

## NEW GENERA AND SPECIES OF EUXANTHINE CRABS (CRUSTACEA: DECAPODA: BRACHYURA: XANTHIDAE) FROM THE BOHOL SEA, THE PHILIPPINES

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**ABSTRACT.** – Two new genera and four new xanthid crab species belonging to the subfamily Euxanthinae Alcock (Crustacea: Decapoda: Brachyura) are described from the Bohol Sea, central Philippines. *Rizalthus*, new genus, with just one species, *R. anconis*, new species, can be distinguished from allied genera by characters of the carapace, epistome, chelipeds, male abdomen and male first gonopod. *Visayax*, new genus, contains two new species, *V. osteodictyon* and *V. estampadori*, and can be distinguished from similar genera using a combination of features of the carapace, epistome, thoracic sternum, male abdomen, pereiopods and male first gonopod. A new species of *Hepatoporus* Serène, *H. pumex*, is also described. It is distinguished from congeners by the unique morphology of its front, carapace sculpturing, form of the subhepatic cavity and structure of the male first gonopod.

**KEY WORDS.** – Crustacea, Xanthidae, Euxanthinae, *Rizalthus*, *Visayax*, *Hepatoporus*, Panglao 2004, the Philippines.

### INTRODUCTION

There are currently 24 genera and 83 species in the xanthid crab subfamily Euxanthinae worldwide, with most occurring in the Indo-Pacific (Ng & McLay, 2007; Ng et al., 2008). Euxanthine crabs are distinguished from other xanthids mainly by having a carapace anterolateral margin that does not meet the exorbital angle, but instead, continues (distinctly or feebly) down across the subhepatic region toward the buccal frame (Serène, 1984; Ng, 1993, 2002; Davie, 2002; Ng et al., 2008). Other diagnostic features include a projecting bilobed front; a distinct subhepatic cavity (in some species); cheliped fingers, palms and carpi that can be coapted against the carapace; and rear ambulatory legs that can be coapted against depressions in the posterolateral carapace margin (Serène, 1984; Ng, 1993, 2002; Davie, 2002; Ng et al., 2008).

A large assemblage of decapod Crustacea was collected from the Bohol Sea, near the islands of Bohol, Panglao, Balicasag and Pamilacan in the central region of the Philippines during the multi-national Panglao 2004 Marine Biodiversity Project and a good number of papers referring to this fauna have already been published (see McLay & Ng, 2004, 2005; Anker

& Jeng, 2006; Anker et al., 2006; Dworschak, 2006; Marin & Chan, 2006; Ahyong & Ng, 2007; Anker & Dworschak, 2007; Manuel-Santos & Ng, 2007; Mendoza & Ng, 2007; Ng & Castro, 2007; Ng & Manuel-Santos, 2007; Ng & Naruse, 2007; Richer de Forges & Ng, 2007a, b, c). Among the numerous species obtained were a number of small but interesting euxanthine brachyuran crabs that are here regarded as new.

### MATERIALS AND METHODS

Specimens were collected from various stations. Those from stations starting with “B” (e.g., B17) were collected by “coral brushing”, which targets animals that may live on or near hard corals. Those from stations starting with “R” were hand-caught by SCUBA divers, and those from stations starting with “S” were suctioned from the sea floor by modified SCUBA-vacuum apparatus (see Bouchet et al., 2002). Specimens are deposited in the following museums: National Museum of the Philippines, Manila, Philippines (NMCR); Muséum national d’Histoire naturelle, Paris, France (MNHN); Florida Museum of Natural History,

University of Florida, USA (UF); and Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC). Measurements are those of carapace width by carapace length, expressed in millimeters (mm). Abbreviations used in this paper are G1 for the first male gonopod, and G2 for the second male gonopod. The term “coapted” is used when a particular pereiopod or segment can be tightly appressed against the lateral surface of the carapace when it is retracted. Alpha-numeric codes for carapace regions follow Serène (1984).

## TAXONOMY

### XANTHIDAE Macleay, 1838, sensu Ng et al., 2008

#### Euxanthinae Alcock, 1898, sensu Ng et al., 2008

##### *Rizalthus*, new genus

**Diagnosis.** – Carapace much broader than long, regions well-defined; epigastric, protogastric, mesogastric and metagastric regions raised, together forming a dorsally convex anterior portion on carapace; all dorsal regions of carapace with large granules, surrounded by short setae basally. Front about 0.4 times carapace width, bilobed; lobes separated by a broad V-shaped cleft, continuous with a deep median fissure on frontal region; each lobe broadly triangular. Anterolateral margin without clearly demarcated teeth or lobes, lined with conical granules, appearing unevenly serrated, feebly cristate, anterior-most part not meeting orbital margin but descending towards anterolateral corner of buccal cavity; anterior two-thirds strongly arcuate, posterior third slightly convex, junction with posterolateral margin marked by prominent, dorsally directed, granular tooth; posterior margin uniformly straight. Last ambulatory leg coapted against concavity in posterolateral margin. Eyestalks with large, conical granules on distal end, bordering the corneas. Antennules folding transversely. Basal antennal segment large, granulose, subrectangular, occupying entire space between antennular fossa and internal orbital angle, filling orbital hiatus; flagellum long, reaching outer edge of orbit. Epistome with small granules near anterior edge, posterior margin slightly sweeping outwards, central region slightly undulate, concave. Endostome without oblique or longitudinal ridges. Outer surface of third maxilliped granulose, appearing eroded; merus subquadrate, median length about half that of ischium; ischium subrectangular, with deep, median longitudinal sulcus bordered by granules; exopod granulose, tapering toward distal end which almost reaches anterior edge of merus, flagellum long. Thoracic sternum eroded, with several distinct depressions on anterior region and on either side of abdomen; sternites 1 and 2 completely fused, separated from sternite 3 by deep transverse suture; sternites 3 and 4 partially fused, with partial suture seen near anterior edge of cheliped coxae; median suture present within a median depression anterior to telson; tubercle for abdominal locking mechanism on sternite 5 slightly nearer to suture with sternite 4. Chelipeds similar, subequal; carpus with prominent lateral truncatiform wedge-like expansion. Ambulatory legs

relatively short, granulose, edges with conical granules and setae. Male abdomen very granulose, appearing eroded; telson subtriangular with rounded tip, about half the length of segment 6; segments 3–5 completely fused, lateral margins concave. G1 long, slender, mostly straight, curving outward and tapering to a fine point distally; terminally located opening unadorned by flaps or folds; several long, thick and stiff plumose setae located subdistally. G2 short, about one-third length of G1.

**Comparative material.** – *Olenothus uogi* Ng, 2002, holotype male (16.5 × 10.8 mm) (UF 2096), on wall, 2 m, at night, Tepungan Channel, Guam, coll. by L. Kirkendale, 17 Nov. 1998; paratype female (14.5 × 9.3 mm) (UF 2097), on wall, 1–2 m, coll. by L. Kirkendale, 17 Jul. 1999; *Euxanthus huonii* (Hombron & Jacquinot, 1846), 1 male (53.7 × 36.3 mm) (ZRC 1965.11.9.46), Linderman Island, Whitsunday Passage, Queensland, Australia, coll. by M. Ward, Dec. 1934; *Euxanthus exsculptus* (Herbst, 1790), 1 female (51.4 × 34.2 mm) (ZRC 1973.10.30.37), Puerto Galera, Mindoro, Philippines, coll. by V. P. Marula, 22 Jun. 1971; *Hypocolpus kurodai* Takeda, 1980, 1 male (21.8 × 13.7 mm) (NMCR-6609), Kasili, Santa Cruz, Marinduque, Philippines, coll. by J. Cabrera, R. Garcia & R. Velarde, 21 Aug. 1979; *H. haanii* Rathbun, 1909, 2 females (30.9 × 22.3 mm, 41.2 × 32.1 mm) (ZRC 1965. 7.6.17–18), 12 fathoms, 05°09.2'S 106°57.25'E, Java Sea, coll. by M. W. F. Tweedie, 6 Sep. 1938.

**Type Species.** – *Rizalthus anconis*, new species, by present designation.

**Etymology.** – This genus is named in honour of Dr. Jose P. Rizal, national hero of the Philippines, who was also an avid naturalist. The genus name is an arbitrary combination of the surname “Rizal” and “-thus”, a common suffix of xanthid genera. Gender masculine.

**Remarks.** – *Rizalthus*, new genus, clearly belongs to the subfamily Euxanthinae because the anterolateral margin of the carapace does not clearly meet the orbit but, instead, continues down to the subhepatic region and terminates at or near the buccal frame. Other features that contribute to its inclusion are chelipeds and ambulatory legs that can be coapted against the carapace (see Serène, 1984). *Rizalthus* is morphologically most similar to the monotypic genus *Olenothus* Ng, 2002 by virtue of the following features: 1) the lobes of the bifid front are broadly triangular; 2) the carapace outline is strongly arcuate anterolaterally and concave posterolaterally; 3) the antennal flagellum is relatively long; and 4) the carpus of the cheliped has an extensive lateral expansion. However, it differs significantly by having the following features: 1) the carapace has well-defined regions, and is highly invested with large granules like the rest of the body (Figs. 1, 2) (vs. carapace regions not well-defined, finely granulose in *Olenothus*); 2) the anterior portion of the carapace, particularly the proto- and epigastric regions, is distinctly elevated over the rest of the carapace (Fig. 1A, B) (vs. not distinctly elevated in *Olenothus*); 3) the epistome is broader and less arched, the central region is more or less straight (Fig. 1B) (vs. narrower, strongly arched, with central convexity in

*Olenothus*); 4) the basal antennal article is relatively narrower and the large tubercle near the internal orbital angle is absent or obscured by many granules (Fig. 2A) (vs. broad, inflated basal antennal article, and tubercle present in *Olenothus*); 5) the posterior two-thirds of the exopod of the third maxilliped is not expanded laterally (Fig. 2B) (vs. distinctly expanded laterally in *Olenothus*); 6) in the male abdomen, segment 6 is distinctly longer than the telson and the lateral margins of the fused segments 3–5 are strongly concave (Fig. 2C) (vs. telson and penultimate segment subequal in length, lateral margins of fused segments 3–5 undulate, not concave in *Olenothus*); and 7) the distal end of the G1 is straight and tapering, with a terminal opening, and with several long, stiff subterminal setae (Fig. 2F, G, H) (vs. hooked with triangular flap, subterminal opening, and only two long, stiff subterminal setae in *Olenothus*). Furthermore, there are visible traces of the suture between thoracic sternites 3 and 4 (vs. completely absent in *Olenothus*) and the tubercle for the abdominal locking mechanism is not adjacent to the suture between sternites 4 and 5 (vs. adjacent to suture between sternites 4 and 5 in *Olenothus*) (cf. Ng, 2002).

In addition to the material we have in our possession (see **Comparative Material**), Guinot-Dumortier (1960) and Serène (1984) provide excellent figures and descriptions of most of the known species of *Euxanthus* Dana, 1851, and *Hypocolpus* Rathbun, 1897, particularly the type species *E. huonii* (Hombron & Jacquinot, 1846) and *H. diverticulatus* (Strahl, 1861), respectively, from which we can now make accurate comparisons. We also took into consideration species belonging to these two genera that have been described afterward (cf. Guinot, 1971; Crosnier, 1991; 1997). *Rizalthus* shares morphological affinities with such genera, particularly in the general outline and sculpturing of the carapace, and in the general form of the third maxillipeds. *Rizalthus* also shares the lateral expansions of the cheliped carpus with at least one species, *Hypocolpus kurodai* Takeda, 1980. However, *Rizalthus* can be easily distinguished from *Euxanthus* by 1) the wide V-shaped gap separating the two triangular lobes of the front (Fig. 1A) (vs. narrow fissure in *Euxanthus*, frontal lobes are more rounded); 2) the straight central region of the epistome (Fig. 1B) (vs. with pointed projection/convexity); 3) the absence of clearly demarcated teeth on the carapace anterolateral margin (Fig. 1A) (vs. with 4–6 teeth); 4) the presence of large conical tubercles on the distal end of the eyestalks, bordering the rim of the corneas (Fig. 2A) (vs. absent or minute); 5) the absence of the tubercle near internal orbital angle (Figs. 1B, 2A) (vs. present); 6) the near-absence of the suture between sternites 3 and 4 (Fig. 1C) (vs. distinct and entire); 7) the presence of lateral expansions on the carpus of the chelipeds (Fig. 1A, D) (vs. absent); 8) the less distinctly triangular and more rounded telson (Fig. 2C) (vs. distinctly triangular); and 9) the tapering terminal end of the G1 with several stiff and long subterminal setae (Fig. 2F–H) (vs. relatively blunt, with triangular flap, and fewer long and stiff setae) (cf. Guinot-Dumortier, 1960; Serène, 1984). *Rizalthus* can also be easily distinguished from *Hypocolpus* by 1) the absence of subhepatic cavities (Fig. 1B) (vs. present); 2) the lack of a cristate anterolateral carapace margin (Fig. 1A) (vs.

present); 3) the wide V-shaped gap between the lobes of the front (Fig. 1A) (vs. narrow fissure between lobes); 4) the flat central region of the epistome (Fig. 1B) (vs. convex); 4) the more rounded telson (Fig. 2C) (vs. more triangular); and 5) the tapering terminal end of the G1 (Fig. 2F–H) (vs. relatively blunt, with triangular flap) (cf. Guinot-Dumortier, 1960; Serène, 1984).

