

Indopinnixa shellorum, a new species of pea crab (Crustacea: Brachyura: Pinnotheridae) associated with a sipunculid from Singapore

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Abstract. A new species of pea crab associated with a sipunculid worm, *Indopinnixa shellorum*, is described from St. John's Island in Singapore. The new species is morphologically similar to *I. kasijani* Rahayu & Ng, 2010, from Lombok, Indonesia, but can be distinguished by its punctate carapace surface, relatively longer ambulatory legs, as well as its differently structured male abdomen and male first gonopod.

Key words. Pea crab, *Indopinnixa*, new species, taxonomy, Singapore, Pinnotheridae

INTRODUCTION

Indopinnixa Manning & Morton, 1987, is a genus of pinnotherid crabs often associated with sipunculan worms in East and Southeast Asia. Currently, six species are recognised: *I. kasijani* Rahayu & Ng, 2010, *I. kumejima* Naruse & Maenosono, 2012, *I. moosai* Rahayu & Ng, 2010, *I. mortoni* Davie, 1992, *I. oryza* Naruse & Maenosono, 2012, and *I. sipunculana* Manning & Morton, 1987 (type species) (Ng et al., 2008; Rahayu & Ng, 2010; Naruse & Maenosono, 2012).

Material examined is deposited in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (formerly Raffles Museum of Biodiversity Research), National University of Singapore. The following abbreviations are used: P2–P5 = first to fourth ambulatory legs, respectively; G1 = male first gonopod; G2 = male second gonopod. Measurements provided (in millimetres), are of the carapace width and length, respectively.

TAXONOMY

Family Pinnotheridae De Haan, 1833

Indopinnixa Manning & Morton, 1987

Remarks. Naruse & Maenosono (2012: 223) reviewed the status of *Indopinnixa*, documenting the wide range of variation in the carapace structure as well as the extent of fusion of the male abdominal somites, ranging from somites 3–6, 4–6, and only 5 and 6. They noted that the male abdominal condition in some species of *Pinnixa*

White, 1846, also overlapped with that of *Indopinnixa*, contravening one of the supposedly diagnostic characters of the genus observed by Manning & Morton (1987); which is having male abdominal somites 5 and 6 fused. In *I. shellorum*, new species, male abdominal somites 4–6 are immobile, despite all the sutures between them being distinct. As has been discussed in Ng et al. (2008: 14), they should be regarded as functionally fused (see also Ng & Chia, 1994).

Naruse & Maenosono (2012) suggested that *Indopinnixa* will probably have to be redefined in the context of a revision of *Pinnixa*, which clearly contains several morphologically distinct groups. The taxonomic position of some taxa (notably *I. oryza*, which has an atypical male abdomen and G1 for an *Indopinnixa* species) will have to be re-appraised at that time.

Indopinnixa shellorum, new species (Figs. 1–3)

Material examined. Holotype – male (4.01 × 2.45 mm) (ZRC 2014.0367), station YB63, second lagoon, next to public jetty and swimming area, St. John's Island, 1°13'19.72"N 103°50'51.70"E, intertidal mud-sand flats, in lagoon, 0.3–1 m, 1700 hours, coll. A. Anker, yabby pump, 24 May 2013.

Comparative material. *Indopinnixa kasijani* Rahayu & Ng, 2010: Paratype – 1 ovigerous female (5.20 × 2.60 mm) (ZRC 2010.0097), apparently free living in shell and coral debris in intertidal seagrass area, Ekas, East Lombok, Indonesia, coll. 23 July 2009. *Indopinnixa moosai* Rahayu & Ng, 2010: Paratypes – 3 males (4.00 × 2.00 mm; 3.30 × 1.75 mm; 4.50 × 2.25 mm) (ZRC 2010.0098), 2 ovigerous females (5.50 × 2.70 mm; 3.75 × 1.92 mm) (ZRC 2010.0099), 2 females (4.30 × 2.15 mm; 3.50 × 1.75 mm) (ZRC 2010.0100), apparently free living in sand substrate with shell and coral debris, intertidal area, Sira, West Lombok, Indonesia, coll. 21 July 2009.

