

REVISION OF THE GENUS *INSULAMON* NG & TAKEDA, 1992 (CRUSTACEA: DECAPODA: POTAMIDAE) WITH DESCRIPTION OF FOUR NEW SPECIES

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ABSTRACT. — Four new species of *Insulamon* Ng & Takeda, 1992, are described, adding on to the one and only known species *Insulamon unicorn* Ng & Takeda, 1992. While the latter could be only confirmed by further records from the island of Busuanga, all Palawan Island records, including juvenile specimens previously designated as paratypes of *I. unicorn*, are herein referred to as different species. The characters of all species of the genus, namely male first and second pleopods, telson, mouthparts, and carapace are described in detail and illustrated. A key to the *Insulamon* species is provided.

KEY WORDS. — Freshwater crab, Brachyura, Philippines, taxonomy, new species

INTRODUCTION

Two species of potamid freshwater crabs are known from Greater Palawan (mainland Palawan and the adjacent small islands of the Calamian group, Dumaran, and the Balabac group, which make up the Philippine Province of Palawan): *Carpomon pomulum* Tan & Ng, 1998, and *Insulamon unicorn* Ng & Takeda, 1992. They are endemic to the region and are true freshwater crabs that display direct development, in which eggs hatch directly into juvenile crabs (Yeo et al., 2008; Cumberlidge et al. 2009). The Aquatic Biodiversity Research and Conservation Program on the Philippine Island of Palawan (AQUA Palawana) recently revealed more comprehensive material of the potamid fauna of the Philippine Province of Palawan. Two regions, the St. Paul Subterranean River National Park in Puerto Princesa and the Lake Manguao area in Taytay, have been intensively sampled in 2000–2001 and 2007–2008 respectively. Additional material collected by the author in the mid-1990s, now allows a revision of this genus, which is endemic to Greater Palawan. The entire region was declared a UNESCO biosphere reserve in 1991 and it is subjected to the specific Strategic Environmental Plan (SEP) for Palawan (Congress of the Philippines, 1992).

Following the probably most accepted opinion and valid systematic classification system regarding a potamid family concept, *Insulamon* is placed in Potamiscinae Bott, 1970 (sensu Yeo & Ng, 2003), and Potamidae Ortmann, 1896,

as one of only two families of Potamoidea Ortmann, 1896 (Ng et al. 2008). There have been indications that the now synonymised family “Isolapotamidae Bott, 1970” (Ng, 1988) might be valid (Brandis, 2002). A monophyletic entity is supported by molecular data corresponding with a revised “Isolapotamidae” concept (Shih et al., 2009). However, even if such monophyletic clade exists, *Insulamon* would most likely not belong there, but to an Eastern Asia subclade of Potamiscinae (Shih et al., 2009).

When the genus was erected, it consisted only of a single species, *Insulamon unicorn*, which was described from a holotype male from Busuanga Island and several paratypes from Palawan mainland. Based on available new material, a total of five species are recognised presently, four of which are new to science. The present work aims to describe the newly discovered species of *Insulamon* and delimit the boundaries of the species *Insulamon unicorn* and the genus *Insulamon* based on examination of new material.

MATERIAL AND METHODS

The material has been retrieved by manual examination of typical habitats of potamid crabs, such as burrows, underside of boulders, and submerged root packs. Specimens have been preserved in 75% ethanol. All collection localities are illustrated in Fig. 12.

Specimens examined are from or are hereby deposited in the following scientific collections:

NMCR	Crustacean Collection of the National Museum of the Philippines, Manila
NHMW	Naturhistorisches Museum Wien, Austria
PCSD	Palawan Council for Sustainable Development, Philippines
SMF	Senckenberg Museum Frankfurt, Germany
SMTD	Senckenberg Museum für Tierkunde Dresden, Germany
WPU	Western Philippines University, Aquatic & Marine Biology Section, Puerto Princesa City, Philippines
ZMUC	Zoological Museum, University of Copenhagen
ZRC	Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore

The terminology used follows mainly Ng et al. (2008). The size of the specimens is given as carapace width by carapace length. The images of the dissected parts of the material were taken with a NIKON SMZ800 stereo microscope with digital photo adapter NIKON DS-Fi1. Photos were taken of various focus layers and subsequently stacked using CombineZM software (Hadley, 2008) to retrieve images with sufficient depth of sharpness. The label codes for the sampling sites of the author are arbitrary. They do not follow any temporal or spatial pattern, except for the fact that eventually varying small letters following a common code number refer to different sections of the same water system.

The following abbreviations were used:

asl	above sea level (altitude)
CPOM	Coarse Particulate Organic Matter
FPOM	Fine Particulate Organic Matter
G1	gonopod 1 = male first pleopod
G2	gonopod 2 = male second pleopod
M	manual collection
ov	ovigerous

KEY TO THE *INSULAMON* SPECIES

Proper identification without comparative material should be based on adult males.

- Carapace not broader than 1.29 times length, and G1 with long distal part (tip) of terminal segment as long as or longer than dilated proximal base (Figs. 3D, 7F) 2
 - Carapace at least, but usually more than 1.29 times as broad as long, and G1 with short distal part (tip) of terminal segment always shorter than dilated proximal base (Figs. 5F–K, 9F, 11F) 3
- Male telson less than 1.2 times as broad as long (Fig. 2C). Tip of G1 sharply tapered (Fig. 3C–E). (Calamian Islands) *I. unicorn*
 - Male telson more than 1.2 times as broad as long (Fig. 6C). Tip of G1 not sharply tapered, rather clubbed or hooked (Fig. 7D–H). (Palawan) *I. magnum*
- Male sixth abdominal somite not broader than 1.9 times length, and tip of G1 distinctly hooked, perpendicular to the longitudinal axis (Fig. 9D–H). (Palawan) *I. johannchristiani*

- Male sixth abdominal somite at least, but usually broader than 1.9 times length; tip of G1 more or less straight, not hooked, pointing somewhat in the direction of the G1 longitudinal axis, not perpendicular (Figs. 4A–C, F–K, 11D–H). (Palawan) .. 4
- Distal portion of G1 terminal segment corkscrew-like, curly at its base; proximal portion of terminal segment slender, not inflated subproximally and appearing evenly tapered (Fig. 11D–H). Terminal segment of mandibular palp most narrow medially, not evenly tapering. (Palawan) *I. porculum*
- Distal portion of G1 terminal segment not corkscrew-like at its base, only slightly twisted or bent at its base and proximal portion of terminal segment at least slightly, usually distinctly inflated subproximally and not evenly tapered (Fig. 4A–C, F–K). Terminal segment of mandibular palp evenly tapering towards apex. (Palawan) *I. palawanense*

TAXONOMY

Family **Potamidae Ortmann, 1896**

Subfamily **Potamiscinae Bott, 1970**

Genus ***Insulamon* Ng & Takeda, 1992**

Insulamon Ng & Takeda, 1992: 156–157 (original designation, gender: neuter); Freitag, 2005: app. 2 (ecological study); Ng et al., 2008: 163 (checklist of Brachyuran crabs of the world); Tan & Ng, 1998: 93 (comparative remarks on *Insulamon* and *Carpomon*); Shih et al., 2009: 714 (phylogenetic remarks).

Type species. — *Insulamon unicorn* Ng & Takeda, 1992.

Redescription. — Carapace broader than long (approximately 1.2 to 1.4×), almost straight anteriorly in dorsal view, dorsally convex to slightly inflated; cervical grooves narrow; posterolateral regions lined with oblique striae, margins converging; orbital regions almost smooth; outer margin of external orbital angle granulate to uneven; epibranchial tooth low and blunt; epigastric cristae distinct, rugose, separated from postorbital cristae by more or less distinct oblique grooves; external portion of postorbital cristae more uneven and granulose than internal portion; mesogastric cristae present, rugose, subparallel to epigastric cristae; antero-lateral margin convex, granulate to dentate; hepatic region with oblique striae.

Frontal region distinctly rugose; frontal margin almost straight, medially slightly depressed; suborbital margin finely beaded, arcuate; supraorbital margin very finely beaded, appearing almost entire.

Antenna small and inconspicuous, shorter than ocular peduncle width; epistome inconspicuous, covered by supraorbital margin; first peduncular article short; basal article (in fact fused second and third peduncular articles) largest; remaining six distal articles flagellum-like. Antennule about as long as third maxilliped flagellum, fold into subfrontal fossa; proepistome laminar; first peduncular article globular, with inconspicuous epipod; second peduncular article largest; third peduncular article slightly smaller, folded back; medial flagellum three-segmented, perpendicular; lateral flagellum short conical, number of segments variable (depending on number of moults).

Mandible with three-segmented palp (Fig. 1A) and with sharp cutting edge; masticatory surface subtriangular. First maxilla (Fig. 1B) without exopod; endopod ending broadly truncate; second endite large, flattened, single-lobed; first endite smaller, compact, reflexed. Second maxilla (Fig. 1C) medially with large, flattened, bi-lobed second endite; first endite elongate, rod-like; endopod elongate, rod-like. First maxilliped (Fig. 1D) with flagellate exopod; endopod apically very broad, flattened; second endite large, flattened, single-lobed; first endite smaller, flattened. Second maxilliped (Figs. 1E, 3A, 7B, 9B, 11B) without endites; exopod large, moderately chitinous to membranous, with flagellum; endopod with well-defined five segments; dactylus broadly conical, with apical fringe of large petiolate spines; propodus subtriangular. Third maxilliped (Figs. 3B, 5E, 7A, 9A, 11A) with rod-like, flagellate exopod; flagellum approximately as long as merus wide or shorter; endopod with subquadrate merus, at least 2/3 as long as broad; ischium subtrapezoidal, about 1.3 (juveniles) to 1.6 (adults) times as broad as long; merus about 2.0 to 2.7 times as long as ischium, with oblique, ovoid sulcus.

Chelipeds unequal, outer surface more or less rugose, inner side smooth; dactylus and palm subequal in length; carpus subtriangular, with one conspicuous, sharp, subdistal spine and one or two smaller, more proximal, sharp spines or granules at inner side; merus with the two inner margins distinctly granulose; ischium with sharp distal granule and two transverse, depressed lines.

Ambulatory legs short, second longest; dactyli, propodi and carpi with stiff hairs arranged in line patterns; meri broadest in the middle or subdistally, approximately as long as respective propodus and carpus combined; dactyli as long as or slightly longer than propodi.

Suture between male second and third sternites bent anteriad. Male abdomen (Figs. 2C, 4C, 6C, 8C, 10C) slightly tapering towards telson, moderately broad; telson subtriangular; lateral margins usually slightly concave; sixth abdominal somite broader than long, slightly shorter than telson, or both subequal in length. Female abdomen (Figs. 4D, 6D, 8D, 10D) broadly subovate; sixth abdominal somite and telson subequal in length or telson slightly longer.

G1 stout and overall subsinuously curved (proximally mediad, distally laterad); terminal segment distinctly shorter than basal segment, dilated by well-developed somewhat membranous collar, more or less contorted from longitudinal axis, proximal portion of terminal segment subtriangular to elongately conical, tapered towards elongated distal portion; sagittal groove for G2 on median ventral surface of subterminal segment; sagittal groove continued in terminal segment, but not occupied by G2 flagellum in preserved specimens.

G2 with proximal portion of basal segment dilated, abruptly attenuating into elongated shaft; flagellum filiform, sharp, about half as long as basal segment.

