

## First record of the deep-water xanthid crab genus, *Pulcratis* Ng & Huang, 1997, from the Indian Ocean, with description of a new species (Crustacea: Brachyura: Xanthidae)

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### ABSTRACT

The monotypic xanthid crab genus *Pulcratis* Ng and Huang, 1997, previously known only from the South China Sea, is recorded for the first time in the Indian Ocean. The new material was collected by commercial trawlers fishing off the coast of Tamil Nadu state, in southeastern India, and represents a new species, herein described. *Pulcratis amabilis* n. sp. is similar to the only other congener and type species, *P. reticulatus* Ng and Huang, 1997, in the general form and fresh coloration, but differs mainly in the outline of the carapace, and morphology of the chelipeds, and the male pleon and gonopods. The subfamilial classification of *Pulcratis* within Xanthidae is also discussed.

### KEYWORDS

Decapoda, Xanthoidea, Zosiminae, Xanthinae, *Pulcratis amabilis*, Tamil Nadu, India, taxonomy

### INTRODUCTION

The deep-water xanthid crab, *Pulcratis reticulatus* Ng and Huang, 1997, was described as a new genus and species based on material trawled off the southern coast of Taiwan. Subsequently, this species has also been recorded further south in the South China Sea (Ng and Chen, 2004). Recently, a few specimens resembling this species was brought to the attention of the first author. They had been collected by commercial trawlers operating near the

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south-eastern coast of India, in the Bay of Bengal. These trawlers land both commercially important catch and relatively low-value bycatch (consisting of brachyuran crabs and other decapod crustaceans) in the Pazhayar fish port, Nagapattinam district, Tamil Nadu state. Some recent work on deep-water brachyurans, including descriptions of new taxa, have been made possible from material collected from this port, contributing to a better understanding of the regional diversity of brachyurans in India (Ng *et al.*, 2017a; 2017b; 2018; Prema *et al.*, 2017; 2019). After detailed morphological comparisons with the type material and other material of *P. reticulatus*, the Indian specimens are considered to be a new species and are described herein. The subfamilial classification of *Pulcratis* within the family Xanthidae is also discussed in light of recent developments in the understanding of evolutionary relationships among xanthid crabs.

## MATERIAL AND METHODS

Material examined is deposited in the Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India (CASAU); and the Zoological Reference Collection of the Lee Kong Chian Natural History Museum, National University of Singapore (ZRC). Measurements provided, in millimetres (mm), are of the maximum carapace width and the carapace length at the midline. The following abbreviations are used: G1, G2 = first and second male pleopods, respectively; P1–P5 = first to fifth pereopods, respectively. The nomenclature for the carapace regions follows Dana (1852) (also Serène, 1984).

## SYSTEMATICS

### Superfamily Xanthoidea MacLeay, 1838

#### Family Xanthidae MacLeay, 1838

#### Subfamily Xanthinae MacLeay, 1838 *sensu lato*

#### *Pulcratis* Ng and Huang, 1997

*Pulcratis* Ng and Huang, 1997: 272. — Ng *et al.*, 2008: 206. — De Grave *et al.*, 2009: 43.

*Type species. Pulcratis reticulatus* Ng and Huang, 1997, by original designation, gender masculine.

*Remarks.* The subfamilial placement of *Pulcratis* in Xanthidae requires further evaluation. Ng and Huang (1997) assigned it to Zosiminae Alcock, 1898 (*sensu* Serène, 1984), primarily due to the cristate margins of the meri of the ambulatory legs, and cited its similarity in general form and color pattern to *Paratergatis* Sakai, 1965 (type and only species: *P. longimanus* Sakai, 1965). Jeng and Ng (1998) commented further on the morphological distinctions between *Paratergatis* and *Pulcratis*.

Subsequently another new genus, *Ovatis* Ng and Chen, 2004 (type species: *O. simplex* Ng and Chen, 2004; monotypic), was described from the South China Sea. Ng and Chen (2004) considered *Ovatis* to be closely related to *Liagore* De Haan, 1833, and assigned it to Xanthinae MacLeay, 1838. They also noted the morphological similarities among the xanthines, *Ovatis* and *Liagore*, and the zosimines, *Paratergatis* and *Pulcratis*, leading them to note that the only definitive morphological character being used to separate members of the two subfamilies is whether or not the articles of the ambulatory legs are cristate, and even then, there are difficulties in assessing the degree of such cristation. Ng *et al.* (2008) also pointed out incongruencies in the larval morphology of members of these two groups (see also Ng and Clark, 1994; Clark *et al.*, 2004).

