carina, lateral view; E, ventrolateral part of carapace; F, lateral carina on sixth pleonal somite, right, dorsal view; G, second segment of left antennular peduncle, dorsal view; H, left antennal scale, dorsal view (setae omitted); I, distal two segments of left antennular peduncle; J, endopod of left first pleopod, ventral view; K, appendices interna and masculina of left second pleopod, mesial view. Scale bars: A–F, H = 2 mm; G, I = 1 mm; J, K = 0.5 mm.

posterior fifth carina weak, separated from sixth carina. Sixth (submarginal) carina (Fig. 7E) showing as broad, low elevation, but its surface marked by sharp longitudinal ridge. Submarginal posteroventral ridge absent. Orbital region without submarginal groove. Median part of gastric region with tiny anterior median tubercle. Hepatic region with upper part slightly convex; lower part slightly concave. Antennal tooth moderately strong, slightly diverging in dorsal view, weakly directed dorsally (angle 15–20° against horizontal plane of carapace). Branchiostegal tooth not visible in dorsal view, directed slightly downward in lateral view, not exceeding antennal tooth, slightly overreaching distal margin of antennal basicerite; lateral face with 1 thin ridge in contact with anterior fourth carina. Posterolateral corner forming obtuse angle, slightly flared. Lateral and cervical grooves moderately deep. Lateromarginal groove generally shallow.

Sculpture of pleon weak for genus with relatively low major carinae and shallow grooves or depressions (Fig. 6); no conspicuous tubercles on surface. First pleonal somite with sharply delineated median carina on weakly defined median elevation, not reaching posterodorsal margin of somite, terminating anterodorsally in small, acute tooth; dorsolateral carina moderately high, strongly compressed laterally, terminating anteriorly in acute tooth; pleuron with rounded anteroventral margin. Median carinae on second and third somites blunt, each slightly divided in two sections; that on fourth carina sharply delimited, also divided in 2 sections by shallow notch, terminating posteriorly in blunt or subacute point; dorsolateral carinae on second to fourth somites obsolete; pleural lobes on second to fourth somites pitted; pleural teeth rather broad, none acuminate. Fifth pleonal somite with anterior median carina sharply delimited, forming blunt tooth; posterior median carina produced as blunt triangular projection; anterior submedian carina short, but distinct; posterior submedian carina also distinct, reaching posterodorsal margin of somite, only slightly diverging posteriorly in dorsal view; pleuron with 2 greatly unequal ventral teeth, posterior tooth acute. Sixth somite with sharp median carina, divided in 2 sections by small V-shaped notch, both section smooth marginally; anterior section terminating in small spine, posterior section produced posterodorsally as moderately large, subacute tooth; lateral carina composed of 1 sharp ridge and 2 small acute or subacute tubercles (Fig. 7F); pleuron shallowly concave; lateroventral carina clearly delimited, marginally smooth; posterolateral tooth moderately strong, with sharp carina on surface continuous with lateroventral carina. Telson about 0.8 times as long as carapace; anterior projection not strongly compressed laterally, broadly triangular with blunt apex, without secondary tubercle; dorsolateral and ventrolateral carinae smooth.

Cornea (Figs. 6, 7C) large, maximum diameter 0.20–0.23 of carapace length, pigmented with light yellowish brown; ocular peduncle with small anteromesial process.

Antennular peduncle (Figs. 6, 7G) slender, overreaching distal margin of scaphocerite by length of first segment and 0.10–0.20 of second segment; second segment elongate, 4.5–4.7 times longer than wide; outer flagellum with aesthetasc-bearing portion 0.45–0.50 times as long as carapace. Antennal scale (Figs. 6, 7H) elongate oval, about half length of carapace, 1.9–2.0 times longer than wide; dorsal surface naked; lateral margin weakly convex, with distinct lateral tooth arising from 0.45–0.60 of antennal scale length; carpocerite elongate, reaching or slightly overreaching distal margin of scaphocerite.

Third maxilliped (Fig. 8A) reaching distal margin of scaphocerite; marginal spines on distal 2 segments elongate, slender.

First pereopod (Fig. 8B) moderately stout; palm devoid of pubescence or short setae on lateral face; ventrodistal projection of ischium acuminate. Second pereopods (Fig. 8C) unequal with right longer; left slightly overreaching midlength of scaphocerite, carpus composed of 16–18 articles; right slightly falling short of anterior margin of antennal scale, carpus composed of 20–25 articles. Posterior 3 pairs of pereopods relatively slender. Third pereopod (Fig. 8D) reaching or overreaching anterior margin of scaphocerite by length of dactylus. Fourth pereopod (Fig. 8E) overreaching scaphocerite by half length of dactylus; dactylus (Fig. 8F) 0.50–0.60 times as long as propodus, narrow but subspatulate, terminating in simple, acuminate unguis, dorsal surface slightly concave, with short distolateral groove accompanied by row of curved short setae; carpus 0.7–0.8 times as long as propodus; merus about 14.5–15.5 times longer than wide. Fifth pereopod (Fig. 8G) reaching distal margin of scaphocerite by at most half length of dactylus; dactylus 0.35–0.45 times as long as propodus, generally similar to that of fourth pereopod in structure, but relatively shorter; carpus 0.6–0.8 times as long as propodus.

Egg size 2.00–2.23 × 1.41–1.59 mm.

Males. Generally similar to females except for less acute tubercles on fifth and sixth pleonal somites. Antennular peduncle stouter, second segment about 2.6 times as long as wide (Fig. 7I). Endopod of first pleopod (Fig. 7J) subovate; appendix interna subterminal, distinct, relatively stout. Appendix masculina of second pleopod (Fig. 7K) distinctly longer than appendix interna, slightly curved ventrally, rod-like, bearing numerous spiniform setae in distal half, extending to proximal 0.80 of dorsal margin.

Colouration. **–** Rostrum red. Carapace with anterolateral part including antennal and branchiostegal teeth, hepatic region, and upper and middle parts of branchial region red, remainder whitish translucent. Terga of pleon generally whitish translucent, with tinge of red along each posterodorsal margin; pleura red; telson generally whitish translucent, reddish distally. Cornea dark brown, with reflecting pigment. Antennule, antenna, and third maxillipeds to fifth pereopods all red. Eggs light yellowish-brown.

Distribution. **–** Known only from the Philippines, 613–1,412 m (see Remarks).

Remarks. **–** In the original description of *Glyphocrangon parva*, Komai (2004) noted that the two paratypes from the Sogod Bay at a depth of 1,412 m differed from the holotype collected in the Sulu Sea at a depth of 2,021 m in several minor points. The present specimens from the Bohol Sea agree well with the paratypes of *G. parva*, clarifying that some of the minor differences mentioned by Komai (2004) are of species specific. The new species is distinguished from *G. parva* by the following morphological characters: (1) the first to fourth pleonal somites are nearly smooth in *G. panglao*, whereas there are low but clearly discernible tubercles or elevations on those somites in *G. parva* (see Komai, 2004: fig. 12); (2) the third to fifth pereopods are less slender in *G. panglao* than in *G. parva* (e.g. the merus of the fourth pereopod is 14.5–15.5 times longer than wide in *G. panglao*, about 17.0 times in *G. parva*); and (3) the carpus of the fourth pereopod is proportionally longer in *G. panglao* than in *G. parva* (0.7–0.8 times as long as the propodus versus 0.45 times as long).