Remarks. — The genus is most distinguishable from all other genera by the form of the G1. The terminal segment in particular is characterised by a dilated, subtriangular proximal portion and a very slender, somewhat contorted distal portion. The genera that appear most closely related, *Mindoron* Ng & Takeda, 1992, and *Ovitamon* Ng & Takeda, 1992, display a terminal G1 segment without clear division into proximal and distal portion. Their entire terminal segment is bent or subcylindrical and only slightly tapered proximally. The entire male abdomen including the telson is more evenly conical in *Mindoron* and especially in *Ovitamon*, while the abdomen in *Insulammon* is less distinctly conical towards the sixth somite, but the telson more abruptly tapered. The frontal carapace margin in *Mindoron* is medially depressed and somewhat interrupted by the epistome, while it is slightly sinuous to almost straight in *Insulammon* and *Ovitamon*. The presence of mesogastric cristae is a rather inconspicuous diagnostic character and not always reliable. Mesogastric cristae are always present in *Insulammon*, but shallow and indistinct in some specimens as well as in all known *Mindoron* species, while they are always lacking in *Ovitamon*. *Isolapotamon* Bott, 1968, which is present in the southern Philippines (Mindanao) resembles *Insulammon* as well by the general shape of the carapace, the chelipeds and ambulatory legs, but it can clearly be distinguished by the very long and slender G1 with terminal and subterminal segments subequal in length, by lacking real mesogastric cristae (not grooves) and its very broad exopod of the third maxilliped. The second potamid genus present in Palawan, *Carpomon* Tan & Ng, 1998, is easily distinguishable from *Insulammon* by its G1 (overall very stout, distal portion of terminal segment very broad and truncate), the short flagellum of the third maxilliped exopod and is most obviously varying by the very swollen, smooth carapace that lacks granulations, striations, and epibranchial teeth.

Distribution. — Palawan and Busuanga, Philippines

***Insulammon unicorn* Ng & Takeda, 1992**
(Figs. 2A–C; 3A–F)

Insulammon unicorn Ng & Takeda, 1992: (part) 157–160, Figs. 4, 5; Esser & Cumberlidge, 2008 (IUCN red list); Ng et al., 2008: 163 (checklist).

Type locality. — Barangay [= municipal district] Salvacion, Busuanga Island/Municipality, Palawan Province, Philippines.

Material examined. — 1 male (38.8 by 30.2 mm) (ZRC 2010.0330), Busuanga, Coron, San Nicolas/Borac, small mount. fall, residual pools, rock, boulders, leaves, secondary vegetation, c. 100 m asl, 12°03'26"N, 120°14'31"E (164a), coll. H. Freitag, 2 Feb. 1995; 1 female (25.1 by 19.6 mm) (SMF-38291), Busuanga, 5 km NW Coron town, Mabintangan River tributary, mountain creek upstream of artificial pool, secondary forest, riffle & run, gravel, roots, leaves, c. 50 m asl, 12°01'44"N, 120°12'19"E (167b), coll. H. Freitag, 2 Feb. 1995; 1 male (37.4 by 29.1 mm) (NMCR-39034), Busuanga, Coron; Tagumpay, small lowland river, pool, CPOM, leaf litter, secondary vegetation, c. 50 m asl, 12°01'00"N, 120°17'14"E (171b), coll. H. Freitag, 4 Feb. 1995.

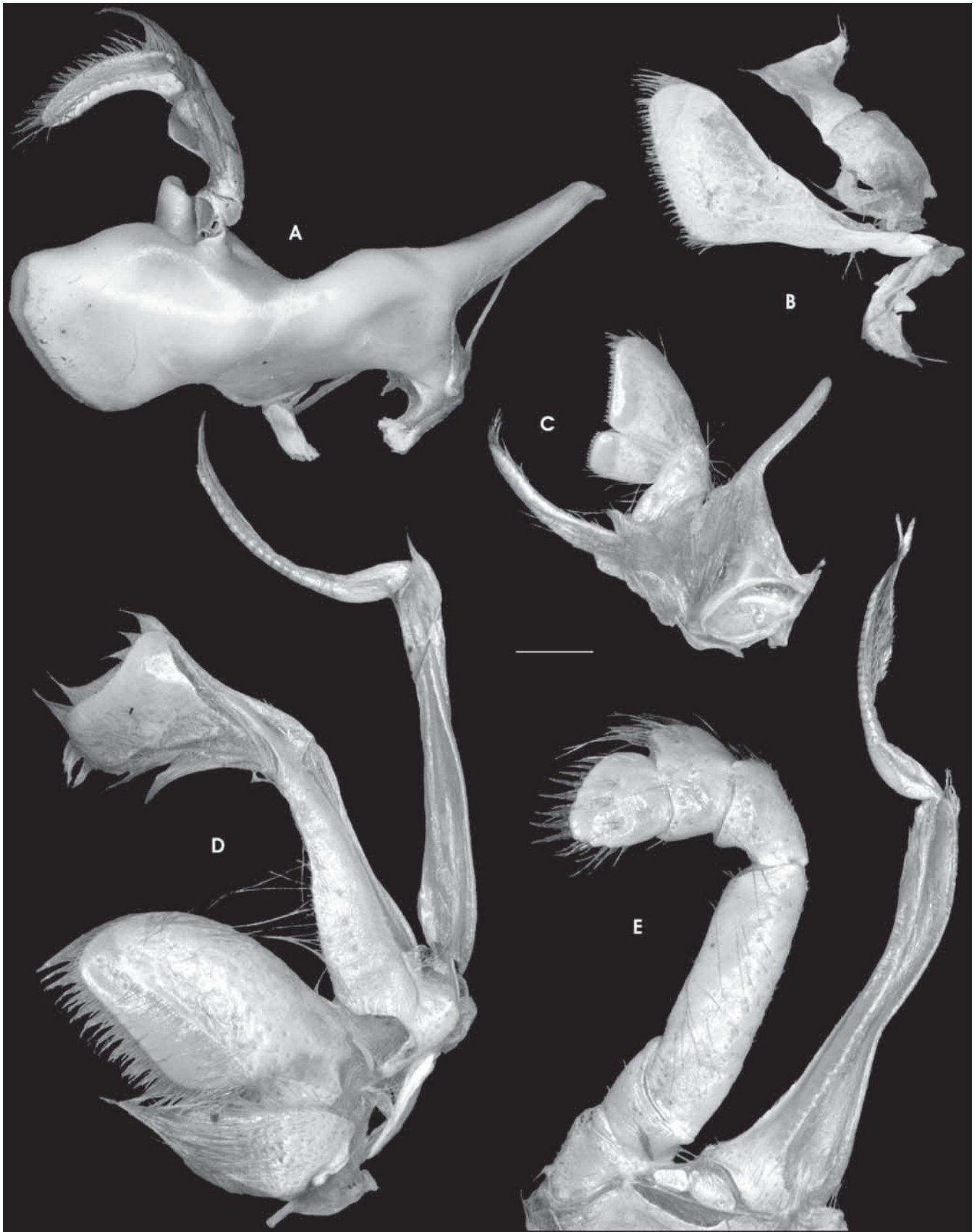


Fig. 1. Internal mouthparts of *Insulamon*, in ventral view: A, left mandible; B, left first maxilla; C, left second maxilla; D, left first maxilliped; E, left second maxilliped. Specimen: *I. palawanense*, new species, holotype male. Scale bar = 1 mm.

Diagnosis. — Carapace (Fig. 2A, B) 1.28–1.29 times as broad as wide, moderately high; cervical grooves moderately deep; suborbital margin obliquely connecting to external orbital angle; epigastric cristae not distinctly projected over postorbital cristae; mesogastric cristae rather low. Progastric, mesogastric, cardiac and intestinal regions slightly convex; branchial regions distinctly convex; medio-posterior carapace margin straight in dorsal view.

Male abdominal somites (Fig. 2C) moderately broad; telson c. 1.15 times as broad as long; sixth abdominal somite c. 1.75 times as broad as long; telson c. 1.15 times as long as sixth abdominal somite in males, and also longer than sixth abdominal somite in females (Fig. 2D).

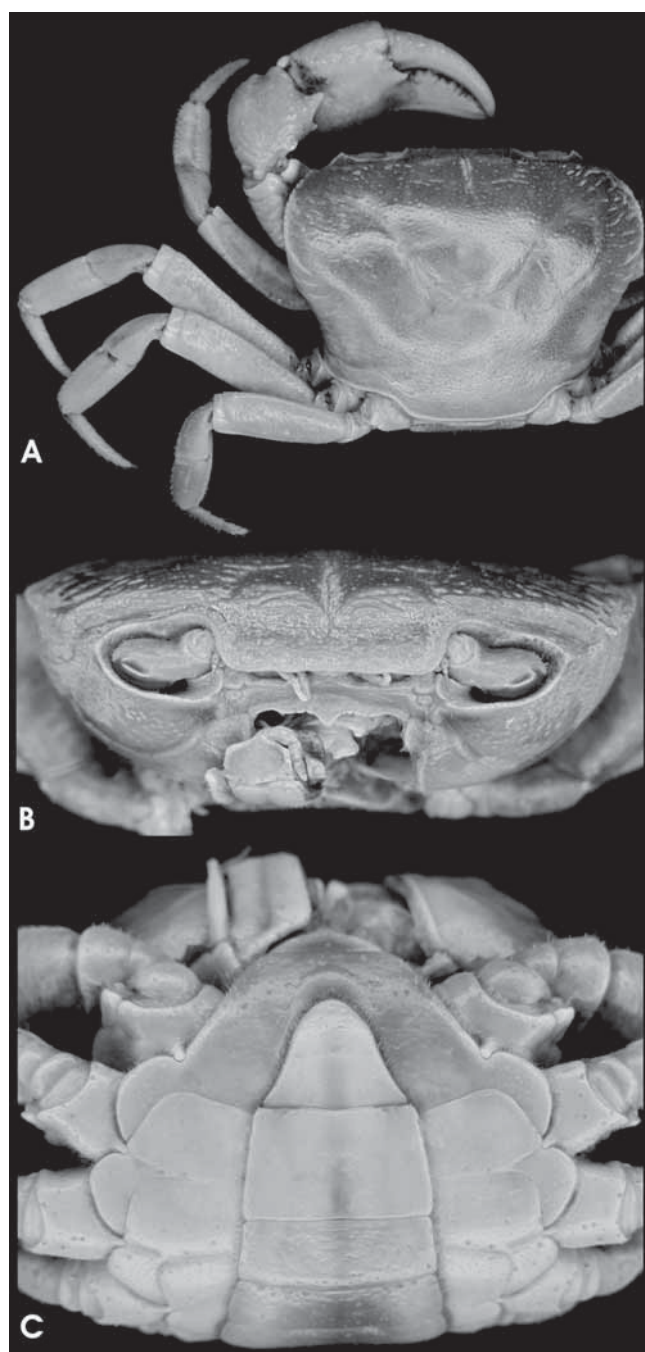


Fig. 2. *Insulamon unicorn*, male (38.8 by 30.2 mm) from San Nicolas (164a): A, dorsal view; B, frontal view; C, ventral view.

Mandible with moderately broad and rather shallow incision opposite of palpus insertion; terminal segment of palp moderately long, evenly slender almost up to apex. Second maxilliped (Fig. 3A) exopod rather flat, partly membranous, lateral margin distinctly indented at c. half length; propodus almost as long as broad; outer distal margin of carpus slightly dilated. Third maxilliped (Fig. 3B) with dactylus only slightly longer than carpus; propodus about 1/4 shorter than carpus; merus rather long, more than 2/3 as long as broad, margins almost straight, outer distal edge rather sharp.

Larger cheliped in adult males with dactylus almost half as broad as entire chela length.

