Revision of the *Glyphocrangon caeca* species group (Crustacea, Decapoda, Glyphocrangonidae)

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ABSTRACT

A review of the species of the *Glyphocrangon caeca* Wood-Mason & Alcock, 1891 group is presented based on samples obtained during French expeditions to the southwestern Pacific and western Indian Ocean, and supplemented with materials deposited in various museums and institutions in the world. Eight species are now recognized in this species group. The two previously described species, *G. caeca* from the Bay of Bengal and *G. cerea* Alcock & Anderson, 1894 from the Laccadive Sea, are rediagnosed based on literature, as types or supplemental topotypic specimens of these two species have not been available for study. Six new species are described: *G. brevis* n. sp. from Madagascar, *G. demani* n. sp. from Indonesia, *G. humilis* n. sp. from Japan and Taiwan, *G. musorstomia* n. sp. from Wallis and Futuna Islands, Vanuatu, Fiji and Chesterfield Islands, *G. parviocullus* n. sp. from New Caledonia, and *G. rudis* n. sp. from the Solomon Islands. Species of this group occur exclusively in the Indo-West Pacific. The horizontal and bathymetric distributions of the species are briefly summarized. The available data suggests that species of the group are highly localized.

RÉSUMÉ

Révision des espèces du groupe de *Glyphocrangon caeca* (Crustacea, Decapoda, Glyphocrangonidae).

Une révision des espèces du groupe de *Glyphocrangon caeca* Wood-Mason & Alcock, 1891 est présentée à partir des échantillons obtenus pendant les expéditions françaises dans le Pacifique sud-ouest et l'ouest de l'Océan Indien, complétés par du matériel déposé dans divers musées et institutions du monde. Huit espèces sont maintenant reconnues dans ce groupe. Les types ou du matériel topotypique des deux espèces déjà décrites, *G. caeca* de la Baie du Bengal et *G. cerea* Alcock & Anderson, 1894 de la Mer de Laccadive, n'étant pas disponibles, les diagnoses sont refaites à partir de la littérature. Six nouvelles espèces sont décrites : *G. brevis* n. sp. de Madagascar, *G. demani* n. sp. d'Indonésie, *G. humilis* n. sp. du Japon et de Taiwan, *G. musorstomia* n. sp. de Wallis et Futuna, Vanuatu, Fidji et des Îles Chesterfield, *G. parviocullus* n. sp. de Nouvelle-Calédonie et *G. rudis* n. sp. des Îles Salomon. Les espèces de ce groupe se rencontrent exclusivement dans l'Indo-ouest Pacifique. Les distributions géographique et bathymétrique sont brièvement résumées. Les données disponibles montrent que les espèces de ce groupe sont très localisées.

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INTRODUCTION

This work is the second contribution toward a thorough review of the Indo-Pacific species of the deep-water shrimp genus *Glyphocrangon* A. Milne-Edwards, 1880. The first part of this review (Komai 2004) dealt with the *G. spinicauda* A. Milne-Edwards, 1880 species group, in which 26 previously known species from the Indo-Pacific were reviewed and 28 new species were described. In the present article, the *Glyphocrangon caeca* Wood-Mason & Alcock, 1891 species group proposed by Komai (2004) is reviewed. This informal species group was established to accommodate species characterized by the more or less reduced, unpigmented eyes and the absence of arthrobranch gills above the first and second pereopods. Two previously described species, *G. caeca* from the Bay of Bengal and *G. cerea* Alcock & Anderson, 1894 from the Laccadive Sea, were assigned to this species group by Komai (2004) on the basis of examination of literature.

Both *G. caeca* and *G. cerea* are very rare. Since the original description, the former has been recorded from Indonesia (De Man 1920) and Japan (Toriyama *et al.* 1990; Miya 1995; Sakaji 2001). The latter remains represented only by the holotype. During a study of extensive glyphocrangonid material collected by the French expeditions in the Indo-Pacific Ocean and supplemental material deposited in various institutions, six species were recognized. Unfortunately, the type or supplemental topotypic material of *G. caeca* and *G. cerea* has not been available for study. Comparison with the previous accounts of *G. caeca* and *G. cerea* (see Wood-Mason & Alcock 1891, 1894; Alcock & Anderson 1894, 1895; Alcock 1901; Chace 1984) has shown that any of the six species represented in the present material can not be assigned to *G. caeca* or *G. cerea*. Therefore, the six species are described as new in this study, including two confounded with *G. caeca*: *G. brevis* n. sp. from Madagascar; *G. demani* n. sp. from Indonesia; *G. humilis* n. sp. from Japan and Taiwan; *G. musorstomia* n. sp. from Wallis and Futuna Islands, Fiji, Vanuatu and Chesterfield Islands; *G. parviocullus* n. sp. from New Caledonia; and *G. rudis* n. sp. from the Solomon Islands. The available data suggests that the species of the group are highly localized like the Indo-West Pacific species of the *G. spinicauda* group.

MATERIALS AND METHODS

Specimens used in this study are deposited in the following institutions: Kuroshio Research Division, National Research Institute of Fisheries Science, Kochi, Japan (KRD); Muséum national d'Histoire naturelle, Paris, France (MNHN); Natural History Museum and Institute, Chiba, Japan (CBM); Nagasaki University Museum, Nagasaki, Japan (NUM); National Taiwan Ocean University, Keelung, Taiwan, R.O.C. (NTOU); Zoological Museum, University of Amsterdam, the Netherlands (ZMA).

The terminology generally follows that of Komai (2004) except for the following point. The acute lamina formed by the anterior section of the fourth (lateral) carina on the carapace is simply termed in this paper as "acute lamina on carapace." The postorbital carapace length (cl) is used as a standard measurement indicating the size of specimens.

The differences among the species of this group are often so slight that a general description containing common characters for the species of the group is given at first. In order to supplement the general description, some body parts are illustrated from *G. musorstomia* n. sp. In the species account, a diagnosis containing only differential characters is given for each species in order to avoid repetitious description.

LIST OF SPECIES TREATED IN THIS STUDY

Glyphocrangon caeca Wood-Mason & Alcock, 1891
Glyphocrangon cerea Alcock & Anderson, 1894
Glyphocrangon brevis n. sp.
Glyphocrangon demani n. sp.
Glyphocrangon humilis n. sp.

Glyphocrangon musorstomia n. sp.
Glyphocrangon parviocullus n. sp.
Glyphocrangon rudis n. sp.

TAXONOMIC ACCOUNT

Family GLYPHOCRANGONIDAE Smith, 1884
Genus *GLYPHOCRANGON* A. Milne-Edwards, 1881

Glyphocrangon caeca species group

GENERAL DESCRIPTION. — Body moderately robust for genus; integument of carapace and abdomen microscopically punctate, naked except for *G. rudis* n. sp.

Rostrum gradually tapering distally in dorsal view, moderately narrow, slightly descending and noticeably curved dorsally in distal part, deepest point at about midlength; armed with 2 pairs of small teeth on dorsolateral ridges, anterior pair acute, posterior pair blunt to acute, occasionally rudimentary; middorsal carina usually obsolete; dorsal surface with 2 rows of faveolate depressions or corrugation in anterior to level of anterior pair of lateral teeth; dorsolateral ridge between 2 lateral teeth low, broad, with shallow longitudinal sulcus; lateral surface of rostrum not 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 posteriorly, flanked by sharply edged ventrolateral carinae; midventral carina absent or obsolescent if present.

Carapace with major carinae roughly eroded with minute to small depressions; most intercarinal spaces unarmed. First (submedian) carina usually low, anterior section with 4-6 small tubercles, posterior section broad, usually divided in 2 lobes, posterior end of carina not overhanging posterodorsal margin of carapace. Anterior second (intermediate) carina composed of low, broad tubercles, occasionally rudimentary; posterior second carina divided in 3 lobes. Anterior third (antennal) carina absent; posterior third carina, low, broad, nearly parallel to plane of dorsal surface of carapace, entire or faintly divided in 2 lobes, terminating anteriorly in at most low, right angle. Anterior fourth (lateral) carina independent from branchiostegal spine, expanded into vertically compressed acute lamina; posterior fourth carina low, broad, entire, terminating anteriorly in blunt point. Anterior fifth (sublateral) carina low, broad, surface often marked by thin longitudinal ridges; posterior fifth carina absent. Sixth (submarginal) carina distinct, independent from seventh carina; additional thin ridge occasionally present between sixth and seventh carina, connecting to submarginal posterolateral ridge incompletely fused with marginal posterolateral corner. Postorbital region without submarginal ridge. Median part of gastric region with 2 submedian rows of small tubercles; posterior median region slightly concave, unarmed. Lateral part of gastric region with space between first and second carinae nearly flat; space between second carina and lateral groove with few low tubercles. Posterior dorsolateral region flat, with longitudinal row of low tubercles. Hepatic region with upper part slightly convex, unarmed; lower part nearly flat. Each part of branchial region unarmed or with only a few tiny tubercles on upper part; middle part slightly concave. Subbranchial region with space between anterior fifth and sixth carina moderately broad for genus, slightly concave; space between posterior fourth and sixth (submarginal) carina moderately broad. Antennal spine short, directed forward in dorsal view, slightly to strongly ascending in lateral view. Branchiostegal spine short, visible from dorsal view, directed forward in dorsal view, somewhat descending in lateral view; lateral surface with 1 or 2 inconspicuous ridges. Marginal posterolateral corner slightly delineated. Lateral and cervical grooves shallow; anterior groove very shallow.

First abdominal somite with median elevation low, defined by shallow to moderately deep transverse groove, laterally with 1 small tubercles; median carina broad, divided in 2 sections (posterior section occasionally obsolete), anterior section

usually produced anteriorly. Dorsolateral carina low to moderately high, shape variable. Posterior section of tergum with few tubercles on either side of midline. Lateral carina low, thick, entire or faintly bi-lobed. Pleuron with few low tubercles; posterior depression distinctly delimited; anteroventral corner produced, bluntly or subacutely pointed.

Second to fourth abdominal somites unarmed or with few tubercles on intercarinal spaces; median carinae absent to moderately high, broad, if present, divided in 2 sections by U-shaped notch; dorsolateral carinae present or absent, if present, showing as short, broad ridge or tubercle; posterior transverse grooves usually shallow; lateral pleural elevations weakly divided in 2 lobes, each lobe not tuberculate, but faintly pitted; pleural teeth greatly unequal, anterior teeth broadly triangular, posterior teeth reduced in blunt triangular processes. Second somite with anteroventral corner of pleuron distinctly produced in rounded process.

Fifth abdominal somite with anterior median carina distinct, somewhat to strongly compressed laterally; posterior median carina low, posterior end truncate. Tergum with shallow dorsal groove; anterior submedian carina low, short; posterior submedian carinae low, reaching posterodorsal margin of somite, weakly diverging posteriorly in dorsal view, each dorsal margin slightly convex in lateral view. Pleuron with ventral teeth short, acutely or subacutely pointed (in *G. cerea*, only 1 tooth present); posterior margin always unarmed.