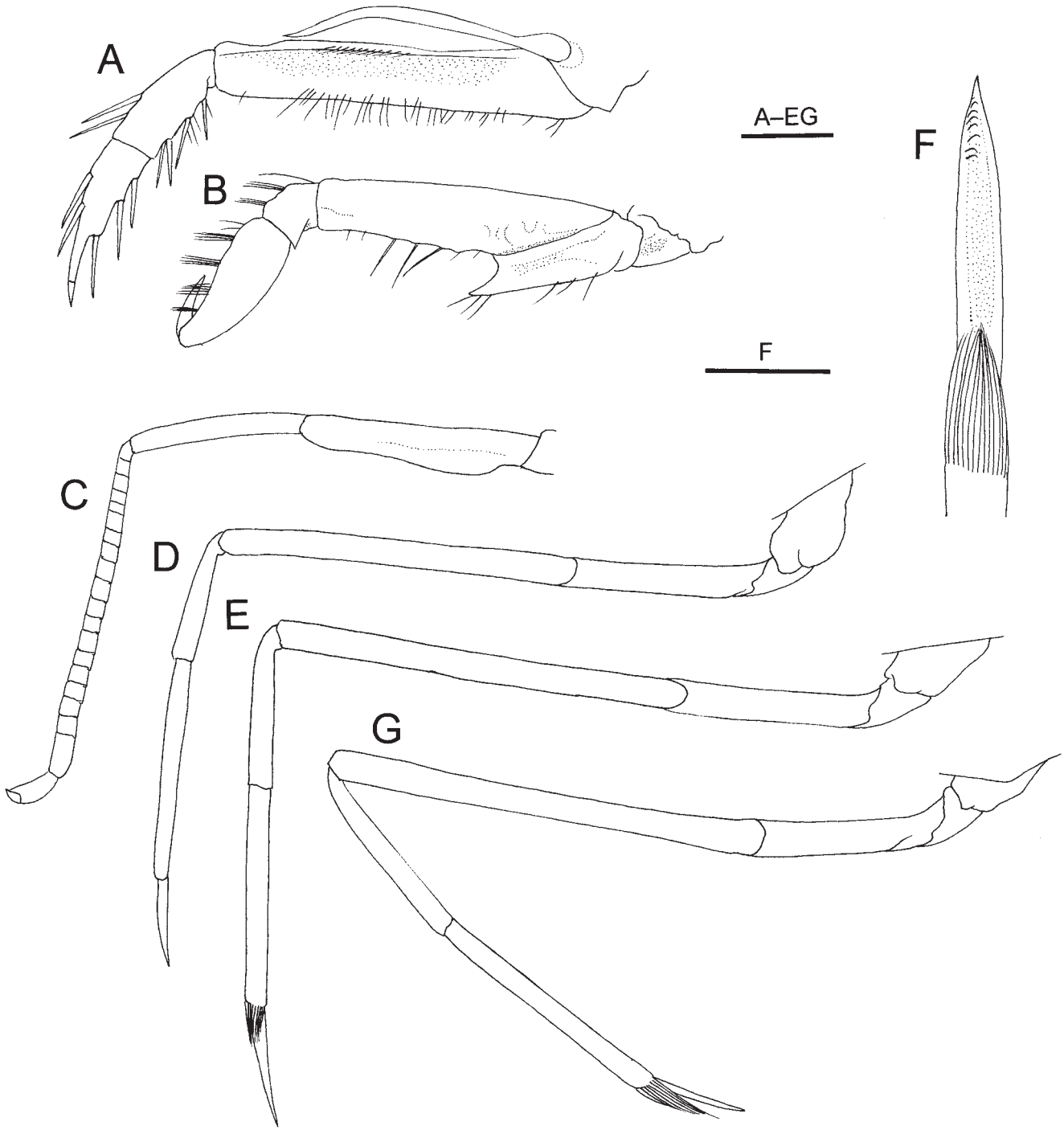

Fig. 8. *Glyphocrangon panglao*, new species. Holotype, ovig. female (cl 15.6 mm), NMCR 27061, PANGLAO 2005 Expedition, stn CP 2385, left appendages: A, third maxilliped, lateral view; B, first pereopod, lateral view; C, second pereopod, lateral view; D, third pereopod, lateral view; E, fourth pereopod, lateral view; F, dactylus of fourth pereopod, dorsal view; G, fifth pereopod, lateral view. Scale bars: A–E, G = 2 mm; F = 1 mm.

Komai (2004) noted that the conformation of the middorsal carina on the third pleonal somite, the position of the lateral tooth of the antennal scale and the length and number of the carpal articles of the second pereopods were also different between the holotype and the two paratypes of *G. parva*, but the present material shows that these differences are only intraspecific variations in *G. panglao*. The middorsal carina on the third pleonal somite varies from almost entire to somewhat subdivided. The position of the lateral tooth of the antennal scale appears to become more posteriorly with the increase of the body size; and the length and the number of carpal articles of each second pereopod also tend to be greater with the increase of the body size.

***Etymology*. –** This new species is named after the expedition by which the type series was collected.

Glyphocrangon proxima Komai, 2004
(Fig. 13C1, C2)

Glyphocrangon gilesii – Chace, 1984: 11 (in part). Not *Glyphocrangon gilesii* Wood-Mason, 1891.
Glyphocrangon proxima Komai, 2004: 416, Figs. 14, 15, 115 (type locality: Kai Islands, Banda Sea, Indonesia, 688–694 m).

***Material examined*. –** AURORA 2007 Expedition – NTOU, 2 females (cl 10.0, 12.5 mm), 2 ovig. females (cl 14.7, 15.0 mm), 1 male (cl 12.2 mm), 15°47'N 121°46'E, 562–562 m, stn CP 2663, 21 May 2007.

***Colouration*. –** Rostrum reddish in distal half, whitish in proximal half, lateral teeth red. Carapace generally whitish translucent, first and posterior second carinae red; antennal and branchiostegal teeth also reddish. Terga of pleon red, carinae and tubercles darker, pleura mostly whitish translucent; telson reddish. Cornea dark brown, with reflecting pigment. Antennular peduncle pale red. Antennal scale generally red, but central part colourless and transparent. Third maxilliped and first pereopod red. Second to fifth pereopods generally white, distal parts of propodi and dactyli of posterior 3 pereopods reddish. Pleopods reddish. Eggs whitish.

***Distribution*. –** The Philippines, Indonesia, Northwestern Australia; 562–809 m (Komai, 2004).

Glyphocrangon pugnax De Man, 1918
(Fig. 13D1, D2)

Glyphocrangon pugnax De Man, 1918: 293 (type locality: Selat Roti, west of Timor, 520 m); 1920: 225, Pl. 18, Fig. 56, pl. 19, Fig. 56a–c; Chace, 1984: 9; Jones and Morgan, 2002: 76, unnumbered Fig.; Komai, 2004: 399, Figs 6, 7, 114.

***Material examined*. –** PANGLAO 2005 Expedition – NTOU, 1 ovig. female (cl 21.1 mm), 2 males (cl 11.4, 13.1 mm), 9°27.4'N 123°43.1'E, 627–613 m, stn CP 2390, 30 May 2005.

***Colouration*. –** Rostrum red in distal 0.3, remainder whitish translucent, dorsolateral ridges edged by orange. Carapace orangish dorsally, whitish translucent laterally, first, second and third carinae, and intercarinal tubercles on median, dorsolateral and upper hepatic regions orange. Pleon also pale orange on terga and whitish translucent on pleura, carinae and tubercles on terga orange; telson pale orange, dorsolateral ridge dark orange. Eye dark brown, with reflecting pigment. Antennule pale orange. Antennal scale white with tinge of orange; flagellum reddish. Third maxilliped and first pereopods reddish-pink. Second to fifth pereopods generally white, distal parts of propodus and merus with tint of orange. Pleopods white. Endopod of uropods orange with darker margins; exopod whitish translucent, tinged with orange distally. Eggs pale blue.

***Distribution*. –** Known from the Philippines, Indonesia and Northwestern Australia, at depths of 293–1,013 meters (Komai, 2004).

***Remarks*. –** Komai (2004) noted that the rostrum is proportionally longer in the specimens from the Philippines than in those from Indonesia, the latter including the types. In the present specimen, the rostrum is 0.81 times as long as the carapace, rather approaching to the value of the Indonesian specimens (0.68–0.77). This suggests that the length of the rostrum is rather variable in this species.