The lateral expansion on the cheliped carpus of *Rizalthus* is most similar to those seen in the monotypic genus *Pleurocolpus* Crosnier, 1995 in that the apices of these extensions are more acute than in *Olenothus uogi* Ng, 2002, and *Hypocolpus kurodai* Takeda, 1980, which tend to be broader. There is also some similarity in the form of the G1. However, *Rizalthus* is easily distinguished from *Pleurocolpus* by the bilobed front (Fig. 1A) (vs. quadrilobate in *Pleurocolpus*); the relatively shorter antennal flagellum (Fig. 2A) (vs. long, going beyond orbit); the absence of a respiratory cavity formed by the carapace and pereiopods (Fig. 1A) (vs. present and diagnostic in *Pleurocolpus*); the absence of a large, laterally directed triangular tooth at the junction of the anterolateral and posterolateral carapace margins (Fig. 1A) (vs. present); the feeble median longitudinal suture on the male thoracic sternum just anterior to the sternal cavity (Fig. 1C) (vs. deep and extensive fissure); and the more slender G1, with several stiff and long subterminal setae (Fig. 2F–H) (vs. stouter and without subterminal setae) (cf. Crosnier, 1995).

The combination of characters seen in *Rizalthus* make its placement within the four genera mentioned rather difficult and thus the establishment of a new genus is warranted.

### *Rizalthus anconis*, new species (Figs. 1, 2, 9A)

**Material examined.** – Holotype: 1 male (12.5 × 7.9 mm) (NMCR-27507), Station R30, reef slope with black coral, 15–37 m, 9°37.1'N 123°46.1'E, Napaling, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 8 Jun.2004.

Paratypes: Two females (7.8 × 4.5 mm to 11.2 × 7.3 mm) (MNHN-B30700), 1 ovigerous female (12.7 × 8.1 mm) (ZRC 2008.0215), Station B39, reef wall with small caves, 17–25 m, 9°32.8'N 123°42.1'E, Pontod Lagoon 1, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 2 Jul.2004; 1 male (4.2 × 2.7 mm) (ZRC 2008.0216), Station B10, reef wall with small caves, 3–14 m, 9°36.5'N 123°45.6'E, Momo Beach, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 10 Jun.2004; 1 female (7.0 by 4.3 mm) (ZRC 2008.0217), Station B17, reef wall with small caves, 3–21 m, 9°37.5'N 123°46.9'E Bingag, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 19 Jun.2004.

**Description.** – Carapace (Fig. 1A) much broader than long, regions well-defined; epigastric, protogastric, mesogastric and metagastric regions raised, together forming a dorsally convex anterior portion on carapace; 2M partially divided longitudinally, lateral lobe larger, 4M almost indistinct, with 5 widely-spaced granules; 1L, 2L and 3L modified into large, granular, dorsally directed tubercles/teeth, 3L most prominent; all dorsal regions of carapace with large granules, surrounded by short setae basally, suborbital, subhepatic and

pterygostomial regions with smaller, lower granules. Front about 0.4 times carapace width, bilobed; lobes separated by broad V-shaped cleft, continuous with a deep median fissure on frontal region; each lobe broadly triangular, bluntly tipped, continuing laterally and separated from rounded inner orbital angle by a short groove. Supraorbital margin granulose with 2 small notches laterally, relatively short, no obvious external orbital tooth, not clearly meeting anterolateral margin. Orbita relatively small, width about 0.1 times carapace width. Anterolateral margin lined with tooth-like granules, appearing unevenly serrated, feebly cristate, anterior-most part not meeting orbital margin but becoming lower and less distinct and eventually indiscernible as it curves ventrally to meet pterygostomial region; anterior two-thirds strongly arcuate; posterior third slightly convex, curving posteriad to posterolateral margin, junction of margins marked by prominent, dorsally directed, granular tooth. Posterolateral margin granulose, deeply concave, anterior portion almost parallel to frontal margin, then curving sharply to converge posteriad with posterior carapace margin. Last ambulatory leg coapted against concavity in posterolateral margin. Posterior carapace margin granulose, straight, with rows of granules anterior to it.

Eye with short eyestalks, distal edge with cornea lined with small, tooth-like granules; corneas well developed (Fig. 2A). Antennules (Fig. 2A) folding transversely. Basal antennal segment large, granulose, subrectangular, occupying entire space between antennular fossa and internal orbital angle, filling orbital hiatus; long flagellum arising from distal margin, reaching outer edge of orbit. Epistome (Fig. 1B) with small granules, distal edge slightly sweeping outward, central region slightly undulate, concave. Endostome without oblique or longitudinal ridges.

Outer surface of third maxilliped (Figs. 1B, C, 2B) granulose, appearing eroded. Merus subquadrate, median length about half that of ischium, with 2 shallow depressions on either side of a submedian, granular ridge; margins with small granules, anterior and external margins slightly concave, internal margin straight; anteroexternal angle auriculiform. Ischium subrectangular, inner margin with large granules and short, stiff setae; with deep, longitudinal median sulcus bordered by granules; separated from basis by distinct suture. Exopod granulose, tapering toward distal end which almost reaches anterior edge of merus, flagellum long.

Surface of thoracic sternum (Fig. 1C) eroded, with granules

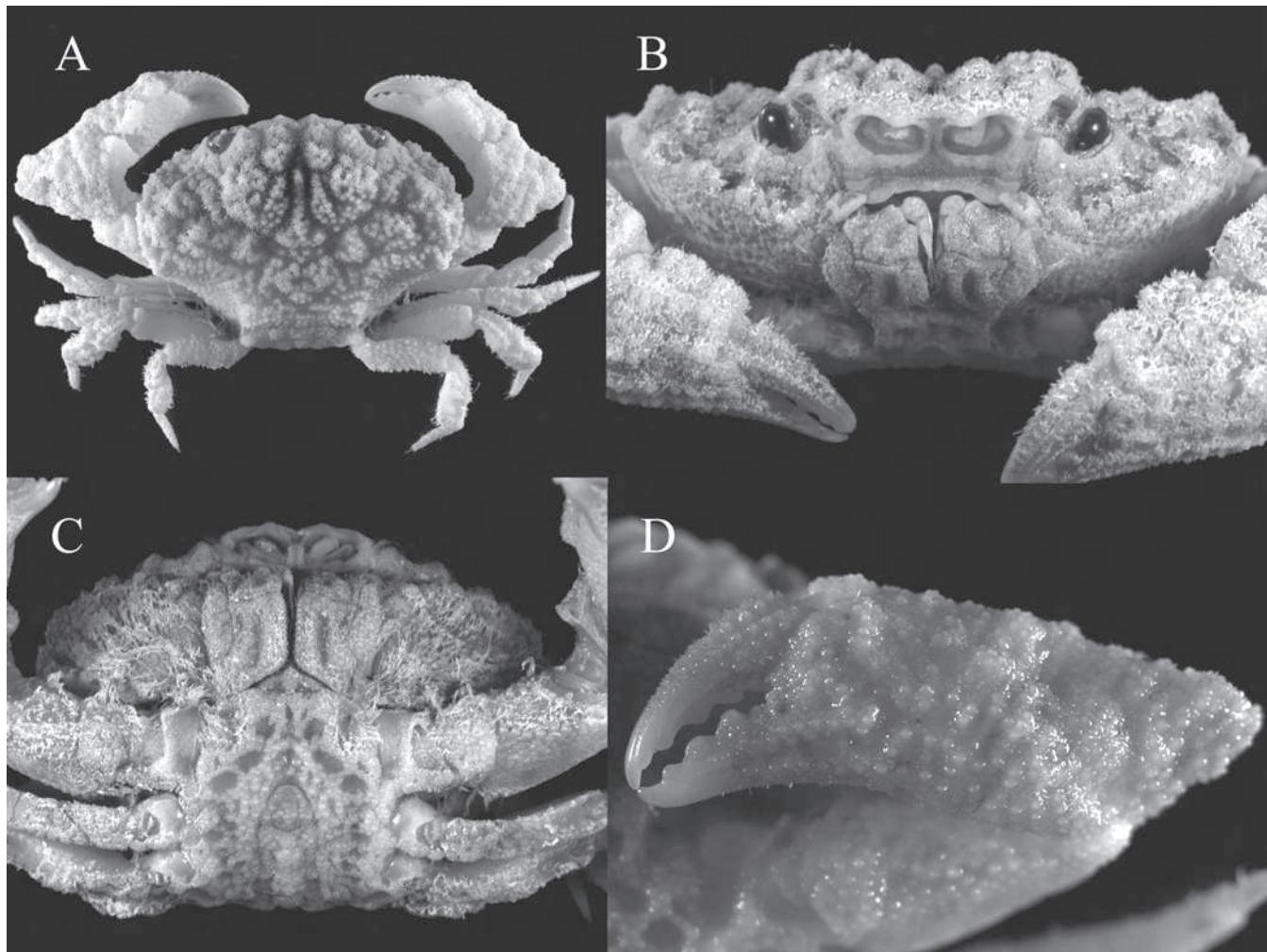


Fig. 1. *Rizalthus anconis*, new genus, new species, male holotype (NMCR-27507) (12.5 × 7.9 mm): A, dorsal view; B, frontal view; C, ventral view; D, left chela, outer surface.