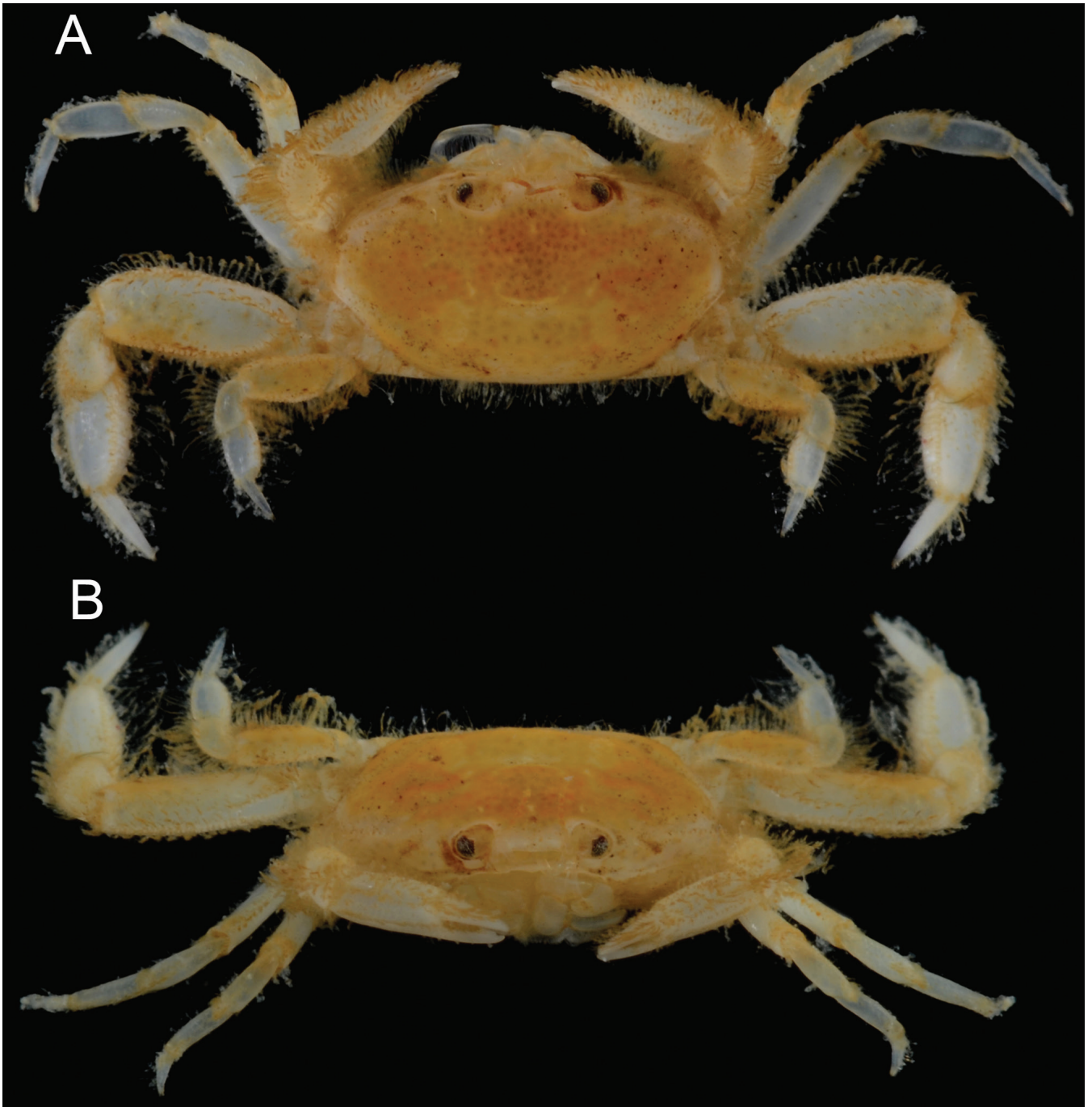


Fig. 1. *Indopinnixa shellorum*, new species, holotype male (4.01×2.45 mm) (ZRC 2014.0367), St. John's Island, Singapore. A, dorsal view; B, frontal view. Photographs by A. Anker.

Description. Carapace transversely ovate, 1.63 times broader than long (Figs. 1A, 2A, 3A); dorsal surface of carapace gently convex, punctate, otherwise smooth; regions poorly defined, only H-shaped median gastro-cardiac groove visible; cardio-intestinal region with low but distinct transverse ridge (Figs. 1A, 2A, 3A). Frontal margin slightly bilobed, ca. 0.15 times carapace width, separated from supraorbital margin by low indentation (Figs. 2A, 3A). Supraorbital margin entire; eye completely filling orbit; ocular peduncle stout, smooth; cornea large, pigmented (Figs. 1A, B, 2A, 3A). Suborbital margin smooth, entire; subhepatic region with low oblique ridge; suborbital and pterygostomial regions smooth (Fig. 1B).