Komai (2004) described the colouration of *G. pugnax* based on the colour photograph published by Jones & Morgan (1994) as "salmon pink throughout", apparently differing from the present specimen. The difference may be due to the preservation condition of the photographed specimen or to the printing condition of the photograph.

Glyphocrangon richeri Komai, 2004
(Fig. 14A1, A2)

Glyphocrangon richeri Komai, 2004: 495, Figs. 54, 55, 118 (type locality: SW slope of Combe Bank, Wallis and Futuna Islands, 1,280–1,300 m).

***Material examined*.** – AURORA 2007 Expedition – NTOU, 1 ovig. female (cl 23.3 mm), 15°27.4'N 123°13'E, 1,191–1,262 m, stn CC 2703, 27 May 2007.

***Colouration*. –** Rostrum reddish subdistally; dorsolateral ridges also reddish. Carapace semitransparent, edges of first, second, anterior fourth carinae reddish; tinge of reddish brown on postorbital region; vivid red stomach visible. Pleon generally whitish translucent, edges of carinae and tubercles, margins of pleura orangish. Cornea dark brown with reflecting pigments; eyestalk darker reddish-brown. First segment of antennular peduncle red, distal two segments whitish translucent. Antennal scale generally transparent, lateral margin reddish. Third maxilliped and first pereopod red. Second to fifth pereopods whitish transparent, tinged with red. Eggs light greenish-gray.

***Distribution*. –** Previously known from the southwest Pacific localities, including Wallis and Futuna Islands, Vanuatu and New Caledonia, 1,191–1,665 m (Komai, 2004). The present specimen represents a major range extension of this species to the northern hemisphere, i.e. to the Philippines.

Remarks. **–** The present specimen closely agrees with the type series from Wallis and Futuna Islands in the southwestern Pacific and other specimens from Vanuatu and New Caledonia, examined in Komai (2004).

Glyphocrangon robusta Komai, 2004
(Fig. 14B1, B2)

Glyphocrangon faxoni: Chace, 1984: 10 (in part).
Glyphocrangon hakuhoae: Brand and Takeda, 1996: 270 (in part).
Glyphocrangon robusta Komai, 2004: 526, Figs 69, 70, 119 (type locality: south of Mindoro, the Philippines, 320–337 m).
? *Glyphocrangon robusta*: Han & Li, 2007: 550, Fig. 5.

Material examined. **–** PANGLAO 2005 Expedition – NTOU, 1 ovig. female (cl 10.6 mm), 9°38.2'N 123°43.5'E, 596.0–565.5 m, stn CP 2333, 22 May 2005; NTOU, 3 ovig. females (cl 9.5–12.3 mm), 5 males (cl 8.5–10.9 mm), 8°49.9'N 123°34.9'E, 437–443 m, stn CP 2359, 26 May 2005; NTOU, 1 female (cl 10.0 mm), 9°32.6'N 123°40.5'E, 731–741 m, stn CP 2398, 31 May 2005.

Distribution. **–** Known with certainty only from the Philippines, at depths of 285–741 m (see Remarks).

Colouration. **–** Body generally pale brown; rostrum with broad brown median band, tip and first dorsolateral tooth white; carinae and tubercles on carapace whitish, their bases tinged with brown. Pleon with carinae and tubercles on pleura whitish, terga with paired blotches of brown on either side of midline. Corneas pale brown. Antennular peduncle generally pinkish-brown. Antennal scale transparent; distal part of carpocerite dark reddish-brown. Third maxilliped to fifth pereopod semi-transparent, sometimes with tinge of brown on some segments. Eggs blackish.

Remarks. **–** *Glyphocrangon robusta* was originally described on the basis of material from Mindoro, Luzon and the Sulu Sea in the Philippines (Komai, 2004). Han & Li (2007) reported the species from the northern part of the South China Sea. They noted some differences between their specimens and the type series from the Philippines described by Komai (2004): the dorsal surface of the rostrum lacks transverse septa in the specimens from the South China Sea, which are present in the type series; the two division of the anterior fourth carina is nearly aligned in the South China Sea specimens, rather than distinctly non-aligned in the type series. The present specimens from the Bohol Sea are well consistent with the type series. These differences are considered to be diagnostic (Komai, 2004), and it is likely that the specimens from the South China Sea represent an undescribed species. Therefore, Han & Li's (2007) record is questionably included in the synonymy.

Glyphocrangon spinossisima Brand & Takeda, 1996
(Fig. 14C1, C2)

Glyphocrangon spinossisima Brand & Takeda, 1996: 264, Figs. 1–4 (type locality: Sulu Sea, the Philippines, 1712–1840 m); Komai 2004: 536, figs. 75, 76, 121.

Material examined. **–** PANGLAO 2005 Expedition – NTOU, 1 ovig. female (cl 24.0 mm), 8°49.3'N 123°1.9'E, 2149–2217 m, stn CP 2386, 29 May 2005.

Colouration. **–** Body entirely red, dorsal surface of carapace and pleon somewhat paler; acute laminae of anterior fourth carina also paler; anterior tooth of posterior third carina white with red tip. Cornea dark brown with reflecting pigment inside. Third maxilliped to fifth pereopod also red. Eggs grayish-white.

Distribution. **–** Heretofore known only from the type locality in the Sulu Sea, at depths of 1,712–1,840 m. The present specimen is collected in the Bohol Sea at depths of 2,149–2,217 m, slightly extending the bathymetric range below.

Remarks. **–** The present specimen is the third of this very rare species. It agrees very well with the redescription given by Komai (2004). This species is characteristic in having unusually elongate lamina of the anterior fourth carina, and acutely dentate middorsal carinae and large, spiniform dorsolateral carinae on the anterior three pleonal somites. Brand and Takeda (1996) indicated the holotype as a male, but Komai (2004) has shown that the holotype was actually a non-ovigerous female. No information on males of this species has yet been available.

Glyphocrangon unguiculata Wood-Mason, 1891
(Fig. 14D1, D2)

Glyphocrangon unguiculata Wood-Mason, in Wood-Mason and Alcock, 1891: 193 (type locality: Arabian Sea off western Ghats, India, 1,353 m); Wood-Mason and Alcock, 1894, Pl. 7, Fig. 2 ; Chace, 1984: 25, Figs. 7, 8; Komai, 2004: 491.

Material examined. **–** RV "Fisheries Researcher 1" – NTOU, 1 male (cl 17.8 mm), 13°21.32'N 124°12.26'E, 1,037–1,100 m, stn PH1-05-95, 30 m otter trawl, 24 Sep.1995. AURORA 2007 Expedition – NTOU, 1 ovig. female (cl 24.3 mm), 14°53'N 123°14'E, 915–924 m, stn CP 2680, 23 May 2007; NTOU, 1 female (cl 11.5 mm), 15°00'N 123°14'E, 1,160–1,184 m, stn CP 2681, 23 May 2007.

Colouration. **–** Body and appendages generally vivid purplish-red, with dorsal surface of carapace, parts around cervical grooves white; pleon whitish dorsally. Eyes dark brown with reflecting pigments. Eggs grayish-white.

Distribution. **–** Arabian Sea, 1,353–1,732 m (Wood-Mason & Alcock, 1891); the Philippines, South China Sea, and Indonesia, 878–1,100 m (Chace, 1984; Komai, 2004).

Remarks. **–** The present specimens agree closely with specimens provisionally assigned to *G. unguiculata* by Komai (2004). Given the discontinuous distribution, Komai (2004) suggested that the western Pacific population might be distinct from the Arabian Sea population. Since no specimen from the Indian Ocean is available for comparison the taxonomic status of the western Pacific population remains unclear.

Glyphocrangon caeca species group

Glyphocrangon isos, new species
(Figs. 9–11, 15)

***Material examined*. –** Holotype: NMCR 27062, ovig. female (cl 14.6 mm), 14°55'N 123°8'E, 922–909 m, AURORA Expedition, stn CC 2691, 25 May 2007.