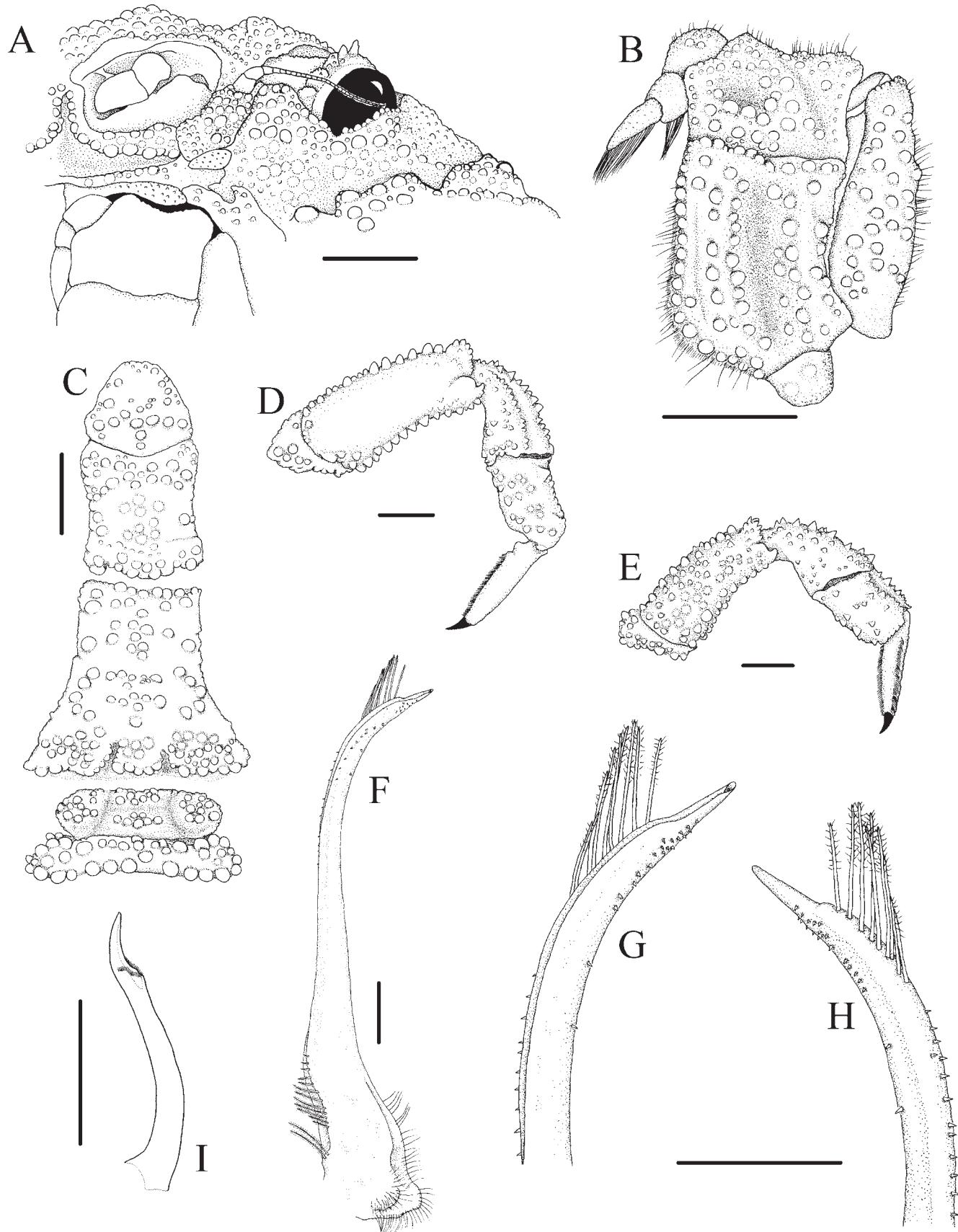


Fig. 2. *Rizalthus anconis*, new genus, new species, male holotype (NMCR-27507) (12.5 × 7.9 mm): A, frontal view, left side, showing antenna, antennule and orbit; B, left third maxilliped, external view; C, abdomen and telson; D, right third ambulatory leg; E, right fourth ambulatory leg; F, left G1, external view; G, distal end of left G1, external view; H, distal end of left G1, internal view; I, left G2, external view. Scale bars: A–E = 1.0 mm; F–I = 0.5 mm.

and several distinct depressions on anterior region and on either side of abdomen, anterior region elongate. Sternites 1 and 2 completely fused into triangular plate, separated from sternite 3 by deep transverse suture. Sternites 3 and 4 partially fused, with partial suture seen near anterior edge of cheliped coxae; median suture present within 1 median depression anterior to telson, 3 depressions obliquely anterior and lateral to it, arranged in an oblique line. Abdominal cavity deep, tubercle for locking mechanism (sternal condyle) on sternite 5 slightly nearer to suture with sternite 4, abdomen reaching to imaginary line joining posterior edge of cheliped coxae.

Chelipeds (Fig. 1A, D) similar, subequal. Fingers shorter than palm, cutting edges with 3 or 4 teeth, not pigmented, tips pointed. Dactylus slightly curved, with 2 rows of granules and deep submarginal groove along length, stiff short setae on upper margin. Fixed finger slightly deflexed with 2 rows of granules and broad submarginal groove continuing from palm. Palm outer surface rugose, upper margin irregular, wedge-like and granulose, with 2 irregular rows of granules near convex proximal-lower margin; inner surface relatively smoother, with fewer and smaller granules when compared with outer surface. Carpus short, dorsal and ventral surface granulose, inner distal angle with low triangular tooth, outer surface with prominent truncatiform wedge-like expansion. Inner surfaces of fingers, palm and carpus coapted against anterolateral margin of carapace. Merus granulose, slightly longer than carpus, with rectangular, ventro-distal tooth apposed against carpus.

Ambulatory legs (Figs. 1A, 2D, E) relatively short, granulose, edges with setae; second leg longest, coxa-to-dactylus length about 0.7 times carapace width. Merus subrectangular, subtriangular in cross-section; anterior and posterior edges, especially in third and fourth ambulatory legs, lined with large, pointed granules; dorsal surface in fourth ambulatory leg more granulose than rest. Dorsal surface of carpus with 1 median row of pointed granules, another row of pointed granules on serrated anterior edge. Propodus subrectangular, anterior edge serrated. Dactylus straight, dorsal surface and edges covered with fine granules, short setae; terminates distally in curved chitinous claw.

Male abdomen and telson (Fig. 2C) very granulose, appearing eroded. Telson subtriangular with rounded tip; lateral margins raised due to presence of granules, slightly convex. Segment 6 rectangular, about 1.5 times length of telson, lateral margins concave. Segments 3–5 completely fused, without any trace of sutures; lateral margins markedly concave; median region raised. Segment 2 subtrapezoidal, with 2 shallow longitudinal grooves on either side of a central raised granular region. Segment 1 trapezoidal with large granules, no transverse ridge.

Gonopod 1 (Fig. 2F–H) long and slender, mostly straight, curving outward and tapering to a fine point distally; terminally located opening unadorned by flaps or folds; several long, thick and stiff plumose setae located subdistally; distal third sparsely covered with tiny spines, mostly found on the inside of the subterminal bend, some spines found in a row on the inner margin; basal region setose. Gonopod 2

(Fig. 2I) short, as figured.

**Live colouration.** – The carapace and pereiopods (Fig. 9A) have a light pinkish or white base; certain regions of the carapace (frontal, epigastric, protogastric, branchial, intestinal) and ambulatory legs light orange; individual granules on carapace (mesogastric, metagastric, cardiac) and ambulatory legs dark orange to reddish-pink. Cheliped fingers are light-brown at the base and white at the tips. This colour pattern probably helps it blend into the reef environment.

**Etymology.** – The specific epithet *anconis* is derived from the Greek word for elbow, alluding to the pronounced elbow-like projection on the carpus of this animal's chelipeds. Used as a noun in apposition.

**Remarks.** – See **Remarks** for the genus. *Rizalthus anconis*, new species, is known thus far only from the type locality, Panglao island in the Bohol Sea, central Philippines, and is associated with coral reef walls, occurring at depths between 3 and 37 m. It has also been collected from reef walls in at least one station (B17) together with the two species of *Visayax*, new genus, described in this paper.

#### *Visayax*, new genus

**Diagnosis.** – Carapace broader than long; regions well-defined; 1M, 2M and 2F raised, with prominent granulose tubercle on 2M; branchial region with 2 dorsally-projecting tubercles; 3M and 1P distinct; suborbital region eroded with small depressions; subhepatic and pterygostomial regions with low, discrete granules; carapace surface with distinct or faint reticulate pattern of fused granules; front bilobed, lobes triangular at the tips; anterolateral margin arcuate, descending into subhepatic region, meeting with anterolateral corner of buccal frame, communicating with raised orbital margin through 2 or 3 thin ridges radiating from external orbital angle and suborbital margin; posterolateral margin concave, with dorsolaterally directed tubercle at junction with anterolateral margin; posterior margin straight, with dorsally projecting tubercle at junction with posterolateral margin. Antennules folding almost transversely. Basal antennal segment large, trapezoidal, proximal end with medial extension toward the antennular fossa, granulose, orbital hiatus completely filled; long flagellum almost reaching outer edge of orbit. Epistome broadly concave. Endostome without ridges. Outer surface of third maxilliped granulose, eroded; merus subquadrate, median length about half that of ischium; ischium subrectangular, inner margin with granules, short, stiff setae; with deep, longitudinal median sulcus; exopod granulose, tapering toward distal end which almost reaches anterior edge of merus, flagellum long. Surface of thoracic sternum eroded, large distinct depression just anterior to sternal cavity, no discernible suture within this anterior depression, smaller depressions seen on either side of sternal cavity; sternites 1 and 2 completely fused, separated from sternite 3 by deep transverse suture; sternites 3 and 4 almost fused except for short sutures near base of cheliped. Chelipeds similar, subequal; fingers shorter than

palm, cutting edges with 4 or 5 teeth, tips pointed, curving inward; palm outer surface eroded in reticulate pattern, inner surface relatively smoother; fingers, palm and carpus coapted against anterolateral margin of carapace. Ambulatory legs relatively short, coapted against carapace. G1 long and slender, mostly straight, curving outward and tapering distally; with terminally located opening; several long, thick and stiff simple setae located subdistally on medial edge and internal (dorsal) surface; basal external (ventral) region with row of stiff simple setae, surrounded by finer setae.

**Comparative material.** – *Glyptoxanthus erosus* (Stimpson, 1859), 1 male ( $53.1 \times 38.1$  mm) (ZRC 1998.9; USNM 168865 ex.), Sapelo Island, 4.75 miles (7.6 km) off Whistle Buoy, Georgia, U.S.A., 60–65 feet (18.2–19.7 m), coll. by M. Gray, 7 Apr. 1966; *Cranaothus deforgesii* Ng, 1993, 1 male (7.5 × 5.3 mm) (NMCR-1521), Station D-1, Maluso Bay, Basilan Island, Philippines, 27 fathoms (49.38 m), coll. by Pele-Sulu Sea Expedition, 15 Feb. 1964.

**Type Species.** – *Visayax osteodictyon*, new species, by present designation.

**Etymology.** – This genus is an arbitrary name derived from the Visayas islands, which comprise the central region of the Philippines. Gender masculine.

**Remarks.** – *Visayax*, new genus, is superficially similar to a monotypic genus *Lipaesthesia* Rathbun, 1898, in the general outline of the carapace, wherein the anterolateral margins are arcuate and the posterolateral margins are concave, and the eroded/reticulate surface of the carapace, sternum and chelae (cf. Rathbun, 1930: 272, pl. 112). However, it can be distinguished from *Lipaesthesia* primarily by having the distal end of the basal segment of the antenna free, with the attachment of the antennal flagellum visible (Figs. 4A, 6A) (vs. distal end fixed against front, with attachment of flagellum not visible in *Lipaesthesia*). Other distinguishing features are the presence of the dorsally projecting tubercles on the gastric and branchial regions (Figs. 3A, 5A) (vs. absent in *Lipaesthesia*); the presence of thin ridges linking the anterolateral margin of the carapace to the orbits (Figs. 3C, 5C) (vs. absent); and the presence of a tubercle each at the junctions between the anterolateral and posterolateral margins and the posterolateral and posterior margins of the carapace (Figs. 3A, 5A) (vs. absent) (cf. Rathbun, 1930: 272, pl. 112). Furthermore, *Lipaesthesia*, which is monotypic and represented solely by *L. leeanus* Rathbun, 1898, is found only in the eastern Pacific Ocean, ranging from the Gulf of California to the Galapagos Islands and is not known to occur in the Indo-west Pacific region.

*Visayax*, new genus, is also similar to another monotypic genus, *Cranaothus* Ng, 1993, in the general carapace outline and dimensions; in having the suborbital region eroded by small depressions; and in the form of the G1. Ng (1993) opined that the single male specimen reported by Serène and Umali (1972: 68, Pl. 7, Figs. 7–9) as “*Paramedaeus noelensis*” is actually conspecific with *Cranaothus deforgesii* Ng, 1993. Having examined this specimen, we concur and

thus confirm this species as occurring in the Philippines as well as the type locality, Chesterfield Island, Coral Sea. *Visayax* is easily distinguished from *Cranaothus* by the absence of squamate granules and vermicular ridges on the carapace (Figs. 3A, 5A) (vs. present); the form of the bilobed front, wherein the lobes are triangular and are not projecting anteriorly (Figs. 3A, C, 5A, C) (vs. lobes truncatiform and projecting well beyond orbits); the well defined regions of the carapace (Figs. 3A, 5A) (vs. not well defined); the presence of tubercles on the gastric and branchial regions and the junction between the posterolateral and posterior carapace margins (Figs. 3A, 5A) (vs. absent); the absence of endostomial ridges (vs. present); the form of the male thoracic sternum, wherein sternites 1 and 2 and sternites 3 and 4 are fused (Figs. 3B, 5B) (vs. sternite 1 separated from sternite 2 by distinct suture; with shallow interrupted sutures between sternites 2 and 3 and sternites 3 and 4); the symmetric chelipeds, without modified cutting tooth at base of dactylus (Figs. 3A, D, 5A, D) (vs. chelipeds asymmetric, dactylus of major chela with modified cutting tooth); and the uniformly slender G1, with simple long subterminal setae (Figs. 4F–G, 6F–G) (vs. G1 stout proximally, tapering distally, subterminal setae plumose) (cf. Ng, 1993).