Hepatic and subhepatic regions prominently swollen, forming convex structure (Figs. 2A, 3A). Anterolateral margin arcuate, defined by crest of uneven granules, not confluent with supraorbital margin by crest, starting some distance from orbit, forming large protuberance at widest point; posterolateral margin smooth, sinuous, distinctly converging towards almost straight posterior carapace margin (Figs. 2A, 3A). Antennules globular; basal article rounded; folding obliquely. Antennae with quadrate basal article; flagellum long, just entering orbital hiatus. Epistome longitudinally narrow, posterior margin with low, broadly triangular median part, lateral margins sinuous (Fig. 1B).

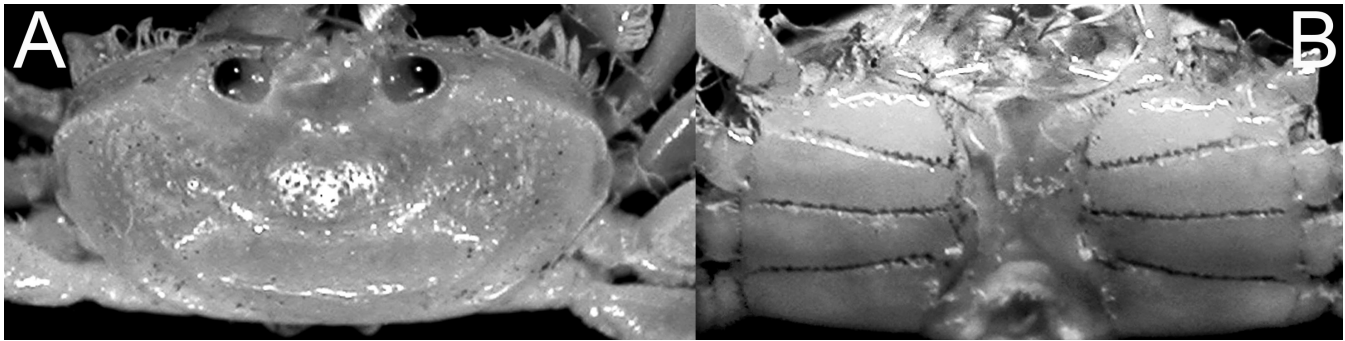


Fig. 2. *Indopinnixa shellorum*, new species, holotype male (4.01 × 2.45 mm) (ZRC 2014.0367), St. John's Island, Singapore. A, dorsal surface of carapace; B, anterior thoracic sternum and sterno-abdominal cavity.

Third maxilliped elongated, buccal space between third maxillipeds mostly covered by large propodus and dactylus (Figs. 1B, 3B). Ischium and merus completely fused to form a subtriangular plate, without median sulcus, outer margin with shallow depression, probably marking junction between articles; carpus subovate; propodus subovate, spatuliform; elongated spatuliform dactylus inserted on median ventral margin of propodus, distal part wider than proximal, tip truncate (Fig. 3B); mesial margins of dactylus, propodus, carpus and ischio-merus with comb-like setae, dactylar, propodal setae very long, ischio-meral relatively shorter, carpal shortest. Exopod shorter than ischio-merus, tapering distally, proximolateral part of outer margin with subtriangular lobiform structure; with long flagellum (Fig. 3B).

Chelipeds subequal, outer surface with but not obscured by short plumose setae (Figs. 1A, B, 3D). Basis-ischium fused but suture visible, margins smooth. Merus relatively short, subtrapezoidal, margins smooth. Carpus with row of low granules on distal margin (Fig. 3D). Outer surface of manus mostly smooth, partially punctated, with median longitudinal row of low granules and setae; dorsal and outer subdorsal surface with scattered low, rounded granules; surface adjacent to propodal finger with longitudinal row of shallow pits; fingers relatively stout, pointed tips crossing when closed, forming hiatus; dactylus smooth, sparse setae on upper margin, cutting edge with large teeth proximally; propodal finger smooth, cutting edge with several moderately teeth, subdistal tooth largest (Fig. 3D).

Ambulatory legs long, P3 longest, P5 shortest (Figs. 1A, 3E–H). P2 slender, elongate, margins with scattered short plumose setae; ventral margin of basis uneven; dorsal margin of merus entire; carpus elongate; margins of propodus entire; dactylus elongate, gently curved (Figs. 1A, 3E). P3 slender, elongate, margins with scattered short plumose setae; ventral margin of basis granular; dorsal margin of merus gently granular; carpus elongate; ventral margin of propodus gently serrated on distal half; dactylus elongate, gently curved (Figs. 1A, 3F). P4 stout, large, margins with numerous long plumose setae; basis with row of granules on margins; merus subovate, 2.22 times longer than broad, ventral margin bicarinate, crests lined with

prominent granules, dorsal margin granular, proximal part bicarinate; carpus short, propodus subovate, ventral margin bicarinate along distal part, granulated; dactylus elongate, almost straight (Figs. 1A, 3G). P5 short, with numerous long plumose setae; basis granular on ventral margin, merus with ventral margin distinctly granular, carpus short, ventral margin granular; dactylus short, almost straight (Figs. 1A, 3H).

