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## Taxonomic notes on two species of xanthid crabs of the genera *Hepatoporus* Serène, 1984 and *Gaillardielus* Guinot, 1976 from the Ryukyu Islands

Masahiro Marumura<sup>1, 3</sup> & Masatsune Takeda<sup>2</sup>

<sup>1</sup>3262 Shinjo-cho, Tanabe, Wakayama, 646-0011 Japan

<sup>2</sup>Department of Zoology, National Museum of Nature and Science,  
4-1-1 Amakubo, Tsukuba, Ibaraki, 305-0005 Japan

<sup>3</sup>Corresponding author ([mmarumura@ares.eonet.ne.jp](mailto:mmarumura@ares.eonet.ne.jp))

**Abstract.** This report deals with two crab species of the family Xanthidae, *Hepatoporus* sp. and *Gaillardielus bathus* Davie, 1997, with some taxonomic comments and photographs. A female specimen of the genus *Hepatoporus* from the Kerama Group in the Ryukyu Islands is similar to *H. pumex* Mendoza & Ng, 2008 reported from the Bohol Sea, the Philippines, and also to *H. orientalis* (Sakai, 1935) known from Japan and the Philippines. The female specimen was compared in detail with the original description of *H. pumex* and with some specimens of *H. orientalis*. We, however, did not identify it to species as we could not assess the range of intraspecific variation or male characters. *Gaillardielus bathus*, previously known from New Caledonia and the Kermadec Islands in the South Pacific, is recorded from Okinoerabu-jima Island in the Ryukyu Islands, the Kii Peninsula and the Ogasawara Islands. Comparative notes on *G. bathus* and allied *G. rueppelli* (Krauss, 1843) are provided.

### Introduction

Continuous discoveries of undescribed and newly recorded species of the shallow-water crabs from the Ryukyu Islands suggest that the knowledge of the crab fauna in this region is still insufficient, probably due to the difficulty of collecting specimens from the topographically complicated seabed. Efforts to collect specimens and records of these specimens are without doubt important in bringing the faunistic knowledge of Japan to a satisfactory level. For example, systematically and biogeographically interesting crabs from the vicinity of the Kii Peninsula have been reported by Marumura (1984a, 1984b, 1985, 1994), Marumura & Manabe (1996), Marumura et al. (2000), Takeda & Marumura (1994, 1995, 1996, 1997a, 1997b, 2000, 2002), and these data have contributed to expanding knowledge of the carcinological fauna of central Japan influenced by the warm Kuroshio Current. In this paper, two species of the family Xanthidae from the Ryukyu Islands are recorded. One species is *Hepatoporus* sp. from Tokashiki Island in the Kerama Group, Ryukyu

Islands, which is similar to *H. pumex* Mendoza & Ng, 2008 reported from the Philippines and also to *H. orientalis* (Sakai, 1935) known from Japan and the Philippines. In the present paper, the identification of a female specimen at hand is restricted to the genus, and the definite identification to the species will be performed in due time after acquisition of a male specimen. The other species is *Gaillardielus bathus* Davie, 1997 from Okinoerabu-jima Island in the Ryukyu Islands, Wakayama Prefecture on the southwestern coast of the Kii Peninsula, and the Ogasawara Islands. This species is known from the South Pacific, and these records extend its distributional range further into the North Pacific.

The specimens examined are deposited in the Department of Zoology (NSMT-Cr) and Showa Memorial Institute (NSMT-R), Tsukuba Research Institute of the National Museum of Nature and Science, Tokyo, and the Wakayama Prefectural Museum of Natural History (WMNH-Na-Cr).

### Taxonomic Notes

#### Family Xanthidae MacLeay, 1838

#### Genus *Hepatoporus* Serène, 1984

#### *Hepatoporus* sp.

(Fig. 1)

**Material examined.** Ryukyu Islands. Naganita, Tokashiki Island, Kerama Group, 1 female (15.0 × 11.3 mm), NSMT-Cr 22975, 10 Oct. 1993, coll. S. Nagai.

**Comparative material.** *Hepatoporus orientalis* (Sakai, 1935). Ryukyu Islands: Oshima Passage, Amami-Oshima Island, 1 young male (6.4 × 5.1 mm), WMNH-Na-Cr 0713, June 1996, coll. Nagai, and recorded by Marumura & Kosaka (2003). Sagami Bay: Kannonzuka-dashi–Maruyama-dashi, 65 m deep, 1 male (10.0 × 7.7 mm: Figs. 3A, B, 4A, B, D), NSMT-R 2858, 21 Jul. 1958; SSW off Jyogashima, 15 km, 77–80 m deep, 1 male (10.8 × 8.4 mm: Figs. 3C, D, 4C), NSMT-R 3292, 25 Jul. 1959; Maruyama-dashi–Kannonzuka-dashi, 60–85 m deep, 1 male (8.1 × 6.1 mm), NSMT-R 3001, 8 Jun. 1960. Kii Penin-