Paratypes: RV "Fisheries Researcher 1" – NTOU, 1 ovig. female (cl 14.8 mm), 2 males (cl 12.1, 12.7 mm), 13°21.32'N 124°12.26'E, 1,037–1,100 m, stn PH1-05-95, 30 m otter trawl, 24 Sep.1995. AURORA 2007 Expedition – NTOU, 1 male (cl 12.6 mm), 14°55'N 123°8'E, 996–1,037 m, stn CP 2686, 24 May 2007; NTOU, 4 ovig. females (cl 13.9–14.6 mm), 2 males (cl 9.4, 10.7 mm), 14°55'N 123°8'E, 922–909 m, stn CC 2691, 25 May 2007; NTOU, 1 male (cl 12.8 mm), 14°34'N 123°14'E, 944–1,004 m, stn CC 2702, 27 May 2007.

***Description*. –** *Female*. Body moderately robust (Fig. 9). Integument of carapace and abdomen partially covered with sparse short setae, setae particularly numerous on dorsal part (Fig. 10B).

Rostrum (Fig. 10A) moderately slender, 0.64–0.71 times as long as carapace (n = 12), gradually tapering distally in dorsal view, somewhat upturned, deepest point at midlength (tip broken off in figured paratype); armed with 2 pairs of teeth on dorsolateral ridges, anterior pair moderately strong, acuminate, posterior pair weaker, subacute; dorsal surface with 2 rows of faveolate depressions distal to anterior pair of lateral teeth; dorsolateral ridge between lateral teeth low, rather broad, with faint longitudinal sulcus; lateral surface of rostrum not particularly erose, with slightly flared ventrolateral margin; lateral carina distinct, extending from base of anterior lateral tooth to orbital margin; ventral surface shallowly sulcate medially, decreasing in width proximally, flanked by sharp ventrolateral carinae; midventral carina absent.

Carapace (Figs. 9, 10C) with major carinae low, roughly eroded with minute to small depressions or punctations; no prominent intercarinal tubercles present. Anterior first (submedian) carina (Fig. 10B) composed of 4 blunt tubercles becoming larger posteriorly, posterior median carina broad, clearly bilobed, sloping posteriorly. Anterior second (intermediate) carina composed of 3 low tubercles becoming larger posteriorly, none acuminate or dentate; posterior second carina divided into 3 lobes, none of them acuminate or dentate. Anterior third (antennal) carina absent; posterior third carina blunt, with anterior end angular. Anterior fourth (lateral) carina independent from branchiostegal spine, expanded into vertically compressed acute lamina, slightly falling short of tip of antennal spine, distance between tips about 0.90 of carapace length; posterior fourth carina blunt, surface strongly eroded. Anterior fifth (sublateral) carina blunt; posterior fifth carina absent (Fig. 10C). Sixth carina very low, but clearly delimited, surface markedly eroded. Posterolateral corner weakly produced, partially fused with submarginal ridge adjacent to it. Postorbital region without submarginal ridge. Median part of gastric region slightly elevated in midline, with 2 irregular rows of small tubercles. Posterior dorsolateral region with 2 very low tubercles anteriorly. Anterior, lateral and cervical grooves shallow. Antennal spine short, directed slightly laterally in dorsal view, slightly ascending in lateral view. Branchiostegal spine short, directed forward, reaching basal 0.20 of antennal scale.

Pleon (Fig. 9) moderately sculptured for *G. caeca* species group. First somite with low median elevation, surrounding grooves very shallow; anterior middorsal carina not clearly delineated; posterior section of middorsal carina showing as tubercle; dorsolateral carina relatively low, blunt (Fig. 10E); lateral carina thick, erose, faintly bilobed; pleuron with few tubercles; anteroventral corner weakly produced, bluntly pointed. Second somite with low middorsal carina faintly divided into two sections; anterior and posterior sections of tergum each with few tubercles along transverse grooves; pleuron with anteroventral and posteroventral corners angular, and with relatively broad, subacute ventral tooth. Third and fourth somites with very low, but clearly discernible middorsal carinae; posterior transverse grooves very shallow, but reaching to midline, thus very shallow notch apparent in dorsal profile in lateral view; pleural ventral teeth week and blunt, anterior tooth much larger than posterior tooth in either somite; anterior vertical ridges on pleura distinct, but unarmed. Fifth somite (Fig. 10D) with middorsal and posterior submedian carinae distinct, sharp; anterior submedian carina showing as small, low tubercle; lateral carinae well demarcated; 2 pleural teeth unequal with posterior tooth larger, both sharply pointed. Sixth somite (Fig. 10D) with moderately high, entire middorsal carina, terminating posteriorly in moderately large blunt tooth; tergum with 1 small tubercle on either side of midline; dorsolateral carina distinct, anterior section slightly sinuous, terminating posteriorly in blunt point, posterior section not exceeding beyond posterior margin of somite; lateral carina also distinct, edge erose; pleuron shallowly depressed, lateroventral carina erose, extending onto posteroventral tooth; posteroventral tooth strong, acuminate. Telson about 0.9 times as long as carapace; middorsal ridge moderately high, extending to 0.25 length of telson, strongly compressed laterally, unarmed; dorsolateral and ventrolateral carinae smooth.

Cornea (Fig. 9) small, maximum diameter 0.13–0.16 of carapace length, lacking dark pigmentation; eyestalk with small anteromesial process.

Antennular peduncle (Fig. 9) moderately stout, slightly falling short of distal margin of antennal scale; thickened aesthetasc-bearing portion of outer flagellum about 0.40 times as long as carapace.

Antennal scale (Figs. 9, 10F) oval, about 0.40 times as long as carapace and 1.70 times longer than wide (except for lateral tooth); lateral tooth sharp, arising at proximal 0.28; dorsal surface with scattered short setae. Articulation between antennal scale and basicerite strongly rotated. Carpocerite falling short of distal margin of antennal scale.