A comprehensive phylogeny of the family Xanthidae was provided by Lai *et al.* (2011) on the basis of four molecular markers (*viz.*, 12S, 16S, COI and H3) sequenced from 147 species. In their consensus tree (Lai *et al.*, 2011: fig. 1), the subfamily Xanthinae was shown to be polyphyletic, with members scattered across 10 distinct clades (Xan 1–10) with varying levels of support. The nominal type genus, *Xantho* Leach, 1814, represented by *X. pilipes* A. Milne-Edwards, 1867, and *X. hydrophilus* (Herbst, 1790), formed its own well-supported clade (Xan 4) distinct from all the other ‘xanthine’ clades. *Pulcratis reticulatus* was nested in a well-supported clade (Xan 1) together with some species of *Demania* Laurie, 1906 [*D. cultripes* (Alcock, 1898), *D. scaberrima* (Walker, 1887) and *D. intermedia* Guinot, 1969], *Neoxanthias* Ward, 1933 [*N. michelae* Serène and Vadon, 1981], *Odhneriana* Ng and Low, 2010 [*O. echinus* (Alcock, 1898)], and

*Liagore* De Haan, 1833 (*L. rubromaculata* De Haan, 1835). Likewise, the subfamilies Zosiminae Alcock, 1898, and Liomerinae Sakai, 1976, were also shown to be polyphyletic, with members split into two distinct clades for each subfamily. *Paratergatis longimanus* actually has closer relationships to true liomerines as it was in a separate well-supported clade (Lio 1; *i.e.*, Liomerinae *sensu stricto*) together with some species of *Liomera* Dana, 1851 [*viz.*, *L. tristis* (Dana, 1852), *L. venosa* (H. Milne Edwards, 1834), *L. bella* (Dana, 1852), *L. cinctimana* (White, 1847)], *Lipkembra* Davie, 2010 [*viz.*, *L. corallina* (Takeda and Marumura, 1997) and *L. holthuisi* Mendoza, 2010] and an undescribed genus and species [*viz.*, “New genus 1 sp. nov.”]. *Ovatis* was not represented in the molecular tree.

Given the presently available evidence, *Pulcratis* is tentatively assigned to Xanthinae *sensu lato* (*viz.*, Ng *et al.*, 2008) pending a revision of this polyphyletic subfamily. Lai *et al.* (2011: 430, 431) did propose some diagnostic characters for the xanthine clade (Xan 2) to which *Pulcratis* belongs: “The characters that define this clade are the presence of distinct longitudinal rows of dense setae on the dactylus of all four ambulatory legs, a broad male thoracic sternite 7, abdominal somites 1 and 2 broad; male thoracic sternite 8 just visible when abdomen is closed, episternites 5–7 delimited by a sulcus, and coxo-sternal condyle of P5 inserted between abdominal somites 2 and 3.” Not all of these characters, however, can be observed in *Pulcratis*. In particular, the episternites 5–7 do not have sulci separating them from their respective thoracic sternites. The xanthid crab group, ‘tribe Liagorini’ (*viz.*, Števcic, 2005) may be an available name for this clade (*i.e.*, perhaps as subfamily Liagorinae), but the formal action required is not part of the scope of this current paper, as the proper taxonomic ranking and morphological diagnosis can only be made in the context of a family-wide revision and after sufficient examination of a large number of related taxa.

***Pulcratis amabilis* n. sp.**

(Figs. 1, 2A–D, 3, 4)

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*Type material.* Holotype, male, 15.3 × 11.3 mm (CASAU), among bycatch of commercial near-shore trawlers (from depths of 50–100 m), Pazhayar fish