*Visayax* is superficially similar to *Glyptoxanthus* A. Milne-Edwards, 1879, in the general outline and surface sculpturing of the carapace. Comparison with the type species, *G. erosus* (Stimpson, 1859), as well as with illustrations of other species of *Glyptoxanthus* (cf. Garth, 1939: 15–17, Pls. 4–5) reveals that it differs from *Visayax* based on the following features: 1) the front is less protruding and the anterolateral margin is more arcuate in *Glyptoxanthus*, giving the carapace a more rectangular outline (vs. hexagonal outline in *Visayax*, Figs. 3A, 5A); 2) adult specimens of the different species of *Glyptoxanthus* are generally much larger than those of *Visayax*; 3) the surface sculpturing of the carapace and pereiopods of *Glyptoxanthus* is more vermiculate in pattern (vs. more reticulate pattern or eroded, Figs. 3A, 5A); 4) the proto- and mesogastric regions are not very much raised above the rest of the carapace regions in *Glyptoxanthus* (vs. visibly and distinctly elevated, Figs. 3C, 5C); 5) the presence of endostomial ridges in the buccal cavern in *Glyptoxanthus* (vs. absent); 6) the 3<sup>rd</sup> maxillipeds are more heavily sculptured in *Glyptoxanthus*, and the proximal half of the exopod is more laterally expanded (vs. less sculptured, exopod more or less uniform in width, Figs. 4B, 6B); and 7) the chelipeds and walking legs of *Glyptoxanthus* are relatively shorter and stockier, giving them a more robust appearance (vs. longer and more slender, Figs. 3A, 5A).

*Visayax* is also superficially similar to the monotypic genera *Danielea* Ng and Clark, 2003, and *Jacforus* Ng and Clark, 2003 in the general outline of the carapace and male abdomen. However, *Visayax* differs from *Danielea* and *Jacforus* in the triangular lobes of the front (Figs. 3A, 5A) (vs. truncate); the presence of tubercles on the gastric and branchial regions and on the junction of the posterolateral and posterior margins of the carapace (Figs. 3A, 5A) (vs. absent); the concave posterolateral margins of the carapace (Figs. 3A, 5A) (vs. straight); the absence of a modified cutting

tooth on the dactylus of the major chela (Figs. 3D, 5D) (vs. present); the trapezoidal basal antennal article, wherein the proximal end has a medial extension toward the antennular fossa (Figs. 4A, 6A) (vs. simply rectangular in *Danielea*; simply subquadrate in *Jacforus*); the absence of a distinct suture dividing thoracic sternite 3 and 4 (Figs. 3B, 5B) (vs. present and complete in *Danielea*; present and interrupted in *Jacforus*). Furthermore, there are distinct differences in the G1 of these genera: in *Danielea* the proximal end is definitely stouter and the subterminal setae are more slender, less stiff and arise only from the internal (dorsal) surface; in *Jacforus* it is relatively shorter and stouter and there are no long, stiff subterminal setae similar to those seen in *Visayax* (cf. Forest and Guinot, 1961; Serène, 1984; Ng and Clark 2003).

The suite of characters found in *Visayax*, new genus, make it difficult to place in any of the aforementioned genera, and as such, must necessarily be placed in its own genus.

***Visayax osteodictyon*, new species**  
(Figs. 3, 4, 9B)

**Material examined.** – Holotype: 1 male (6.3 × 4.3 mm) (NMCR-27508), Station S22, hard ground covered with sand, 15–22 m,

9°29.4'N 123°56.0'E, Pamilacan Island, coll. by Panglao 2004 Marine Biodiversity Project, 21 Jun.2004.

Paratypes: 2 females (7.4 × 5.3 mm) (ZRC 2008.0753), Station B14, reef slope with overhangs, 24m, 9°33.2'N 123°48.3'E, BBC Point, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 1 Jun.2004; 1 male (6.6 × 5.1 mm) (ZRC 2008.0754), Station B6, coral patches, 12–14 m, 9°31.1'N 123°41.3'E, Black Forest, Balicasag Island, coll. by Panglao 2004 Marine Biodiversity Project, 4 Jul.2004; 1 male (2.3 x 1.7 mm) (ZRC 2008.0218), Station B17, reef wall with small caves, 3–21 m, 9°37.5'N 123°46.9'E Bingag, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 19 Jun.2004; 1 male (3.3 x 2.2 mm) (ZRC 2008.0219), Station B39, reef wall with small caves, 17–25 m, 9°32.8'N 123°42.1'E, Pontod Lagoon 1, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 2 Jul.2004.

**Description.** – Carapace (Fig. 3A) broader than long; regions well-defined; 1M, 2M and 2F fused and raised, culminating in a dorsally directed tubercle on 2M; sections of branchial region—3L and 5L—raised into dorsally-projecting tubercles; 3M and 1P distinct, 4M indistinct; entire dorsal surface covered by network of fused granules forming a reticulate pattern, with short setae sparsely distributed at their bases; suborbital region eroded with several small depressions; subhepatic and pterygostomial regions with low, discrete

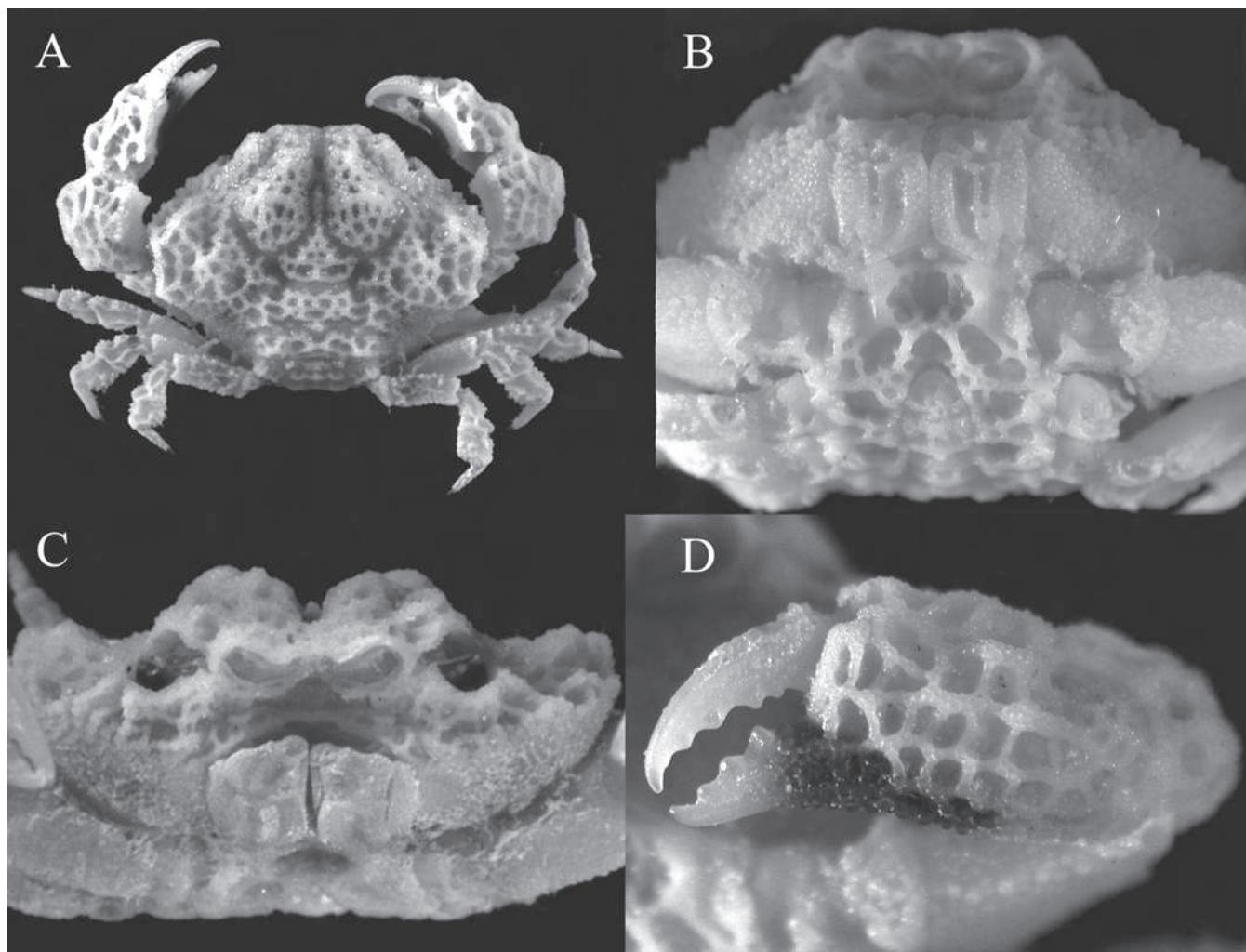


Fig. 3. *Visayax osteodictyon*, new genus, new species, male holotype (NMCR-27508) (6.3 × 4.3 mm): A, dorsal view; B, ventral view; C, frontal view; D, left chela, outer surface.

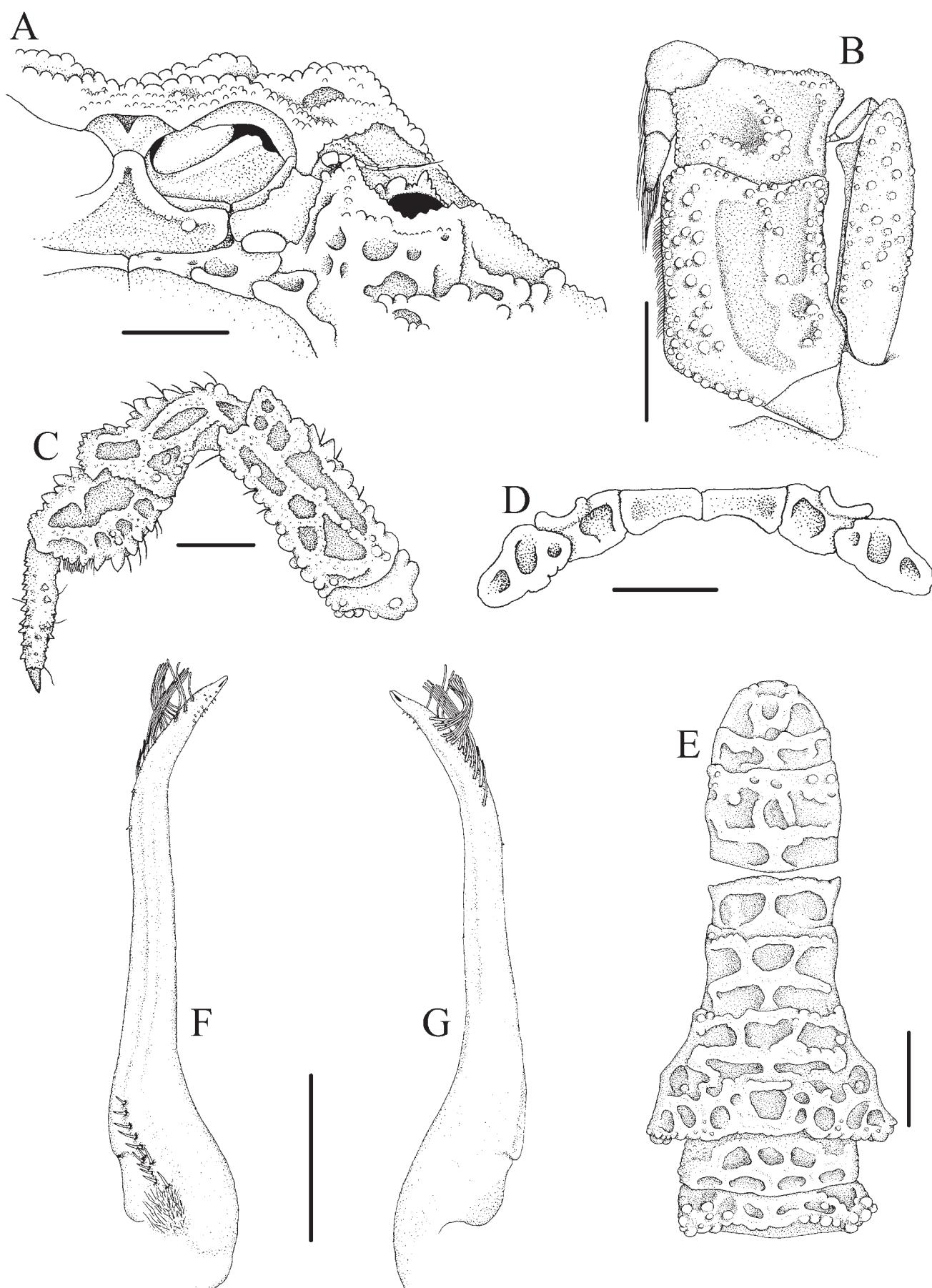


Fig. 4. *Visayax osteodictyon*, new genus, new species, male holotype (NMCR-27508) (6.3 × 4.3 mm): A, frontal view, left side, showing antenna, antennule and orbit; B, left third maxilliped, external view; C, left fourth ambulatory leg; D, epistome; E, abdomen and telson; F, left G1, external view; G, left G1, internal view. Scale bars: A–G = 0.5 mm.

granules. Front deflexed ventrally, appearing truncate, shallowly bilobed from dorsal view; lobes broadly triangular, projecting medially, separated by a wide U-shaped median cleft that continues as a shallow median groove in the frontal region; laterally curving toward inner orbital angle, separated from it by a short groove. Supraorbital region granulose; margin mildly serrated, relatively short, not clearly meeting anterolateral margin, without distinct external orbital tooth. Suborbital margin mildly serrated, outer edge connected to anterolateral margin by a ridge consisting of fused granules. Orbita small, width about 0.1 times carapace width; eyestalks short, distal edge with cornea lined with small, tooth-like granules; corneas well developed. Anterolateral margin strongly arcuate, granulose, appearing irregularly serrated; anteriormost part not meeting supraorbital margin but curving into pterygostomial region where it eventually disappears close to anterolateral corner of buccal cavity; posterior end forming distinct, angular junction with deeply concave posterolateral margin. Anterior portion of posterolateral margin subparallel to frontal margin, and continues as a curve to meet posterior margin. Last ambulatory leg coapted against concavity in posterolateral margin. Junction with posterior carapace margin defined by a granular, upwardly and outwardly projecting tooth; posterior carapace margin straight.