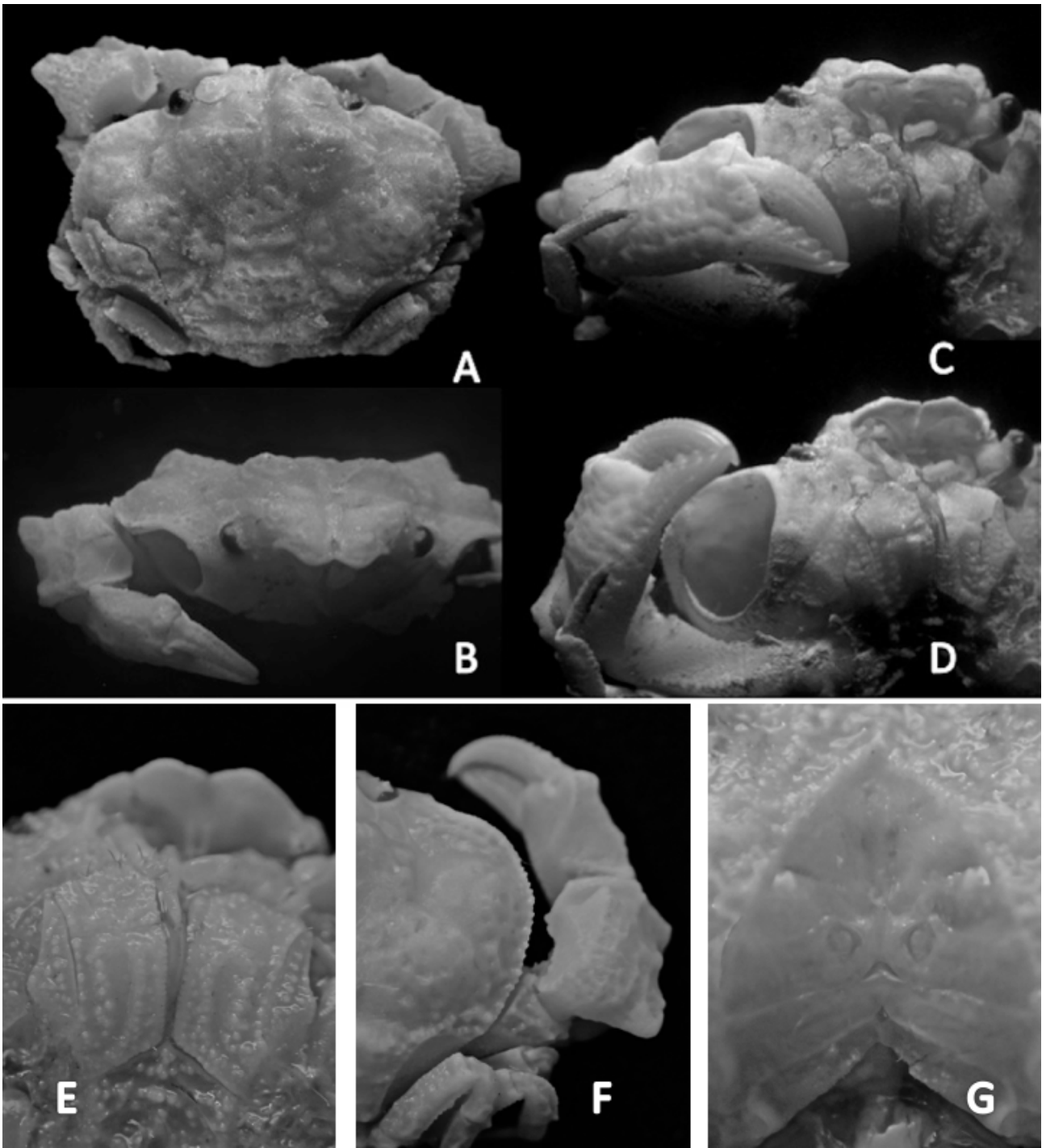


Fig. 1. *Hepatoporus* sp., female (NSMT-Cr22975; 15.0 × 11.3 mm). A, dorsal view; B, frontal views; C, right chela; D, subhepatic cavity; E, third maxillipeds; F, right half of carapace, with right cheliped; G, thoracic sternum.

図 1. ホラガ二属の一種。雌 (NSMT-Cr22975; 15.0 × 11.3 mm)。A, 背面; B, 前面; C, 鉗部; D, 下肝腔; E, 第3顎脚; F, 甲の右前側部と右鉗脚; G, 胸甲。

sula: Off Tanabe Bay, Wakayama Pref., ca. 50m deep, 1 female (9.6 × 7.3 mm: Fig. 2), WMNH-Na-Cr, unregistered, 20 Dec. 1997, coll. M. Marumura; Off Cape Shiono-misaki, Wakayama Pref., 50–60m deep, 1 female (7.5 × 5.4 mm), 1 young female (5.3 × 4.1 mm), WMNH-Na-Cr, unregistered, Aug. 1988, coll. S. Nagai.

**Description.** Carapace (Fig. 1A) broadly subhexagonal, convex dorsally as a whole; dorsal surface of carapace uneven, eroded with many pits and irregular reticulations of variable sizes, separated into regions by broad depressions; epigastric (1M), protogastric (2M), mesogastric (3M), metagastric (4M), cardiac (1P), branchial (L)