G1 (Fig. 3C–E) slightly sinuously bent, distal attenuate part and dilated proximal base of terminal segment subequal in length. Distal part of terminal segment narrow, attenuate, almost straight, entirely slightly laterad directed. Dilated proximal base of terminal segment as broad as or slightly narrower than distal subterminal segment; ventral setae rather short. Collar only slightly protruding dorsad; ventral collar region only slightly notched. G2 flagellum c. 0.6 times as long as basal segment; enlarged proximal portion of basal segment subrectangular to subtrapezoidal (Fig. 3F).

Remarks. — The species appears most similar to *I. palawanense*, new species, but can be distinguished by the carapace proportions (width/length ratio ≤ 1.29), the longer distal portion of the terminal G1 segment (as long as proximal portion), the more slender proximal base of the terminal segment (as broad as or slightly narrower than distal subterminal segment) and the comparably straight and somewhat elongate overall shape of the G1 (see remarks for *I. palawanense*, new species).

The holotype male (34.7 by 26.8 mm) (Salvacion, Busuanga, Palawan, coll. Gonzales et al., Mar. 1976) was not accessible for re-examination despite intense search. It is most likely still deposited, but misplaced, in NSMT. However, the measurements, drawings and remarks by Ng & Takeda (1992) provide enough evidence for the determination of the material listed above. All specimens from the island of Palawan designated as paratypes of this species (Ng & Takeda, 1992) were re-examined and all of them were found to belong to *I. palawanense*, new species, due to the shape of the G1 (distal portion of the terminal G1 segment distinctly shorter than proximal portion and somewhat twisted towards ventral side; dilated base of terminal segment broader than distal subterminal segment; entire G1 stout and strongly bent), and the broader carapace (width/length ratios: 1.36 [ZRC 1992.8360], 1.37 [NSMT-Cr11222], 1.34 [NSMT-Cr11223a], 1.35 [NSMT-Cr11223b], 1.36 [NSMT-Cr11223c]). Although the immature male specimens (NSMT-Cr11223a & b) do not display the mature gonopod characters that are necessary for a proper determination, at least the carapace measurements allow their identification. Furthermore, the copious collection of *Insulamon* material studied suggests that *I. unicorn* is restricted to Busuanga Island or the Calamian Group.

Distribution. — Busuanga Island

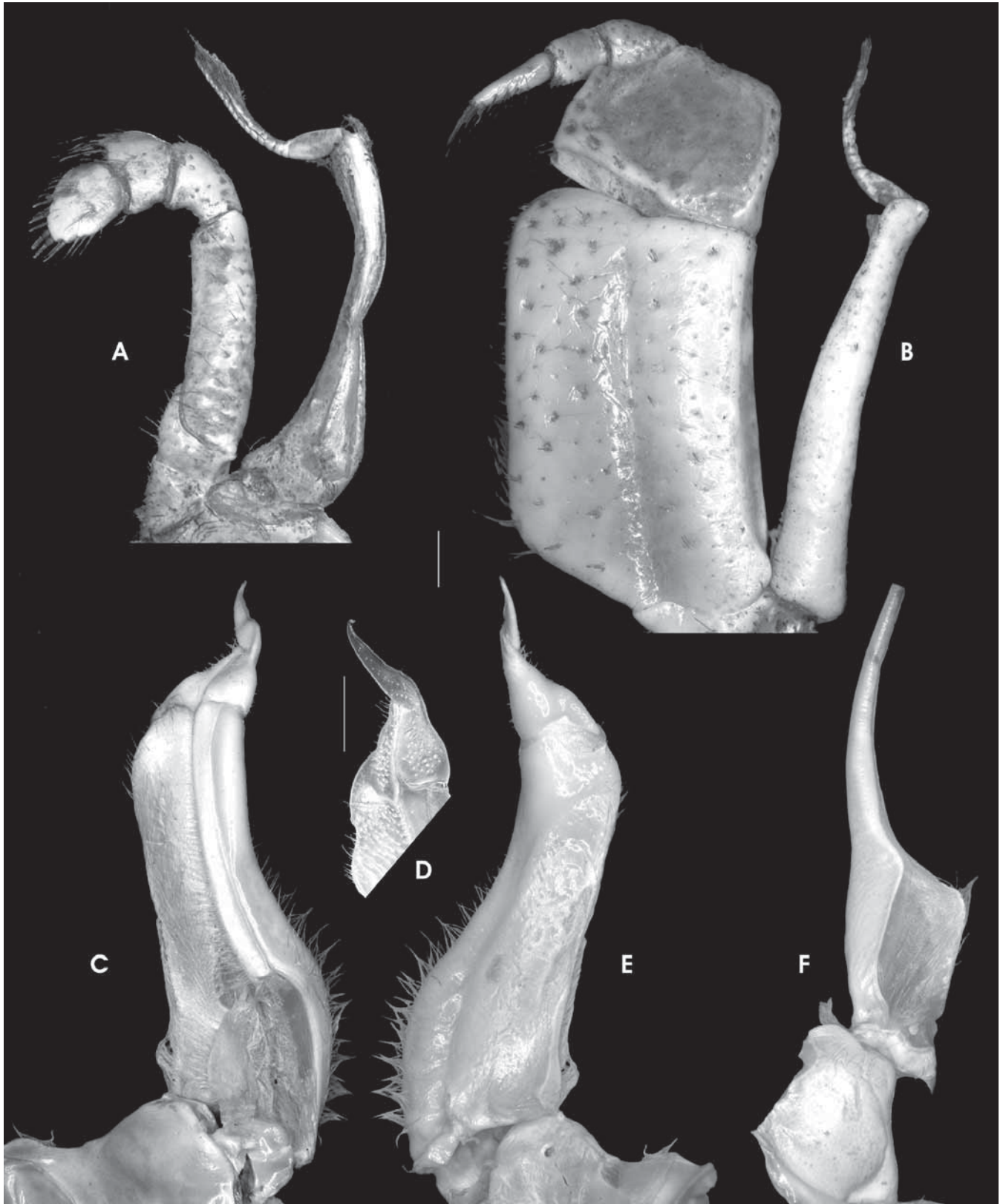


Fig. 3. *Insulamon unicorn*, male (38.8 by 30.2 mm) from San Nicolas (164a): A, left second maxilliped; B, left third maxilliped; C, left G1, ventral view; D, tip of left G1, ventral view (SEM picture); E, left G1, dorsal view; F, left G2 basal segment (flagellum broken off), ventral view. Scale bars = 1 mm.

***Insulamon palawanense* new species**

(Figs. 1A–E, 4A–D, 5A–K, 13F–G)

Insulamon unicorn Ng & Takeda, 1992 (part), p. 160, Fig. 5A–J; Freitag, 2005, app. 2.

Type locality. — Barangay [= municipal district] Dumarao, Roxas Municipality, Palawan Island, Philippines

Type material. — Holotype: male (NMCR-39012) (35.1 by 26.1 mm, dissected), Palawan, Roxas, Dumarao; downstream New Rizal Falls, secondary forest, boulders, sand, CPOM, c. 120 m asl, 10°28'10"N, 119°19'52"E (135), coll. H. Freitag, 5 Dec.1994.

Paratypes: 4 males (35.3 by 26.3 mm, 31.5 by 23.3 mm, 29.3 by 22.1 mm, 24.3 by 18.3 mm), 1 female (21.5 by 16.3 mm) (SMTD-Crustac-S98), same data as holotype; 3 males (31.1 by 23.5 mm, 30.3 by 22.8 mm, 26.2 by 19.8 mm), 1 female (28.5 by 22.2 mm), 1 ov. female (29.2 by 22.0 mm) (ZRC 2010.0331), Palawan, Roxas, Bagong Bayan, downstream of Ilian Falls, degraded primary forest, c. 50 m asl, boulders, sand, CPOM, 10°26'35"N, 119°32'39"E (129c), coll. H. Freitag, 17 Nov.1995; 1 male (34.3 by 25.5 mm) (SMTD-Crustac-S99), Palawan, P. Princesa, Irawan River, 6 km NW of Puerto Princesa City, 2 km upstream of water plant, 9°49'50"N, 118°39'46"E (60), coll. H. Freitag, 6 Apr.1994; 2 males (33.7 by 25.0 mm, 31.1 by 23.2 mm) (WPU), Palawan, Puerto Princesa, Irawan River, 6 km NW of Puerto Princesa City, 2 km upstream water plant, boulders, rocks, gravel, river side, 9°49'50"N 118°39'46"E, coll. S. Schoppe, Jun.2002; 3 males (29.7 by 22.5 mm, 22.0 by 16.3 mm, 18.8 by 14.2 mm) (PCSD), Palawan, Puerto Princesa, Napsan, road km 41.5, big Iwahig River tributary, sidepools, degraded primary forest, rocks, boulders, 9°41'24"N, 118°31'31"E (133a), coll. H. Freitag, 30 Aug.2008; 1 male (26.9 by 21.8 mm) (PCSD), Palawan, Puerto Princesa, 2 km SE Laptay/Napsan, small tributary of Bubugtungan mountain stream, semi-primary forest, 9°43'N, 118°28'E (23b), coll. H. Freitag, 7 Sep.2008; 1 male (24.7 by 19.0 mm) (SMF-38292), PHIL.: Palawan, Puerto Princesa, Cabayugan, Cabayugan River, near Nagsatayan Creek, S of Martapi, 37 m asl, 10°09'47"N, 118°50'37"E (CR2), coll. H. Freitag, 21 Jan.2003; 2 males (22.3 by 16.9 mm, 19.9 by 14.9 mm), 8 juv. ex. (SMTD-Crustac-S100), same locality as previous specimens, coll. H. Freitag, 24 Jan.2001; 1 male (35.1 by 26.2 mm) (SMTD-Crustac-S101) Palawan, P. Princesa, Bacungan, forest creek, 1 km S Nagtabon, secondary forest (heavy metal soil), 10 m asl, underside rocks, 9°55'33"N, 118°38'20"E (188c), coll. H. Freitag, 28 Aug.1995; 2 males (22.5 by 17.1 mm, 24.3 by 18.2 mm) (NMCR-39013), Palawan, Puerto Princesa, Sta. Lourdes, Magarwak River, road km15, heavy metal soil, Acacia mangium forest, 33 m asl, 9°51'50"N, 118°43'39"E (125), coll. H. Freitag, 14 Nov.1994; 4 male (33.9 by 26.3 mm, 27.7 by 20.5 mm, mutilated, 28.8 by 22.3 mm), 1 female (31.4 by 23.8 mm, mutilated) (SMTD-Crustac-S102), Palawan, Puerto Princesa City, Langogan, small creek near highway km 83.9, c. 200 m from coast, boulders, CPOM, FPOM, sand, 10°01'44"N, 119°08'01"E (110a), coll. H. Freitag, 11 Oct.1994; 3 females (29.8 by 22.1 mm, 21.1 by 16.3 mm, 18.8 by 14.7 mm), 3 juv. males (largest 20.4 by 14.9 mm) (NHMW-25378), Palawan, Puerto Princesa, Langogan River Tributary, Mt. Fabrica, Makandring, small mountain fall; boulders, CPOM, mud, prim. forest; 770 m asl, c. 10°06'N, 119°08'E (163e), coll. H. Freitag, 25 Nov.1995; 2 males (29.6 by 22.8 mm, 29.5 by 22.2 mm) (ZMUC-CRU-10083), Palawan, San Vicente, Poblacion; downstream Little Bagio Falls; disturbed primary forest, under boulders; c. 30 m asl, c. 10°30'33"N, 119°18'20"E (191c), coll. H. Freitag, 23 Nov.1995; 4 males (35.0 by 26.7 mm, 34.2 by 25.6 mm, 27.9 by 21.4 mm, 26.6 by 19.7 mm), 2 females (27.2 by 20.5 mm, 20.3 by 15.4 mm) (SMF-38293) Palawan, Puerto Princesa, Langogan River tributary