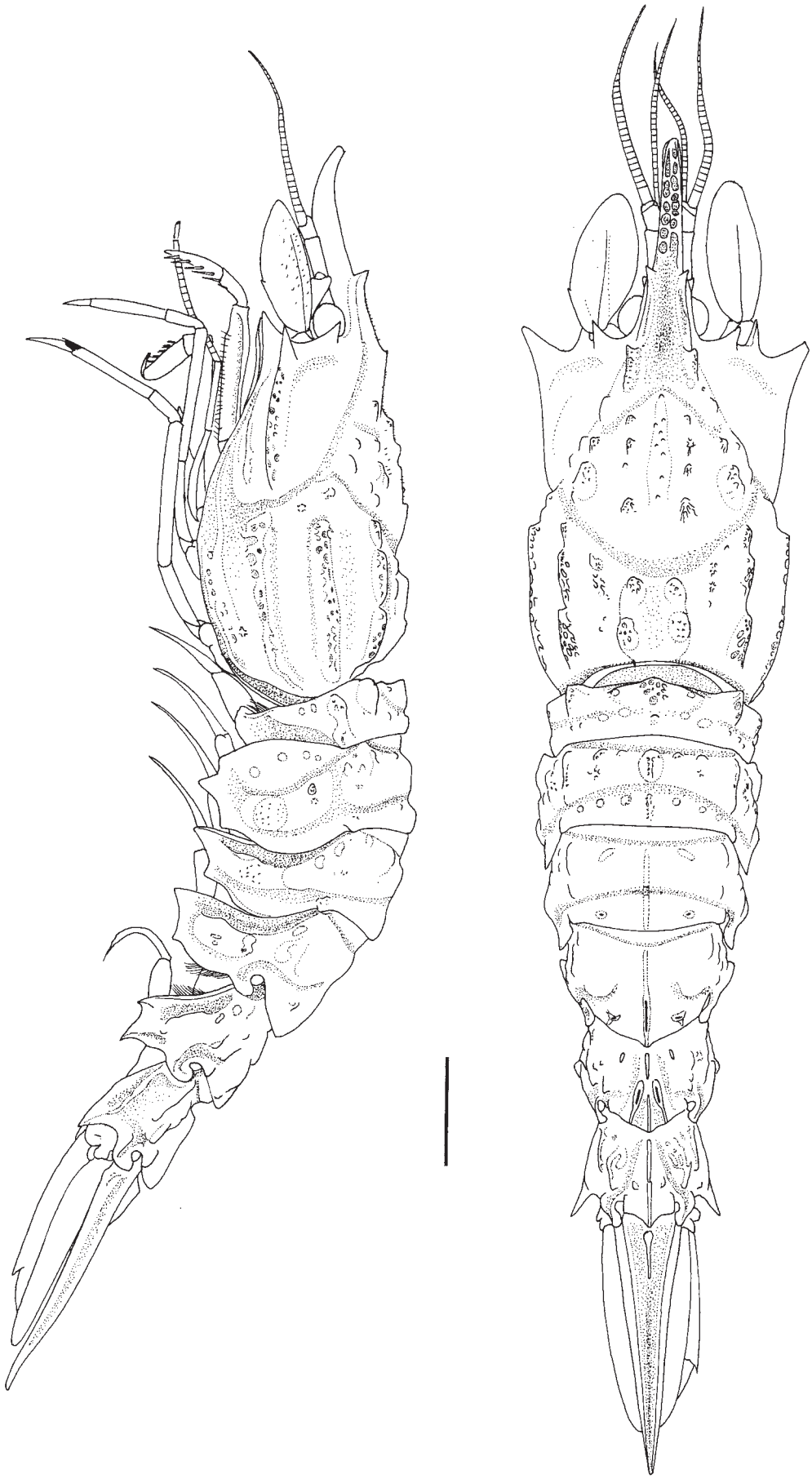

Fig. 9. *Glyphocrangon isos*, new species. Paratype, ovig. female (cl 14.8 mm), NTOU, R/V "Fisheries Researcher 1", stn PH1-05-95, habitus in dorsal and lateral views.

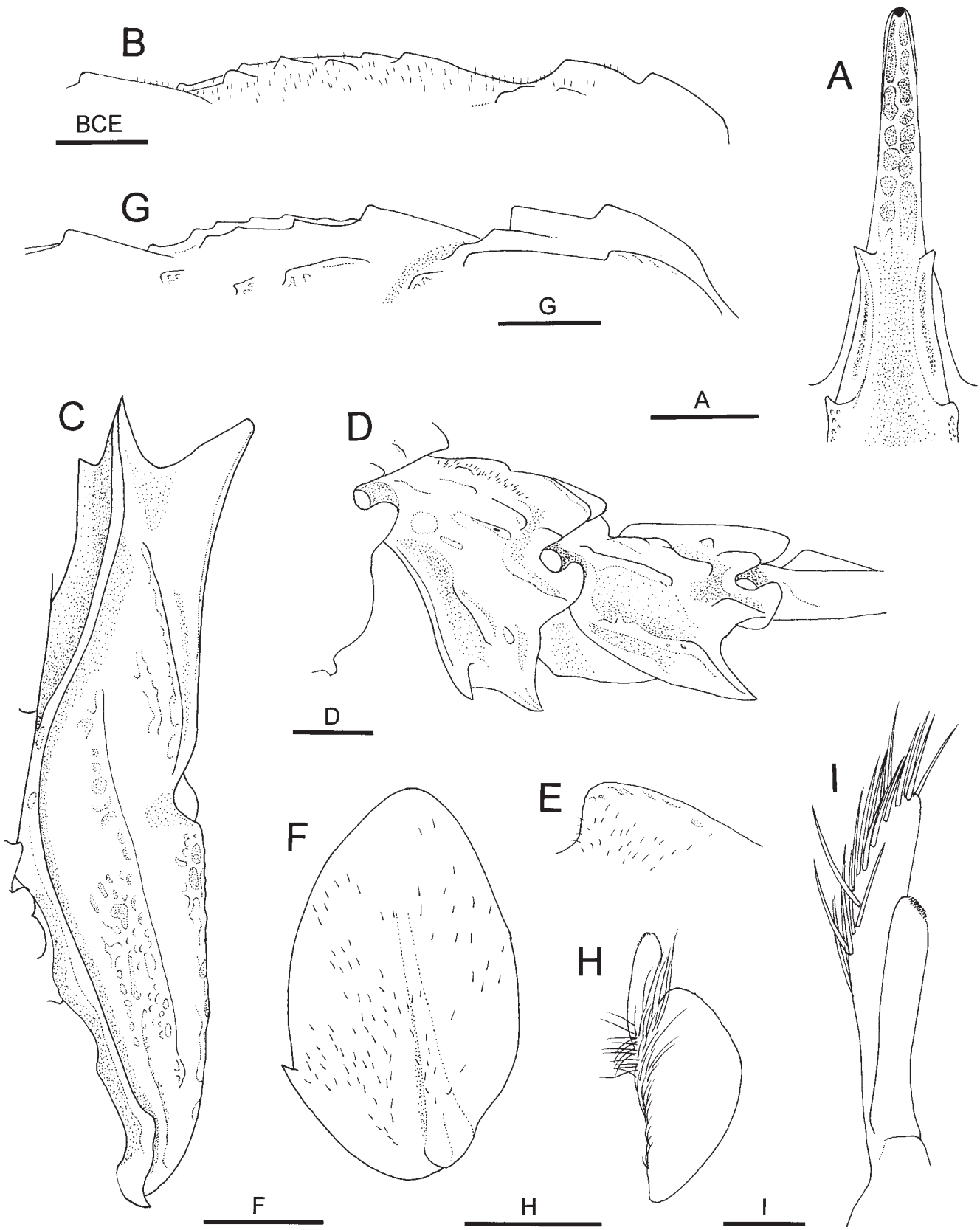

Fig. 10. *Glyphocrangon isos*, new species. A–F, paratype, ovig. female (cl 14.8 mm), NTOU, R/V "Fisheries Researcher 1", stn PH1-05-95; G, paratype, male (cl 12.7 mm), H, I, paratype (cl 12.1 mm), same lot. A, rostrum, dorsal view; B, dorsal part of carapace, showing configuration of first carina; C, ventrolateral part of carapace, obliquely ventral view; D, fifth and sixth pleonal somites, lateral view; E, left dorsolateral carina on first pleonal somite, lateral view; F, left antennal scale, dorsal view; G, dorsal part of carapace, showing configurations of first and second carinae, lateral view; H, endopod of left first pleopod, ventral view; I, appendices interna and masculina of left second pleopod, mesial view. Scale bars: A–D, F, G = 2 mm; E, H = 1 mm; I = 0.5 mm.