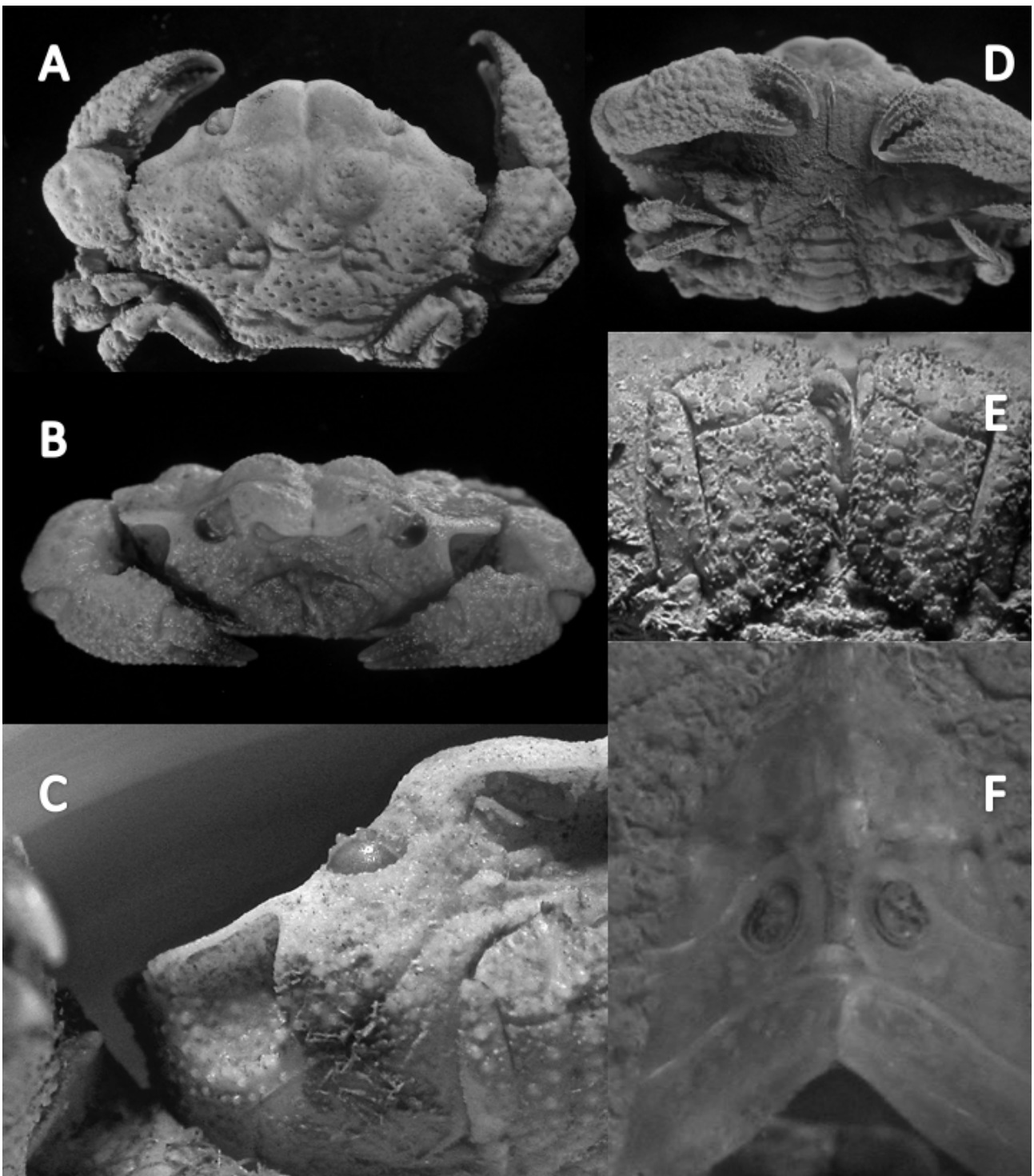


Fig. 2. *Hepatoporus orientalis* (Sakai), female (WMNH-Na-Cr, unregistered; 9.6 × 7.3 mm). A, dorsal view; B, frontal view; C, subhepatic cavity; D, ventral view; E, third maxillipeds; F, thoracic sternum.

図 2. ホラガニ. 雌 (WMHN-Na-Cr, unregistered; 9.6 × 7.3 mm). A, 背面; B, 前面; C, 下肝腔; D, 腹面; E, 第 3 顎脚; F, 胸甲.

regions demarcated; 2M most prominent, high, subacute at tip; L shallowly subdivided into 2 oblique subregions, posterior subregion as high as, slightly becoming sharper than 2M; 4M linear transversely, franked by deep depressions.

Front (Fig. 1A–D) deflexed, bilobed, thin. Subhepatic cavity (Figs. 1B–D) very deep, sharply edged along whole margin, not visible from above, occupying most of subhepatic region. Anterolateral margin of carapace narrowly cristate; anterior

one-third weakly concave anterolaterally, weakly convex dorsally; posterior two-thirds regularly convex, with a row of minute granules; posterolateral margin of carapace about half as long as anterolateral margin, strongly turned to lateral end of posterior margin of carapace, with deeply excavated dorsal surface to receive last ambulatory leg. Posterior margin of carapace weakly concave, with deep concavity adjacent to lateral end for accommodating coxa of last ambulatory leg.

Both chelipeds (Fig. 1A) equal in size and shape, with uneven surfaces as seen in dorsal surface of carapace; merus short, entirely disguised under carapace, with wholly excavated inner surface; carpus large, with depressed subtruncated tubercle at outer margin (Fig. 1A, B, F); outer surface of palm (Fig. 1C, D) distinctly reticulated, distal margin more or less nodular, with prominent compressed tubercle at upper part (Fig. 1B, C, F). Fingers (Fig. 1C, D) as long as upper margin of palm, cutting edge with 4 sharp, subequal teeth directed obliquely outward in parallel with tip of finger.

Ambulatory legs (Fig. 1A) tightly folded against carapace; anterior margin of each merus thin, nearly entire or microscopically toothed, with angulated distal end; posterior upper and lower margins of each merus narrowly, but distinctly ridged and granulated; upper and lower margins of each carpus weakly ridged, roughened with sharp granules, with two longitudinal ridges on upper surfaces; upper and lower margins of each propodus sharp, minutely granulated like carpus, but granules smaller.

**Color in life.** Carapace, chelipeds and ambulatory legs regularly creamy white.

**Remarks.** A female *Hepatoporus* specimen from Tokashiki Island can be allied to *H. pumex* Mendoza & Ng, 2008 and *H. orientalis* (Sakai, 1935) among five congeners (Ng et al, 2008; Mendoza & Ng, 2008) in the general shapes of the carapace with the raised gastric, branchial and cardiac regions and the deep subhepatic cavity.