Sixth abdominal somite with moderately high, entire median carina terminating posteriorly in moderately large, blunt tooth; dorsal margin nearly straight or slightly convex, not tuberculate or dentate. Tergum with 1 small, but conspicuous tubercle on either side of median carina; dorsolateral carina distinct, with sinuous dorsal margin; lateral carina distinct, entire; posterolateral carina blunt, not produced beyond posterodorsal margin of somite. Pleuron concave, without conspicuous tubercles; lateroventral carina low, eroded, not extending to posterolateral tooth; posterolateral tooth strong.

Telson with moderately high median ridge on dorsal surface anteriorly, extending to anterior 0.2 of telson, gradually becoming lower posteriorly; dorsolateral and ventrolateral carinae smooth.

Eye small for genus (maximal diameter 0.09-0.17 of carapace length), without dark pigmentation; eye-stalk with small anteromesial process.

Antennular peduncle not reaching distal margin of scaphocerite in females, slightly overreaching that in males. Outer flagellum with aesthetasc-bearing portion 0.45-0.50 times as long as carapace in females, 0.55-0.60 times as long in males.

Antennal scaphocerite broadly oval, 0.40-0.45 times as long as carapace, 1.40-1.50 times longer than wide; lateral margin convex, with distinct lateral tooth arising from 0.35-0.40 of scaphocerite length. Carpocerite reaching 0.70-0.80 length of scaphocerite.

Third maxilliped reaching 0.70-0.80 length of scaphocerite; marginal spines on distal two segments slender; penultimate segment about as long as greatest width.

First pereopod with relatively slender palm devoid of pubescence or short setae on lateral face. Second pereopods subequal in length, but right chela smaller than left chela, both reaching at least midlength of scaphocerite by tip of chelae; carpi composed of 18-20 articles. Posterior 3 pairs of pereopods relatively short. Third pereopod with dactylus somewhat compressed laterally, about 0.40 times as long as propodus; propodus with some short setae on distal margin. Fourth and fifth pereopods each with subspatulate dactylus; dactylus 0.60-0.70 times as long as propodus, dorsal surface longitudinally sulcate; ventral surface of dactylus of fourth pereopod with sharp, thin median ridge, that of fifth pereopod not ridged.

COMPOSITION. — *Glyphocrangon caeca* Wood-Mason & Alcock, 1891, *G. cerea* Alcock & Anderson, 1894, *G. brevis* n. sp., *G. demani* n. sp., *G. humilis* n. sp., *G. musorstomia* n. sp., *G. parviocullus* n. sp. and *G. rudis* n. sp.

REMARKS. — Species of this group do not exhibit marked sexual dimorphism in the body sculpture that is frequently seen in species of the *G. spinicauda* group (Komai 2004). Nevertheless, the length of the rostrum and the development of the acute lamina on the carapace seem different between males and females of *G. humilis* and *G. musorstomia*. The short pubescence on the carapace and appendages in *G. rudis* seems to be denser in females than in males.

Other than the reduced, unpigmented eyes and the absence of the arthrobranch gills above the first and second pereopods, there are several important characters for the *G. caeca* species group, strongly suggesting a monophyly of this species group. These characters include: the dorsolateral rostral ridge between the two lateral teeth is low, broad, with a distinct longitudinal sulcus; the median part of the gastric region on the carapace is armed with two submedian rows of tiny tubercles; the antennal and branchiostegal spines are relatively short; the anterior projection on the telson forms a somewhat elongate ridge; and the dactylus of the fourth pereopod is provided with a thin, sharp median ridge on the ventral surface. The anterior fourth carina produced in an acute, vertically compressed lamina links the *G. caeca* group to the *G. regalis* and *G. holthuisi* species complexes in the *G. spinicauda* group. Because of the possible paraphyly of the *G. spinicauda* group, a formal division of *Glyphocrangon* is not proposed for the time being, although the *G. caeca* species group appears to be monophyletic.

Species of this group are in most cases distinguished by a number of subtle diagnostic characters. Particularly useful are characters derived from the rostrum, carinae on the carapace and abdomen, development of the acute lamina on the carapace, and eye. However, positive discrimination of juveniles will be difficult, as these diagnostic characters may remain not fully developed in juveniles. It should be noted that the following key is useful only for identification of adult specimens.

KEY TO SPECIES OF *GLYPHOCRANGON CAECA* GROUP

1. Fifth abdominal pleuron with 1 ventral tooth; [second and third abdominal somites devoid of median carinae] ..... *G. cerea* Alcock & Anderson, 1894
(Laccadive Sea; 1294 m)

— Fifth abdominal pleuron with 2 ventral teeth 2

2. Median and dorsolateral carinae on second and third abdominal somites high, prominent 3

— Median and dorsolateral carinae on second and third abdominal somites low or absent 4

3. Carapace, abdomen and dorsal surface of scaphocerite covered with many short setae; acute lamina on carapace small, not reaching tip of antennal spine; fourth abdominal somite with conspicuous dorsolateral carina ..... *G. rudis* n. sp.
(Solomon Islands; 1036-1138 m)

— Carapace, abdomen and dorsal surface of scaphocerite naked; acute lamina on carapace large, reaching tip of antennal spine; fourth abdominal somite lacking dorsolateral carina ..... *G. demani* n. sp.
(Ceram Sea, Indonesia; 924 m)

4. Lobes of posterior second carina on carapace terminating anteriorly in acute points; median carina on first abdominal somite terminating in acute tooth; [acute lamina of anterior fourth carina elongate, overreaching tip of antennal spine, distance between tips 1.01-1.16 of carapace length; median carinae on second and third abdominal somites rudimentary or absent] ..... *G. parviocullus* n. sp.
(New Caledonia; 760-1256 m)

— Lobes of posterior second carina on carapace terminating anteriorly in blunt points; median carina on first abdominal somite terminating at most in blunt projection 5

5. Tubercles on anterior first carina spine-like; median carinae on second and third abdominal somites low, but distinct ..... *G. caeca* Wood-Mason and Alcock, 1891
(Bay of Bengal west of Andaman Islands; 1026 m)

— Tubercles on anterior first carina blunt, occasionally rudimentary; median carinae on second and third somites rudimentary or absent 6

6. Tubercles on anterior first carina on carapace relatively large; [rostrum 0.63-0.68 times as long as carapace; distance between tips of acute laminae on carapace 0.89-0.98 of carapace length; maximal diameter of eye 0.12-0.13 of carapace length] ..... *G. brevis* n. sp.
(Madagascar; 1075-1530 m)

— Anterior first carina on carapace with relatively small, sometimes rudimentary 7

7. Maximal diameter of eye 0.16-0.17 of carapace length; rostrum 0.53-0.63 times as long as carapace in spawning females, 0.69-0.76 times as long as in non-spawning females and males .... *G. humilis* n. sp.
(Japan and Taiwan; 660-1302 m)
— Maximal diameter of eye 0.12-0.13 of carapace length; rostrum 0.65-0.78 times as long as carapace in spawning females, 0.72-0.87 times as long as in non-spawning females and males ..... *G. musorstomia* n. sp.
(Wallis and Futuna Islands, Fiji, Vanuatu and Chesterfield Islands; 790-1210 m)

Glyphocrangon caeca Wood-Mason & Alcock, 1891

Fig. 10

Glyphocrangon caeca Wood-Mason & Alcock, 1891: 358 [type locality: Bay of Bengal west of Andaman Islands].
Glyphocrangon caeca – Wood-Mason & Alcock 1894: pl. 7, fig. 1. — Alcock 1902, fig. 56.
Glyphocrangon (Plastacrangon) caeca – Alcock 1901: 135.
Glyphocrangon caeca – Chace 1984: 10 (part).
Not *Glyphocrangon (Plastocrangon) caeca* – De Man 1920: 241, pl. 20, fig. 6i (= *Glyphocrangon demani* n. sp.).
Not *Glyphocrangon caeca* – Toriyama *et al.* 1990: 19, pl. 4b. — Miya 1995: 193 . — Sakaji 2001: 70 (= *Glyphocrangon humilis* n. sp.).

TYPE MATERIAL. — *Investigator*: stn 112, Bay of Bengal west of Andaman Islands, 1 ovigerous ♀ and 2 ♂ syntypes, deposited in the Indian Museum, Calcutta, under registration number 6737/9 (supposedly deposited in the Zoological Survey of India at present). Not available for study.

MATERIAL EXAMINED. — None.

DIAGNOSIS (derived from literature). — Body naked. Rostrum 0.63 times as long as carapace. Carapace with anterior first (submedian) carina composed of 4 small, spiniform tubercles; posterior first carina moderately high, clearly divided in 2 blunt lobes; tubercles composing anterior second (intermediate) carina low, blunt, but all distinct; posterior second carina composed of 3 relatively low, blunt lobes; acute lamina formed by anterior fourth (lateral) carina moderately large, entire, reaching tip of antennal spine, distance between tips 0.89 of carapace length; median part of gastric region with 2 rows of small, but distinct tubercles; posterior dorsolateral region with low tubercle anteriorly; branchiostegal spine overreaching anterior margin of antennal basicerite; lateral and cervical grooves shallow. Abdomen weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, blunt, posterior median carina very low, but still discernible; median carinae on second and third somites low, but distinct; anterior median carina on fourth somite low, but distinct; dorsolateral carina on first somite blunt; dorsolateral carinae on third to fourth somites showing as small, low tubercles; carinae and tubercles on fifth and sixth somites distinct; fifth abdominal pleuron with 2 ventral teeth. Eye small, maximal diameter 0.13 of carapace length. Antennal scaphocerite naked on dorsal surface. Second pereopods reaching anterior margin of antennal scaphocerite.

COLOR. — In life bright pink (Wood-Mason & Alcock 1891).

SIZE. — Ovigerous ♀ cl 15.0 mm; male cl 12.5 mm (Wood-Mason & Alcock, 1891).

REMARKS. — This species was originally described based upon three syntypes (one ovigerous female and two males) from the Bay of Bengal west of the Andaman Islands. Unfortunately, the syntypes or supplemental topotypic specimens were not available for study. Nevertheless, the published descriptions (Wood-Mason & Alcock 1891; Alcock 1901) and figures (Wood-Mason & Alcock 1894) are still informative in providing several features that are needed for its proper comparison with other species. These features include: the integument of the carapace and abdomen is naked; the anterior and

posterior first (submedian) carinae on the carapace bear four and two spiniform tubercles, respectively; and the median carinae on the second and third abdominal somites and that on the anterior part of the fourth abdominal somite were reportedly obsolescent (Alcock 1901), but the illustration by Wood-Mason & Alcock (1894) clearly shows low, but clearly defined median carinae on the second to fourth abdominal somites. Furthermore, according to the illustration (Wood-Mason & Alcock 1894), the rostrum is 0.63 times as long as the carapace; the distance between the acute laminae of the anterior fourth carinae is 0.89 of the carapace length; and the branchiostegal spine distinctly overreaches the distal margin of the antennal basicerite.

The possession of spiniform tubercles on the first (submedian) carina on the carapace is shared by *G. caeca* and *G. parviocullus* n. sp. In other species, those tubercles are blunt, occasionally rudimentary. However, *G. parviocullus* is quite distinctive in having the elongate rostrum and acute lamina of the anterior fourth (lateral) carina on the carapace.