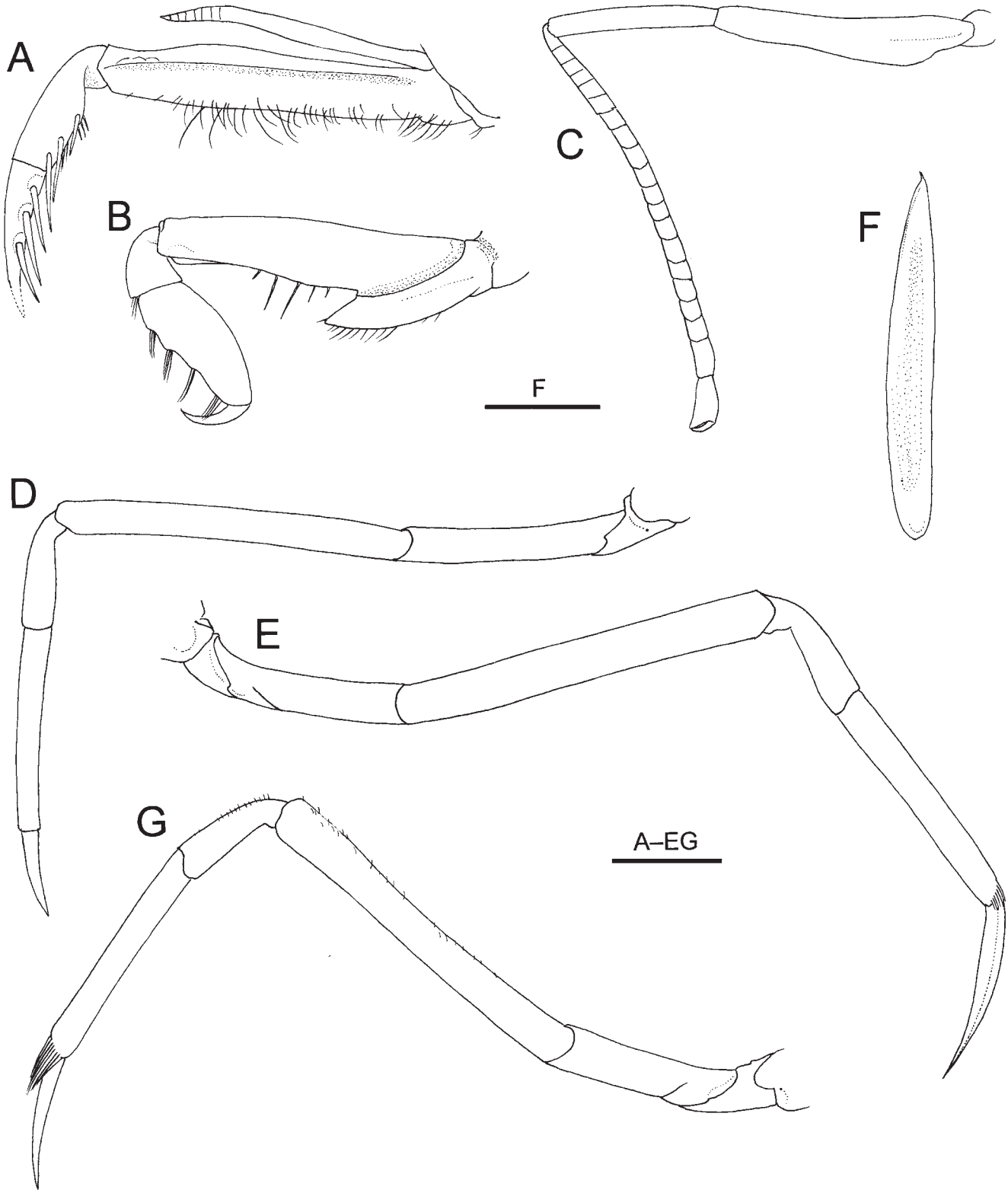

Fig. 11. *Glyphocrangon isos*, new species. Paratype, ovig. female (cl 14.8 mm), NTOU, R/V "Fisheries Researcher 1", stn PH1-05-95. Thoracic appendages. A, left third maxilliped, lateral view; B, left first pereopod, lateral view; C, left second pereopod, lateral view; D, left third pereopod, lateral view; E, right fourth pereopod, lateral view; F, dactylus of right third pereopod, dorsal view; G, left fifth pereopod, lateral view. Scale bars: A–E, G = 2 mm; F = 1 mm.

Third maxilliped (Fig. 11A) moderately stout, reaching distal 0.20 of antennal scale. Ultimate segment triangular in dorsal view, terminating in acuminate spine, with slender, elongate marginal and ventral spines. Penultimate segment subequal in length to ultimate segment. Antepenultimate segment with sharp dorsolateral carina. Exopod not reaching distal margin of antepenultimate segment.

First pereopod (Fig. 11B) relatively slender for genus. Second pereopods (Fig. 11C) subequal in length, reaching distal margin of antennal scale; carpus divided into 20 or 21 articles in left, 21 or 22 articles in right; left chela slightly larger than right chela. Third to fifth pereopods moderately slender. Third pereopod (Fig. 11D) overreaching distal margin of antennal scale by half length of dactylus. Fourth pereopod (Fig. 11E) reaching distal 0.25 of antennal scale by tip of

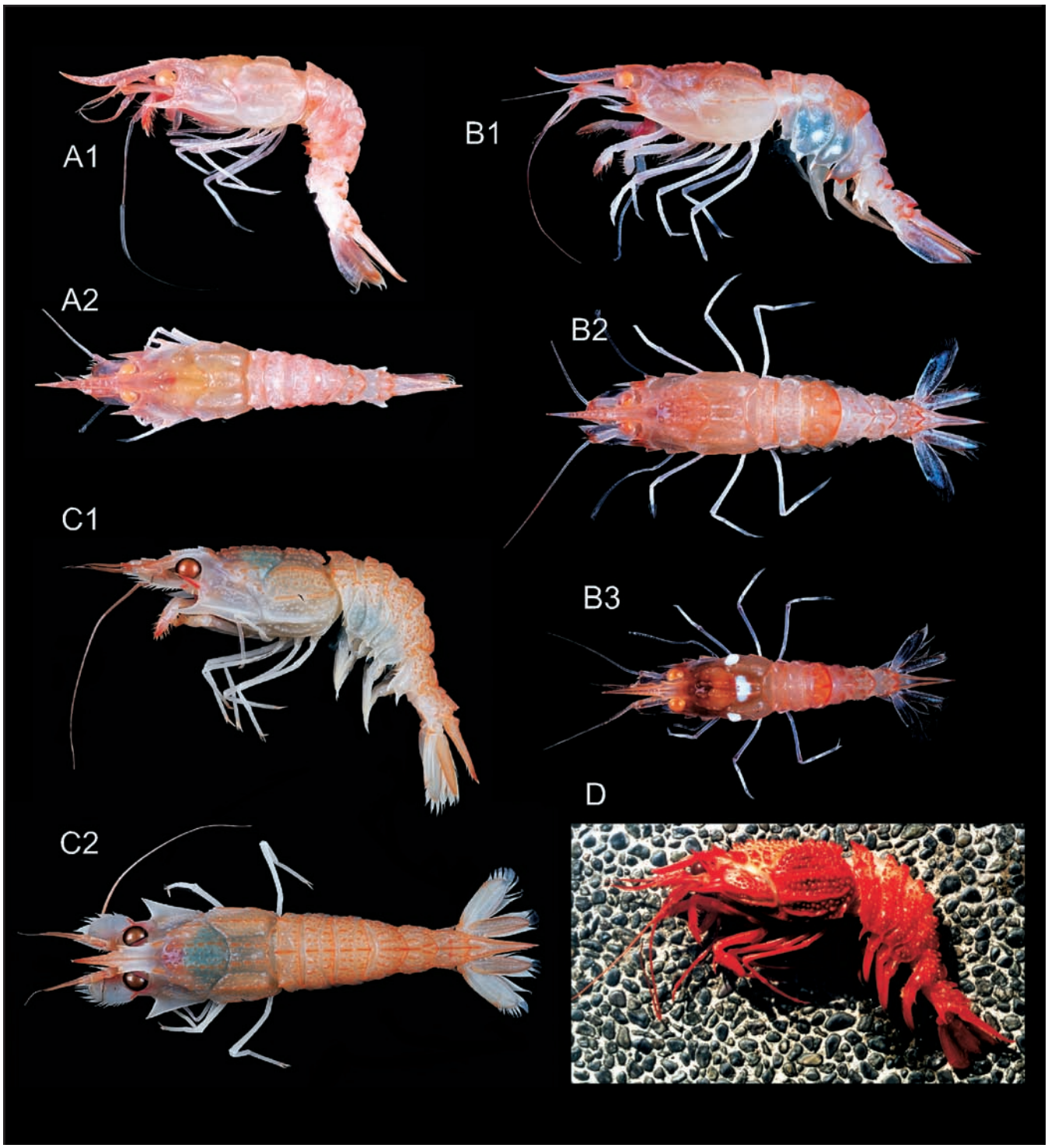

Fig. 12. Entire animals in dorsal and lateral views, showing colouration in life: A, *Glyphocrangon chacei* Komai, 2004, male (cl 8.7 mm), PANGLAO 2005 Expedition, stn CP 2359; B, *G. faxoni* De Man, 1918, 1, 2, ovig. female (cl 14.2 mm), AURORA Expedition, stn CC 2700; 3, female (cl 10.4 mm), AURORA Expedition, stn CC 2744; C, *G. formosana* Komai, 2004, ovig. female (cl 23.3 mm), PANGLAO 2005 Expedition, stn CC 2678; D, *G. grandis*, new species, holotype (cl 43.0 mm), R/V "Fisheries Researcher 1", stn PH1-05-95.