*Hepatoporus pumex* was described from the Bohol Sea, the Philippines. In the original description of *H. pumex*, Mendoza & Ng (2008: 402) raised five diagnostic characters to distinguish the new species from morphologically most similar *H. orientalis*, viz. 1) broader, more truncated front (vs. triangular and acuter), 2) more deeply excavated anterolateral margin (vs. less concave), 3) more even posterior two-thirds of the anterolateral margin of the carapace (vs. more irregular and jagged), 4) the presence of a large, distinct pit in the branchial region of the carapace (vs. absent), 5) reticulate patterns of fused granules and pits near the posterolateral and posterior

margins of the carapace (vs. simply granular).

*Hepatoporus orientalis* was originally described by Sakai (1935) from Sagami Bay. Subsequently the species has been repeatedly reported by Sakai (1936, 1939, 1965, 1976) with original figures, but detailed morphological information has still not been provided. The present study could examine several specimens of *H. orientalis* collected from the type locality and some other stations in Japanese waters (Figs. 2–4).

Detailed comparison of the specimens of *H. orientalis* and the original description of *H. pumex* revealed that there are some additional differences between the two species. They are: 1) the subhepatic cavity of *H. orientalis* is deeper anteriorly with sharp cavity margin and becomes shallower posteriorly, without clear margin (Figs. 2C, 3B). The subhepatic cavity of *H. pumex* is, however, markedly deep throughout, with an entire sharp margin (Mendoza & Ng, 2008: fig. 7E). 2) The outer margin of the cheliped carpus is thick and roundly convex in *H. orientalis* (Figs. 2A, 3A, C) but that of *H. pumex* is crested and bilobed (Mendoza & Ng, 2008: Figs. 7A, 9D). 3) The third maxilliped ischium and merus are thickly covered with large granules in *H. orientalis* (Fig. 2E), but the outer surface of the third maxilliped is described and figured as being eroded and pitted, with scattered granules in *H. pumex* (Mendoza & Ng, 2008: Fig. 8B). 4) The exopod of the third maxilliped gently tapers in *H. orientalis* (Fig. 2C, E), but that of *H. pumex* tapers over distal half (Mendoza & Ng, 2008: Figs. 7B, 8B). 5) The male first pleopod of *H. orientalis* from Sagami Bay (Fig. 4A–C) has a sharply pointed end, with a subterminal cluster of some stout recurved setae, differing from that of *H. pumex* having the auriculiform distal end, with a subterminal flange (Mendoza & Ng, 2008: Fig. 8D–F).

The female specimen from the Ryukyu Islands may be indentified as *H. pumex* due to the basic agreement in the regularly convex posterior two-thirds of the anterolateral margin of the carapace, deeply excavated subhepatic cavity, with a sharp, entire margin, the crested and bilobed outer margin of the cheliped carpus, and the exopod of the third maxilliped being abruptly tapered distally. However, a detailed comparison revealed that there are some discrepancies: 1) The surfaces of the carapace and chelipeds of the holotype (Mendoza & Ng, 2008: Fig. 7A) appear to be smoother than in the present specimen (Fig. 1A); 2) The subhepatic cavity of the holotype (Mendoza & Ng, 2008: Fig. 7C, E) seems to be shallower than that in the present specimen (Fig. 1B, D); 3) The anterior part of the anterolateral mar-