Kapakwan, Purok Bagong Silang, mountain creek, gravel, boulders, CPOM, secondary forest, c. 40m, 10°04'55"N, 119°06'34"E (163d), coll. H. Freitag, 15 Apr.1994; 2 males (26.0 by 20.0 mm, 26.1 by 20.2 mm) (NHMW-25175), Palawan, Puerto Princesa, Concepcion, Taranaban River, c. 6 km upstream highway, mountain river, riffle, boulders, woodlitter, c. 150 m asl, 10°02'30"N, 119°00'45"E (16b), coll. H. Freitag, 20 Jan.1995; 1 male (25.0 by 19.5 mm), 1 female (30.1 by 22.8 mm) (ZMUC-CRU-10084), Palawan, Puerto Princesa, Buena Vista, Baribi, small creek, gravel, boulders, CPOM, secondary vegetation, c. 5 m asl, 10°03'54"N, 118°49'01"E (107), coll. H. Freitag, 6 Oct.2007; 3 males (29.5 by 23.0 mm, 28.5 by 22.0 mm, 24.7 by 19.1 mm) (SMTD-Crustac-S103), Palawan, Puerto Princesa, Luzviminda, small lowland river, 4 km upstream highway km 27.1, riffle, gravel, boulders, CPOM, secondary forest, c. 10 m asl, 9°42'N, 118°41'E (155), coll. H. Freitag, 18 Jan.2009; 1 male (26.5 by 19.6 mm), 1 female (28.4 by 21.2 mm) (ZRC 2010.0332), Palawan, Puerto Princesa, Napsan, road km 42.5, Salakot Falls, small Iwahig River tributary, degraded primary forest, rocks, boulders, CPOM, 9°42'05"N, 118°31'18"E (132a), coll. H. Freitag, 7 Sep.2008; 1 female (26.2 by 20.8 mm) (ZRC 2010.0333), Palawan, Puerto Princesa, 2 km SE Laptay/Napsan, Bubugtungan mountain River, semi-primary forest, 9°41'14"N, 118°27'17"E (23a), coll. H. Freitag, 29 Mar.2008; 1 male (30.3 by 23.4 mm) (SMF-38294), Palawan, Puerto Princesa, 2 km SE Laptay/Napsan, Kalalabong Creek, secondary forest, run & riffle, leaf-litter, CPOM, gravel, c. 50 m asl, 9°41'20"N, 118°27'15"E (24), coll. H. Freitag, 7 Sep.2008; 2 males (30.5 by 22.4 mm, 21.2 by 16.2 mm) (ZRC 2010.0334), Palawan, Narra, 5 km W town proper, Taritien River, riffle, boulders, gravel, wood litter, c. 100 m asl, 9°19'11"N, 118°22'35"E (182a), coll. H. Freitag et al., 17 Apr.1994; 3 males (30.1 by 22.7 mm, 28.5 by 21.8 mm, 21.3 by 15.8 mm), 1 female (29.9 by 22.2 mm) (SMF-38295), Palawan, Narra, 5 km W town proper, Taritien River near DENR Station, riffle, boulders, gravel, wood litter, 9°18'55"N, 118°22'56"E (182b), coll. H. Freitag et al., 17 Apr.1994; 2 females (25.8 by 19.0 mm, 23.2 by 17.4 mm), 1 juv. male (16.9 by 12.9 mm) (SMTD-Crustac-S104), Palawan, Narra, 7 km N town centre, downstream Estrella Falls, mountain river, secondary forest, gravel, boulders, submerged wood, riffle, c. 50 m asl, c. 9°20'N, 118°23'E (180a), coll. H. Freitag & C. Pangantihon, 16 Apr.1994; 2 males (33.7 by 26.3 mm, 30.5 by 23.3 mm, mutilated), 1 juv. ex. (14.0 by 11.1 mm, mutilated) (ZRC 2010.0335), Palawan, Brookes Point, Salogon, Tagbinacao River, temporary tributary, residual pools, rocks, CPOM, sand, riffle, secondary vegetation, 130 m asl, 8°43'41"N, 117°42'16"E (147c), coll. J. Orcullo, 1 Sep.1994.

Other material. — All specimens designated as paratypes of *Insulamon unicorn* by Ng & Takeda (1992): 1 male (24.8 by 18.3 mm) (ZRC 1992.8360), 1 male (24.2 by 17.7 mm) (NSMT-Cr11222), Palawan, vicinity of Puerto Princesa, coll. Y. Kurata, no date; 2 males (19.9 by 14.9 mm, mutilated; 19.5 by 14.4 mm), 1 female (26.0 by 19.1 mm) (NSMT-Cr11223), Palawan, Tagbariri River, coll. M. Takeda & S. Shokita, 9 Aug.1985.

Diagnosis. — Carapace (Figs. 4A, B) c. 1.29–1.37 times as broad as wide, rather flat; cervical grooves shallow, suborbital margin obliquely connecting to external orbital angle; epigastric cristae projected over postorbital cristae; mesogastric cristae rather low and indistinct; progastric, mesogastric, cardiac and intestinal regions almost flat, branchial region slightly convex; medio-posterior carapace margin slightly concave or straight in dorsal view.

Male abdominal somites (Fig. 4C) moderately broad, telson c. 1.15 (south Palawan) to 1.25 (north Palawan) times as

broad as long, sixth abdominal somite c. 1.9–2.1 times as broad as long; telson in males c. 1.2–1.3 times as long as sixth abdominal somite, in females also longer than sixth abdominal somite (Fig. 4D).

Mandible (Fig. 1A) with deep and narrow incision opposite of palpus incertation; terminal segment of palp moderately long, evenly tapering towards apex.

Second maxilliped (Fig. 1E) exopod flat, rather membranous, lateral margin slightly indented at c. half length; propodus slightly longer than broad; outer distal margin of carpus slightly protruding. Third maxilliped (Fig. 5E) with dactylus about 1/3 longer than carpus; propodus slightly shorter than carpus; merus about 2/3 as long as broad, margins slightly curved, outer distal edge slightly rounded.

Larger cheliped in adult males rather slender, with dactylus distinctly narrower than half length of chela.

G1 (Fig. 5A–C, F–K) stout and distinctly sinuously bent; distal attenuate part of terminal segment distinctly shorter

than dilated proximal part; distal part of terminal segment narrow, attenuate, appearing slightly twisted; dilated base of terminal segment broader than distal subterminal segment; ventral setae rather long; collar conspicuously protruding medio-dorsad; ventral collar region only slightly notched. G2 (Fig. 5D) flagellum c. 0.5 times as long as basal segment, enlarged proximal portion subrectangular.

Remarks. — *Insulamon palawanense*, new species, is the most widely distributed species on Palawan Island and might therefore be more variable than the other species of the genus that appear more restricted to intra-island biogeographical subregions.

The enlarged proximal portion of the G2 is slightly more trapezoidal in the southern Palawan specimens (Fig. 5F, G). Furthermore, the distal part of the terminal segment is slightly more twisted from the longitudinal axis in northern specimens (Fig. 5J, K). The tip of the G1 is pointing slightly dorso-laterad, while that of southern specimens is rather dorso-mediad directed. Most specimens from central Palawan (Fig. 5H, I) display a distinctly more inflated base of the terminal segment, which appears somewhat swollen (see also remarks for *I. porculum*, new species). However, these minor differences are regarded as intraspecific variations as they occur gradually along a north-south axis (see Fig. 5F–K) within the species distributional area. Juvenile male specimens have a straighter and slenderer G1 and G2; the species typical characters (protruding, notched collar region; subbasally dilated proximal part of terminal segment; twisted distal part of terminal segment) are less distinct (Fig. 5G, I) or not yet developed (see Ng & Takeda, 1992: Fig. 5F–I).

This new species resembles *I. unicorn*, but can be distinguished by the combination of the characters carapace proportion (width/length ratios: 1.29–1.37 versus 1.28–1.29), the shorter and broader sixth male abdominal somite (c. 1.9–2.1 versus 1.75 times as broad as long; 0.77–0.83 versus 0.87 times as long as telson) and the stouter, more bent G1 with the distal part of the terminal segment shorter than the proximal part (see also remarks for *I. unicorn*).

Etymology. — This species is named after Palawan, in reference to its comparably wide distribution on this island.

Distribution. — Palawan Island

Insulamon magnum new species

(Figs. 6A–C, 7A–H, 13A–E)

Type locality. — Lake Manguao catchment, Taytay Municipality, Palawan Island, Philippines.

Type material. — Holotype: male (53.0 by 41.8 mm) (NMCR-39014), Palawan, Taytay, Lake Manguao, Alipuran Stream, riffle, gravel, boulders, CPOM, 45 m asl, c. 10°45'04"N, 119°31'06"E (11c), coll. H. Freitag, 22 Aug. 2008.

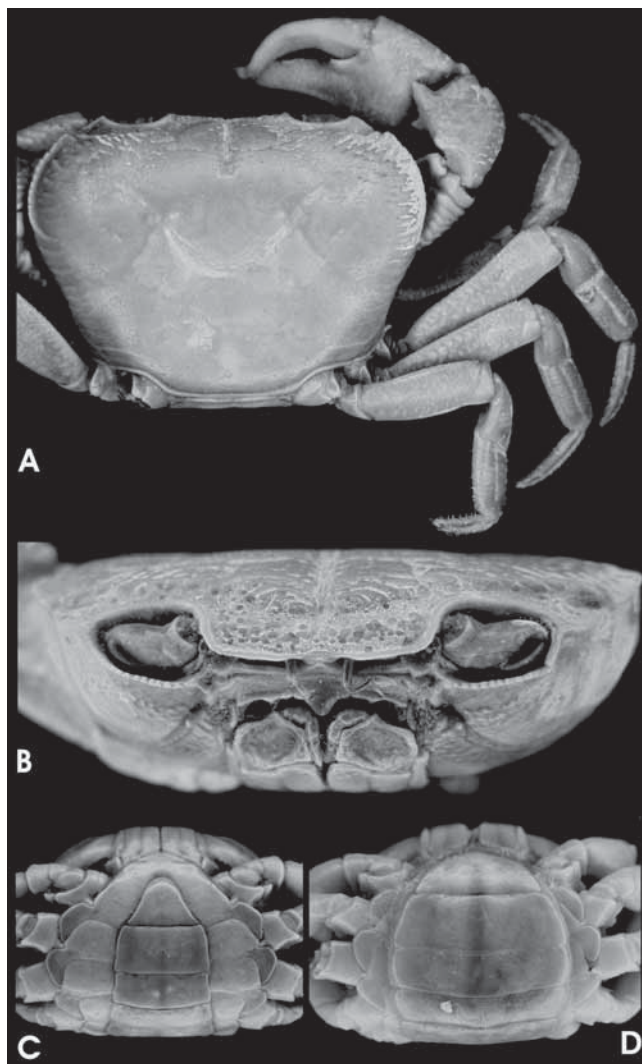


Fig. 4. *Insulamon palawanense*, new species. Paratype male (35.3 by 26.3 mm) from Dumarao (135): A, dorsal view; B, frontal view; C, ventral view. D, paratype female (28.5 by 22.2 mm) from Bagong Bayan (129c), ventral view.