Antennules (Figs. 3C, 4A) folding almost transversely. Basal antennal segment large, subrectangular, granulose, almost occupying entire space between antennular fossa and internal orbital angle, orbital hiatus completely filled; long flagellum arising from distal margin, almost reaching outer edge of orbit. Posterior edge of epistome (Fig. 4D) slightly undulate, with very shallow, rounded median projection, lateral regions with slight depressions. Endostome without any discernible ridges.

Outer surface of third maxilliped (Figs. 3B, 4B) granulose, eroded. Merus subquadrate, median length about half that of ischium, with 2 shallow depressions on either side of a submedian, granular ridge; margins with small granules, anterior and external margins slightly concave, internal margin straight; anteroexternal angle rounded. Ischium subrectangular, inner margin with granules and short, stiff setae; with deep, longitudinal median sulcus, with smaller longitudinal depression anterolateral to it, adjacent to anteroexternal margin; separated from basis by distinct suture. Exopod granulose, tapering toward distal end which almost reaches anterior edge of merus, flagellum long.

Surface of male thoracic sternum (Fig. 3B) eroded, with reticulate pattern of ridges and depressions similar to dorsal carapace surface; large distinct depression just anterior to telson of abdomen, no discernible suture within, smaller depressions seen on either side of abdomen; anterior region relatively elongate. Sternites 1 and 2 completely fused into triangular plate, separated from sternite 3 by deep transverse suture. Sternites 3 and 4 partially fused, with partial suture seen near anterior edge of cheliped coxae. Abdominal cavity deep, sternal condyle on sternite 5 slightly nearer to suture

with sternite 4, abdomen reaching to imaginary line joining posterior edge of cheliped coxae.

Chelipeds (Figs. 3A, 3D) similar, subequal. Fingers shorter than palm, cutting edges with 4 or 5 teeth, tips pointed. Dactylus slightly curved, with three rows of granules, continuing distally as ridges and separated by shallow grooves along its length, base granulose. Fixed finger, slightly deflexed with 2 rows of granules continuing as ridges and broad submarginal groove on outer surface continuing from palm; base granulose and pigmented. Palm outer surface eroded in reticulate pattern similar to dorsal carapace surface, upper margin irregular, wedge-like and granulose, lower margin slightly convex and granulose; inner surface relatively smoother, with fewer and smaller granules; pigmentation on base of fixed finger continues into lower portions of palm outer and inner surfaces forming a dark patch. Carpus short, dorsal and ventral surface eroded, reticulate, inner distal angle with low triangular tooth. Inner surface of fingers, palm and carpus coapted against anterolateral margin of carapace. Merus granulose, slightly longer than carpus, with rectangular, ventro-distal tooth apposed against carpus.

Ambulatory legs (Figs. 3A, 4C) relatively short, first leg longest, coxa-to-dactylus length about 0.7 times carapace width, sparsely setose. Merus subrectangular, subtriangular in cross-section; anterior and posterior edges, especially fourth ambulatory leg, lined with large, pointed granules; dorsal surface in fourth ambulatory leg with reticulate pattern of fused granules, others finely granular. Dorsal surface of carpus reticulate, with row of pointed granules on serrated anterior edge. Propodus subrectangular, rugose, anterior and posterior edges serrated in most legs. Dactylus slightly curved inwards, dorsal surface and edges covered with small spines, short setae; terminates distally in curved chitinous claw.

Male abdomen and telson (Fig. 4E) with reticulate pattern of fused granules and depressions. Telson rounded; lateral margins convex. Segment 6 subquadrate, about 1.5 times length of telson, lateral margins convex. Segments 3–5 completely fused, without any trace of sutures; lateral margins markedly concave. Segment 2 subtrapezoidal, segment 1 trapezoidal without transverse ridge.

G1 (Fig. 4F–G) long and slender, mostly straight, curving outward and tapering distally; terminally located opening bordered by 2 lamellar folds; several long, thick and stiff simple setae located subdistally; basal external region with row of stiff simple setae, surrounded by finer setae.

**Live colouration.** – The carapace and pereiopods (Fig. 9B) are basically white. The fused granules forming the reticulate pattern on the carapace, chelipeds and ambulatory legs are variably tinged light pink. There are also small, discrete spots or smudges of dark orange-brown on carapace, palm of chelae, and anterior edge of merus and carpus of ambulatory legs. The lower part of outer and inner surfaces of palm of the chelae is black while both fingers of the chelae are white.

**Etymology.** – The specific epithet *osteodictyon* derives from two Greek words, “*osteon*” which means bone, and “*dictyon*” which means net, characterizing the reticulate sculpturing—reminiscent of spongy bone tissue—on the carapace, pereiopods and other surfaces of this species. Used as a noun in apposition.

**Remarks.** – *Visayax osteodictyon*, new species, is superficially similar to the various species of *Glyptoxanthus* A. Milne-Edwards, 1879, particularly in the sculpturing of the carapace and pereiopods (cf. Rathbun, 1930: 263, pls. 107–109). It is easily distinguished from the type species, *Glyptoxanthus erosus* (Stimpson, 1859), by having a networked, anastomosing pattern to the fused granules (Figs. 3A, D, 4C, E), whereas in *G. erosus*, the fused granules tend to take a more vermicular pattern and are more closely spaced. The front of *G. erosus* has two deep lateral notches, giving it a quadridentate appearance (vs. two simple, broadly triangular lobes in *V. osteodictyon*, Fig. 3A); there are no dorsally directed tubercles on the carapace (vs. present, Fig. 3A); there are oblique ridges in the endostome (vs. absent); there is a visible median longitudinal suture on male thoracic sternite 4, just anterior to the telson (vs. absent, Fig. 3B);

the palm of the chela is stouter and more robust (vs. more slender, Fig. 3A, D); and while the G1 is similar to those seen in species of *Euxanthus*: it is much longer, the distal end is blunt, with only one subterminal seta, and the terminus folds over the opening forming a triangular flap (vs. distal end tapering, with several subterminal setae and no triangular flap, Fig. 4F–G).

*Visayax osteodictyon* is thus far known only from the type locality, Pamilacan Island, and nearby islands of Panglao and Balicasag, all of which are in the Bohol Sea, central Philippines. It has been collected at depths ranging between 3 to 25 m, in sandy substrate and in coral reef walls. It has been observed to occur together with *Rizalthus anconis*, new species, and *V. estampadori*, new species, in reef walls from at least one station (B17).

***Visayax estampadori*, new species**  
(Figs. 5, 6, 9C)

**Material examined.** – Holotype: 1 male (6.7 × 4.6 mm) (NMCR-27509), Station B17, reef wall with small caves, 3–21 m, 9°37.5'N

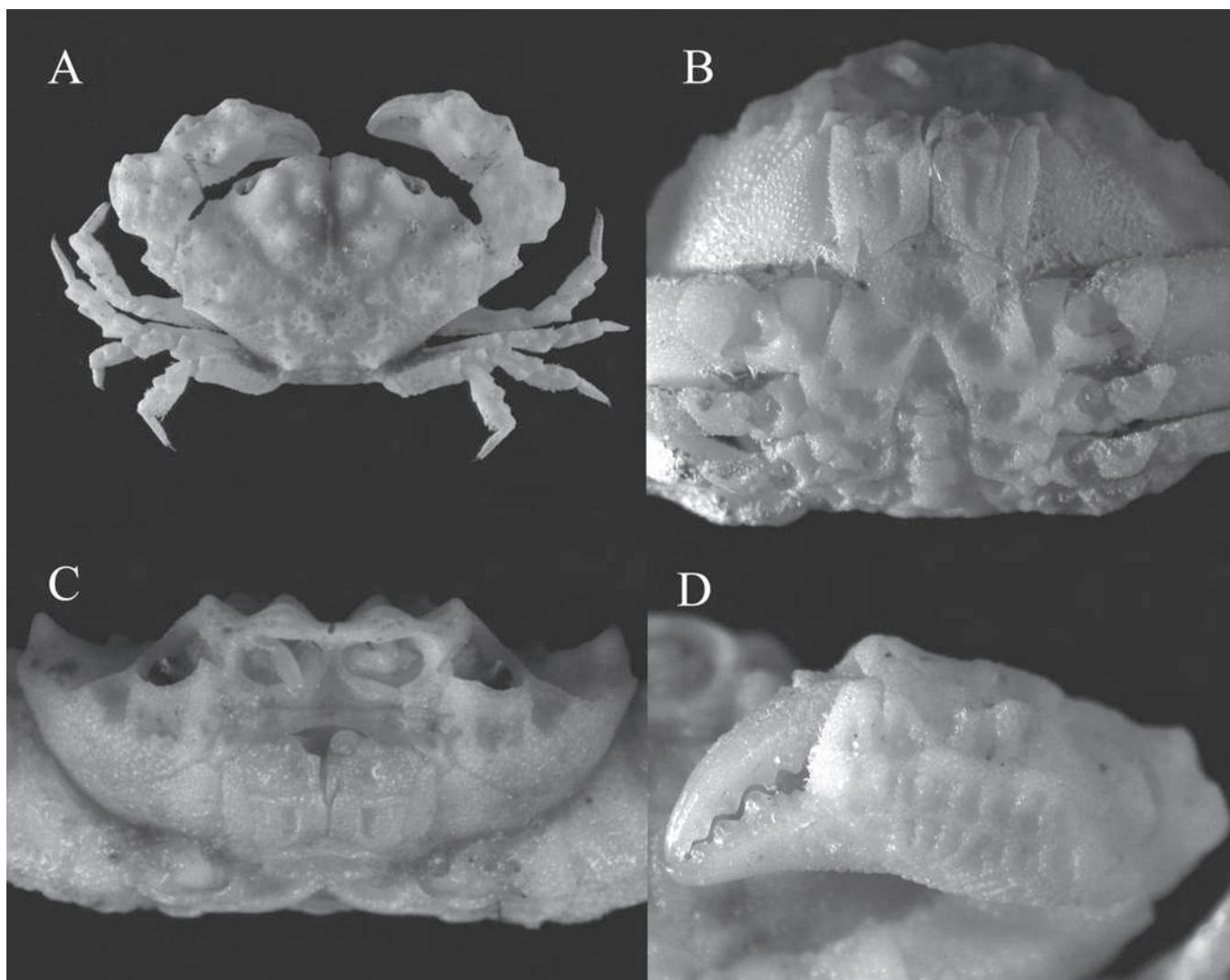


Fig. 5. *Visayax estampadori*, new genus, new species, male holotype (NMCR-27509) (6.7 × 4.6 mm): A, dorsal view; B, ventral view; C, frontal view; D, left chela, outer surface.