dactylus; dactylus (Fig. 11F) narrow, subspatulate, 0.65–0.70 times as long as propodus, dorsal surface shallowly concave, ventral surface sharply carinate on midline; carpus 0.54 times as long as propodus; merus about 8.8 times longer than wide. Fifth pereopod (Fig. 11G) generally similar to fourth pereopods; dactylus 0.54–0.66 times as long as propodus, ventral surface not carinate.

Uropodal endopod relatively narrow, 5.3 times longer than wide.

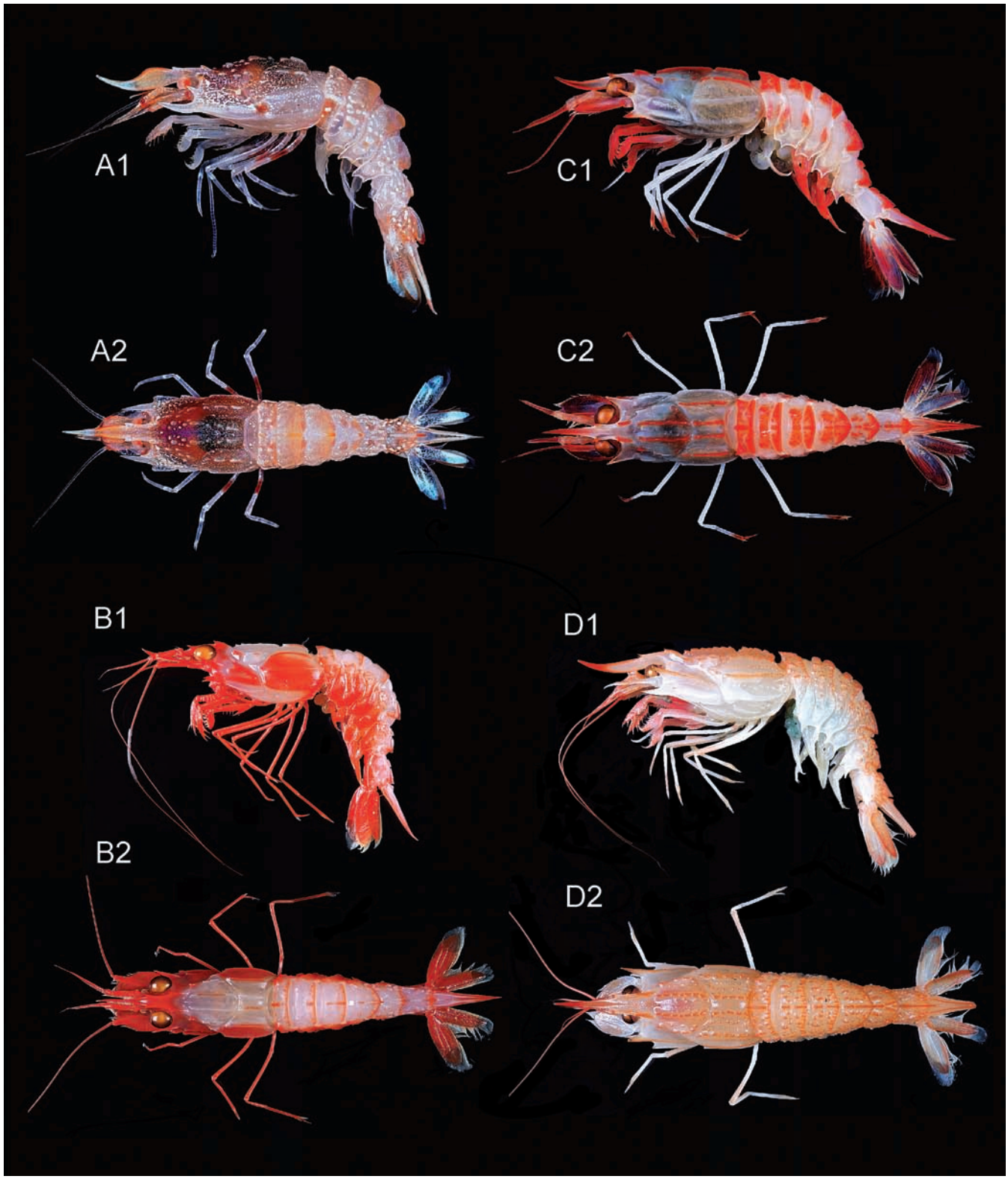

Fig. 13. Entire animals in dorsal and lateral view, showing colouration in life: A, *Glyphocrangon hakuhoae* Takeda & Hanamura, 1994, female (cl 11.5 mm), AURORA Expedition, stn CP 2695; B, *G. panglao*, new species, holotype, ovig. female (cl 15.6 mm), PANGLAO 2005 Expedition, stn 2385; C, *G. proxima* Komai, 2004, ovig. female (cl 14.7 mm), AURORA Expedition, stn CP 2663; D, *G. pugnax* De Man, 1918, ovig. female (cl 21.1 mm), PANGLAO 2005 Expedition, stn 2390.

Gill formula typical of *G. caeca* species group, lacking arthrobranchiae on first and second pereopods.

Egg size 2.00–2.23 × 1.41–1.59 mm.

Male (paratypes). Generally similar to females. Short setae on carapace, pleon and antennal scale fewer or almost absent (Fig. 10G). Rostrum 0.69–0.78 times as long as carapace. Distance between tips of acute lamina of anterior fourth carina 0.84–1.02 of carapace length. Endopod of first pleopod (Fig. 10H) subovate, with prominent appendix interna situated subterminally. Appendix masculina of second pleopod (Fig. 10I) distinctly longer than appendix interna, widest at midlength, bearing numerous spiniform setae on distal half of dorsal margin to tip.

Colouration. – Body generally whitish translucent. Rostrum reddish subdistally, proximal 0.20 wine-red dorsally. Carapace with tinge of wine red on postorbital region to upper part of hepatic region; median part of gastric region sometimes