Paratypes: 1 male (26.9 by 22.0 mm) (PCSD), Palawan, Taytay, Lake Manguao, Alipuran stream, residual pool, leaves, boulders, c. 50 m asl, c. 10°45'02"N, 119°30'44"E (11b), coll. H. Freitag, 20 Nov.2008; 1 male (43.6 by 33.9 mm) (ZRC 2010.0336), Palawan, Taytay, Poblacion, Culanga Stream, private farm Reyes, rocks, leaves, secondary forest, c. 10 m asl, 10°47'48"N, 119°30'46"E (78), coll. H. Freitag, 17 May 2007; 1 male (30.9 by 24.7 mm) (WPU), same locality as previous specimen, coll. G. Albunda, 17 May 2007; 1 ov. female (44.0 by 34.2 mm) (ZRC 2010.0337), Palawan, Taytay, Abongan, Ibangley, Abongan River tributary, highway km 178, shallow, sand, CPOM, 10°37'36"N, 119°23'07"E

(108), coll. H. Freitag, 28 Sep.2007; 1 juv. male (21.5 by 17.3 mm) (ZRC 2010.0338), Palawan, Taytay, Abongan, Ibangley, Abongan River tributary, Kaylubong Stream, highway km 179.1, gravel, sand, CPOM, c. 10°37'35"N 119°23'44"E (109), coll. H. Freitag, 28 Sep. 2007; 1 male (32.1 by 25.1 mm) (SMF-38296), Palawan, Taytay, Cataban, Cataban River, highway km 230, medium lowland river, farmland, FPOM, gravel, slightly polluted, 10°59'15"N, 119°24'12"E (115), coll. H. Freitag, 16 Oct.2007; 3 males (17.6 by 13.9 mm, 19.4 by 15.4 mm, 23.3 by 17.4 mm), 1 female (25.5 by 20.2 mm) (SMTD-Crustac-S105), Palawan, Roxas, Abaroan, Candelaria, Road to Port Barton, slash and burn farmland, small

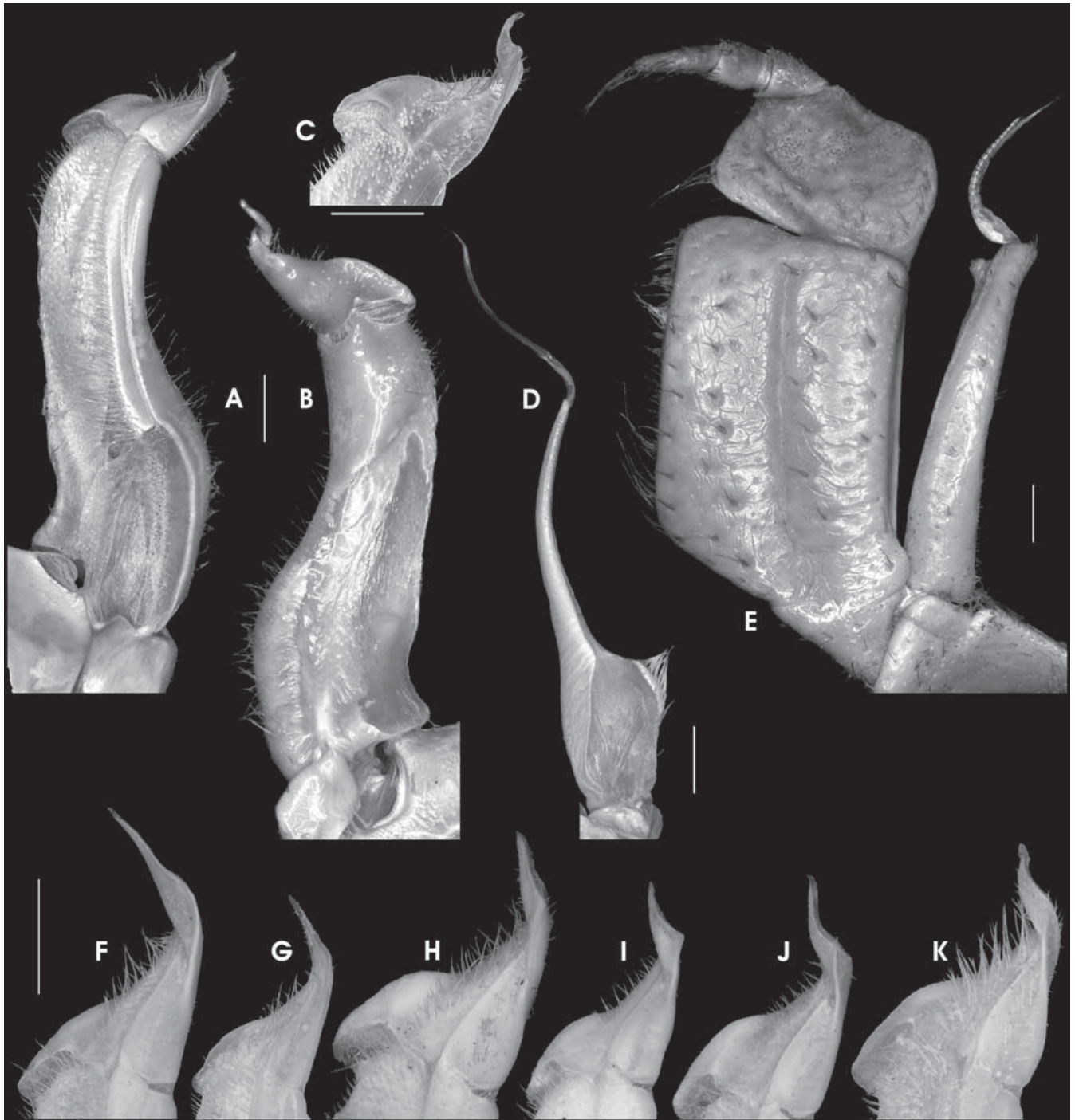


Fig. 5. *Insulamon palawanense*, new species. Holotype male: A, left G1 ventral view; B, left G1 dorsal view; C, tip of left G1 ventral view (SEM picture); D, left G2 ventral view; E, left third maxilliped; paratype males, left G1 tip ventral, gradual variations from southern to northern specimens: F, from Salugon (147c), (30.5 by 23.3 mm); G, from Luzviminda (155) (24.7 by 19.1 mm); H, from Irawan (60), (33.7 by 25.0 mm); I, from Tarabanan (16b), (26.1 by 20.2 mm); J, from Dumarao (135), (29.3 by 22.1 mm); K, from Bagong Bayan (129c), (31.1 by 23.5 mm). Scale bars = 1 mm.

temporary creek, sand, boulders, CPOM, 10°20'14"N, 119°16'29"E (127c), coll. H. Freitag, 16 Nov.1995; 1 male (37.3 by 29.2 mm) (SMTD-Crustac-S106), Palawan, El Nido, Pasadeña, Nagkalit-Kalit Falls, small mountain river, degraded primary forest, rocks, gravel, wood litter, c. 11°15'N, 119°26'E (112), coll. H. Freitag, 14 Oct.1994; 1 male (33.4 by 26.0 mm) (NHMW-25176), same data as previous specimen; 1 male (31.1 by 25.0 mm), 1 female (26.3 by 21.0 mm) (ZMUC-CRU-10086), Palawan, El Nido, Villa Libertad, small creek near dump site, secondary forest, rocks, sand, CPOM, fall & pool, c. 50 m asl, c. 11°12'N, 119°26'E (113b), coll. H. Freitag, 15 Oct.1994; 1 male (33.6 by 26.2 mm), 1 ov. female (38.0 by 29.5 mm) (NMCR-39015), PHIL.: Palawan, El Nido, Pasadeña, Sitio Kalanpinay, downstream Bulalacao Falls, degraded primary forest, rocks, gravel; c. 100 m asl, 11°13'18"N, 119°27'52"E (114a), coll. H. Freitag, 15 Oct.1994; 1 female (34.7 by 27.2 mm) (SMF-38297), Palawan, El Nido, Pasadeña, Sitio Kalanpinay, Bulalacao River, degraded primary forest, boulders, gravel, CPOM, c. 80 m asl, 11°13'18"N, 119°27'28"E (114b), coll. H. Freitag, 15 Oct.1994.

Diagnosis. — Carapace (Figs. 6A, B) c. 1.23–1.29 times as broad as wide, moderately high; branchial region only

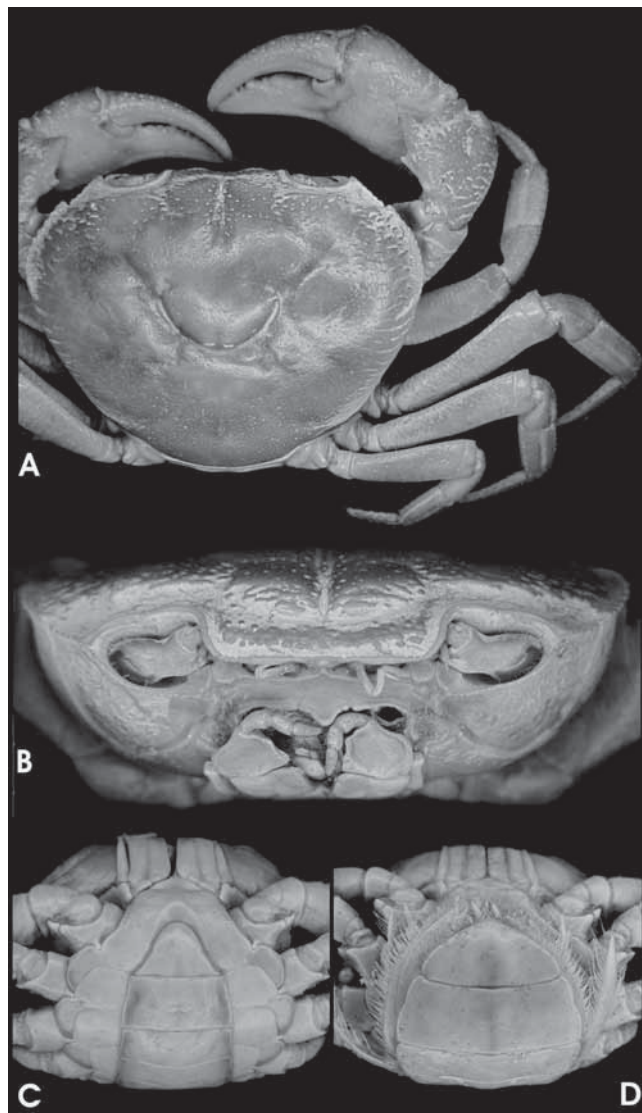


Fig. 6. *Insulamon magnum*, new species. Holotype male from Lake Manguao catchment: A, dorsal view; B, frontal view; C, ventral view. D, ov. female (44.0 by 34.2 mm) from Abongan (108), ventral view.

slightly inflated laterally; cervical grooves rather deep; frontal margin slightly sinuously curved; suborbital margin obliquely connecting to external orbital angle; epigastric cristae projected over postorbital cristae; mesogastric cristae rather low; branchial, progastric, mesogastric, cardiac and intestinal regions slightly convex; medio-posterior carapace margin distinctly convex in dorsal view.

Male abdominal somites (Fig. 6C) broad; telson c. 1.25 (juveniles) to 1.55 (holotype) times as broad as long; sixth abdominal somite c. 1.65 (juveniles) to 1.95 (holotype) times as broad as long; telson and sixth abdominal somite subequal in length in adult males as well as in females (Fig. 6D).

Mandible with deep and narrow incision opposite of palp incertation; terminal segment of palp rather short and broad, evenly tapering towards apex.

Second maxilliped (Fig. 7B) exopod subcylindrical, moderately chitinous, lateral margin not indented; propodus slightly longer than broad; outer distal margin of carpus slightly protruding.

Third maxilliped (Fig. 7A) with dactylus about 1/3 longer than carpus; propodus slightly shorter than carpus; merus about 2/3 as long as broad, margins slightly curved, outer distal edge slightly rounded, inner distal groove (for carpus) shallower; exopodit with distinctly protruding subdistal projection at inner dorsal side.