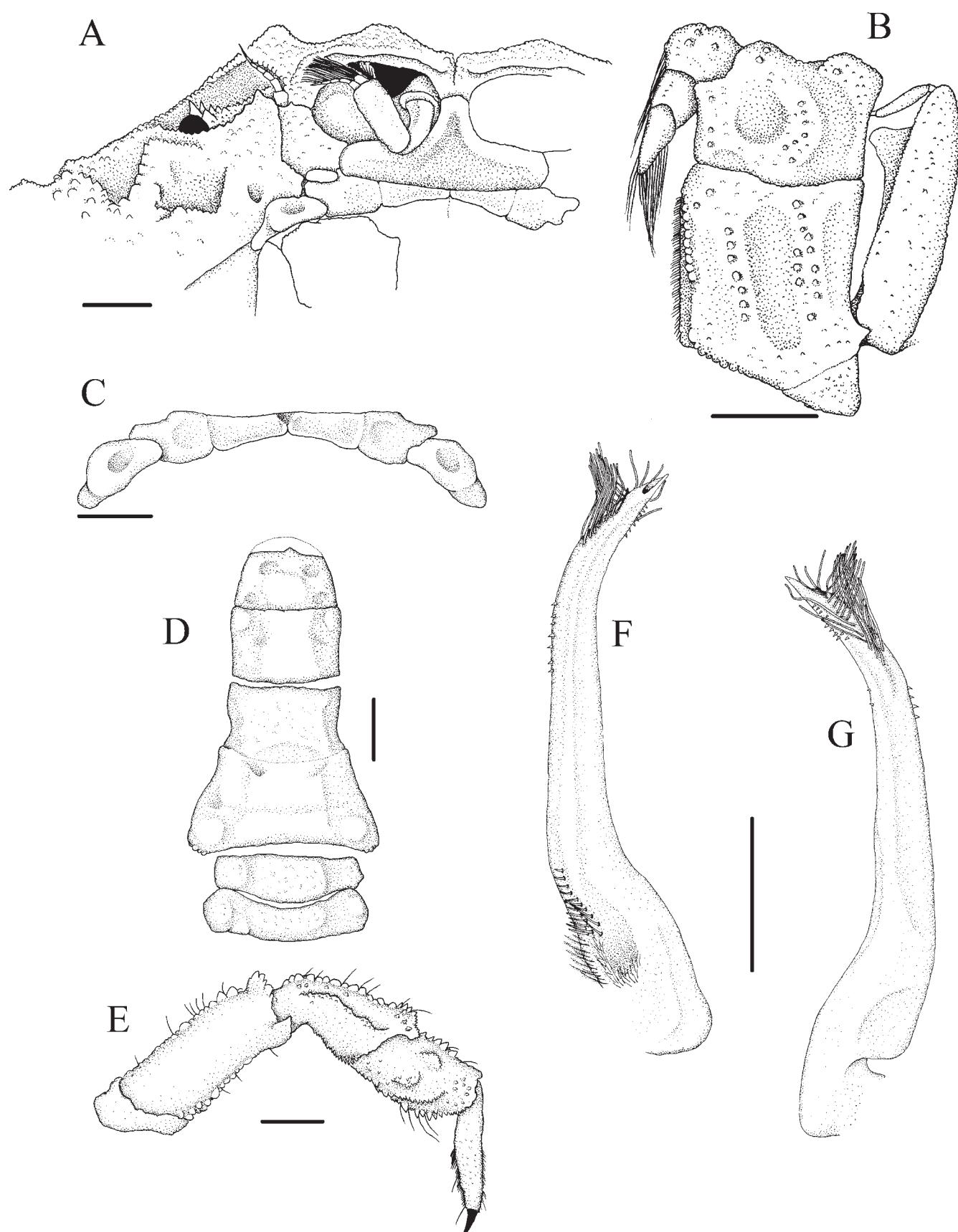


Fig. 6. *Visaya estampadori*, new genus, new species, male holotype (NMCR-27509) (6.7 × 4.6 mm): A, frontal view, right side, showing antenna, antennule and orbit; B, left third maxilliped, external view; C, epistome; D, abdomen and telson (partially damaged); E, left fourth ambulatory leg; F, left G1, external view; G, left G1, internal view. Scale bars: A–G = 0.5 mm.

123°46.9'E, Bingag, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 19 Jun.2004.

Paratype: 1 female (6.1 x 4.4 mm) (ZRC 2008.0755), small as holotype; 1 male (4.5 x 3.3 mm) (ZRC 2008.0220), Station B21, reef wall with small caves, 20–21 m, 9°37.2'N 123°46.4'E, Napaling, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 24 Jun.2004.

**Description.**—Carapace (Fig. 5A) broader than long; regions more or less defined; 1M, 2M and 2F raised, distinct from each other, 2M culminates in a large dorsally projecting tooth; sections of branchial region—3L, 4L and 5L—raised into dorsally-projecting tubercles; 3M and 1P distinct, 4M indistinct, cardiac region raised; entire dorsal surface finely granulose or pitted, limited and shallow reticulate patterns formed in mesogastric and cardiac regions; suborbital region eroded with several small depressions; subhepatic and pterygostomial regions with low granules. Front relatively narrow, about 0.3 times carapace width; slightly deflexed ventrally; bilobed, lobes separated by wide V-shaped cleft which continues into frontal region as a thin fissure, then a groove; lobes broadly triangular, bluntly tipped, continuing laterally toward, but not meeting, supraorbital margin, separated from it by short groove. Supraorbital region finely granulose; margin slightly crenulate, relatively short, not clearly meeting anterolateral margin, without distinct external orbital tooth. Suborbital margin slightly crenulate, outer edge connected to anterolateral margin by a ridge consisting of fused granules. Orbita small, width about 0.1 times carapace width; eyestalks short, distal edge with cornea lined with small, toothlike granules; corneas well developed. Anterolateral margin strongly arcuate, feebly cristate, granulose, serrated; anterior-most part not meeting supraorbital margin but curving into pterygostomial region where it eventually disappears close to anterolateral corner of buccal cavity; posterior end with a large, dorsally directed tooth at junction with posterolateral margin. Posterolateral margin gently concave, last ambulatory leg coapted against this concavity. Junction with posterior carapace margin defined by a large, granular, upwardly and outwardly projecting tooth; posterior carapace margin slightly concave.

Antennules (Figs. 5C, 6A) folding almost transversely. Basal antennal segment large, subrectangular, granulose, occupying entire space between antennular fossa and internal orbital angle, orbital hiatus completely filled; long flagellum arising from distal margin, almost reaching outer edge of orbit. Ventral edge of epistome (Fig. 6C) slightly undulate, central region concave, lateral regions with slight depressions. Endostome without any discernible ridges.

Outer surface of third maxilliped (Figs. 5B, 6B) granulose, eroded. Merus subquadrate, median length about half that of ischium, with 2 shallow depressions on either side of a submedian, granular ridge; margins with small granules, anterior and external margins slightly concave, internal margin straight; anteroexternal angle subauriculiform. Ischium subrectangular, inner margin with granules and short, stiff setae; with deep, longitudinal median sulcus, with smaller longitudinal depression anterolateral to it, adjacent to

anteroexternal margin; separated from basis by distinct suture. Exopod finely granulose, tapering toward distal end which almost reaches anterior edge of merus, flagellum long.

Surface of male thoracic sternum (Fig. 5B) granulose, eroded; with a large, distinct, granule-filled depression just anterior to telson of abdomen, no discernible suture within, smaller depressions seen on either side of abdomen; anterior region relatively elongate. Sternites 1 and 2 completely fused into triangular plate, separated from sternite 3 by deep transverse suture. Sternites 3 and 4 partially fused, with partial suture seen near anterior edge of cheliped coxae. Abdominal cavity deep, sternal condyle on sternite 5 slightly nearer to suture with sternite 4, abdomen reaching to imaginary line joining posterior edge of cheliped coxae.

Chelipeds (Fig. 5A, D) similar, subequal. Fingers shorter than palm, cutting edges with 4 or 5 teeth, tips pointed. Dactylus slightly curved, with three rows of granules, continuing distally as ridges and separated by shallow grooves along its length, base granulose. Fixed finger slightly deflexed with 2 rows of granules continuing as ridges and broad submarginal groove continuing from palm. Palm outer surface eroded in faintly reticulate pattern, upper margin irregular, wedge-like and granulose, lower margin slightly convex and granulose; inner surface relatively smoother, with fewer and smaller granules. Carpus short, dorsal and ventral surface eroded, inner distal angle with low triangular tooth. Inner surface of fingers, palm and carpus coapted against anterolateral margin of carapace. Merus granulose, slightly longer than carpus, with rectangular ventro-distal tooth apposed against carpus.

Ambulatory legs (Figs. 5A, 6E) relatively short, first leg longest, coxa-to-dactylus length about 0.9 times carapace width, sparsely setose. Merus subrectangular, subtriangular in cross-section; anterior and posterior edges lined with granules; dorsal surface finely granular. Dorsal surface of carpus rugose, with row of pointed granules on irregularly serrated anterior edge. Propodus subrectangular, rugose, anterior and posterior edges serrated in most legs. Dactylus slightly curved, dorsal surface and edges covered with small spines, short setae; terminates distally in curved chitinous claw.

Male abdomen and telson (Fig. 6D) granulose, eroded; central regions of segments raised. Telson rounded; lateral margins convex. Segment 6 subquadrate, about 1.5 times length of telson, lateral margins straight. Segments 3–5 completely fused, very faint trace of suture between fourth and fifth segments; lateral margins markedly concave at level of fifth segment, widening gradually towards base of third. Segment 2 subtrapezoidal, segment 1 subtrapezoidal without transverse ridge.

Gonopod 1 (Figs. 6F, G) long and slender, mostly straight, curving outward and tapering distally; distal aperture subterminal; several long, thick and stiff simple setae located subdistally behind aperture; basal external region with row of stiff simple setae, surrounded by finer setae.

**Live colouration.** – The carapace and pereiopods (Fig. 9C) have a pinkish-white basal colouration. The region immediately surrounding the anterior portion of 3M (protogastric) and the central portion of cardiac region are dark purplish-red; while the regions adjacent to the anterolateral and posterolateral margins, as well as the groove dividing the gastric and branchial regions are light pink; all other regions are in varying tones of reddish-orange. The chelipeds and ambulatory legs are basically light pink and variably mottled with reddish-orange. There are also gradual transitions between the background colour and the darker mottlings, especially on carapace and chelipeds.

**Etymology.** – This species is named after Eulogio Estampador, a highly respected Filipino carcinologist, for his work on the crab fauna of the Philippines.

**Remarks.** – The similarities shared by *Visayax estampadori*, new species, and *V. osteodictyon*, new species, are discussed in the **Diagnosis** and **Remarks** for the genus. *Visayax estampadori* can be distinguished from *V. osteodictyon* primarily by the very faint reticulation of the carapace and pereiopod surfaces (Fig. 5A, D), which is very distinct in the type species (Figs. 3A, D, 4C, E). This reticulation is apparently not age- or size-related as the holotypes of the two species are almost the same size. Furthermore, the reticulate pattern is already distinct in smaller individuals of *V. osteodictyon* and thus it is a good character for telling the two species apart. In addition to this, *V. estampadori* can be distinguished from *V. osteodictyon* by its relatively straighter front (Fig. 5A, C) (vs. more deflexed ventrally in *V. osteodictyon*, Fig. 3A, C); the larger tubercles in the branchial region of the carapace (Fig. 5A) (vs. smaller, Fig. 3A); the straight central region of the epistome (Fig. 6C) (vs. slightly convex, Fig. 4D); the broader basal antennal segment, which reaches up to the antennular fossa (Fig. 6A) (vs. narrower, does not reach up to antennular fossa, Fig. 4A); the lack of a pigmented patch on the lower surface of the chela (Fig. 5D) (vs. present, Fig. 3D); and by having a larger terminal opening and more subdistal setae—ca. 25—in the G1 (Figs. 6F-G) (vs. smaller terminal opening, less subterminal setae: ca. 16, Fig. 4F-G).

*Visayax estampadori* is so far known only from the type locality, Panglao Island, in the Bohol Sea, central Philippines. It is sympatric with *V. osteodictyon* and *Rizalthus anconis* having been collected from the same locality, on a reef wall at a depth ranging from 3 to 21 m.

#### *Hepatoporus* Serène, 1984

*Carpoporoides* Sakai, 1935: 77, Fig. 11, Pl. 7; 1939: 458; 1965: Pl. 33; 1976: 414, 416; Zarenkov, 1971: 191, Fig. 86. Not *Carpoporoides* Stimpson, 1871.

*Hepatoporus* Serène, 1984: 74–75, Fig. 40, Pl. X, Figs. D–F; Davie & Turner, 1994: 83, Figs. 1, 2; Ng et al., 2008: 199.

*Carpoporoides* Takeda & Nagai, 1986: 547, Fig. 1.