The presence of distinct median carinae on the second and third abdominal somites separates *G. caeca* from *G. brevis* n. sp., *G. humilis* n. sp. and *G. musorstomia* n. sp. The two other new species described in this study, *G. demani* n. sp. and *G. rudis* n. sp., are immediately distinguished from *G. caeca* by the prominent median carinae and dorsolateral carinae on the second and third abdominal somites.

DISTRIBUTION. — Bay of Bengal near the Andaman Islands, at depth of 1026 m (Fig. 10).

Glyphocrangon cerea Alcock & Anderson, 1894

Fig. 10

Glyphocrangon cerea Alcock & Anderson, 1894: 151 [type locality: off the northern Maldive Atoll, Laccadive Sea].
Glyphocrangon cerea – Alcock & Anderson 1895, pl. 9, fig 6. — Alcock 1901: 135. — Chace 1984: 6 (key).

TYPE MATERIAL. — *Investigator*: stn 150, off northern Maldive Atoll, Laccadive Sea, 07°04.45'N, 75°04'E, 1294 m, ♂ holotype (supposedly deposited in the Zoological Survey of India). Not available for study.

MATERIAL EXAMINED. — None.

DIAGNOSIS (derived from literature). — Carapace and abdomen naked. Rostrum about 0.70 times as long as carapace. Carapace with anterior first (submedian) carina with low tubercles; posterior first carina also low, but distinctly divided in 2 lobes; tubercles composing anterior second (intermediate) carina very low, occasionally inconspicuous; posterior second carina composed of 3 low, blunt lobes; acute lamina relatively large, distance between tips approximating carapace length; median part of gastric region with 2 submedian rows of tiny tubercles; lateral and cervical grooves shallow. Abdomen weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, blunt; median carinae on second and third somites absent; anterior median carina on fourth somite faint; dorsolateral carinae on second to fourth somites rudimentary or absent; carinae and tubercles on fifth and sixth somite low, sometimes faint; fifth abdominal pleuron with only 1 ventral tooth. Eye small, 0.20 of rostrum length. Dorsal surface of antennal scaphocerite naked.

SIZE. — Not indicated.

COLOR. — Unknown.

REMARKS. — This species was described from a single specimen from the Laccadive Sea in the Indian Ocean. The holotype or supplemental specimens were not available for study. Therefore, this species is rediagnosed based on literature (Alcock

& Anderson 1894, 1895; Alcock 1901; Chace 1984). *Glyphocrangon cerea* appears similar to *G. brevis*, *G. humilis* and *G. musorstomia* in the poorly developed median carinae on the second and third abdominal somites. However, *G. cerea* appears unique in the species group in the possession of only a single pleural tooth on the fifth abdominal somite (Alcock 1901; Chace 1984). In other species referred to the *G. caeca* species group, the fifth abdominal pleuron bears always two ventral teeth.

DISTRIBUTION. — Known only from the type locality in the Laccadive Sea, at depth of 1294 m (Fig. 10).

Glyphocrangon brevis n. sp.

Figs 1A, 2A, 3, 10

TYPE MATERIAL. — Madagascar (holotype and paratypes). — *Vauban*: stn CH 124, 17°40'S, 43°12'E, 1075-1175 m, 15.01.1975: ovigerous ♀ holotype cl 13.5 mm (MNHN-Na 15389) and 1 ovigerous ♀ 13.3 mm (MNHN-Na 15390); stn CH 126, 17°50'S, 43°07'E, 1475-1530 m, 16.01.1975: 1 ♀ 12.7 mm (MNHN-Na 15391).

MATERIAL EXAMINED. — Type material (see above).

DIAGNOSIS. — Body naked. Rostrum (Fig. 3) 0.63-0.68 times as long as carapace. Carapace (Fig. 1A, 3) with anterior first (submedian) carina composed of 6 small, blunt tubercles; posterior first carina moderately high, rather clearly divided in 2 blunt lobes; tubercles composing anterior second (intermediate) carina low, blunt, but distinct; posterior second carina composed of 3 blunt lobes; acute lamina formed by anterior fourth (lateral) carina moderately large, entire, not reaching tip of antennal spine, distance between tips 0.89-0.98 of carapace length; median part of gastric region with 2 rows of small, but distinct tubercles, partially visible in lateral view; posterior dorsolateral region with low, broad longitudinal ridge; branchiostegal spine short, reaching distal margin of antennal basicerite; lateral and cervical grooves shallow. Abdomen (Fig. 3) weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, blunt, posterior median carina very low, but still discernible; median carinae on second and third somites rudimentary; anterior median carina on fourth somite very low, but distinct; dorsolateral carina on first somite blunt; dorsolateral carinae on second somite very low, those on third to fourth somites rudimentary or absent; tergal tubercles on second to fourth somites rudimentary or absent; carinae and tubercles on fifth and sixth somites relatively high and rather sharply delineated (Fig. 2A); fifth abdominal pleuron with 2 ventral teeth. Eye small, maximal diameter 0.13 of carapace length. Antennal scaphocerite naked on dorsal surface. Second pereopods short, reaching only mid-length of scaphocerite.

COLOR. — Unknown.

SIZE. — Ovigerous females cl 13.2-13.5 mm; males unknown.

ETYMOLOGY. — From the Latin *brevis* (= short), in reference to the short branchiostegal spine on the carapace of this new species.

REMARKS. — *Glyphocrangon brevis* n. sp. is most similar to *G. humilis* n. sp. and *G. musorstomia* n. sp. The three share the possession of blunt tubercles on the anterior first carina on the carapace and the poorly developed median carinae on the second and third abdominal somites. *Glyphocrangon brevis* can be distinguished from the latter two species by differences in the first carina on the carapace, length of the branchiostegal spine on the carapace and development of the sculpture of the fifth and sixth abdominal somites. The tubercles on the anterior first carina on the carapace are more conspicuous in *G. brevis* than in *G. humilis* and *G. musorstomia* (Fig. 1A, C, D). The branchiostegal spine of *G. brevis* reaches the anterior margin of the antennal basicerite, but that of *G. humilis* and *G. musorstomia* clearly overreaches it. The carinae and tubercles on the fifth and sixth abdominal somites seem to be relatively higher and thus more clearly delineated in *G. brevis* than in

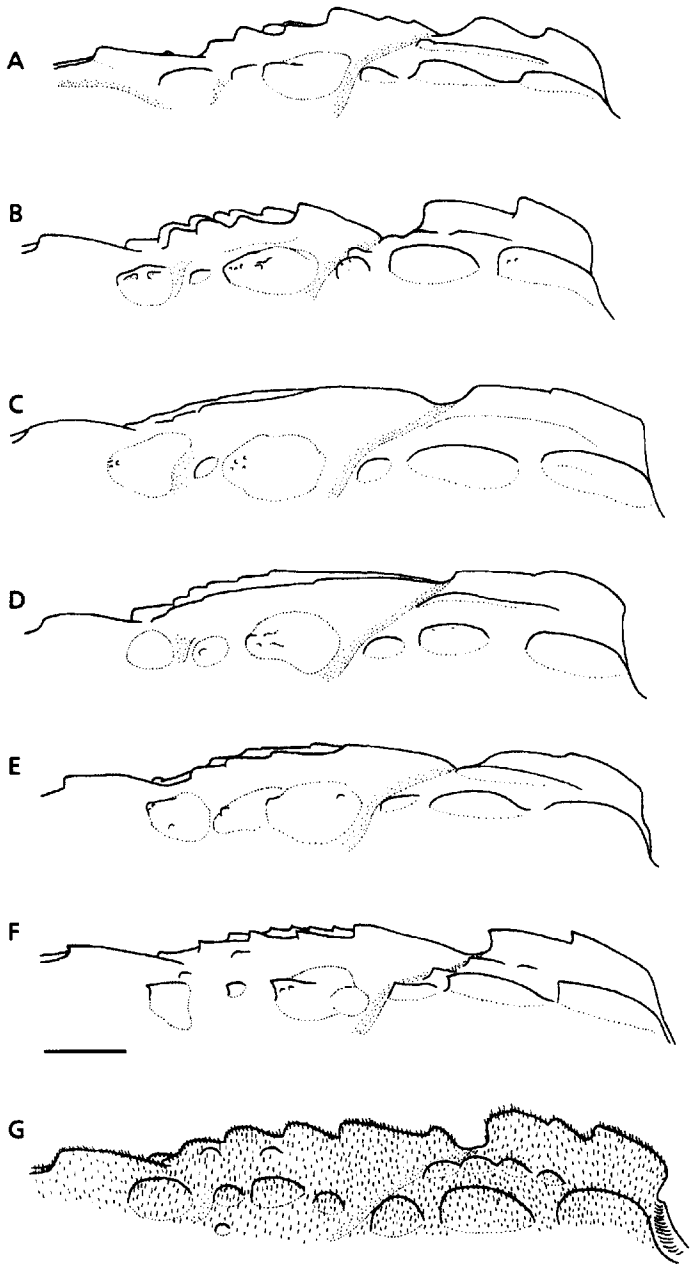

FIG. 1. Dorsal part of carapace in lateral view (left), showing conformation of first (submedian) and second (intermediate) carinae. A, *Glyphocrangon brevis* n. sp., ovigerous female holotype (cl 13.5 mm) from Madagascar (MNHN-Na 15389); B, *G. demani* n. sp., male holotype (cl 14.5 mm) from Seram, Indonesia (ZMA Crust De 240165); C, *G. humilis* n. sp., ovigerous female paratype (cl 15.7 mm) from Taiwan (NTOU M00660); D, *G. musorstomia* n. sp., ovigerous female holotype (cl 14.7 mm) from Wallis and Futuna Islands (MNHN-Na 15392); E, *G. musorstomia* n. sp., ovigerous female paratype (cl 14.7 mm) from same locality (MNHN-Na 15394); F, *G. parviocullus* n. sp., ovigerous female holotype (cl 16.5 mm) from New Caledonia (MNHN-Na 15404); G, *G. rudis* n. sp., ovigerous female holotype (cl 15.6 mm) from Solomon Islands (MNHN-Na 15424). *Scale bar = 2 mm.*

FIG. 1. *Partie dorsale de la carapace en vue latérale (gauche), montrant la forme des première (submédiane) et deuxième (intermédiaire) carènes. A,* Glyphocrangon brevis *n. sp., femelle ovigère holotype (cl 13,5 mm) de Madagascar (MNHN-Na 15389) ; B,* G. demani *n. sp., mâle holotype (cl 14,5 mm) de Seram, Indonésie (ZMA Crust De 240165) ; C,* G. humilis *n. sp., femelle ovigère paratype (cl 15,7 mm) de Taiwan (NTOU M00660) ; D,* G. musorstomia *n. sp., femelle ovigère holotype (cl 14,7 mm) des Îles Wallis et Futuna (MNHN-Na 15392) ; E,* G. musorstomia *n. sp., femelle ovigère paratype (cl 14,7 mm) de la même localité (MNHN-Na 15394) ; F,* G. parviocullus *n. sp., femelle ovigère holotype (cl 16,5 mm) de Nouvelle-Calédonie (MNHN-Na 15404) ; G,* G. rudis *n. sp., femelle ovigère holotype (cl 15,6 mm) des Îles Salomon (MNHN-Na 15424).* Échelle = 2 mm.