Larger cheliped in adult males rather broad; dactylus almost half as broad as chela length, comparably stout and short.

G1 (Fig. 7D–H) rather stout; distal part of terminal segment at least as long as its dilated proximal base, narrow, elongate, with subclavate to hamulose tip, twisted at its proximal area, entirely slightly dorso-laterad directed; dilated proximal base of terminal segment broader than distal subterminal segment; collar distinctly cuneately protruding dorso-mediad; ventral collar region distinctly notched. G2 (Fig. 7C) flagellum c. 0.55 times as long as basal segment; enlarged proximal portion of basal segment subtrapezoidal, rather slender.

Remarks. — Juvenile male specimens of the species have a straighter and slenderer G1 and G2, and the typical species characters (protruding collar region; subbasally dilated proximal part of terminal segment; distal part of terminal segment proximally twisted and distally subclavate to hamulose) are less distinct (Fig. 7G, H).

Insulamon magnum, new species, differs most remarkably from other species of the genus, not only by the unique gonopod characters (distal part of terminal segment long, twisted to ventrad, not distinctly attenuate, with subclavate to hamulose tip; collar distinctly, cuneately protruding dorso-laterad), but also by the more distinct antero-lateral dentation (versus rather granulate antero-lateral margin in all other species of the genus) and the more squarish carapace (only 1.23–1.29 times as broad as long, versus at least 1.29 times as broad as long in the other species from Palawan) and the

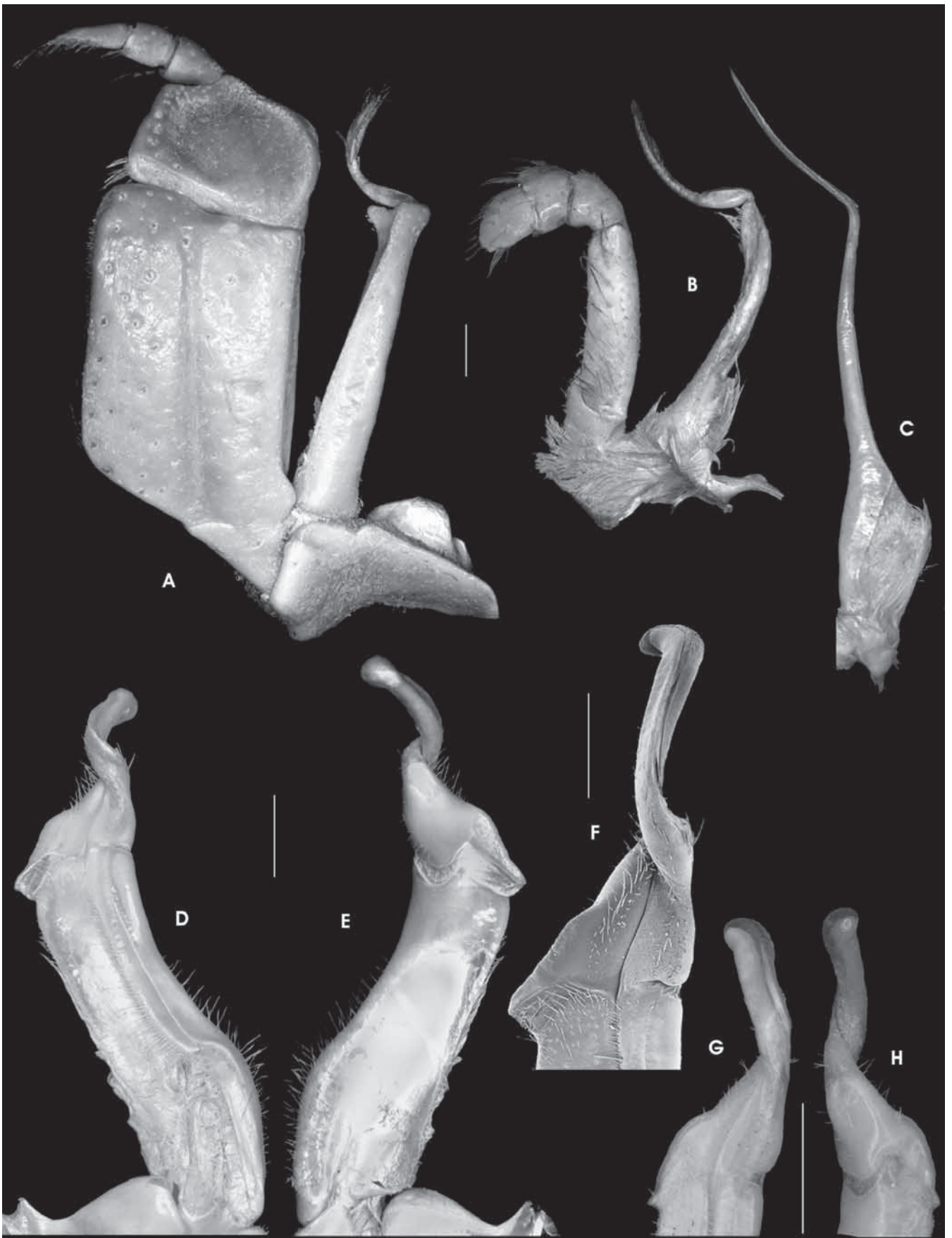


Fig. 7. *Insulamom magnum*, new species. Paratype male (33.6 by 26.2 mm) from Pasadeña (114a): A, left third maxilliped; B, left second maxilliped; C, left G2 ventral view; D, left G1 ventral view; E, left G1, dorsal view, F, tip of left G1, ventral view (SEM picture). Paratype male (26.9 by 22.0 mm) from Manguao (11b) tip of left G1: G, ventral view; H, dorsal. Scale bars = 1 mm.

relatively broader and shorter telson than in all other species of the genus (about as long as sixth abdominal somite versus longer than sixth abdominal somite, 1.25–1.55 times as broad as long versus not more than 1.25 times as broad as long in males). The third maxilliped exopod displays a more protruding subdistal projection at the inner dorsal side, than in all other species of the genus and the G2 basal segment is more slender than in *I. unicorn* and *I. palawanense*, new species.

The immature stage of the G1 in males of intermediate size (26.9 by 22.0 mm; Figs. 7G–H) as well as the size of the holotype (53.0 by 41.8 mm) suggest that this is the biggest species in the genus. It was found sympatric with *I. johannchristiani*, new species.

Etymology. — Magnum (Latin), big. The species is named for its large size, as it is indicated by the examined material that the species grows bigger than its congeners.

Distribution. — Northern Palawan Island

***Insulamon johannchristiani* new species**

(Figs. 8A–D, 9A–H, 13H–I)

Type locality. — Lake Manguao catchment, Taytay Municipality, Palawan Island, Philippines

Type material. — Holotype: male (38.5 by 28.7 mm) (NMCR-39016), Palawan, Taytay, Poblacion, Manguao, W spring Enolbong Creek, temporary mountain tributary N coast, primary forest, rocks, gravel, CPOM, c. 20 m asl, 10°46'40"N, 119°32'19"E (121b), coll. H. Freitag, 5 Nov.2008.

Paratypes: 1 male (28.8 by 21.6 mm) (PCSD), same label as holotype; 1 male (34.5 by 26.9 mm) (ZRC 2010.0339), Palawan, Taytay; road to Lake Manguao, Manguao Stream tributary, primary forest, c. 35 m asl, 10°47'N, 119°31'E (13b), coll. H. Freitag, 29 Apr.2008; 1 female (27.4 by 20.7 mm) (NMCR-39017), Palawan, Taytay, Poblacion, Southern Manguao Stream tributary, primary forest, c. 30 m asl, 10°46'00"N, 119°30'43"E (63a), coll. H. Freitag, 16 Apr.2008; 1 female (25.9 by 19.7 mm) (SMTD-Crustac-S107), Palawan, Taytay, Southern Manguao Stream tributary, primary forest c. 30 m asl, 10°46'17"N, 119°30'55"E (63b), coll. H. M. Macmac, 19 Aug.2007; 1 ov. female (27.2 by 22.0 mm) (SMTD-Crustac-S108), same locality as previous specimen, coll. H. Freitag, 19 Aug.2007; 2 males (32.2 by 24.2 mm, 31.2 by 24.0 mm) (ZRC 2010.0340), Palawan, Taytay, Poblacion, Manguao, Malarad Creek, tributary NE coast, degraded primary forest, rocks, boulders, gravel, CPOM, c. 20 m asl, 10°46'22"N, 119°33'36"E (120), coll. H. Freitag, 4 Nov.2008; 3 males (26.3 by 20.5 mm, 20.0 by 15.0 mm, 19.6 by 15.2 mm) (SMTD-Crustac-S109), Palawan, Taytay, Poblacion, Manguao, Mechico Creek, temporary tributary N coast, degraded primary forest, boulders, gravel, sand, CPOM, c. 20 m asl, 10°46'37"N, 119°33'14"E (119), coll. H. Freitag, 4 Nov.2007; 2 males (29.0 by 21.4 mm, 23.6 by 17.8 mm) (SMTD-Crustac-S110), Palawan, Taytay, Poblacion, Manguao, small waterfall, W coast, secondary forest, c. 20 m asl, 10°46'07"N, 119°31'40"E (14), coll. H. Freitag, 15 Sep.2008; 1 female (28.2 by 21.4 mm) (SMTD-Crustac-S111), Palawan, Taytay, Manguao tributary W Sinangalit Stream, residual pool, rocks & leaves, c. 20 m asl, c. 10°46'46"N, 119°31'05"E (73b), coll. A. Norte, 28 Sep.2008; 1 male (31.2 by 24.2 mm), 1 ov. female (26.9 by 20.8 mm) (ZRC 2010.0341),

Palawan, Taytay, Bato, mountain creek near highway, secondary forest, shallow, rocks, sand, CPOM, c. 80m asl, 10°44'56"N, 119°30'20"E (101), coll. H. Freitag, 22 Aug.2007; 1 male (34.2 by 26.8 mm) (SMTD-Crustac-S112), Palawan, Taytay, Bato, mountain creek, degraded primary forest, rocks, sand, CPOM, riffle & fall, 10°44'57"N, 119°30'09"E (122), coll. H. Freitag, 6 Nov.2007; 3 males (33.6 by 26.2 mm, 27.1 by 20.6 mm, 23.1 by 17.8 mm) (SMF-38298), Palawan, Taytay, Poblacion, Tubog Creek tributary, public water source/ shallow spring, leaves, gravel, 10°49'02"N, 119°30'53"E (65), coll. H. Freitag, 21 Apr.2007; 1 male (31.1 by 24.0 mm) (WPU), Palawan, Taytay, Poblacion, small hill stream, c. 4 km SE town proper, rocks, sand, leaves, degraded forest, c. 15 m asl, c. 10°48'05"N, 119°33'02"E (100), coll. H. Freitag, 21 Aug.2007; 1 male (29.7 by 22.0 mm) (NHMW-25177), Palawan, Taytay, Abongan, Ibangley, Abongan River tributary, highway km 178, shallow, sand, CPOM, 10°37'36"N, 119°23'07"E (108), coll. H. Freitag, 28 Sep.2007; 2 males (25.2 by 19.5 mm, 24.9 by 19.5 mm) (ZMUC-CRU-10085), Palawan, El Nido, road to Taytay, 0.5 km S of town proper, small creek, semi-primary forest, c. 10 m asl, 11°10'29"N, 119°23'39"E (70), coll. H. Freitag, 5 May 1995; 1 male (20.6 by 15.8 mm), 1 female (34.8 by 25.7 mm) (SMTD-Crustac-S113), Palawan, El Nido, Villa Libertad, small creek near