Thoracic sternum wide; sternites 1 and 2 fused, sunken into buccal cavity with median part of sternite 3; only lateral parts of sternite 3 clearly visible; sternite 3 separated from sternite 4 by distinct suture; sternite 8 wide, not covered by male abdomen (Fig. 2B). Sterno-abdominal cavity deep, reaching to base of buccal cavity; telson touching base of third maxillipeds (Fig. 2B). Margin of sterno-abdominal cavity along sternites 4–6 distinctly granular; that on sternite 6 raised to form ledge-like structure that grips closed abdomen; press-button abdominal locking mechanism not obvious, no distinct tubercle or granule on sternite 5 (Fig. 2B). Penis sternal.

Male abdomen relatively broad; somites 1 and 2 transversely wide and short; somite 3 trapezoidal; somites 4–6 effectively fused, somites immobile although sutures clearly visible, suture between somites 4 and 5 deeper than that between somites 5 and 6; somite 4 with lateral margin deeply indented, forming almost right-angled cleft; lateral margin of somite 5 distinctly concave; distal margin of somite 6 distinctly wider than proximal margin, lateral margin gently concave; telson wider than somite 6, distal margin sinuous, lateral margin strongly convex (Fig. 3C).

G1 relatively long, apical process long with distal part curved upwards, tip rounded; outer margin with long plumose setae, subdistal surfaces before and around apical process with numerous very long, plumose setae which obscure margins, surface of apical process just before curvature with numerous long simple setae which obscure margin (Fig. 3I–K). G2 very short, with spatuliform tip, ca. quarter length of G.

Colour. Overall orange-white, with dorsal surfaces darker (Fig. 1).