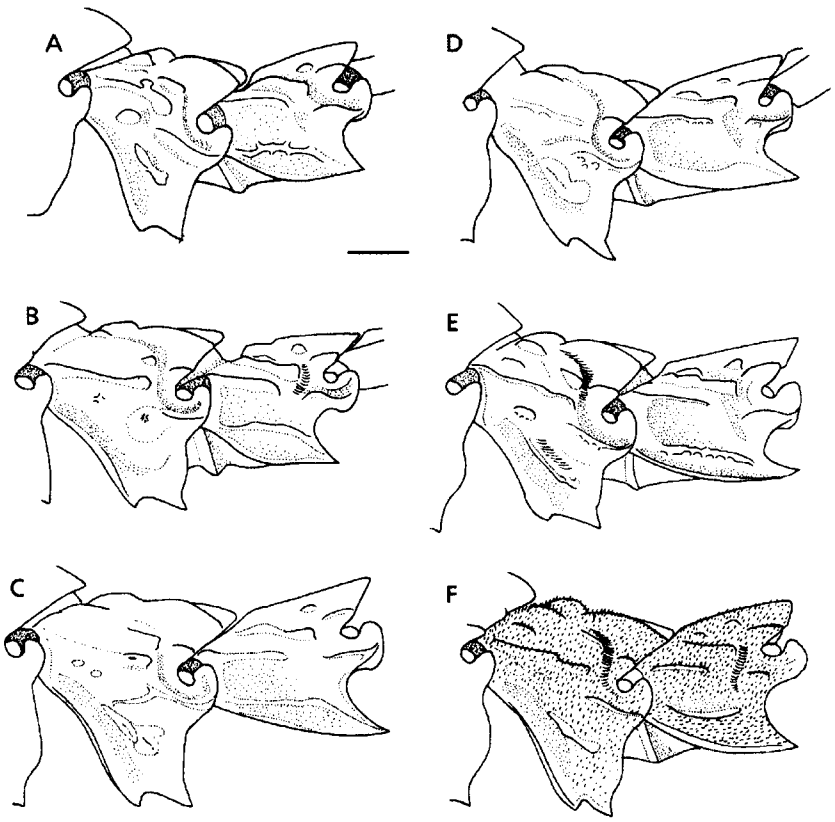

FIG. 2. Fifth and sixth abdominal somites in lateral view (left), showing development of carinae and tubercles. A, *Glyphocrangon brevis* n. sp., ovigerous female holotype (cl 13.5 mm) from Madagascar (MNHN-Na 15389); B, *G. demani* n. sp., male holotype (cl 14.5 mm) from Ceram, Indonesia (ZMA Crust De 240165); C, *G. humilis* n. sp., ovigerous female paratype (cl 15.7 mm) from Taiwan (NTOU M00660); D, *G. musorstomia* n. sp., ovigerous female holotype (cl 14.7 mm) from Wallis and Futuna Islands (MNHN-Na 15392); E, *G. parviocullus* n. sp., ovigerous female holotype (cl 16.5 mm) from New Caledonia (MNHN-Na 15404); F, *G. rudis* n. sp., ovigerous female holotype (cl 15.6 mm) from Solomon Islands (MNHN-Na 15424). *Scale bar = 2 mm.*

FIG. 2. *Cinquième et sixième somites abdominaux en vue latérale gauche, montrant le développement des carènes et des tubercules. A,* Glyphocrangon brevis *n. sp., femelle ovigère holotype (cl 13,5 mm) de Madagascar (MNHN-Na 15389) ; B,* G. demani *n. sp., mâle holotype (cl 14,5 mm) de Ceram, Indonésie (ZMA Crust De 240165) ; C,* G. humilis *n. sp., femelle ovigère paratype (cl 15,7 mm) de Taiwan (NTOU M00660) ; D,* G. musorstomia *n. sp., femelle ovigère holotype (cl 14,7 mm) des Îles Wallis et Futuna (MNHN-Na 15392) ; E,* G. parviocullus *n. sp., femelle ovigère holotype (cl 16,5 mm) de Nouvelle-Calédonie (MNHN-Na 15404) ; F,* G. rudis *n. sp., femelle ovigère holotype (cl 15,6 mm) des Îles Salomon (MNHN-Na 15424). Échelle = 2 mm.*

G. humilis and *G. musorstomia* (Fig. 2A, C, D). Other character allowing differentiation between *G. brevis* and the latter two species is observed on the posterior first carina on the carapace. This character, however, is subject to variation in *G. humilis*, and is less reliable. In *G. brevis*, the posterior first carina is distinctly divided in two blunt lobes, while the division is usually faintly indicated in *G. humilis* and *G. musorstomia*.

This new species is also similar to *G. caeca*. However, it can be distinguished from *G. caeca* by the rudimentary median carinae on the second to third abdominal somites. As mentioned before, the median carinae on the second and third abdominal somites are low but still distinct in *G. caeca*, according to the illustration given by Wood-Mason & Alcock (1894). Furthermore, the tubercles on the anterior first carina on the carapace are reportedly spiniform in *G. caeca*, rather than blunt in *G. brevis*.

DISTRIBUTION. — Mozambique Strait west of Madagascar, at depths of 1075-1530 m (Fig. 10).

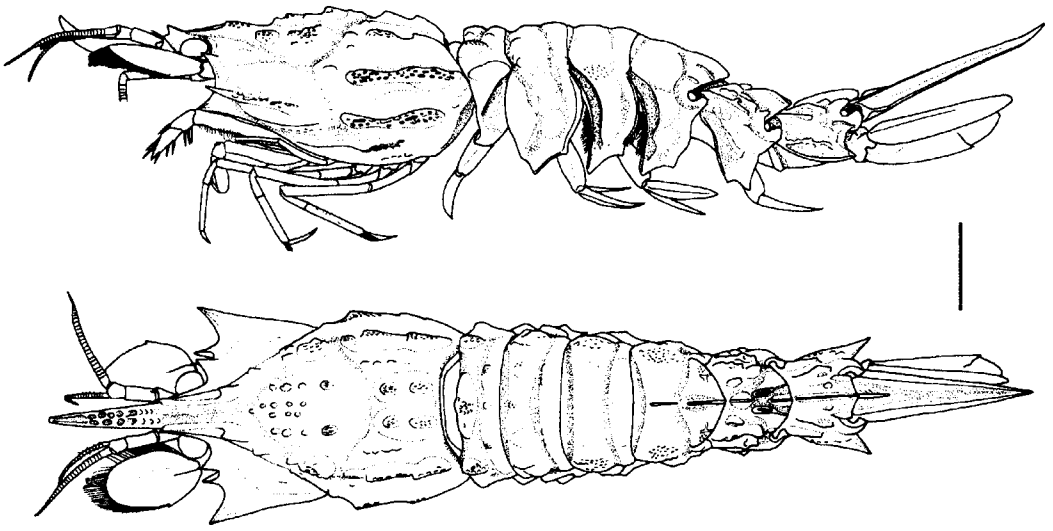

FIG. 3. *Glyphocrangon brevis* n. sp. Habitus. Ovigerous female holotype (cl 13.5 mm) from Madagascar (MNHN-Na 15389). Scale bar= 5 mm.
FIG. 3. *Glyphocrangon brevis* n. sp. *Habitus. Femelle ovigère holotype (cl 13,5 mm) de Madagascar (MNHN-Na 15389). Échelle = 5 mm.*

Glyphocrangon demani n. sp.

Figs 1B, 2B, 4, 10

Glyphocrangon caeca – De Man 1920: 241, pl. 20, fig. 6i. Not *Glyphocrangon caeca* Wood-Mason & Alcock, 1891.
Glyphocrangon caeca – Chace 1984: 10 (part).

TYPE MATERIAL. — Indonesia. "*Siboga*": stn 170, between Ceram and New Guinea, 03°37.7'S, 131°26.4'E, 924 m, 26.08.1899: ♂ holotype cl 14.5 mm (ZMA Crust De 240165).

MATERIAL EXAMINED. — The holotype (see above).

DIAGNOSIS. — Carapace and abdomen naked. Rostrum (Fig. 4) 0.70 times as long as carapace. Carapace (Fig. 1B, 4) with anterior first (submedian) carina composed of blunt, relatively high tubercles; posterior section relatively high, distinctly divided in 2 blunt lobes; tubercles composing anterior second (intermediate) carina low, but distinct; posterior section of second carina composed of 3 relatively high, blunt lobes; acute lamina relatively large, reaching tip of antennal spine, distance between tips 0.94 of carapace length; median part of gastric region with 2 submedian rows of small, conspicuous tubercles, visible in lateral view; posterior dorsolateral region with low longitudinal ridge; branchiostegal spine distinctly overreaching tip of antennal spine; lateral and cervical grooves relatively deep. Abdomen (Fig. 4) sculptured with relatively deep grooves and depressions; anterior median carina on first somite relatively high, showing as large rounded tubercle, posterior median carina low, but distinct; median carinae on second to fourth somites high; dorsolateral carina on first somite blunt; dorsolateral carinae on second and third somites showing as tubercles, fourth somites without dorsolateral carinae; tergal tubercles on second and third somites small, but distinct, those on fourth somite rudimentary or absent; carinae and tubercles on fifth and sixth somites relatively high, conspicuous (Fig. 2B); fifth abdominal pleuron with 2 ventral teeth. Eye relatively large for this species group, maximal diameter 0.16 of carapace length. Antennal scaphocerite naked on dorsal surface. Second pereopod reaching distal margin of antennal scaphocerite.

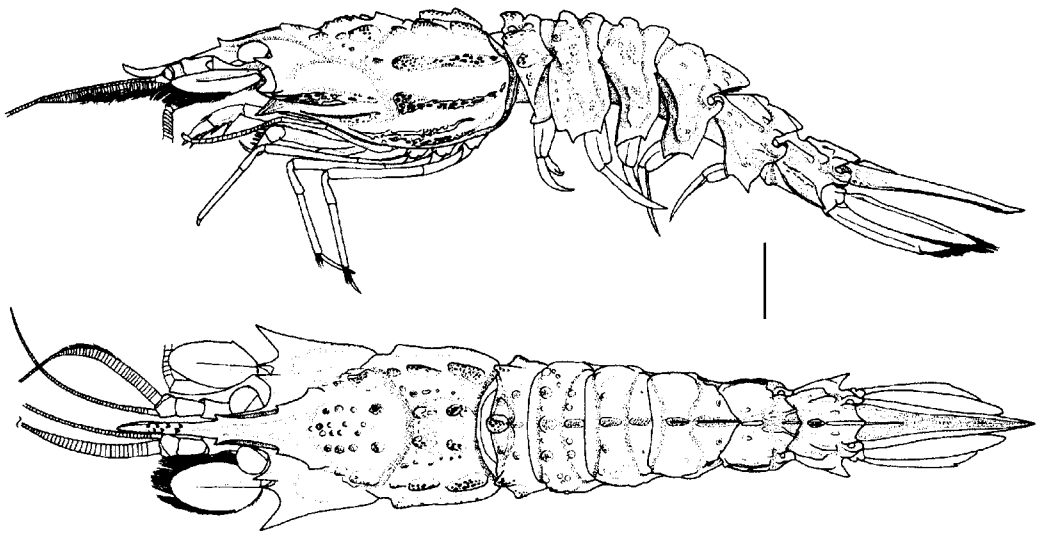

FIG. 4. Glyphocrangon demani *n. sp.* Habitus. Mâle holotype (cl 14.5 mm) from east of Ceram, Indonesia (ZMA Crust De 240165). *Scale bar = 5 mm.*
FIG. 4. *Glyphocrangon demani n. sp. Habitus. Mâle holotype (cl 14,5 mm) de l'est de Ceram, Indonésie (ZMA Crust De 240165).* Échelle = 5 mm.