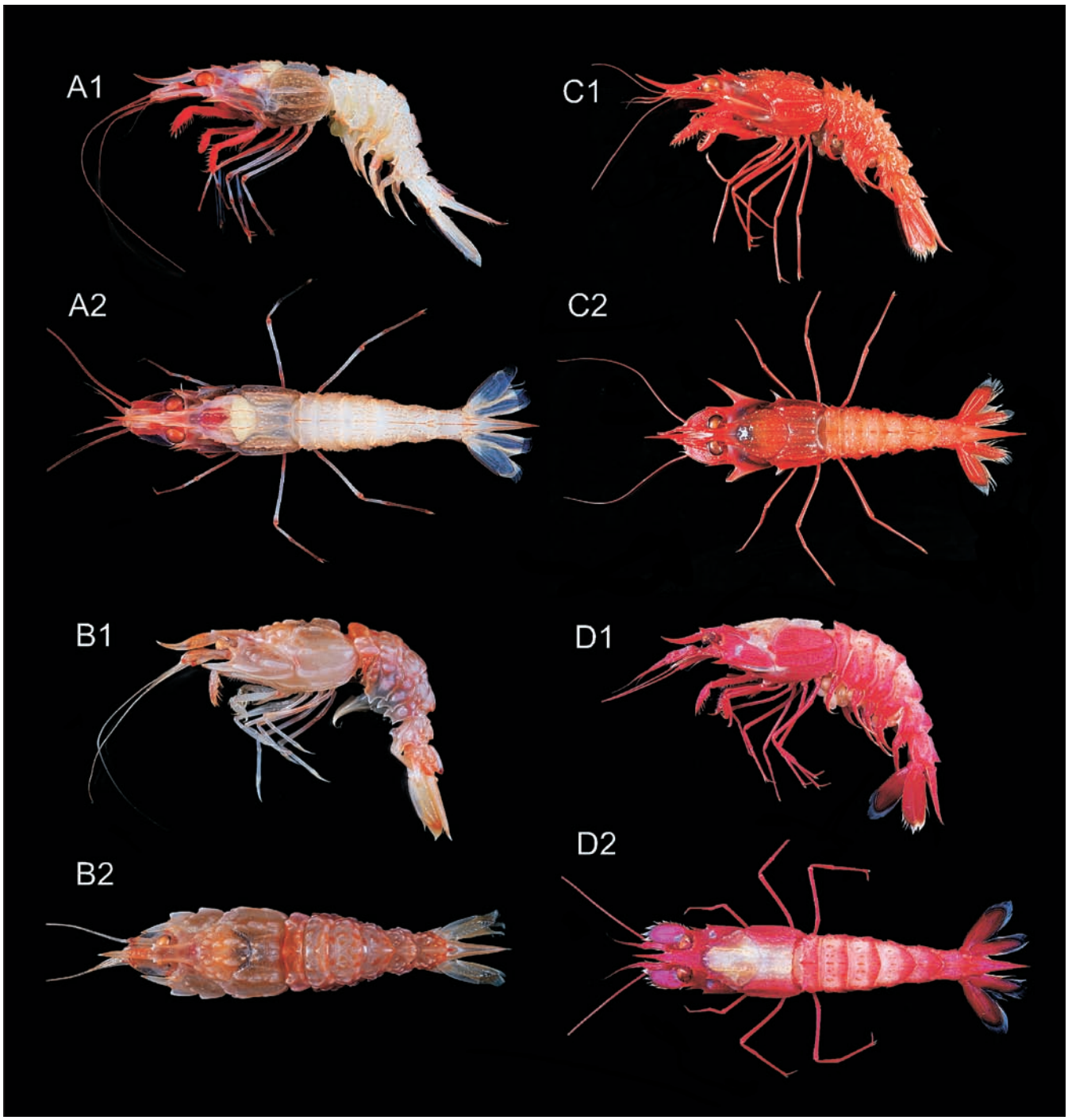

Fig. 14. Entire animals in dorsal and lateral views, showing colouration in life: A, *Glyphocrangon richeri* Komai, 2004, ovig. female (cl 23.3 mm), AURORA Expedition, stn CC 2703; B, *Glyphocrangon robusta* Komai, 2004, ovig. female (cl 10.6 mm), PANGLAO 2005 Expedition, stn CP 2333; C, *G. spinossisima* Brand & Takeda, 1996, ovig. female (cl 24.0 mm), PANGLAO 2005 Expedition, stn CP 2386; D, *G. unguiculata* Wood-Mason, 1891, ovig. female (cl 24.3 mm), AURORA, stn CP 2680.

also wine red; acute lamina of anterior fourth carina reddish. Pleura of second and third pleonal somites sometimes with tint of red marginally; ventrolateral margin of sixth somite also reddish; distal part of telson reddish. Cornea opaque, yellowish-white; eyestalk red. Antennular peduncle reddish. Antennal scale vivid red. Third maxilliped to fifth pereopod reddish, carpi to dactyli of fourth and fifth pereopods paler. Pleopods and uropods also reddish. Eggs jade-green.

Distribution. **–** So far known only from the northern part of the Philippines at depths of 909–1,100 m. Considering the general limited distributional pattern of the *G. caeca* species group (see Komai, 2006), it is likely that this species is endemic to the Philippines.

Remarks. **–** All female specimens are covered with short setae on the carapace, pleon and the dorsal surface of the antennal scale, whereas in male specimens, such setae are absent or very sparse. Such sexual dimorphism is not known in the other species of *Glyphocrangon*.

The new species is clearly assignable to the *Glyphocrangon caeca* species group because of the anterior fourth carina of the carapace forming an acute lamina, a non-pigmented, small cornea, and the lack of arthrobranchiae on the first and second pereopods. The presence of a coat of short setae on the carapace, pleon and antennal scale links the new species to *G. rudis* Komai, 2006 from the Solomon Islands. However, in *G. isos*, new species, the carinae and tubercles on the carapace and pleon are much lower than those in *G. rudis*. The acute lamina of the anterior fourth carina is also more strongly expanded in *G. isos* than in *G. rudis*. Short setae on the carapace and pleon appear to be less dense in *G. isos* than in *G. rudis*.

With regard to males, the exact difference between the new species and the other species of the *G. caeca* species group remains uncertain, because no information on male specimens is available for *G. brevis* Komai, 2006, *G. caeca* Wood-Mason & Alcock, 1891 and *G. cerea* Alcock & Anderson, 1894. Nevertheless, males of *G. isos*, new species, can be distinguished from males of *G. humilis* and *G. musorstomia* in the anterior first carina on the carapace composed of conspicuous tubercles, the clearly bilobed posterior first carina, and the clearly delineated carinae on the fifth pleonal somite. From males of *G. parvioculus* Komai, 2006, males of *G. isos*, new species, is easily separable by the non-acuminate tubercles or lobes that consisting the first and second carinae on the carapace, the less expanded acute lamina of the anterior fourth carina, and the blunt median and dorsolateral carinae on the first pleonal somite.

Etymology. **–** From the Greek *isos*, meaning equal or like, alluding to the similarities of the new species to the other members of the *Glyphocrangon caeca* species group.

CONCLUDING REMARKS

This study increases the number of species of *Glyphocrangon* known from the Philippines from 13 to 20, adding three new species and four new regional records: *G. albatrossae*, *G.*

Fig. 15. Entire animals in dorsal and lateral views, showing colouration in life. A, *Glyphocrangon isos*, new species, holotype, ovig. female (cl 14.6 mm), AURORA Expedition, stn CC 2691; B, same species, paratype, male (cl 12.6 mm), AURORA Expedition, stn CP 2686.

caecescens, *G. chacei*, *G. faxoni* (new record), *G. formosana* (new record), *G. grandis*, new species, *G. hakuhoae* (new record), *G. indonesiensis*, *G. isos*, new species, *G. longipes*, *G. panglao*, new species, *G. parva*, *G. proxima*, *G. pugnax*, *G. punctata*, *G. richeri* (new record), *G. robusta*, *G. spinossisima*, *G. unguiculata*, and *G.* aff. *stenolepis*. The following 10 species are still known only from the Philippines so far: *G. albatrossae*, *G. chacei*, *G. grandis*, new species, *G. isos*, new species, *G. longipes*, *G. panglao*, new species, *G. parva*, *G. punctata*, *G. spinossisima* and *G.* aff. *stenolepis*. On the other hand, five species extends their geographical range to Indonesia or Northwestern Australia: *G. faxoni*, *G. hakuhoae*, *G. indonesiensis*, *G. proxima*, *and G. pugnax*. *Glyphocrangon caecescens* and *G. richeri* are rather widespread, the former is recorded also from Japan and mid-Indian Basin (Komai, 2004), while the latter heretofore known from the southwestern Pacific. Only *G. formosana* has more northern distribution, extending to Taiwan and southern Japan (Komai, 2004). The presumably endemic species appear to be restricted to inland seas, i.e., Sulu Sea, Bohol Sea, and Mindanao Sea, suggesting vicariant speciation processes caused by complex geological structure are common in the Philippine Seas.

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