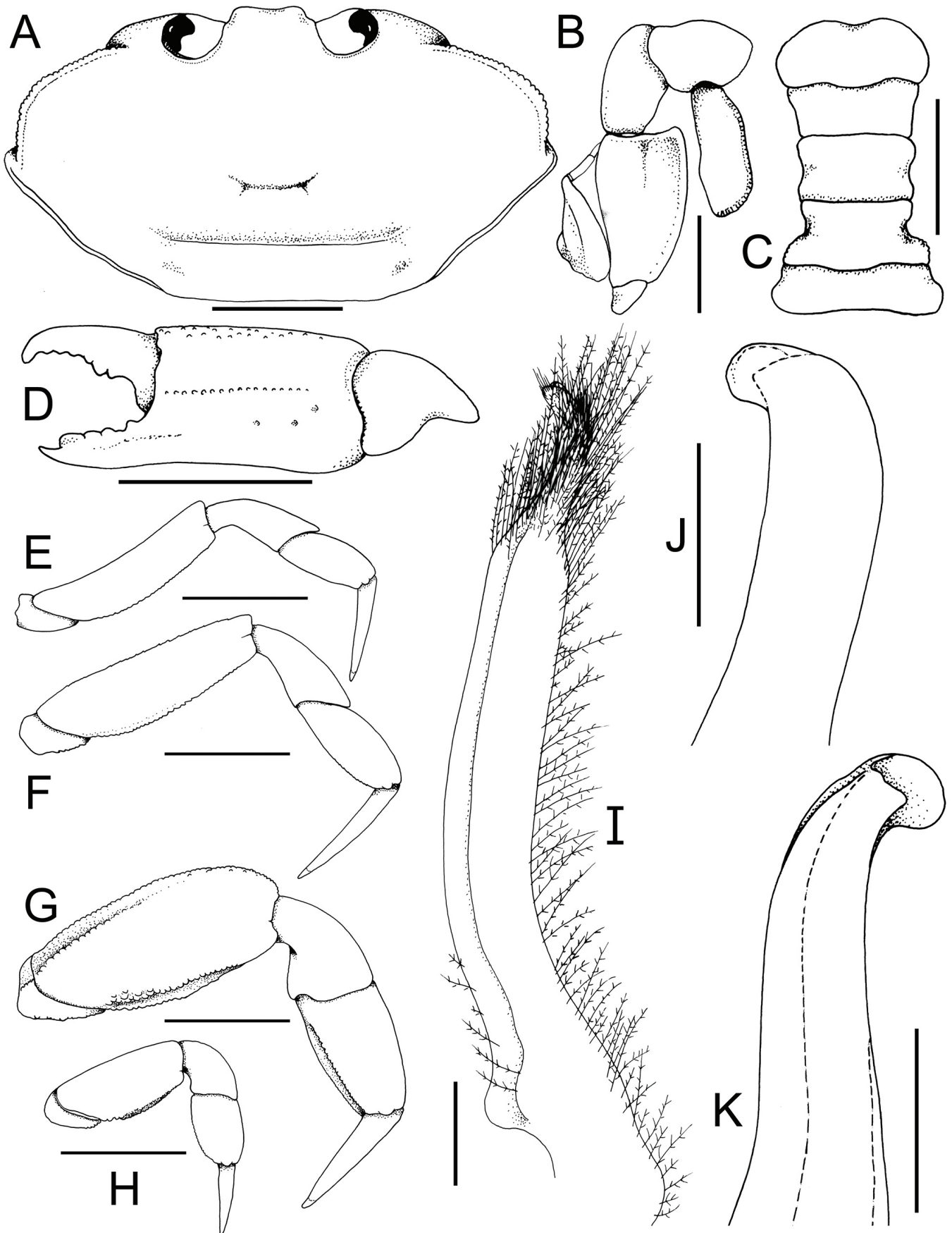


Fig. 3. *Indopinnixa shellorum*, new species, holotype male (4.01 × 2.45 mm) (ZRC 2014.0367), St. John's Island, Singapore. A, dorsal view of carapace (punctuation not drawn); B, right third maxilliped (setae not drawn); C, telson and abdominal somites 3–6; D, outer view of left chela; E, right P2; F, right P3; G, right P4; H, right P5; I, left G1 (ventral view); J, distal part of left G1 (ventral view, setae not drawn); K, distal part of left G1 (dorsal view, setae not drawn). Setae on chela and ambulatory legs not drawn. Scales: A, C–H = 1.0 mm; B = 0.5 mm; I = 0.2 mm; J, K = 0.1 mm.

Etymology. This species is named after the employees of Shell Singapore Private Limited. Since 1978, Shell Singapore Private Limited has strongly supported a national science program (with the Singapore Science Centre) to train young students in research, for which the author is grateful. In addition, Shell Singapore has generously sponsored the Raffles Museum Visiting Scientist Program for many years, which is designed to increase our knowledge of Singapore biodiversity. The company is also a major supporter of the Comprehensive Marine Biodiversity Survey Project, organised by National Parks Board (Singapore) to document the marine plants and animals on the island, and during which the present new species was collected.

Habitat. *Indopinnixa shellorum*, new species, was collected from the burrow of a sipunculid, *Sipunculus* (*Sipunculus*) *norvegicus* Danielssen, 1869 (Sipuncula: Sipunculidae) at low tide (ZRC.SIP.0001). *Sipunculus norvegicus* is a widely distributed species from the Atlantic and Indo-West; and has been found in both shallow and deep waters (Cutler, 1994). In southern China, it has been recorded from intertidal zones (Zhou et al., 2007).

Remarks. *Indopinnixa shellorum*, new species, is most similar to *I. kasijani* in the general form and proportions of the carapace, and has a similar G1 structure in which the tip is distinctly curved. However, it can be distinguished by the dorsal surface of the carapace being punctate (Fig. 2A) (completely smooth and even in *I. kasijani*, Rahayu & Ng, 2010: fig. 1A, B); the P2–5 are proportionately longer (Figs. 1, 3E–H) (relatively shorter and stouter in *I. kasijani*, Rahayu & Ng, 2010: fig. 2C–F); the proportionately wider male telson and abdominal somite 6 (Fig. 3C) (relatively narrower in *I. kasijani*, Rahayu & Ng, 2010: fig. 3C); the deep and distinct suture between male abdominal somites 5 and 6 (Fig. 3C) (shallow and less distinct in *I. kasijani*, Rahayu & Ng, 2010: fig. 3C); the lateral margin of male abdominal somite 4 is deeply indented forming an almost right-angled cleft (Fig. 3C) (margin concave in *I. kasijani*, Rahayu & Ng, 2010: fig. 3C); and the relatively shorter and stouter G1 (Fig. 3I) (more elongate in *I. kasijani*, Rahayu & Ng, 2010: fig. 3A, B).

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