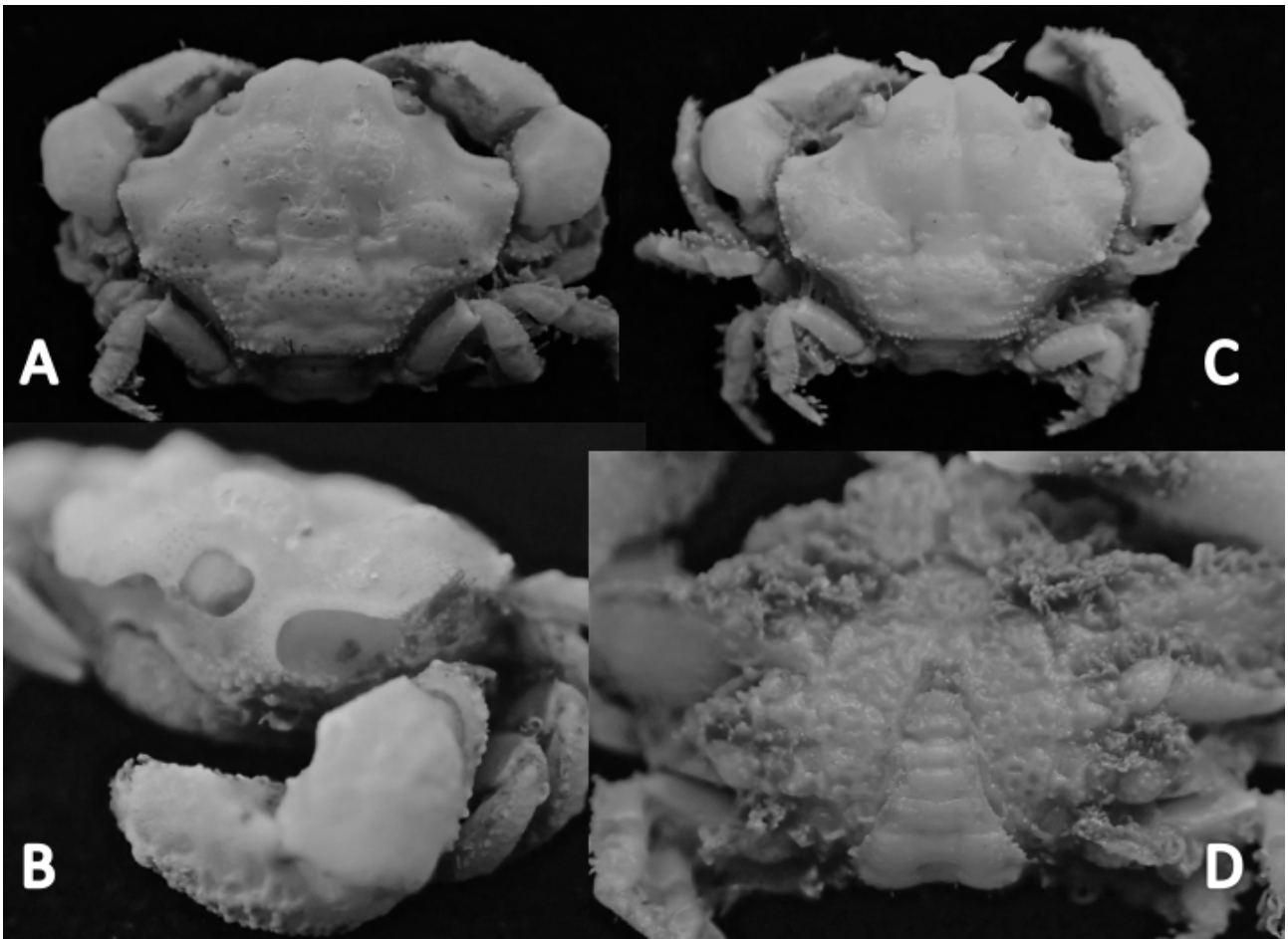


Fig. 3. *Hepatoporus orientalis* (Sakai). A, B, male (NSMT-R2858; 10.0 × 7.7 mm); C, D, male (NSMT-R3292; 10.8 × 8.4 mm).

図3. ホラガニ. A, B, 雄 (NSMT-R2858; 10.0 × 7.7 mm); C, D, 雄 (NSMT-R3292; (10.8 × 8.4 mm)).

gin of the carapace, viz. the upper margin of the subhepatic cavity, is concave in dorsal view on the carapace margin in the holotype (Mendosa & Ng, 2008: Fig. 7A), but in the present specimen this part is hardly concave and even convex (Fig. 1A, F); 4) The third maxilliped of the holotype is figured as being poorly granulated (Mendosa & Ng, 2008: Fig. 8B), but covered with prominent pearly granules in the present specimen (Fig. 1E); 5) The armature of the cheliped carpus is rather nodular in the holotype (Mendosa & Ng, 2008: Fig. 7A), whereas tubercular and high in the present specimen (Fig. 1E). It is uncertain whether these discrepancies are due to interspecific differences, or intraspecific variations. The present report treats this Ryukyuan specimen as *Hepatoporus* sp.

Genus *Gaillardiiellus* Guinot, 1976

*Gaillardiiellus bathus* Davie, 1997

[New Japanese name: Minami-kebuka-awatsubugani]

(Figs. 4E, F, 5A–D)

**Material examined.** Ryukyu Islands: Off Okinoerabu-jima Island, 177m deep, R/V *Toyoshio Maru* cruise TY-04-05, 21 May 2004, 1 male (15.2 × 11.5 mm), 1 female (10.4 × 7.6 mm), NSMT-Cr 16182, coll. M. Osawa. Kii Peninsula: Off Tanabe, Wakayama Pref., ca. 100 m deep, 15 Jan. 1993, 1 male (15.5 × 12.0 mm), NSMT-Cr 23915, coll. M. Marumura; Off Kirime, 70–80 m deep, 2 Feb. 1996, 1 ovigerous female (18.0 × 12.9 mm), NSMT-Cr23000, coll. M. Marumura; Off Iwashiro, ca. 120 m deep, 6 Mar. 2001, 1 male (18.6 × 14.0 mm), 1 female (11.0 × 8.0 mm), NSMT-Cr 22974, coll. M. Marumura. Ogasawara Islands: Yabe guyot (Shiba, 1979), seamount far off to the east of Ogasawara Is. (27°15.7' N, 145°11.4' E, 110 m – 27°15.8' N, 145°11.7' E, 150 m deep), R/V *Soyo Maru*, 1990 cruise to Ogasawara Is., sta. 5, 8 July 1990, 1 male (9.9 × 7.3 mm), NSMT-Cr 22990, coll. H. Saito.

**Comparative material.** *Gaillardiiellus rueppelli* (Krauss, 1843). Ryukyu Islands: Oshima Passage between Amami-Oshima Island and Kakeroma-jima Island, 25–40 m deep, 1 male (12.0 × 9.2 mm), 1