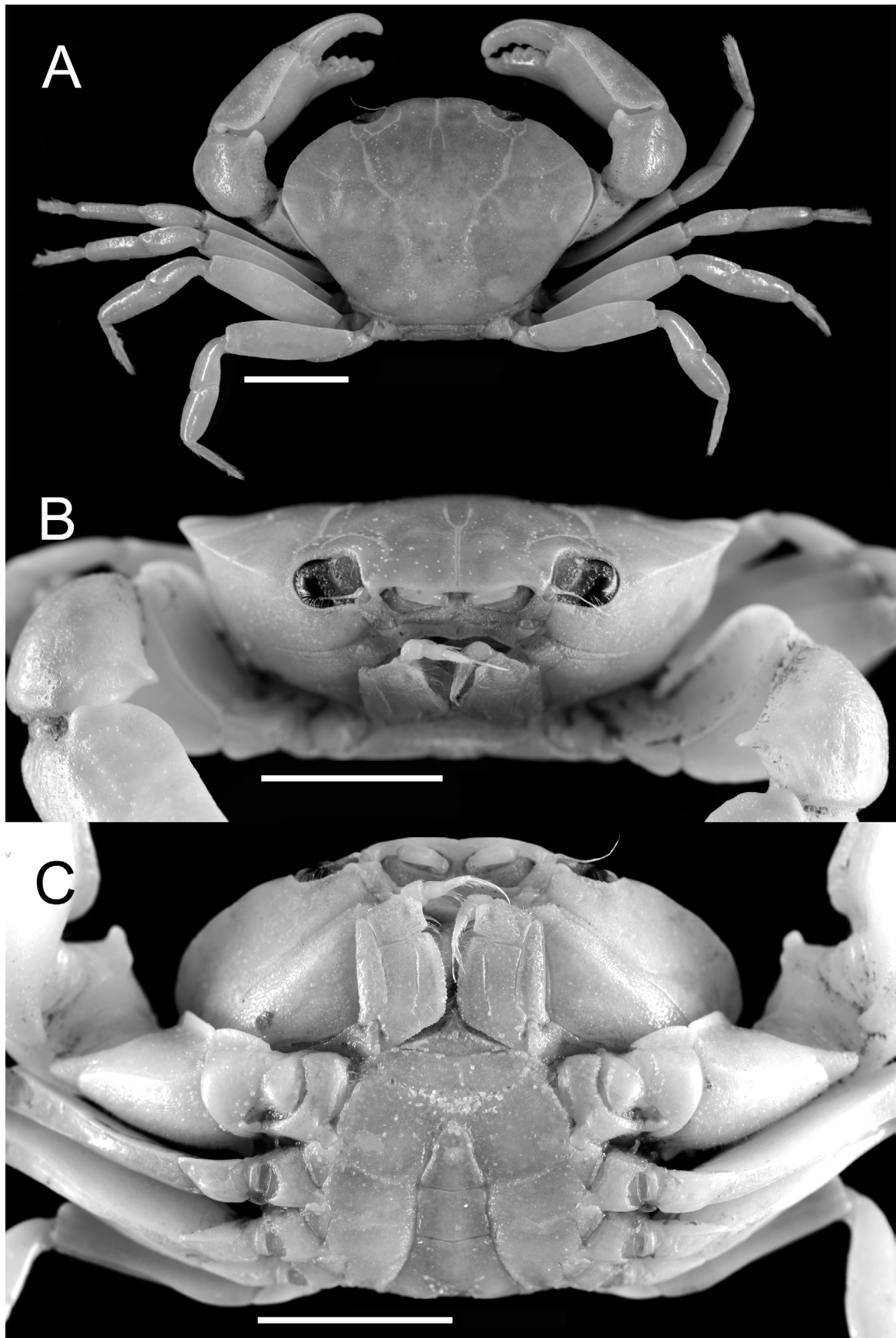
port, Nagapattinam District, Tamil Nadu, India, coll. S. Ravichandran and M. Prema, Sep. 2018. Paratypes: 1 female, 12.5 × 9.1 mm (CASAU), same data as holotype; 1 ovig. female, 13.9 × 9.8 mm (CASAU), from bycatch of commercial near-shore trawlers, Pazhayar fish port, Nagapattinam District, Tamil Nadu, India, coll. S. Ravichandran and M. Prema, 18 Mar. 2018.

*Comparative material.* *Pulcratis reticulatus* Ng and Huang, 1997: holotype, male, 15.0 × 10.6 mm (ZRC 1997.0662), from commercial near-shore trawler, 100–400 m depth, Tungkang fish port, Pingtung, Taiwan, coll. S.-H. Lai, 4 Aug. 1996; paratypes, 1 ovig. female, 14.0 × 10.1 mm (ZRC 1997.0402), 1 female, 13.7 × 9.9 mm (NTOU; ZRC 2001.0137 – long-term loan), from commercial near-shore trawler, 100–400 m depth, Tungkang fish port, Pingtung, Taiwan, coll. P.K.L. Ng, 5 Aug. 1996.