COLOR. — "This specimen (in spirit) has a cream colour, the tips of some spines are red, namely the apex of the rostrum, of the anterior pair of rostral spines, of the orbital, the branchiostegal and the large wing-like spine of the fourth carina, of the short spines on the lower border of the pleura, the apex of the telson, the hairs on the two last joints of the external maxillipeds and the dactyli of the first pair of legs" (De Man 1920).

SIZE. — Male cl 14.5 mm.

ETYMOLOGY. — This new species is named after Dr. G. J. De Man for his great contributions to the systematics of the decapod Crustacea.

REMARKS. — This new species is represented only by the holotype, which was assigned to *G. caeca* by De Man (1920). It somewhat resembles *G. rudis* n. sp. in having the conspicuous median carinae and dorsolateral tubercles on the first to fourth abdominal somites. However, it can be easily distinguished from *G. rudis* by the lack of many short setae on the carapace and antennal scaphocerite, larger acute lamina of the anterior section of the fourth carinae on the carapace, and the absence of the dorsolateral tubercles on the tergum of the fourth abdominal somite. The acute lamina on the carapace reaches the tip of the antennal spine in *G. demani*, rather than falling short of it in *G. rudis*.

DISTRIBUTION. — Known only from the type locality in Indonesia, 924 m (Fig. 10).

Glyphocrangon humilis n. sp.

Figs 1C, 2C, 5, 10

Glyphocrangon caeca – Toriyama *et al.* 1990: 19, pl. 4b. — Miya 1995: 193; 1996: 321. Sakaji 2001: 211. Not *Glyphocrangon caeca* Wood-Mason & Alcock, 1891.

TYPE MATERIAL. — Japan (holotype and paratypes). RV *Kotaka-maru*: Tosa Bay, 33°00'N, 133°35'E, 660-700 m, 23.05.1985, coll. M. Toriyama: ovigerous ♀ holotype cl 14.3 mm (CBM-ZC 8020); Tosa Bay, 32°59.2'N, 133°35.5'E,

700-728 m, 24.05.1987, coll. M. Toriyama: 1 ovigerous ♀ 16.0 mm (KRD); stn K98-12-800, Tosa Bay, 33°11.4'N, 133°53.8'E, 741-801 m, 11.12.1998, coll. H. Sakaji: 1 ♂ cl 11.2 mm (KRD).

East China Sea (paratypes). FB *Yuryo-maru No. 8*: net 18, Okinawa Trough, 29°38.92'N, 127°55.95'E, 750 m, 04.02.1978: 2 ♀ cl 10.0, 12.4 mm, 5 ovigerous ♀ cl 12.8-15.8 mm, 1 ♂ 12.2 mm (NUM-Cr 10346); net 61, Okinawa Trough, 29°03'N, 127°16'E, 915-908 m: 2 ovigerous ♀ cl 13.5, 14.3 mm, 1 ♂ cl 12.7 mm (NUM-Cr 10347).

Taiwan (paratypes). TAIWAN 2001: stn CD 136, W of Ping-Tong County, 22°17.75'N, 120°00.87'E, 1211-998 m, 22.11.2001: 1 ♀ cl 12.7 mm, 2 ovigerous ♀ cl 14.1, 15.1 mm, 1 ♂ cl 12.7 mm (NTOU M00659); stn CD 141, W of Ping-Tong County, 22°12.04'N, 119°59.96'E, 1110-985 m, 24.11.2001: 2 ♀ cl 12.6 mm, 14.8 mm, 2 ovigerous ♀ cl 15.0, 16.0 mm (NTOU M00660). TAIWAN 2002: stn CD 192, SW of Ping Tong County, 22°17.19'N, 120°01.01'E, 960-1302 m, 28.08.2002: 1 ♂ cl 14.0 mm (NTOU M00661).

MATERIAL EXAMINED. — The type material (see above).

DIAGNOSIS. — Carapace and abdomen naked. Rostrum (Fig. 5) 0.53-0.63 times as long as carapace in spawning females, 0.69-0.72 in non-spawning females and males. Carapace (Figs 1C, 5) with anterior first (submedian) carina composed of 3 or 4 very low tubercles, thus median part of gastric region visible in lateral view; posterior first carina also low, usually faintly divided in 2 (rarely 3) lobes; tubercles composing anterior second (intermediate) carina very low, occasionally rudimentary; posterior second carina composed of 3 low, blunt lobes; acute lamina formed by anterior fourth (lateral) carina relatively large, entire, distance between tips 0.83-1.00 of carapace length in both spawning and non-spawning females, 0.95-1.10 in males; median part of gastric region with 2 submedian rows of tiny, occasionally rudimentary tubercles; posterior dorsolateral region with rudimentary longitudinal ridge; branchiostegal spine distinctly overreaching distal margin of antennal basicerite; lateral and cervical grooves shallow. Abdomen (Fig. 5) weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, blunt, posterior median carina rudimentary or absent; median carinae on second and third somites rudimentary or absent; anterior median carina on fourth somite rudimentary or absent; dorsolateral carina on first somite bluntly pointed; dorsolateral carinae on third to fourth somites rudimentary or absent; tergal tubercles on second to fourth somites rudimentary or absent; carinae and tubercles on fifth and sixth somite relatively low (Fig. 2C); fifth abdominal pleuron with 2 ventral teeth. Eye relatively large for species group, maximal diameter 0.16-0.17 of carapace length. Dorsal surface of antennal scaphocerite naked. Second pereopod not reaching or reaching distal margin of antennal scaphocerite.

COLOR. — In life. Generally white or light yellow, but telson with tinge of red; distal parts of rostrum, acute laminae on carapace and telson red; antennule, third maxilliped and pereopods red; eye white or light yellow.

SIZE. — Ovigerous females cl 12.8-16.0 mm; males cl 12.7-14.0 mm.

ETYMOLOGY. — From the Latin *humilis*, meaning low, in reference to the generally low carinae on the carapace and abdomen.

REMARKS. — The specimens from Japan and Taiwan are almost identical, except that the acute laminae on the carapace in females is more divergent in the specimens from Taiwan than in those from Japan (the distance between the tips is 0.83-0.93 of the carapace length in the Japanese specimens, 0.91-1.00 in the specimens from Taiwan). There are overlapping in these two characters between the two populations, and thus they are treated as a single species for the time being.

This new species closely resembles *G. musorstomia*. These two species can be distinguished from other species of the *G. cacea* group by the very low anterior first carina on the carapace, the median carinae on the second and third abdominal somites rudimentary or absent and the less conspicuous carinae and tubercles on the fifth and sixth abdominal somites.

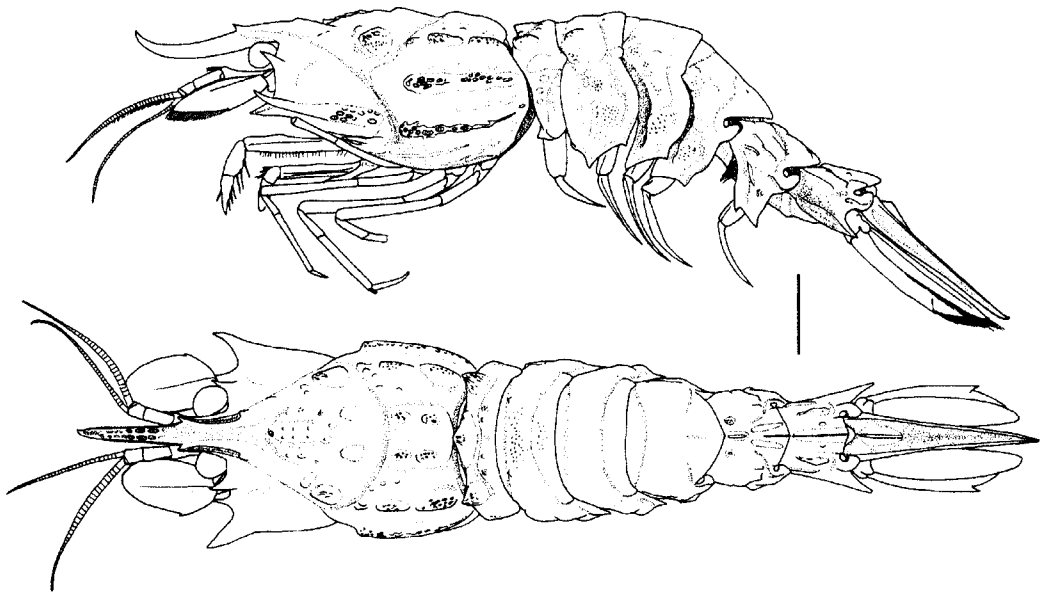

FIG. 5. *Glyphocrangon humilis* n. sp. Habitus. Ovigerous female holotype (cl 14.3 mm) from Tosa Bay, Japan (CBM-ZC 8020) (left eye slightly damaged). *Scale bar = 5 mm.*

FIG. 5. Glyphocrangon humilis *n. sp. Habitus. Femelle ovigère holotype (cl 14,3 mm) de Tosa Bay, Japon (CBM-ZC 8020) (œil gauche légèrement endommagé).* Échelle = 5 mm.

Glyphocrangon humilis can be separated from *G. musorstomia* by subtle differences in the rostrum and the size of the eye. The rostrum is relatively shorter in *G. humilis* than in *G. musorstomia*, 0.53-0.63 times as long as the carapace in spawning females and 0.60-0.72 times in non-spawning females and males in *G. humilis* versus 0.60-0.73 times as long in spawning females and 0.72-0.82 times in non-spawning females and males in *G. musorstomia*. The eye of *G. humilis* is relatively large for the *G. caeca* species group, the maximal diameter 0.16-0.17 of the carapace length, in contrast to 0.12-0.13 in *G. musorstomia*.

The specimens referred to *G. caeca* by Toriyama *et al.* (1990: from Tosa Bay) and Miya (1995: from the East China Sea) are included in the type series of this new species. Sakaji (2001) listed *G. caeca* from Tosa Bay. One of the two Sakaji's specimens have been reexamined, and it has been confirmed that the specimen represents the present new species.

DISTRIBUTION. — Japan (Tosa Bay and Okinawa Trough) and southwestern Taiwan; 660-1302 m (Fig. 10).

Glyphocrangon musorstomia n. sp.