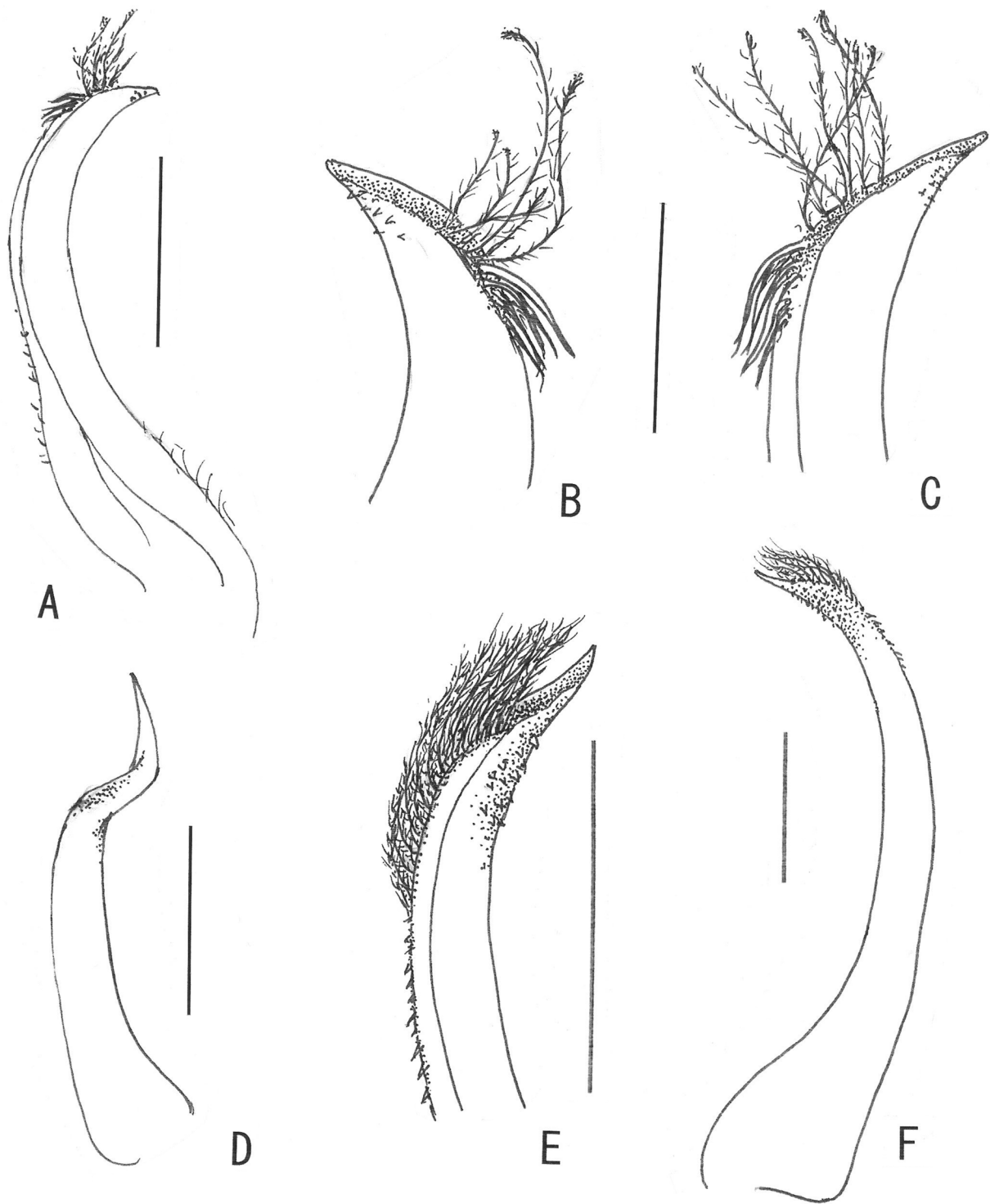


Fig. 4. A–D, *Hepatoporus orientalis* (Sakai). A, left first pleopod of male (NSMT-R 2858; 10.0 × 7.7mm) in abdominal view; B, distal part of the same in sternal view; C, distal part of left first pleopod of male (NSMT-R3292; 10.8 × 8.4 mm) in abdominal view; D, left second pleopod of male (NSMT-R2858; 10.0 × 7.7 mm) in abdominal view. E, F, *Gaillardiiellus bathus* Davie. E, distal part of left first pleopod of male (NSMT-Cr23915; 15.5 × 12.0 mm) in abdominal view; F, overall view of the same in sternal view. Scales for A, E, F = 1 mm; B, C, D = 0.5 mm.

図 4. A–D, ホラガニ. A, B, 雄 (NSMT-R 2858; 10.0 × 7.7 mm) の左第1腹肢の腹面図 (A) と先端部 (B) の背面図; C, 雄 (NSMT-R 3292; 10.8 × 8.4 mm) の左第1腹肢の先端部, 背面図; D, 雄 (NSMT-R 2858; 10.0 × 7.7 mm) の左第2腹肢, 腹面図; E, F, ミナミケブカアワツブガニ (新称). 雄 (NSMT-Cr 23915; 15.5 × 12.0 mm) の左第1腹肢先端部の腹面図 (E) と全体の背面図 (F). スケール A, E, F = 1 mm; B, C, D = 0.5 mm.

female (12.0 × 8.9mm), NSMT-Cr 9712, 29 June 1970, coll. Kagoshima Univ. Kii Peninsula: Off Koza, Wakayama Pref., 20–30 m deep, 1 male (34.3 × 25.8 mm; Fig. 5E, F), NSMT-Cr10869, 13 Dec. 1987, S. Nagai leg. Boso Peninsula: Mera-se, submarine bank off Boso Penin., R/V *Tansei Maru* cruise KT-76-16, stn. C9 (35°50.5'N, 139°45.1'E, 100–102 m deep), 1 male (9.5 × 6.9 mm), NSMT-Cr15509, Sept. 1976, R/V *Tansei Maru*. Seychelles (04°29.2'S, 56°10.6'E, 63 m deep), 1 male (NSMT-Cr4373), 22 Nov. 1968, R/V *Koyo Maru*.

**Description.** Carapace (Fig. 5A, B) transversely subhexagonal, wider than long, weakly convex longitudinally and transversely; regions distinctly separated from each other by narrow, shallow smooth furrows; each region rather flattened, covered with regularly dispersed pearly granules of equal size interspaced with short thick tomentum and some scant short setae; epigastric region (1M) weakly convex dorsally and laterally, being hardly separated from anteromesial part of protogastric region (2M); 2M almost, but incompletely, subdivided into 2 by longitudinal sulcus, lateral subregion slightly longer than mesial subregion; mesogastric (3M) and cardiac (1P) regions prominent, not subdivided; branchial region (L) typically subdivided into 4 parts; anterior two (2L, 3L) on lateral part of 2M placed side by side, posterior two (4L, 5L) on lateral to 3M placed obliquely.