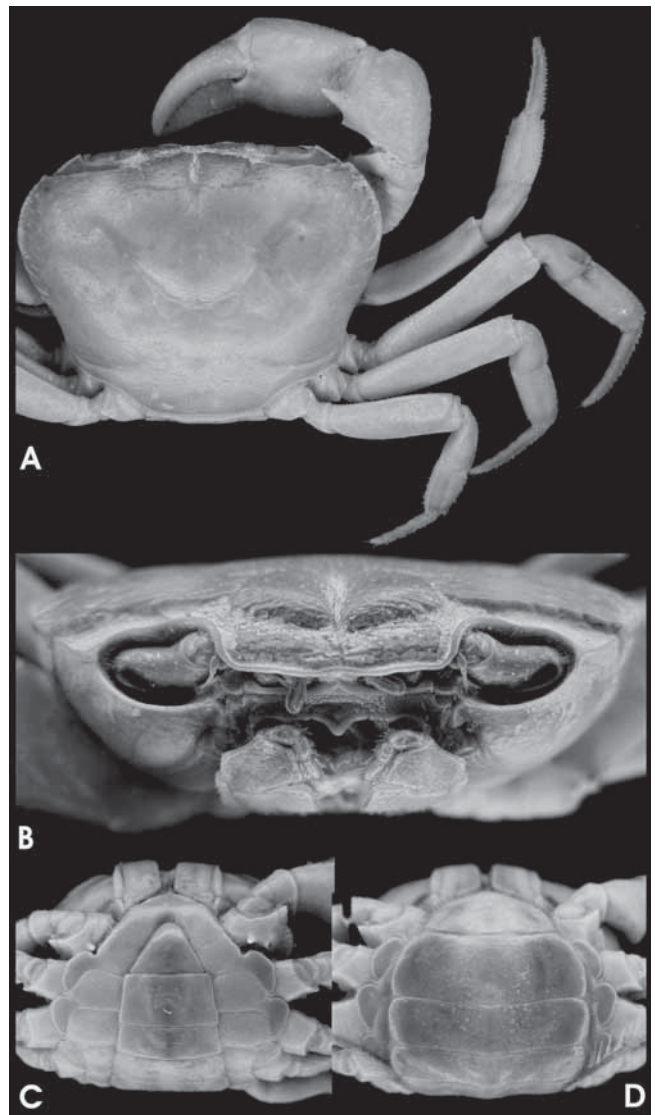


Fig. 8. *Insulamon johannchristiani*, new species. Paratype male (31.0 by 23.9 mm) from Lake Manguao catchment (63a): A, dorsal view; B, frontal view; C, ventral view. D, paratype female (34.8 by 25.7 mm) from Villa Libertad (113b), ventral view.

dump site, secondary forest, rocks, sand, CPOM, fall & pool, c. 50 m asl, c. 11°12'N, 119°26'E (113b), coll. H. Freitag, 15 Oct.1994; 1 male (23.6 by 18.0 mm) (ZRC 2010.0342), Palawan, El Nido, Pasadeña, Sitio Kalanpinay, Bulalacao Falls, degraded primary forest, rocks, gravel, c. 100 m asl, 11°13'18"N, 119°27'52"E, coll. H. Freitag, 15 Oct.1994.

Other material. — 1 juv. male (13.3 by 10.2 mm) (SMTD-Crustac-S114), Palawan, Taytay, Poblacion, Manguao, W spring Enolbong Creek, temporary mountain tributary N coast, primary forest, rocks, gravel, CPOM, c. 20 m asl, 10°46'40"N, 119°32'19"E, coll. H. Freitag, 5 Nov.2008.

Diagnosis. — Carapace (Figs. 8A, B) c. 1.31–1.40 times as broad as wide, moderately high; anterior-lateral branchial regions swollen; cervical grooves moderately deep; suborbital margin ventrally dilated, not oblique; epigastric cristae slightly projected over postorbital cristae; mesogastric cristae conspicuous and rather high; progastric, mesogastric, cardiac and intestinal regions convex; medio-posterior carapace margin slightly convex in dorsal view.

Male abdominal somites (Fig. 8C) moderately broad; telson c. 1.2 as broad as long; sixth abdominal somite c. 1.6–1.9 times as broad as long; telson c. 1.1–1.2 times as long as sixth abdominal somite in males, approximately of same length in females (Fig. 8D).

Mandible with deep incision opposite of palp incertation; terminal segment of palp rather short and broad, evenly tapering towards apex. Second maxilliped (Fig. 9B) exopod rather flat, partly membranous, lateral margin broadly indented at about half length; propodus distinctly longer than broad, outer distal margin of carpus protrudingly dilated. Third maxilliped (Fig. 9A) with dactylus about 1/5 longer than carpus; propodus about 1/5 shorter than carpus; merus more than 2/3 as long as broad, margins slightly curved, edges rather sharp.

Larger cheliped in adult males broad; dactylus at least half as broad as chela length.

G1 (Fig. 9D–H) stout, sinuously bent; distal part of terminal segment hook-like curly and attenuate, twisted towards ventral side; tip perpendicularly contorted from the longitudinal axis; base of terminal segment dilated, broader than distal subterminal segment, sub-proximally inflated; collar distinctly, but not cuneately protruding dorsally; ventral collar region conspicuously broadly notched. G2 with flagellum c. 0.4–0.5 times as long as basal segment; enlarged proximal portion of basal segment rather broad and subtriangular (Fig. 9C).

Remarks. — The species is best distinguished from other representatives of the genus by the G1 that combines characters of *I. magnum*, new species, and *I. palawanense*, new species, but is unique in the attenuate, hook-like curly tip of the terminal segment (versus straight or subclavate to hamulose tip in the other species). Externally, it can be distinguished by the somewhat inflated carapace (progastric, mesogastric, cardiac and intestinal regions convex versus

slightly convex or almost flat; branchial region swollen versus more or less convex in all other species). Furthermore, it varies respectively from the abovementioned species by the broad carapace (1.31–1.40 times as broad as wide versus 1.23–1.29 in *I. magnum*, new species), the more conspicuous and slightly higher mesogastric cristae and the slenderer male sixth abdominal somite (≤ 1.9 times as broad as wide versus ≥ 1.9 in *I. palawanense*, new species).

The G1 and G2 in juvenile male specimens (Fig. 9G, H) are straighter and less sinuously curved. Their distal part of the G1 terminal segment is relatively broader and stouter, already distinctly curly, but not yet hook-like and the G1 collar is less developed and less protruding.

Etymology. — Named after Johann Christian Freitag, Schwerin, Germany

Distribution. — Northern Palawan Island

Insulamom porculum new species

(Figs. 10A–D, 11A–H)

Type locality. — Barangay [= municipal district] Tinitian, Roxas Municipality, Palawan Island, Philippines

Type material. — Holotype: male (33.1 by 25.1 mm) (NMCR-39018), Palawan, Roxas, Tinitian, small temporary tributary, highway km 83.9, c. 600 m asl, boulders, sand, FPOM, CPOM, pool, 10°02'15"N, 119°08'15"E, coll. H. Freitag, 22 Aug.1994.

Paratypes: 1 male (23.5 by 17.7 mm) (ZRC 2010.0343), Palawan, Puerto Princesa, Concepcion, Taranaban River, c. 6 km upstream highway, mountain river, riffle, boulders, woodlitter, c. 150 m asl, 10°02'30"N, 119°00'45"E (16b), coll. H. Freitag, 20 Jan.1995.

Other material. — 1 female (32.5 by 25.1 mm) (PCSD), Palawan, Roxas, Tinitian, small creek, highway km 83.9, c. 200 m from coast, boulders, CPOM, FPOM, sand, c. 50 m asl, 10°01'44"N, 119°08'01"E (110a), coll. H. Freitag, 11 Oct.1994.

Diagnosis. — Carapace (Fig. 10A, B) c. 1.32–1.35 times as broad as wide, moderately high; cervical grooves shallow; suborbital margin finely beaded, distinctly arcuate, convex towards ventral, not oblique; epigastric cristae archly aligned with postorbital cristae; mesogastric cristae conspicuous; progastric, mesogastric, cardiac and intestinal regions slightly convex; branchial region convex; medio-posterior carapace margin more or less straight in dorsal view.

Male abdominal somites (Fig. 10C) moderately broad, telson c. 1.14 times as broad as long (holotype), sixth abdominal somite c. 2.0 times as broad as long (holotype); telson in the holotype male 1.3 times as long as sixth abdominal somite, in the female specimen 1.2 times as long as sixth abdominal somite (Fig. 10D).

Mandible with rather shallow and broad incision opposite of palp incertation; terminal segment of palp long, most narrow medially, not evenly tapering.

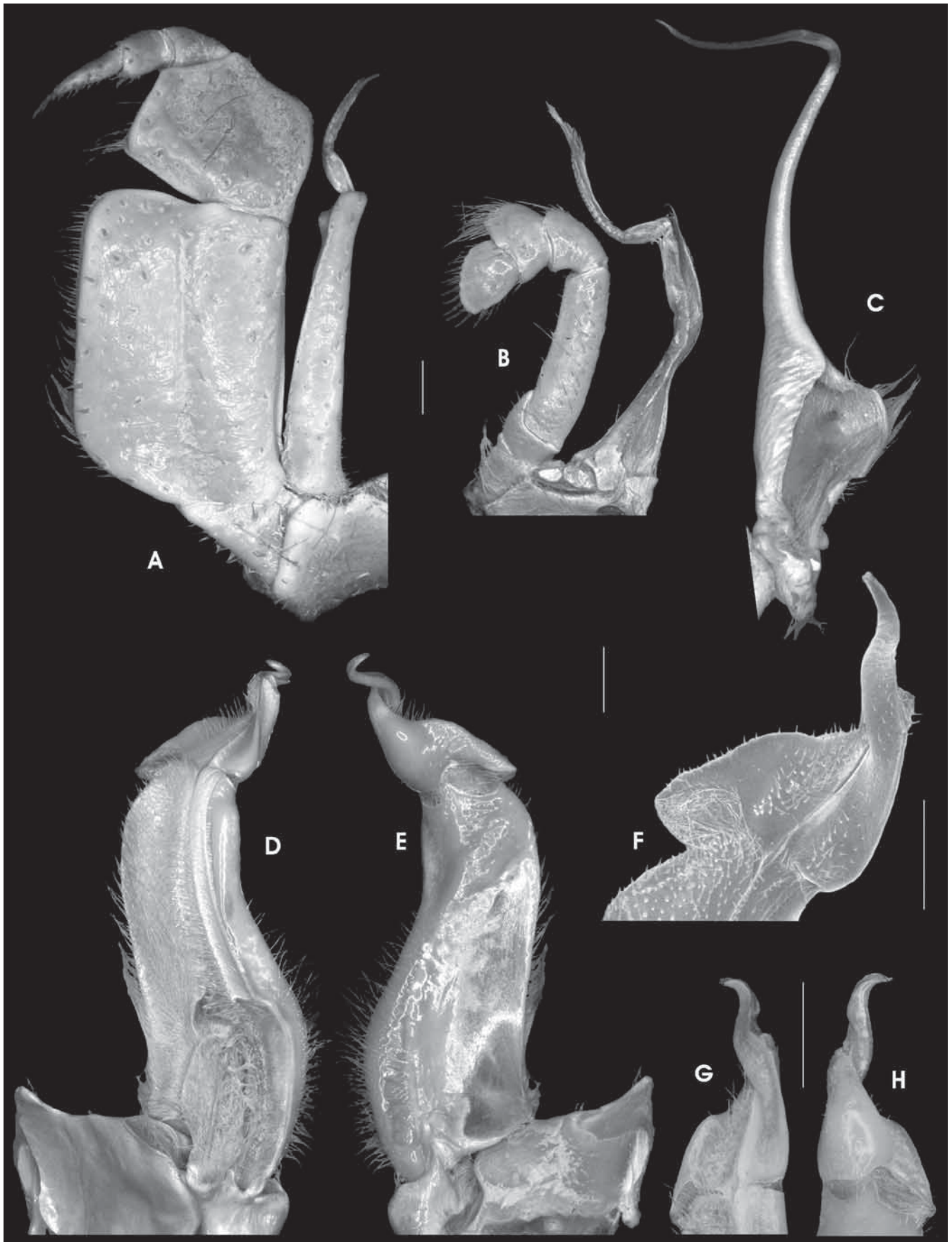


Fig. 9. *Insulamon johannchristiani*, new species. Holotype male: A, left third maxilliped; B, left second maxilliped; C, left G2 ventral view; D, left G2 ventral; E, left G2 dorsal; F, tip of left G1 ventral (SEM picture). Paratype male (23.1 by 17.8 mm) from Taytay (65), tip of left G1: G, ventral view, H, dorsal view. Scale bars = 1 mm.