Figs 1D, E, 6, 7, 10

TYPE MATERIAL. — Wallis and Futuna Islands (holotype and paratypes). — MUSORSTOM 7: stn CP 565, Tuscarora Bank, 11°47.4'S, 178°25.3'E, 900 m, 20.05.1992: ovigerous ♀ holotype cl 14.7 mm (MNHN-Na 15392), and 1 ♀ cl 15.3 mm, 8 ovigerous ♀ cl 13.3-16.3 mm (MNHN-Na 15394); stn CP 551, Combe Bank, 12°15'S, 177°28'W, 791-795 m, 18.05.1992: 1 ovigerous ♀ cl 14.4 mm (MNHN-Na 15393); stn CP 564, 11°46'S, 178°27'W, 1015-1020 m, 20.05.1992: 29 ♀ cl 9.7-13.1 mm, 9 ovigerous ♀ 13.1-15.7 mm, 34 ♂ cl 9.7-13.9 mm, 1 juvenile cl 8.2 mm (MNHN-Na); stn CP 567,

11°47'S, 178°27'W, 1010-1020 m, 20.05.1992: 14 ♀ cl 9.1-13.4 mm, 19 ovigerous ♀ cl 13.0-15.4 mm, 32 ♂ cl 8.6-13.3 mm, 4 juveniles cl 6.7-8.5 mm (MNHN-Na 15395).

MATERIAL EXAMINED. — The type material (see above). — Vanuatu. MUSORSTOM 8: stn CP 956, southeast of Anatom, 20°33.41'S, 169°35.95'E, 1175-1210 m, 20.09.1994: 1 ♂ cl 14.6 mm (photographed, MNHN-Na 15396); stn CP 1036, southeast of Efate, 18°01.00'S, 166°48.20'E, 920-950 m, 29.09.1994: 1 ♀ cl 11.7 mm (MNHN-Na 15397); stn CP 1037, southeast of Efate, 18°03.70'S, 168°54.40'E, 1058-1086 m, 29.09.1994: 9 ♀ cl 7.5-12.7 mm, 2 ovigerous ♀ cl 14.1 mm (photographed), 14.5 mm, 3 ♂ cl 10.6-11.5 mm, 1 juv cl 6.0 mm (MNHN-Na 15398).

Fiji. MUSORSTOM 10: stn CP 1361, southeast of Viti Levu, 18°00.0'S, 178°53.7'E, 1058-1091 m, 13.08.1998: 2 ♀ cl 10.7, 10.9 mm, 10 ♂ cl 9.1-14.1 mm (MNHN-Na 15399). — BORDAU 1: stn CP 1457, 17°19'S, 179°34'W, 942-976 m, 05.03.1999: 3 ovigerous ♀ cl 12.9-14.1 mm, 6 ♂ cl 10.9-12.7 mm (MNHN-Na 15400).

Chesterfield Islands. MUSORSTOM 5: stn CP 323, Coriolis Bank, 21°18.52'S, 157°57.62'E, 970 m, 14.10.1986: 4 ovigerous ♀ cl 14.1-14.5 mm (MNHN-Na 15401); stn CP 324, Coriolis Bank, 21°15.01'S, 157°51.33'E, 970 m, 14.10.1986: 1 ovigerous ♀ cl 14.7 mm (photographed; MNHN-Na 15402); same data, 1 ♀ cl 9.3 mm, 1 ovigerous ♀ cl 14.0 mm, 5 ♂ cl 7.6-12.9 mm (MNHN-Na 15403).

ETYMOLOGY. — The specific name is derived from the expedition acronym, MUSORSTOM.

DIAGNOSIS. — Carapace and abdomen naked. Rostrum (Fig. 6) 0.65-0.78 times as long as carapace in spawning females, 0.72-0.87 times as long in non-spawning females and males. Carapace (Figs 1D, 1E, 6) with first (submedian) carina composed of 3-5 very low tubercles, thus median part of gastric region visible in lateral view; posterior first carina low, faintly divided in 2 lobes; tubercles composing anterior second (intermediate) carina very low, occasionally rudimentary; posterior second carina composed of 3 low, blunt lobes; acute lamina formed by anterior fourth (lateral) carina moderately

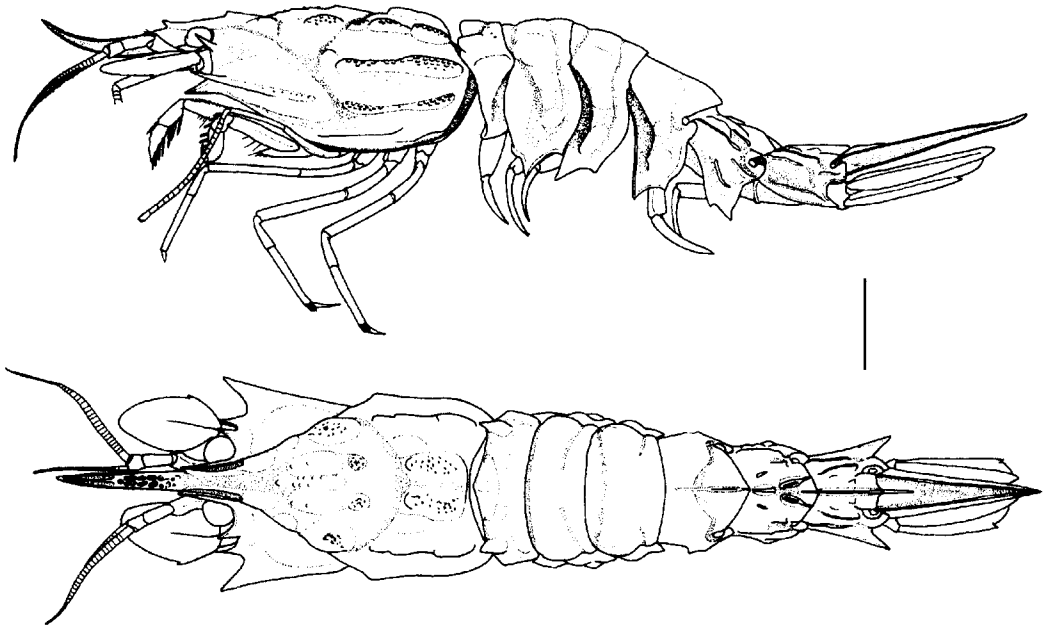

FIG. 6. *Glyphocrangon musorstomia* n. sp. Habitus. Ovigerous female holotype (cl 14.7 mm) from Wallis and Futuna Islands (MNHN-Na 15392). *Scale bar = 5 mm.*

FIG. 6. Glyphocrangon musorstomia *n. sp. Habitus. Femelle ovigère holotype (cl 14,7 mm) des Îles Wallis et Futuna (MNHN-Na 15392).* Échelle = 5 mm.

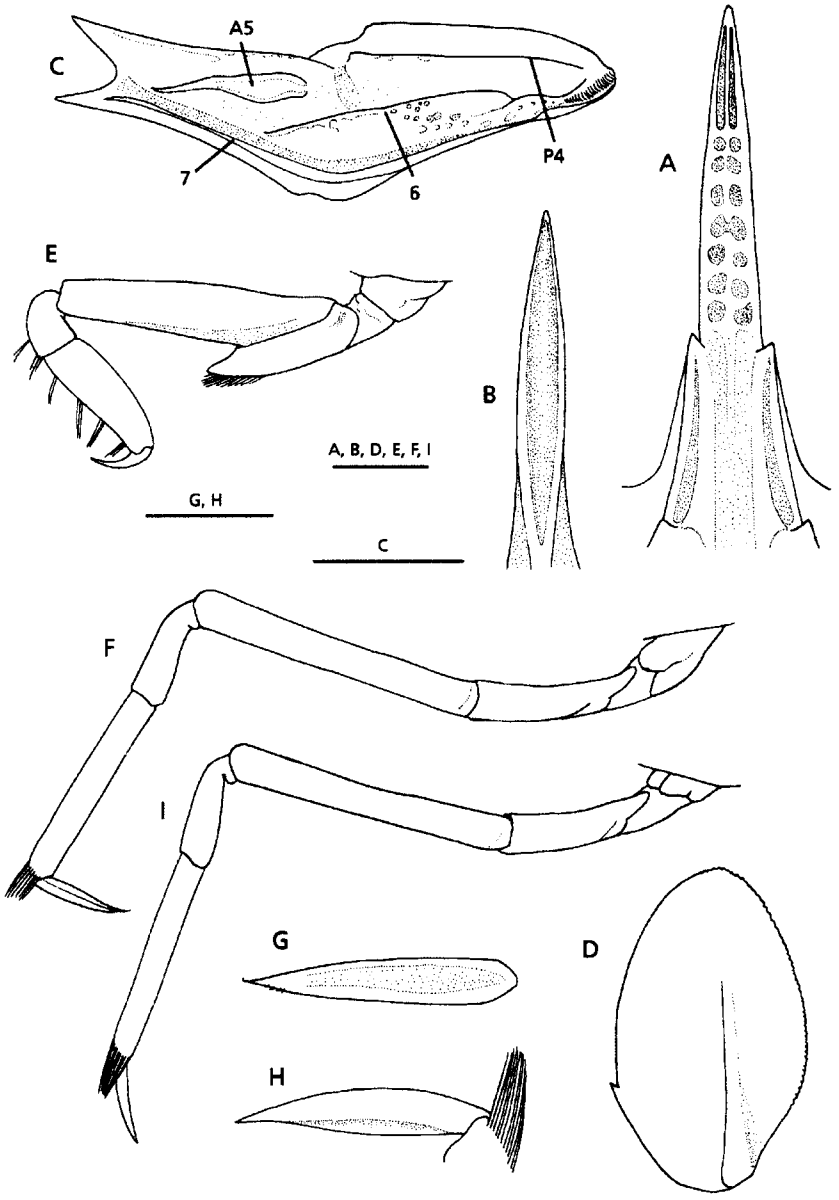

FIG. 7. *Glyphocrangon musorstomia* n. sp. Ovigerous female paratype (cl mm) from Wallis and Futuna Islands (MNHN-Na 15394). A, rostrum, dorsal view; B, distal part of rostrum, ventral view; C, ventrolateral part of carapace, ventrolateral view; D, left antennal scaphocerite, dorsal view; E, left first pereopod, lateral view; F, left fourth pereopod, lateral view; G, dactylus of left fourth pereopod, dorsal view; H, same, lateral view; I, left fifth pereopod, lateral view. Scale bars: A, B, D, E, F, I = 2 mm; C = 1 mm; G, H = 5 mm.

FIG. 7. *Glyphocrangon musorstomia* n. sp. *Femelle ovigère paratype (cl mm) des Îles Wallis et Futuna (MNHN-Na 15394). A, rostre, vue dorsale ; B, partie distale du rostre, vue ventrale ; C, partie ventrolatérale de la carapace, vue ventrolatérale ; D, scaphocérite de l'antenne gauche, vue dorsale ; E, péréiopode gauche, vue latérale ; F, quatrième péréiopode gauche, vue latérale ; G, doigt du quatrième péréiopode, vue dorsale ; H, le même en vue latérale ; I, cinquième péréiopode gauche, vue latérale. Echelles : A, B, D, E, F, I = 2 mm ; C = 1 mm ; G, H = 5 mm.*

large for this species group, entire, distance between tips 0.82-0.93 of carapace length in spawning and non-spawning females, 0.80-0.97 in males; median part of gastric region with 2 submedian rows of tiny, occasionally rudimentary tubercles; posterior dorsolateral region with faint longitudinal ridge; branchiostegal spine distinctly overreaching distal-margin of antennal basicerite; lateral and cervical grooves shallow. Abdomen (Fig. 6) weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, blunt, posterior median carina rudimentary or absent; median carinae on second and third somites rudimentary or absent; anterior median carina on fourth somite very low, occasionally absent; dorsolateral carina on first somite blunt to acute; dorsolateral carinae on second to fourth somites rudimentary or absent; tergal tubercles on second to fourth somites rudimentary; carinae and tubercles on fifth and sixth somite relatively low, less conspicuous (Fig. 2D); fifth abdominal pleuron with 2 ventral teeth. Eye small, maximal diameter 0.12-0.13 of carapace length. Dorsal surface of antennal scaphocerite naked. Second pereopod reaching or slightly overreaching distal margin of antennal scaphocerite.