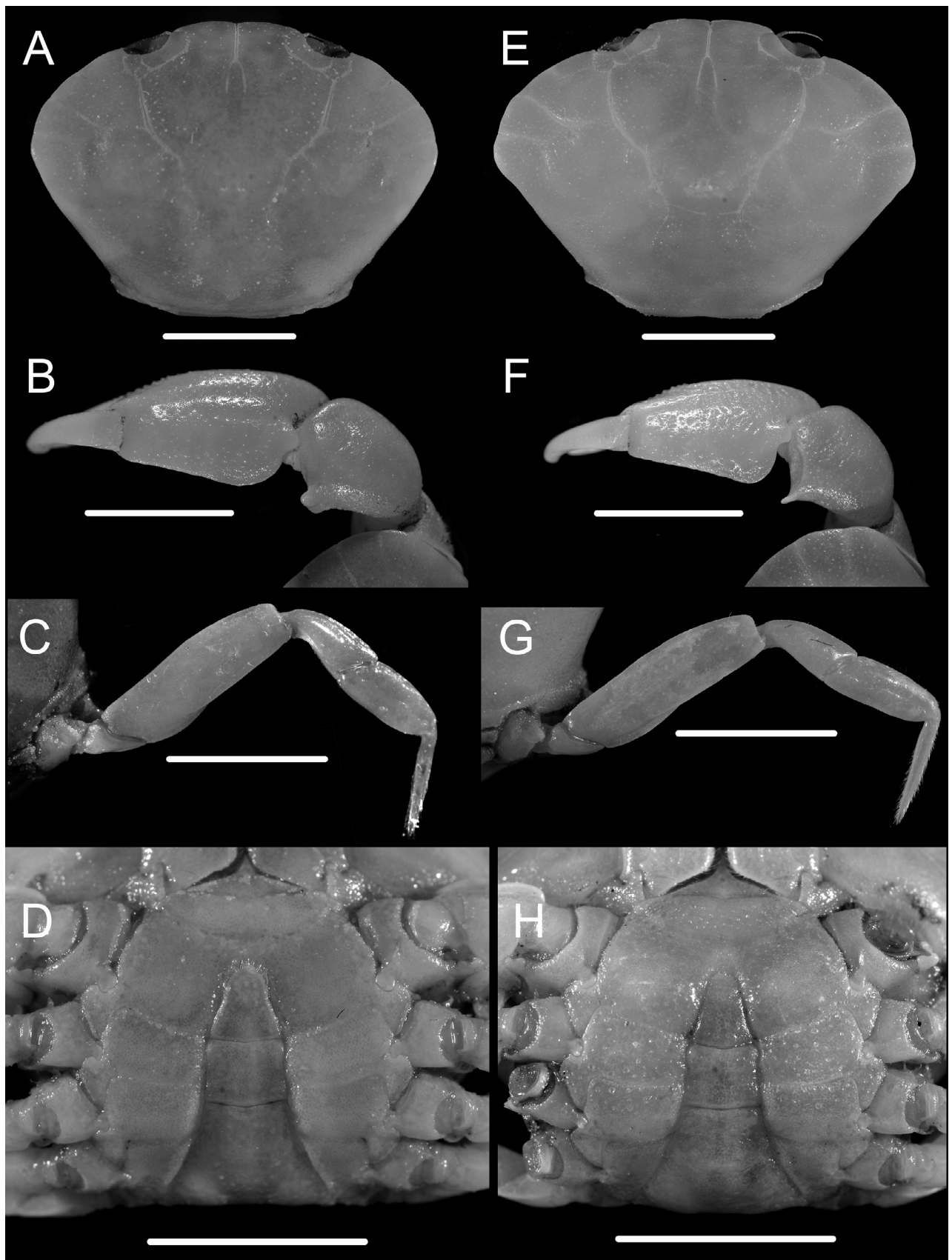
*Etymology.* The specific epithet “*amabilis*”, L. lovely (adj.), is used, alluding to the beautiful pattern of the fresh colouration of the new species.

*Description.* Carapace (Figs. 1A, 2A) subhexagonal, broader than long, maximum width approximately 1.4 times length at midline; regions poorly defined, cervical groove narrow, gastric grooves indistinct or incomplete; 2M entire with inner margins mostly fused with 3M, only anterior tip of 3M bounded by thin grooves, the rest indiscernible, posterior part fused with 4M, 1P; 1L, 2L, 3L fused, bounded mesially by cervical groove, laterally by thin groove running from notch between second and third lobes of carapace anterolateral margin to cervical groove; dorsal surfaces smooth, slightly punctate, glabrous. Front barely projecting beyond level of orbits, slightly deflexed ventrally, bilobate, lobes separated by narrow fissure which connects with anterior tip of 3M, anterior margin of each lobe broadly convex in dorsal view. Supra-, infraorbital margins finely granular. Anterolateral margin gradually joining junction of supra- and infraorbital margins, widely arcuate, with sharp edge (subcristate) feebly divided into 4 very low lobes (including external orbital angle), each lobe with slightly convex margin, demarcated by short but distinct fissure, except for fissure between second and third lobe which joins with cervical groove; junction of antero-, posterolateral margins rounded; posterolateral margins almost straight, lined with numerous small, rounded granules; posterior margin of carapace distinctly sinuous, lined with small, rounded granules.