Frontal margin (Fig. 5A, B) divided into 2 lobes by median V-shaped notch in dorsal view; each lobe strongly produced downwards as rounded lobe in inner half in frontal view, deeply concave upwards sublaterally.

Anterolateral margin of carapace (Fig. 5B) divided into 4 obtuse, convex lobes by shallow depressions. Posterolateral margin of carapace (Fig. 5B) strongly retreated. Posterior margin of carapace (Fig. 5B) as wide as frontal margin, with shallow concavity at each lateral end to accommodate coxa of last ambulatory leg.

In male (Fig. 5) and ovigerous female, both chelipeds stout, not long, subequal in shape and size; merus short, nearly obscured beneath carapace; carpus prominently large, as long as palm and fingers combined, its inner surface shallowly concave to fit subhepatic region of carapace, with outer surface cut into some obtuse nodules; outer surface of palm (Fig. 5C) covered with prominent pearly granules; upper margin of palm divided into 2 humps, proximal one rather sharp along margin, with obtusely angulated basal end; male fingers armed with strong, subacute teeth, 2 in immovable finger and 3 in dactylus; inner

surfaces of fingers and teeth deeply excavated in both sexes, but especially so in male; dark color of immovable finger extended onto half of lower outer surface of palm in male (Fig. 5C), restricted to immovable finger proper in female.

Ambulatory legs stout, covered with pearly granules and short setae; both margins of each segment fringed with larger granules and longer, but sparse setae; dactyli covered with thick tomentum; upper surface of each carpus sculptured with longitudinal furrow along anterior margin.

Male telson (Fig. 5D) longer than sixth abdominal somite, ca. 1.3 times wider than long; sixth somite rectangular, ca. 1.7 times wider than long; third to fifth somites fused, with vestigial sutures; lateral margins sinuous, bluntly angled at supposed junction of fourth and fifth somites; first somite as wide as third.

Male first pleopod (Fig. 4E, F) slender, weakly curved outward, distal part long, sharply pointed at tip; shaft of pleopod with many conical granules at subdistal part of outer margin; tuft of plumose setae at subterminal part of inner margin reaching tip of distal part, mesial margin of shaft behind plumose setae with line of sharp, equidistantly placed small tubercles.

**Color in life.** Carapace, chelipeds and ambulatory legs regularly brick red.

**Remarks.** The specimens examined in the present study (four males, two females and one ovigerous female from some localities in Japanese waters) share a similar shape of the carapace that is deeply sculptured and densely covered with short stiff setae and pearly granules of good size on the dorsal surface.

These carapace characters as well as the characteristics of its male first pleopod indicate that it belongs to the genus *Gaillardiellus* Guinot, 1976. *Gaillardiellus* currently contains six species (five known species listed by Ng et al., 2008, and a new species described by Takeda & Komatsu, 2010).

The Japanese specimens in question is seemingly close to *Gaillardiellus rueppelli* (Krauss, 1843), which is widely distributed in the Indo-West Pacific including Japanese waters, and to *G. bathus* Davie, 1997 known from New Caledonia and the Kermadec Islands in the South Pacific. According to Davie (1997: 341), *G. bathus* differs from *G. rueppelli* most obviously by the shape of the male abdomen with its broad telson and sixth somite, which is noticeably broader than long and not subquadrate as in *G. rueppelli*. It is otherwise mentioned that the dorsal areolation of the carapace of *G. bathus* is lower and less strongly defined, with the shallower interregion-