**Type species.** – *Carpoporoides orientalis* Sakai, 1935, by original designation.

**Remarks.** – Sakai (1935) described *Carpoporoides orientalis* from Japan, making it at that time, only the second species of the genus to be described and the first to be discovered in the Indo-Pacific. The genus *Carpoporoides* Stimpson, 1871, was originally established for one western Atlantic species, *C. papulosus* Stimpson, 1871. Zarenkov (1971) described a third species, *C. guinotae*, from the Red Sea and the western Indian Ocean. Serène (1984), citing comments made by Guinot-Dumortier (1960: 161) that there are many carapace, third maxilliped and chela characters distinguishing the Japanese species from the Atlantic one, established the genus *Hepatoporus* to accommodate both *C. orientalis* Sakai, 1935 and *C. guinotae* Zarenkov, 1971. Serène (1984) designated *C. orientalis* Sakai, 1935 as the type species. Takeda & Nagai (1986) independently established a new genus, *Carpoporoides*, to accommodate *C. orientalis* and a new Japanese species they described, *C. distinctus*. Both species are known only from Japan. Takeda (1986) subsequently recognized *Hepatoporus* Serène, 1984, as having priority over *Carpoporoides* Takeda & Nagai, 1986. Davie & Turner (1994) described a fourth species, *H. asper*, from Western Australia. *Hepatoporus* now contains five species, including *H. pumex*, new species.

#### *Hepatoporus pumex*, new species

(Figs. 7, 8, 9D)

**Material Examined.** – Holotype: 1 male (8.0 × 5.7 mm) (NMCR-27510), Station B11, coral rubble, 2–4 m, 9°29.4'N 123°56.0'E, Pamilacan Island, coll. by Panglao 2004 Marine Biodiversity Project, 11 Jun. 2004.

Paratypes: 1 male (4.0 × 3.0 mm) (ZRC 2008.0221), Station S28, reef wall with small caves, 28–32 m, 9°37.2'N 123°46.4'E, Napaling, Panglao Island, coll. by Panglao 2004 Marine Biodiversity Project, 24 Jun. 2004; 1 male (3.8 × 2.7 mm) (ZRC 2008.0222), Station S10, coral plateau with fine sand covering rocks, 6–14 m, 9°29.4'N 123°56.0'E, Pamilacan Island, coll. by Panglao 2004 Marine Biodiversity Project, 11 Jun. 2004.

**Description.** – Carapace (Fig. 7A) broader than long, subpentagonal in its outline, with deep cavity at anterior portion of anterolateral margins characteristic for genus; regions more or less defined, grooves separating them distinct; epigastric, protogastric and cardiac regions raised; 3L in branchial region raised; entire dorsal surface finely granular, densely pitted with cavities, mostly visible only under magnification, larger pits found in mesogastric, cardiac and intestinal regions, surrounded by reticulations formed by small, fused granules especially near posterior and posterolateral margins; with a pair of depressions on either side of posterior part of 3M, and 1 smaller depression on central part of each branchial region. Front (Fig. 7A, C) projecting, broad, about 0.4 times carapace width, with a median thin notch that continues into epigastric groove; frontal margin divergent posteriorly toward supraorbital margin. Orbit small, completely occupied by eyestalk and cornea; eyestalk short, stout, distal end with cornea lined with granules; cornea well developed. Postorbital region raised, supraorbital margin with small granules, no distinct

external orbital tooth. Infraorbital region granulose, pitted, margin with small granules. Subhepatic region and most of pterygostomial region occupied by deep cavity (Fig. 7C, E), visible from dorsal view as a concavity in the anterolateral margin; upper margin of cavity thick, ventral and posterior margins thin, crested; walls of cavity granulose, bottom pitted; rest of pterygostomial region granulose, pitted. Anterolateral margin lined with small granules, anterior one-third excavated, posterior two-thirds gently convex, feebly cristate; meeting almost at right angles with posterolateral margin. Posterolateral margin lined with partially fused granules, appearing raised; deeply concave, last ambulatory leg can be coapted against this concavity; junction with posterior carapace margin angulated. Posterior carapace margin slightly concave, with distinctly deeper concavities adjacent to junctions with posterolateral margins for accommodating coxae of last ambulatory legs.

Antennules (Fig. 8A) folding almost transversely. Basal antennal segment broad, subrectangular, distal part granulose,

remainder pitted; medial edge convex; occupying entire space between antennular fossa and internal orbital angle, orbital hiatus completely filled; antennal flagellum arising from distal end, short, not reaching external orbital angle. Ventral edge of epistome (Fig. 7C) out-turned, central region with pointed convexity, outer surface pitted. Posterolateral region of endostome with thin, oblique ridge.

Outer surface of third maxillipeds (Figs. 7B, 8B) eroded, pitted, with scattered granules, sparsely setose. Merus subquadrate, median length about half that of ischium; with submedian, granular hump bordered on either side by shallow depressions; anterior margin irregular and sparsely setose, anteroexternal margin rounded, external margin slightly concave, internal margin slightly convex. Ischium subrectangular, appearing more pitted than merus; with shallow, median, longitudinal sulcus; internal and external margins straight, granulose; separated from basis by a distinct suture. Exopod similarly pitted, proximal half expanded into a convexity, tapering to narrower distal end.

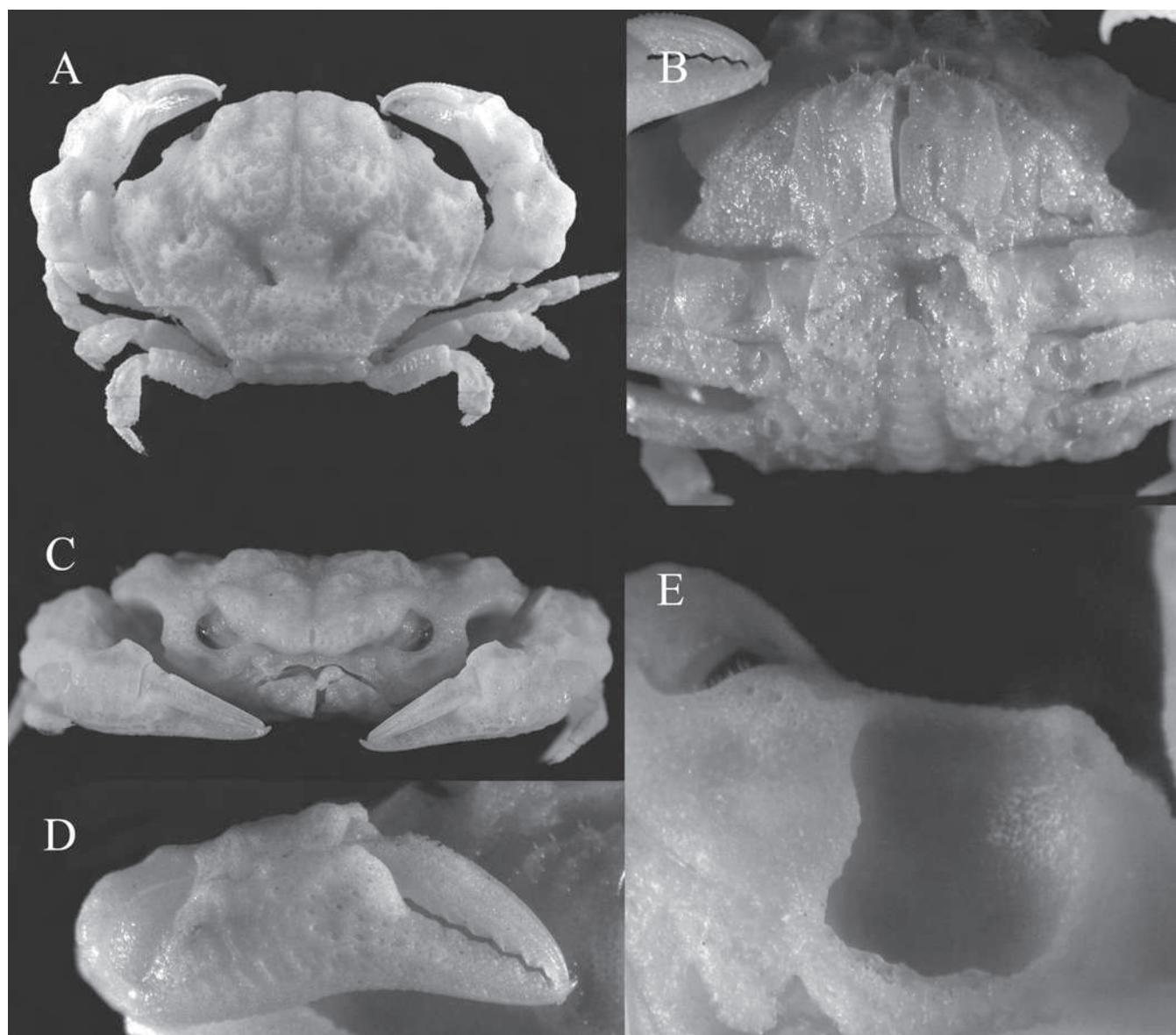


Fig. 7. *Hepatoporus pumex*, new species, male holotype (NMCR-27510) (8.0 × 5.7 mm): A, dorsal view; B, ventral view; C, frontal view; D, right chela, outer surface; E, left subhepatic cavity, oblique view.

Surface of thoracic sternum (Fig. 7B) heavily pitted, rugose, uneven. Sternites 1 and 2 completely fused to form triangular plate. Sternites 3 and 4 completely fused, without any sutures visible; with shallow median depression just anterior to telson. Intersternal sutures in depressed, giving sternites 5, 6 and 7 a raised appearance. Abdominal cavity deep; with sternal condyle on sternite 5 adjacent to suture with sternite 4; abdomen almost reaching to imaginary line joining middle part of cheliped coxae in situ.

Chelipeds (Fig. 7A, C, D) similar, subequal. Fingers unpigmented, slightly shorter than palm, distal ends pointed, curved inward, cutting margins with at least 4 or 5 low triangular teeth. Dactylus about 0.8 times median length of palm (outer surface), slightly curved; with 4 longitudinal ridges—including upper margin—on distal half of outer surface, continuing proximally as rows of granules on proximal half. Fixed finger slightly deflexed, with 2 longitudinal ridges on distal half of outer surface, continuing as rows of fused

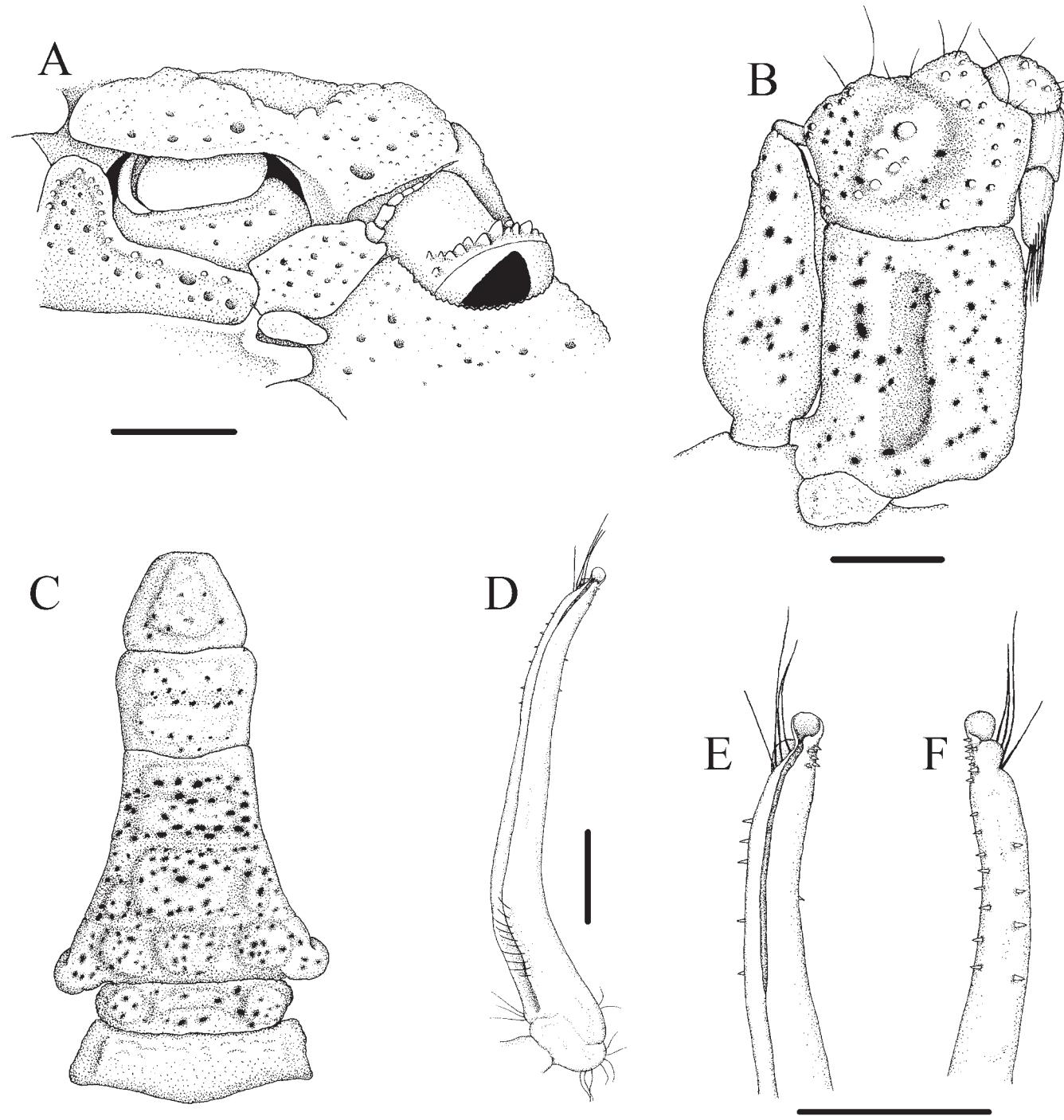


Fig. 8. *Hepatoporus pumex*, new species, male holotype (NMCR-27510) (8.0 × 5.7 mm): A, frontal view, left side, showing antenna, antennule and orbit; B, right third maxilliped, external view; C, abdomen and telson; D, left G1, external view; E, distal end of left G1, external view; F, distal end of left G1, internal view. Scale bars: A, B, D–F = 0.5 mm; C = 1.0 mm.