Second maxilliped (Fig. 11B) exopod rather flat, partly membranous, lateral margin somewhat contorted, not indented; propodus distinctly longer than broad, outer distal margin of carpus protrudingly dilated. Third maxilliped (Fig. 11A) with dactylus slightly longer than carpus; propodus about 1/3 shorter than carpus; merus more than 2/3 as long as broad, margins slightly curved, outer distal edge broadly rounded.

Larger chela in the holotype male rather elongate, with dactylus distinctly less than half as broad as entire chela long.

G1 (Fig. 11D–H) moderately stout, distinctly curved mediad; distal part of terminal segment short, very distinctly curved, pigtail-like curly at its base; tip pointing more or less in the direction of the G1 longitudinal axis; proximal portion of terminal segment rather slender, elongate, not inflated subproximally, appearing evenly tapered; collar comparably inconspicuous, not protruding. G2 with flagellum c. 0.45 times as long as basal segment; enlarged proximal portion of basal segment subrectangular.

Remarks. — The species most resembles externally *I. palawanense* by the carapace proportions and shape of striae, grooves and granulations, but varies in the epigastric cristae that are less distinctly separated from postorbital cristae in *I. porculum*, new species, than in other representatives of the genus (except for *I. unicorn*).

It can, however, easily be distinguished by the unique G1 characters (distal part of terminal segment short, pigtail-like curly; tip straight; collar less pronounced). Furthermore, the base of the G1 terminal segment is very slender and conically elongate, not inflated as in all other Palawan species. This might be interpreted as an anatomical barrier inhibiting interbreeding, especially with *I. palawanense*, new species, which was found to be sympatric in that area and even syntopic in the same streams, but displays a distinctly inflated base of the terminal segment, particularly in central Palawan (see remarks for *I. palawanense*).

Etymology. — Porculus (Latin), piglet. The species is named for its curly, pigtail-like distal part of the terminal G1 segment.

Distribution. — Central Palawan Island, north of Honda Bay / Ulugan Bay demarcation

DISCUSSION

Insulamon species, as most Southeast Asian Potamidae in general, inhabit small to medium-sized running water. They are semi-aquatic and hide in burrows at the stream bank, which are usually found under boulders and roots. Small to medium-sized individuals are frequently found in riffle stream sections among CPOM. *Insulamon* crabs, as most Brachyura, are much more active in the night when they are foraging under water.

Insulamon johannchristiani and *I. magnum* as well as *I. palawanense* and *I. porculum*, respectively, are sometimes found to occur sympatrically. A distinct habitat or behavioural partitioning among sympatric species of the genus was not observed. Some of the streams where *Insulamon* was recorded are inhabited by *Parathelphusa* species (Gecarcinucidae) too. However, a tendency at least, is apparent that *Insulamon* species rather occur in the rhithral, characterised by higher hydraulic stress, than in the potamal or slow flowing stream section where *Parathelphusa* is usually found (Freitag, 2005; pers. obs.). In the Lake Manguao catchment, which has been sampled intensively, *Parathelphusa manguao* Freitag & Yeo, 2004, was collected from lower reaches of tributaries as well as the lake itself, while *Insulamon magnum* and *I. johannchristiani* occurred in upper stream reaches. However, the species covered in this paper are still regarded as lowland taxa. The highest altitude from where *Insulamon* was recorded is at 770 m asl (*I. palawanense*, Langogan, Puerto Princesa). The rarely collected Palawan-endemic *Carpomon pomulum* might replace *Insulamon* in higher altitudes. However, that species is only known from the ambiguous type locality and a further unpublished record from the Matalingajan mountain range so far.

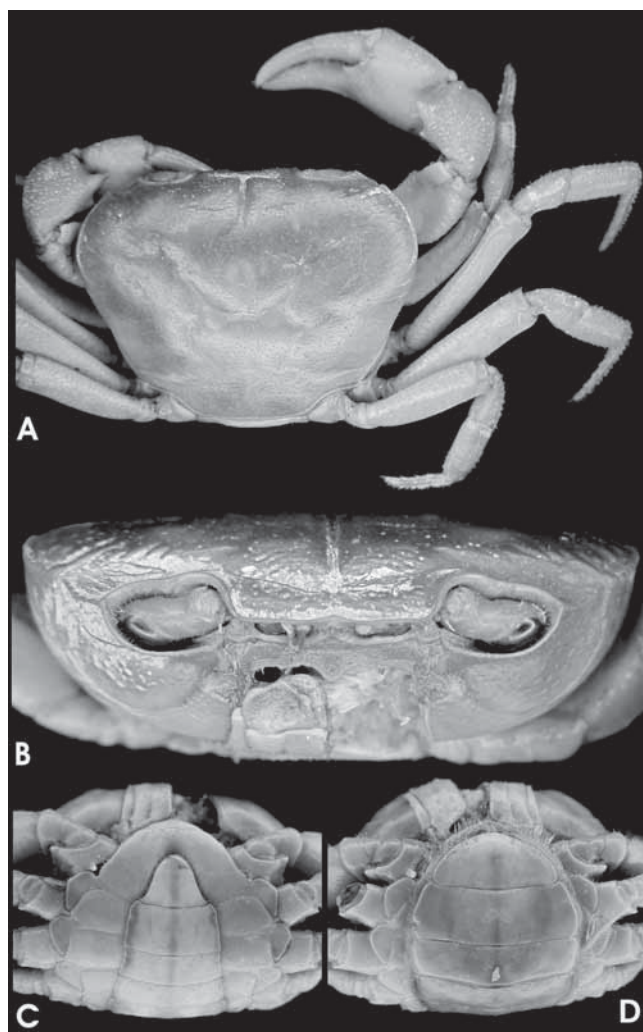


Fig. 10. *Insulamon porculum*, new species. Holotype male: A, dorsal view; B, frontal view; C, ventral view. D, female (32.5 by 25.1 mm) from Tinitian (110a), ventral view.



Fig. 11. *Insulamon porculum*, new species. Holotype male: A, left third maxilliped; B, left second maxilliped; C, right G2, ventral view, flipped; D, left G1 (with G2 flagellum) ventral view; E, left G1 dorsal view; F, tip of left G1 ventral view (SEM picture). Paratype male (23.5 by 17.7 mm) from Taranaban (16b), tip of G1: G, ventral view; H, dorsal view. Scale bars = 1 mm.

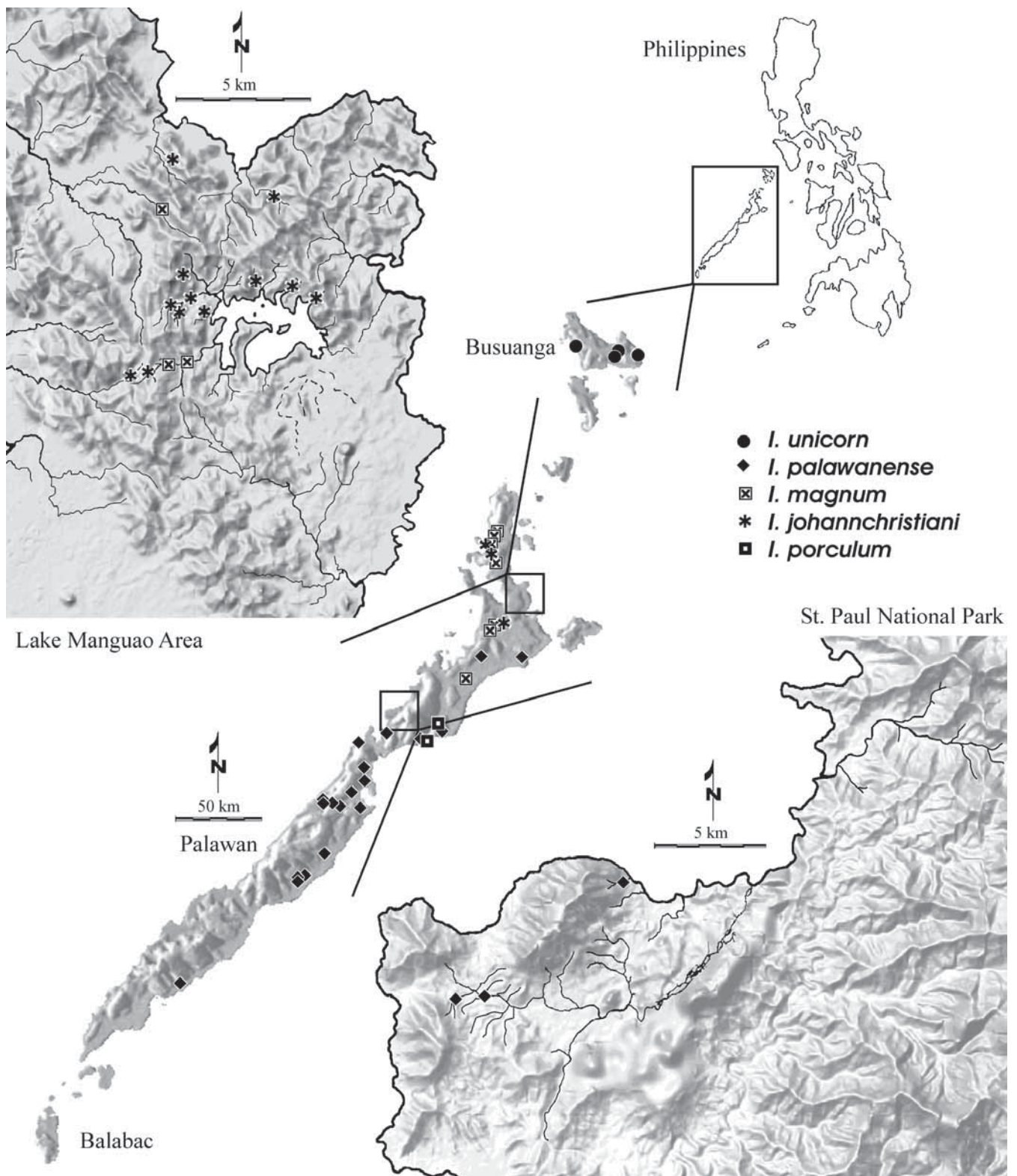


Fig. 12. Distribution of *Insulamon* records in Greater Palawan (Ng & Takeda, 1992; Freitag, 2005; recent study) with enlarged maps of the AQUA Palawana Program study sites at the Lake Manguao area and the St. Paul Subterranean River National Park.



Fig. 13. Colour in live *Insulamon* species. A–E, *I. magnum*, new species (A, B, male; C–E, oviigerous female). F, G, *I. palawanense*, new species (both male). H, I, *I. johannchristiani*, new species (H, female; I, male).

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