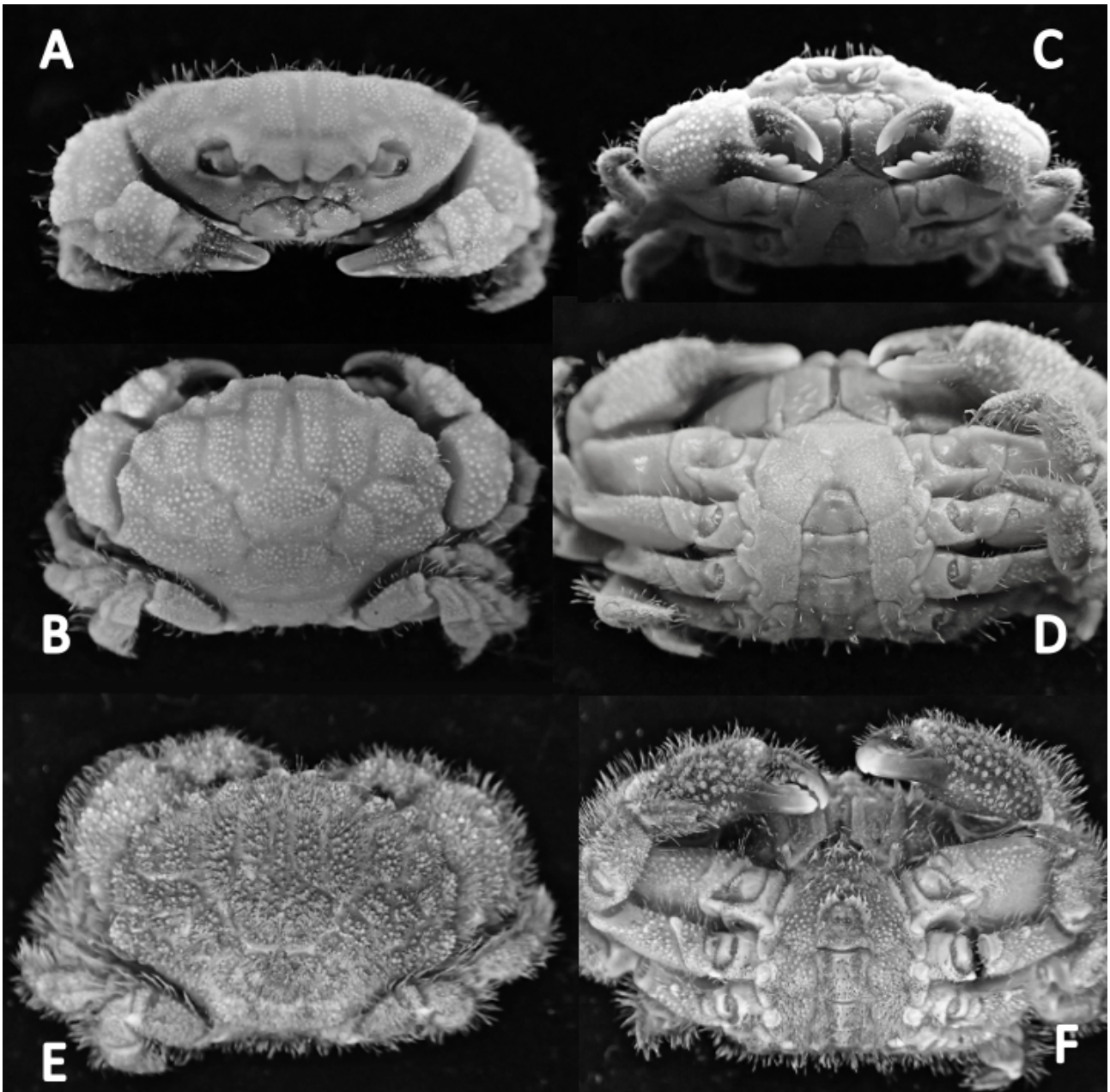


Fig. 5. A–D, *Gaillardiiellus bathus* Davie. Male (NSMT-Cr22974; 18.6 × 14.0 mm). A, frontal view; B, dorsal view; C, chelae; D, ventral view. E, F, *Gaillardiiellus rueppelli* (Krauss). Male (NSMT-Cr 10869; 34.3 × 25.8 mm). E, dorsal view; F, ventral view.

図 5. A–D, ミナミケブカアワツブガニ (新称). 雄 (NSMT-Cr 22974; 18.6 × 14.0 mm). A, 前面; B, 背面; C, 鉗部; D, 腹面. E, F, アワツブオウギガニ. 雄 (NSMT-Cr 10869; 34.3 × 25.8 mm). E, 背面; F, 腹面.

al grooves, the granulation is slightly finer, the transverse groove between sternites 3 and 4 is less deeply marked, and the chela has a strong bluntly rounded tooth on the cutting margin of the immovable finger.

The specimens examined in the present study can be identified as *G. bathus* as they have the above-mentioned characteristics of the species. It is otherwise noted that in *G. rueppelli* the anterolateral teeth of the carapace are more strongly angulated and

weakly directed dorsally. These observations justify the identification of the present specimens with *G. bathus*, and warrant the occurrence of the two species, *G. rueppelli* and *G. bathus* in Japanese waters.

Direct comparison of the Japanese specimens of the two species revealed that the male abdomen of *G. bathus* (Fig. 5D) is apparently wider than that of *G. rueppelli* (Fig. 5F), in addition to the differences of the sixth somite and telson mentioned by Davie

(1997: 341). In the original figure of *G. bathus* (Davie, 1997: Fig. 1d), the lateral margin of the supposed third segment of the male abdomen was figured as convex as a whole, with proximolateral granulation. The lateral margin of the male abdomen in the Japanese specimens is similarly convex, but also extended posterolaterally as usual in other xanthid crabs, e.g. male abdomen and sternum of *G. rueppelli* given by Guinot (1976; fig. 42A).

**Distribution.** The type locality is New Caledonia, 270–312 m deep (Davie, 1997), and the additional locality is the Kermadec Islands, 108–198 m deep (Takeda & Webber, 2006). This report extends the distributional range from the South Pacific northward to Japan (Ryukyu Islands, Kii Peninsula and Ogasawara Islands). The bathymetric range in Japan is from 70 to 150 m.

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## 琉球列島産のオウギガニ科 2 種

丸村眞弘<sup>1,3</sup>・武田正倫<sup>2</sup>

<sup>1</sup>〒646-0011 和歌山県田辺市新庄町 3262

<sup>2</sup>〒305-0005 茨城県つくば市天久保 4-1-1  
国立科学博物館 動物研究部

<sup>3</sup>通信著者 ([mmarumura@ares.eonet.ne.jp](mailto:mmarumura@ares.eonet.ne.jp))

**要旨.** 慶良間諸島で得られた *Hepatoporus* sp. と沖永良部島, 紀伊半島および小笠原諸島で得られた *Gaillardiiellus bathus* Davie, 1997 を記録した. *Hepatoporus* sp. ホラガニ属の一種はフィリピンから報告された *H. pumex* Mendoza & Ng, 2008 と近縁のホラガニ *H. orientalis* (Sakai, 1935) のいずれかに同定される可能性が高いことから, 手許の標本 (雌 1 個体) を *H. pumex* の原記載およびホラガニの標本と詳細に比較した. しかし, 1 個体では形態差が種としての特徴であるのか変異であるのかを断定することが難しく, また雄の第 1 腹肢を調べないと決定的な同定に疑問が残るため, 本論文では種名を決定するのを控えた. 南太平洋のニューカレドニアとケルマデック諸島から知られていた *G. bathus* ミナミケブカアワツブガニ (新称) に関しては, 近縁のアワツブオウギガニ *G. rueppelli* (Krauss, 1843) との異同に言及し, 写真とともに雄の第 1 腹肢を図示した.

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