granules in palm. Outer surface of palm with reticulated pattern of fused granules, rugose; inner surface granulose; distal portion of upper margin slightly keeled, granulose; proximal portion of upper margin, together with distal portion of carpus, forms an ovate aperture with effaced portion of carapace anterolateral margin when chela are coapted against carapace. Carpus large, outer surface irregular, rugose and covered in reticulate pattern of fused granules; inner surface granulose, distal portion with low, granular, triangular tooth. Merus mostly hidden from dorsal view, slightly longer than carpus, unarmed, surfaces and margins granulose.

Ambulatory legs (Fig. 7A) relatively short; first ambulatory leg longest, coxa to dactylus length about 0.8 times carapace width. Merus rectangular, subtriangular in cross-section; anterior and posterior edges granulose, with larger granules on posterior edge; dorsal and ventral surfaces finely granulose with scattered larger granules. Anterior edge of carpus serrated by conical granules, with short stiff setae; dorsal surface granulose or pitted, with traces of reticulate pattern of ridges; inner surface and lower posterior edge with granules.

Propodus subrectangular; anterior and posterior edges serrated with conical granules, setose; dorsal surface with reticulate pattern of ridges, granulose or pitted. Dactylus straight; surface with conical granules, short stiff setae; terminating in simple chitinous claw.

Abdomen (Fig. 8C) appearing eroded, with pits and granules. Telson subtriangular, distal portion rounded. Penultimate segment subquadrate, median length as long as that of telson; distal one-third of lateral margins convex, proximal two-thirds straight. Segments 3–5 fused, with traces of sutures visible, lateral margins concave, surface heavily pitted. Segment 2 subtrapezoidal, granulose. Segment 1 divided into 2 parts by transverse ridge, subpentagonal, granulose.

Gonopod 1 (Fig. 8D–F) relatively long, tapering, with proximal third bent outwards prominently and a less substantial bend subterminally. Terminal end auriculiform, with about 4 subterminal, long, simple setae and subterminal flange. Distal half with scattered spines, especially on internal surface.

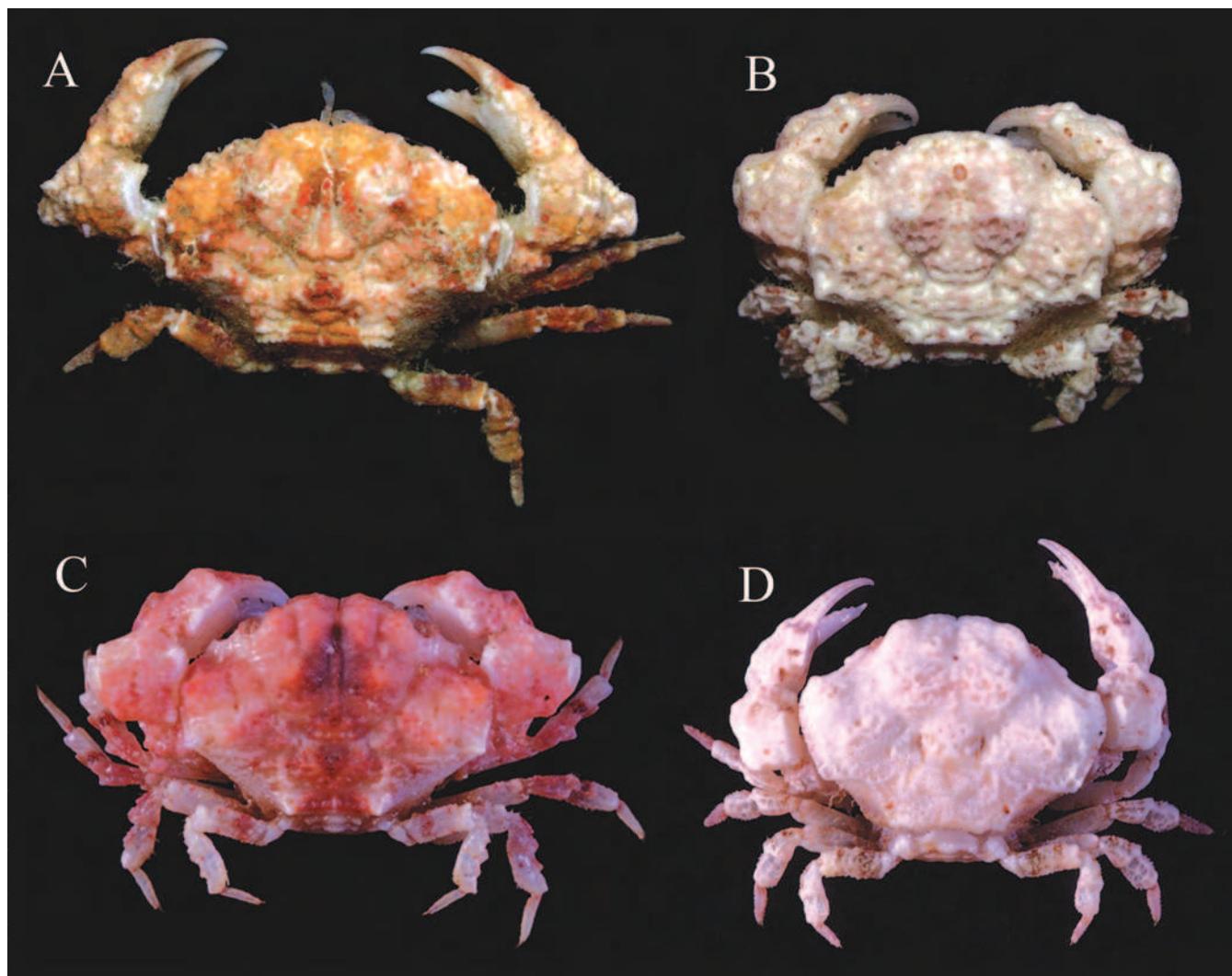


Fig. 9. Live or freshly killed colouration of: A, *Rizalthus anconis*, new genus, new species, female paratype (MNHN- B30700) (11.2 × 7.3 mm); B, *Visayax osteodictyon*, new genus and new species, paratype male (ZRC 2008.0219) (3.3 × 2.2 mm); C, *Visayax estampadori*, new genus and new species, male holotype (NMCR-27509) (6.7 × 4.6 mm); and D, *Hepatoporus pumex*, new species, male holotype (NMCR-27510) (8.0 × 5.7 mm).

**Live colouration.** – Carapace and pereiopods (Fig. 9D) generally creamy white to very light pink; with a few small spots of brown or brownish-orange on carapace; similar spots and smudges seen on fingers, palms and carpus of chelipeds and on merus and carpus of ambulatory legs.

**Etymology.** – The specific epithet *pumex* is the Latin word for pumice, a light, porous volcanic rock, whose texture is similar to the carapace surface of this species. Used as a noun in apposition.

**Remarks.** – Comparing it to the excellent illustrations (cf. Sakai, 1935:77, Fig. 11, Pl. 7; 1939: 458, Fig. 28, Pl. 60; 1976: 416, Fig. 220a, Pl. 150; Takeda & Nagai, 1986: 548, Figs. 1c, 1d) of the type species for the genus, *Hepatoporus pumex*, new species, is morphologically most similar to *H. orientalis* (Sakai, 1935) in: 1) the general outline of the carapace; 2) the raised gastric, branchial and cardiac regions; and 3) the shape of the cavity formed by the carapace anterolateral margin and chela. It differs significantly from the type species by having: 1) a broader, more truncated front (Fig. 7A, C) (vs. triangular and acute); 2) a more deeply excavated anterolateral margin (Fig. 7A, C) (vs. shallow concavity); 3) the posterior two-thirds of the carapace anterolateral margin more even (Fig. 7A) (vs. irregular and jagged); 4) a large, distinct pit in the branchial region of the carapace (Fig. 7A) (vs. absent); and 5) reticulate patterns of fused granules and pits near the posterolateral and posterior margins of the carapace (Fig. 7A) (vs. simply granular).

*Hepatoporus pumex* was also compared to illustrations of *H. guinotae* (Zarenkov, 1971) (see Serène, 1984; Davie & Turner, 1994). It is morphologically similar to *H. guinotae* in the general outline and surface texture of the carapace, and, to a certain extent, in the G1 morphology. It differs from *H. guinotae* in the following features: 1) the carapace dorsal surface, male thoracic sternum and third maxillipeds are not as pitted or reticulate in *H. pumex* (Figs. 7A, B, 8B) (vs. pronouncedly pitted and/or reticulate); 2) the concavity in the anterolateral margin is shallower (Fig. 7A) (vs. deeper); 3) the subhepatic cavity is more extensive, reaching further posteriad (Fig. 7E) (vs. not so posterior); 4) the lobes of the front are evenly convex (Fig. 7A, C) (vs. concave laterally); and 5) the fingers of the chelae are almost as long as the palm (Fig. 7D) (vs. distinctly shorter). Furthermore, the G1 of *H. pumex* differs distinctly from that of *H. guinotae* as figured by Serène (1984: Fig. 40): it is more slender and tapering (Fig. 8D) (vs. stouter and more uniform in thickness); the terminal flap/process is more circular (Fig. 8E, F) (vs. more elongate); there are fewer, about four, subterminal setae (Fig. 8E, F) (vs. more subterminal setae, about 7). Davie & Turner (1994) believe that *H. distinctus* (Takeda & Nagai, 1986) and *H. guinotae* may be conspecific. We find that *H. pumex* differs from *H. distinctus*, with the exception of G1 characters (G1 of *H. distinctus* not known), in the same features stated above for *H. guinotae*.

*Hepatoporus pumex*, new species, differs from *H. asper* Davie & Turner, 1994 in the general outline and surface

features of the carapace, as well as the morphology of the G1. The carapace of *H. pumex* is relatively broader (Fig. 7A) (vs. narrower, almost as long as broad); the frontal and protogastric region is not eroded (Fig. 7A) (vs. eroded with large pits, some coalescing into a deep median groove); the branchial regions are finely granular and pitted, with some sections raised as tubercles (Fig. 7A) (vs. branchial regions with a deep crescent-shaped cavity lined with fungiform granules); the sternum is granular and rugose with shallow depressions (Fig. 7B) (vs. more extensively eroded with deep depressions); the G1 tapers distally, has an auriculiform terminal process and fewer but longer subterminal setae (Fig. 8D–F) (vs. inflated subterminally, without an auriculiform terminal process and with more but shorter subterminal setae) (cf. Davie and Turner, 1994).

*Hepatoporus pumex* is thus far known only from the type locality, Pamilacan Island, and nearby Panglao Island, both in the Bohol Sea, central Philippines. It has been collected from coral rubble, reef walls, and sandy/rocky seafloors associated with coral reefs, and from depths ranging between 2–32 m.

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