COLOR. — In life. Body generally light orange, tips of rostrum, telson, teeth and tubercles on carapace and abdomen darker. Carapace occasionally with large crimson patch on upper part of hepatic and gastric regions. Median part of abdomen transparent, without colour. Eyes white or light yellow. Third maxilliped, first and third pereopods crimson. Fourth and fifth pereopods generally light orange, meri crimson. Eggs pale green. (Based on colour slides showing a male specimen from MUSORSTOM 8, stn CP 956 and an ovigerous female from MUSORSTOM 8, stn CP 1037).

SIZE. — Ovigerous females cl 12.9-15.7 mm; largest male cl 14.1 mm.

REMARKS. — The material from Wallis and Futuna Islands, Fiji, Vanuatu, and Chesterfield Islands are generally similar, except that the development of the acute lamina on the carapace and shape of the dorsolateral carina on the first abdominal somite are rather variable. The acute laminae of the carapace are slightly more divergent in the specimens from the Chesterfield Islands than in the specimens from other localities. The dorsolateral carina on the first abdominal somite is blunt or subacute in the specimens from Wallis and Futuna Islands and Fiji, but it is subacute or acute in the specimens from Vanuatu and Chesterfield Islands. These morphological differences may suggest that more than one species are included in the present material. However, there are overlapping in the above mentioned characters among the populations, and thus they are treated as a single species for the time being.

As mentioned before, *G. musorstomia* n. sp. is most similar to *G. humilis* n. sp. Differences between the two species are discussed under "Remarks" of *G. humilis*.

DISTRIBUTION. — Known from the following Southwest Pacific localities: Wallis and Futuna Islands, Vanuatu, and Fiji; at depths of 790-1210 m (Fig. 10).

Glyphocrangon parviocullus n. sp.

Figs 1F, 2E, 8, 10

TYPE MATERIAL. — New Caledonia (holotype and paratypes). HALIPRO 1: stn CH 876, 23°10'S, 166°49'E, 870-1000 m, 31.03.1994: ovigerous ♀ holotype cl 16.5 mm (MNHN-Na 15404), and 2 ovigerous ♀ cl 14.2, 16.5 mm, 1 ♀ cl 13.9 mm (MNHN-Na 15415). — BERYX 11: stn CP 58, 23°19'S, 167°59'E, 850-920 m, 22.10.1992: 1 ovigerous ♀ cl 14.7 mm (MNHN-Na 15405). — BIOCAL: stn CP 30, 23°09'S, 166°41'E, 1140 m, 29.08.1985: 1 ovigerous ♀ (crashed), 1 ♂ cl 14.5 mm (MNHN-Na 15406); stn CP 31, 23°08'S, 166°51'E, 850 m, 29.08.1985: 5 ovigerous ♀ cl 14.7-14.9 mm (MNHN-Na 15407); stn CP 32, 23°07'S, 166°51'E, 825 m, 29.08.1985: 5 ovigerous ♀ cl 14.0-15.7 mm (MNHN-Na 15408); stn CP 54, 23°10'S, 167°43'E, 950-1000 m, 01.09.1985: 1 ♀ cl 13.1 mm (MNHN-Na 15409); stn CP 61, 24°11'S, 167°32'E, 1070 m: 1 ovigerous ♀ cl 14.7 mm, 6 ♀ cl 7.9-10.9 mm (MNHN-Na 15410); stn CP 69, 23°52'S, 167°58'E, 1220-

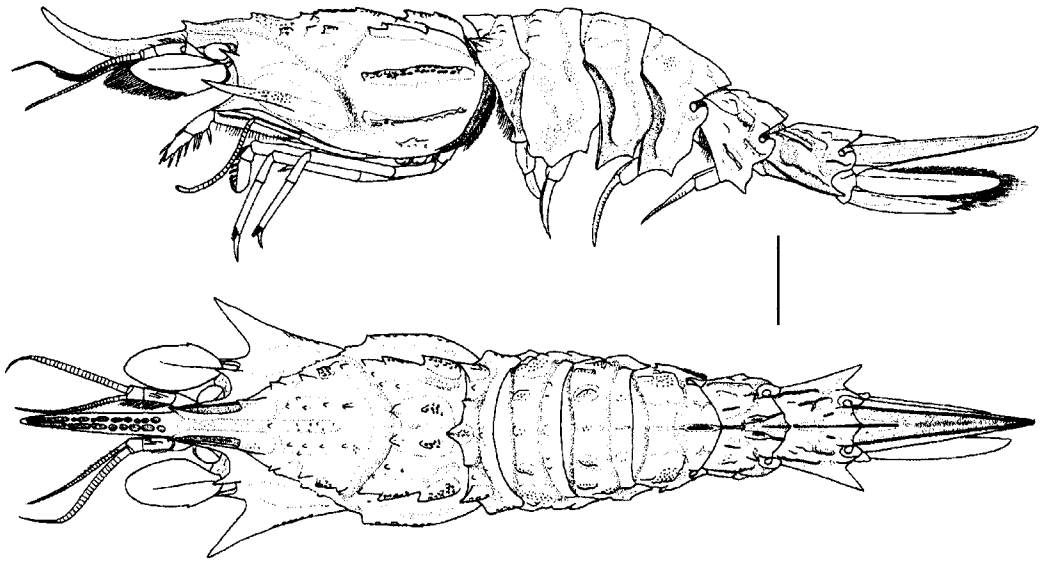

FIG. 8. *Glyphocrangon parviocullus* n. sp. Habitus. Ovigerous female holotype (cl 16.5 mm) from New Caledonia (MNHN-Na 15404). Scale bar = 5 mm.
FIG. 8. Glyphocrangon parviocullus *n. sp. Habitus. Femelle ovigère holotype (cl 16,5 mm) de Nouvelle-Calédonie (MNHN-Na 15404). Échelle = 5 mm.*

1250 m, 03.09.1985: 1 ovigerous ♀ cl 16.0 mm (MNHN-Na 15411). — BIOGEOCAL: stn CP 290, 20°36.91'S, 167°03.34'E, 920-760 m, 04.1987: 2 ♀ cl 11.2, 11.7 mm, 1 ♂ cl 14.0 mm, 1 juv cl 7.7 mm (MNHN-Na15412); stn CP 297, 20°38.64'S, 167°10.77'E, 1230-1240 m, 28.04.1987: 1 ♀ cl 12.1 mm, 3 ♂ cl 11.4-13.7 mm (MNHN-Na 15413). — HALIPRO 1: stn CP 858, 21°42'S, 166°41'E, 1000-1120 m, 20.03.1994: 1 ♂ cl 12.7 mm (MNHN-Na 15414). — HALIPRO 2: stn BT 74, Norfolk Ridge, 24°47'S, 167°41'E, 1213-1246 m, 20.11.1996: 1 ♂ cl 14.3 mm (MNHN-Na 15416); stn BT 76, Lord Howe Rise, 24°08'S, 167°32'E, 936-940 m, 21.11.1996: 1 ovigerous ♀ cl 15.4 mm (MNHN-Na 15417); stn BT 95, 24°00'S, 162°08'E, 1224-1233 m, 25.11.1996: 1 ♂ cl 12.8 mm (MNHN-Na 15418); stn BT 97, 24°00'S, 161°49'E, 964-1031 m, 25.11.1996: 1 ovigerous ♀ cl 15.1 mm (photographed; MNHN-Na 15419), and 1 ♂ cl 15.7 mm (MNHN-Na 15420); stn BT 102, Lord Howe Rise, 24°31'S, 161°52'E, 1060-1130 m, 26.11.1996: 1 ovigerous ♀ cl 15.8 mm, 1 ♀ cl 16.3 mm (MNHN-Na 15426); stn BT 103, Lord Howe Rise, 24°54'S, 162°09'E, 1235-1256 m. 26.11.1996: 2 ♂ cl 13.2, 14.7 mm (MNHN-Na 15421); stn BT 104, Lord Howe Rise, 25°26'S, 162°37'E, 1118-1124 m, 27.11.1996: 2 ovigerous ♀ cl 15.1, 15.7 mm, 1 ♀ cl 13.7 mm (MNHN-Na 15422); stn BT 105, Lord Howe Rise, 25°45'S, 162°50'E, 1200-1218 m, 27.11.1996: 2 ♂ cl 13.7, 14.2 mm (MNHN-Na 15423).

MATERIAL EXAMINED. — The type material (see above).

DIAGNOSIS. — Carapace and abdomen naked. Rostrum (Fig. 8) 0.86-1.00 times as long as carapace. Carapace (Figs 1F, 8) with first (submedian) carina low, bearing 4-6 tiny, but acute or subacute tubercles; posterior first carina low, divided in 2 acute or subacute lobes; tubercles composing anterior second (intermediate) carina low, but each terminating in acute or subacute point; posterior second carina divided in 3 acute or subacute lobes; acute lamina formed by anterior fourth (lateral) carina elongate, entire, slightly overreaching tip of antennal spine, distance between tips 1.01-1.16 of carapace length in both females and males; median part of gastric region with 2 submedian rows of tiny but conspicuous tubercles, partially visible in lateral view; posterior dorsolateral region with very low ridge occasionally bearing small, acute to blunt tubercles; lateral and cervical grooves shallow; branchiostegal spine distinctly overreaching anterior margin of antennal

basicerite. Abdomen (Fig. 8) weakly sculptured with shallow grooves and depressions; anterior median carina on first somite low, but strongly produced in acute tooth, posterior median carina low, occasionally showing as small tubercle; median carinae on second and third somites very low, but clearly discernible; anterior median carina on fourth somite also very low, but still discernible; dorsolateral carina on first somite acute; dorsolateral carinae on second to fourth somites low; tergal tubercles on second to fourth somites rudimentary or absent; carinae and tubercles on fifth and sixth somites relatively high, rather sharply delimited (Fig. 2E); fifth abdominal pleuron with 2 ventral teeth. Eye very small, maximal diameter 0.09-0.10 of carapace length. Dorsal surface of antennal scaphocerite naked. Second pereopod reaching or slightly overreaching distal margin of scaphocerite.

COLOR. — In life. Body generally white; distal part of rostrum, gastric and hepatic regions of carapace, branchiostegal spine, and tip of telson red; carinae or elevations on carapace and abdomen with tinge of red or orange; third to fifth pereopods with reddish meri and white carpi to dactyli; eyes white or light yellow. Based on colour slide showing the female specimen from HALIPRO 2, station BT 97.

SIZE. — Ovigerous female cl 14.0-16.5 mm; largest male cl 14.7 mm.

ETYMOLOGY. — The specific name is derived from the Latin, *parvus* (= small) and *ocullus* (eye), in reference to the relatively small eye of this new species.

REMARKS. — This new species is readily distinguished from other species of the *G. caeca* species group by a suite of characters, including the proportionally long rostrum, acute tubercles on the first and second anterior carinae on the carapace, notably elongate acute lamina on the carapace which reaches or overreaches the tip of the antennal spine, and acute median and dorsolateral carinae on the first abdominal somite. Further, the eye of this new species seems smaller than that of the other species in the *G. caeca* group.

DISTRIBUTION. — Restricted to New Caledonia; at depths of 760-1256 m (Fig. 10).

Glyphocrangon rudis n. sp.

Figs 1G, 2F, 9, 10

TYPE MATERIAL. — Solomon Islands (holotype and paratypes). SALOMON 1: stn CP 1781, 08°31.2'S, 160°37.7'E, 1036-1138 m, 29.09.2001: ovigerous ♀ holotype cl 15.6 mm (MNHN-Na 15424), and 5 ♀ 11.7-13.7 mm (1 crashed), 5 ovigerous ♀ 14.2-15.9 mm, 6 ♂ 9.4-13.0 mm, 2 juveniles 6.2, 6.4 mm (MNHN-Na 15425).

MATERIAL EXAMINED. — The type material (see above).

DIAGNOSIS. — Body and appendages covered with short setae (setae less numerous in males than in females). Rostrum (Fig. 9) 0.48-0.64 times as long as carapace in spawning and non-spawning females, 0.61-0.68 times as long in males. Carapace (Figs 1G, 9) with anterior first (submedian) carina composed of 4-6 relatively large, but blunt tubercles; posterior first carina high, distinctly divided in 2 or 3 blunt lobes; tubercles composing anterior second (intermediate) carina relatively high, blunt; posterior second carina composed of 3 relatively high, blunt lobes; acute lamina formed by anterior fourth (lateral) carina small, entire, not reaching tip of antennal spine, distance between tips 0.74-0.83 of carapace length in spawning and non-spawning females, 0.80-0.86 in males; median part of gastric region with 2 submedian rows of small tubercles (not visible in lateral view); posterior dorsolateral region with longitudinal row of small, conspicuous tubercles; branchiostegal spine reaching or slightly overreaching distal margin of antennal basicerite; lateral and cervical grooves

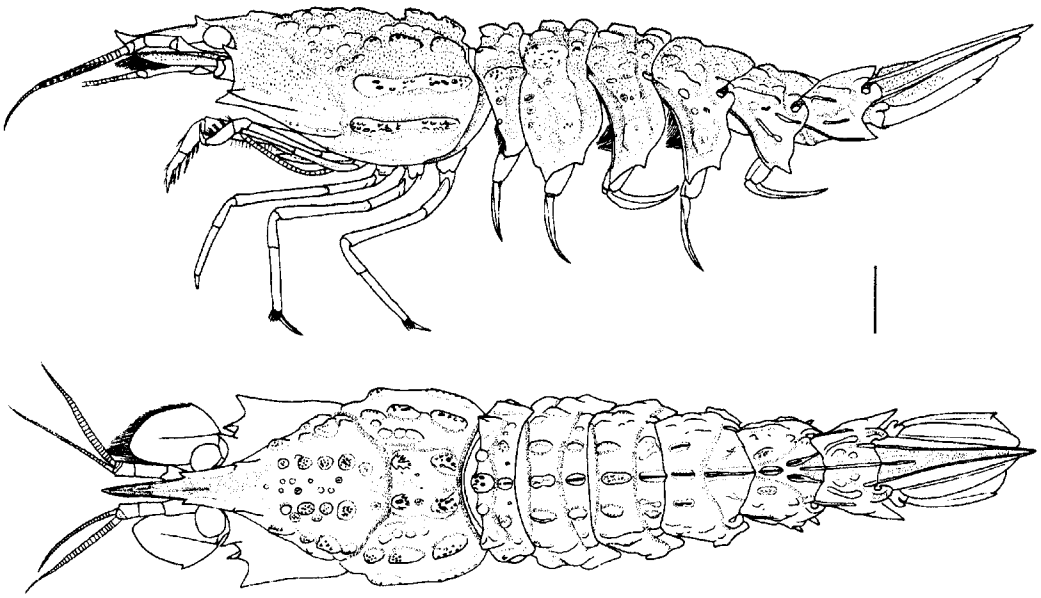

FIG. 9. *Glyphocrangon rudis* n. sp. Habitus. Ovigerous female holotype (cl 15.6 mm) from Solomon Islands (MNHN-Na 15424). Short pubescence on the body and appendages is omitted from the figure depicting the dorsal view of the animal. *Scale bar = 5 mm.*

FIG. 9. Glyphocrangon rudis *n. sp. Habitus. Femelle ovigère holotype (cl 15,6 mm) des Îles Salomon (MNHN-Na 15424). La courte pubescence sur le corps et les appendices est omise de la figure représentant la vue dorsale de l'animal.* Échelle = 5 mm.

relatively deep. Abdomen strongly sculptured with relatively deep grooves and depressions; carinae and tubercles on all somites prominent; anterior median carina on first somite showing as large rounded tubercle; dorsolateral carinae well developed on every somite, that on first somite bluntly pointed; carinae and tubercles on fifth and sixth somites sharply delineated (Fig. 2F); fifth abdominal pleuron with 2 ventral teeth. Eye relatively large for species group, maximal diameter 0.14-0.16 of carapace length. Dorsal surface of antennal scaphocerite with scattered short setae (setae less numerous in males than in females). Second pereopod reaching distal margin of antennal scaphocerite.

COLOR. — Unknown.

SIZE. — Females cl 11.7-15.9 mm, ovigerous females cl 14.2-15.9 mm; males cl 9.4-13.0 mm.

ETYMOLOGY. — From the Latin *rudis* (rough), for the prominent abdominal carinae and tubercles.

REMARKS. — As is apparent from the above description, the short setae on the body and the dorsal surface of the antennal scaphocerite appear less numerous in males than in females. The acute laminae on the carapace seem to be more produced in males than in females.

This new species somewhat resembles *G. demani* n. sp. As mentioned before, *G. rudis* is distinctive in having a covering of short setae on the body and appendages, weakly developed acute lamina on the carapace and the prominent median and dorsolateral carinae on the abdominal somites.

DISTRIBUTION. — Known only from the Solomon Islands; 1036-1138 m (Fig. 10).

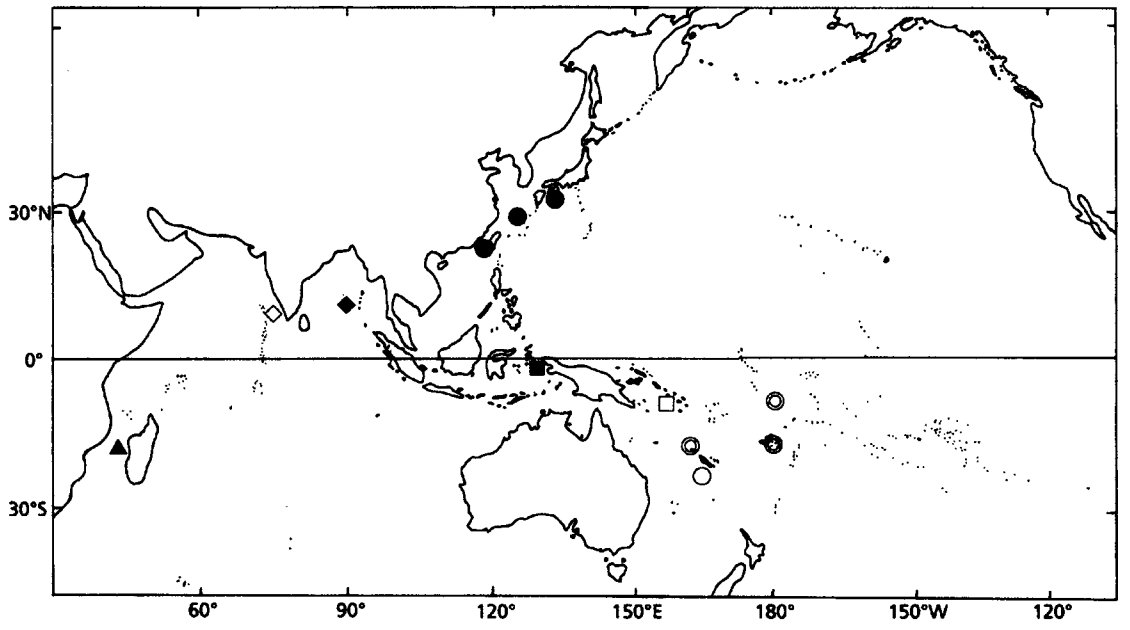

FIG. 10. Geographic distribution of the *Glyphocrangon caeca* group. Black triangle, *G. brevis* n. sp.; slanted black square, *G. caeca* Wood-Mason & Alcock, 1891; slanted white square, *G. cerea* Alcock & Anderson, 1894; black square, *G. demani* n. sp.; black circle, *G. humilis* n. sp.;double white circle, *G. musorstomia* n. sp.; white circle, *G. parviocullus* n. sp.; white square, *G. rudis* n. sp.

FIG. 10. *Distribution géographique du groupe* Glyphocrangon caeca. *Triangle noir,* G. brevis *n. sp. ; carré noir incliné,* G. caeca *Wood-Mason & Alcock, 1891 ; carré blanc incliné,* G. cerea *Alcock & Anderson, 1894; carré noir,* G. demani *n. sp. ; rond noir,* G. humilis *n. sp ; double rond blanc,* G. musorstomia *n. sp. ; cercle blanc,* G. parviocullus *n. sp. ; carré blanc,* G. rudis *n. sp.*

BIOGEOGRAPHY

This species group exclusively occurs in the Indo-West Pacific. In spite of the rather wide geographical range of the group, each species appears highly localized (Fig. 10). There is no example of the sympatric occurrence of species of the group. So far three species are known from the Indian Ocean: *G. brevis* from Madagascar (western Indian Ocean); *G. cerea* from the Laccadive Sea in the middle part of the Indian Ocean; and *G. caeca* from the Bay of Bengal, eastern Indian Ocean. Five species are recorded from the western Pacific: *G. humilis* from Japan and Taiwan; *G. demani* from Indonesia; *G. rudis* from the Solomon Islands; *G. musorstomia* from the Wallis and Futuna Islands, Fiji, Vanuatu and Chesterfield Islands in the Coral Sea; and *G. parviocullus* from New Caledonia. Among them, *G. musorstomia* is the most widespread in the southwestern Pacific, but this may only reflect the high scientific activity in the area or the existence of sibling species. It is interesting to mention that no species of the group are recorded from some particular areas, where marine fauna is highly diverse, i.e. the South China Sea, Philippines, and Australia. Considering the high endemism of the species, more species will be eventually discovered by future investigations. In spite of the highly localized horizontal distributions, the bathymetric ranges of the species are within a rather restricted range between 660-1530 m. No significant difference in the bathymetric range is found among the species. Therefore, it can be assumed that the speciation events of the species group may be caused by isolation of ancestral species by tectonic plate movements.

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