**Figure 1.** *Pulcratis amabilis* n. sp., holotype, male, 15.3 × 11.3 mm (CASAU), Pazhayar Fish Port. **A**, dorsal habitus; **B**, cephalothorax, frontal view; cephalothorax, ventral view. Scale bar: 5 mm.

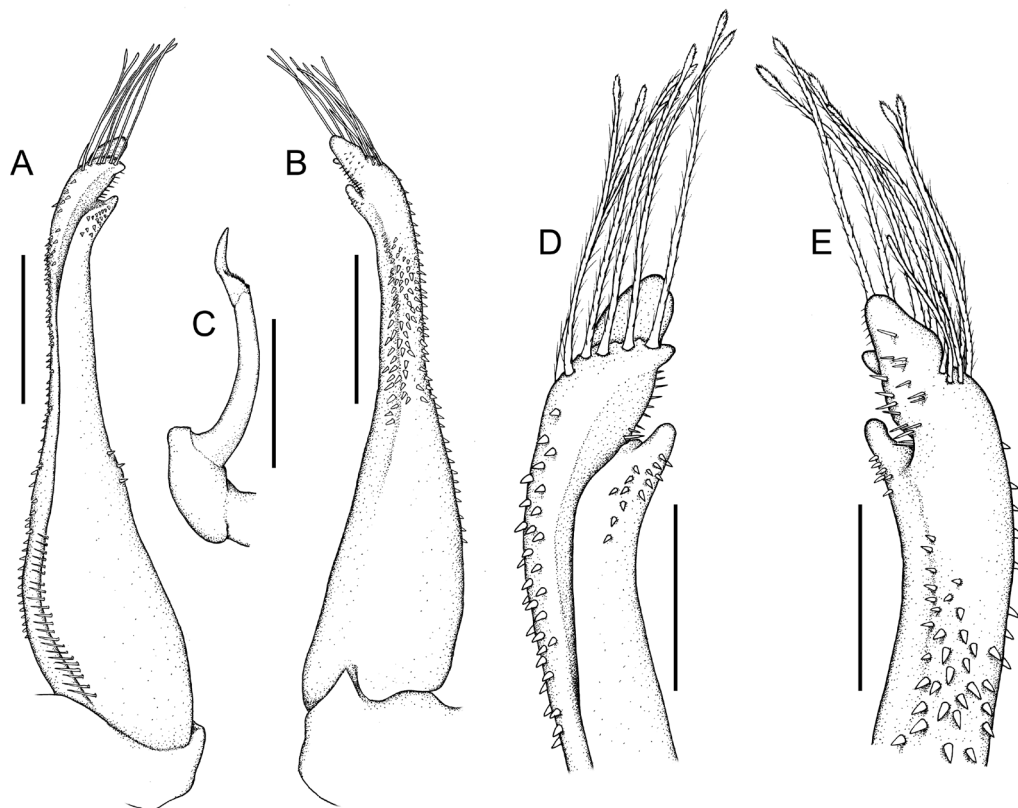


**Figure 2.** *Pulcratis amabilis* n. sp., holotype, male, 15.3 × 11.3 mm (CASAU), India (A–D); *P. reticulatus* Ng and Huang, 1997, holotype, male 15.0 × 10.6 mm (ZRC 1997.0662), Taiwan (E–H). A, E, Carapace, dorsal view; B, F, right cheliped, dorsal view; C, G, right PS, dorsal view; D, H, thoracic sternum and pleon, ventral view. Scale bar: 5 mm.

Eyes (Fig. 1B) well developed, filling entire orbit, corneas large; distal part of ocular peduncle finely granulated. Basal antennal segment (Fig. 2B, C) subrectangular, completely filling orbital hiatus; antennal flagellum not obstructed from orbital hiatus. Antennular fossa (Fig. 1B) broadly ovate, antennules folding transversely, slightly obliquely. Third maxilliped (Fig. 1B, C) merus subquadrate, slightly broader than long, with shallow submedian depression; ischium subrectangular, twice as long as broad, with submedian oblique sulcus, inner margin minutely crenulated; exopod stout, tapering distally, distal tip reaching anterolateral angle of merus, inner margin with subdistal triangular projection, flagellum present, well-developed. Epistome (Fig. 1B) well developed, with 1 median fissure, 2 lateral fissures, dividing posterior margin into 4 lobes; margins of lateral lobes slightly convex, margins of mesial lobes slightly concave; central portion projecting slightly. Endostomial ridges indiscernible.

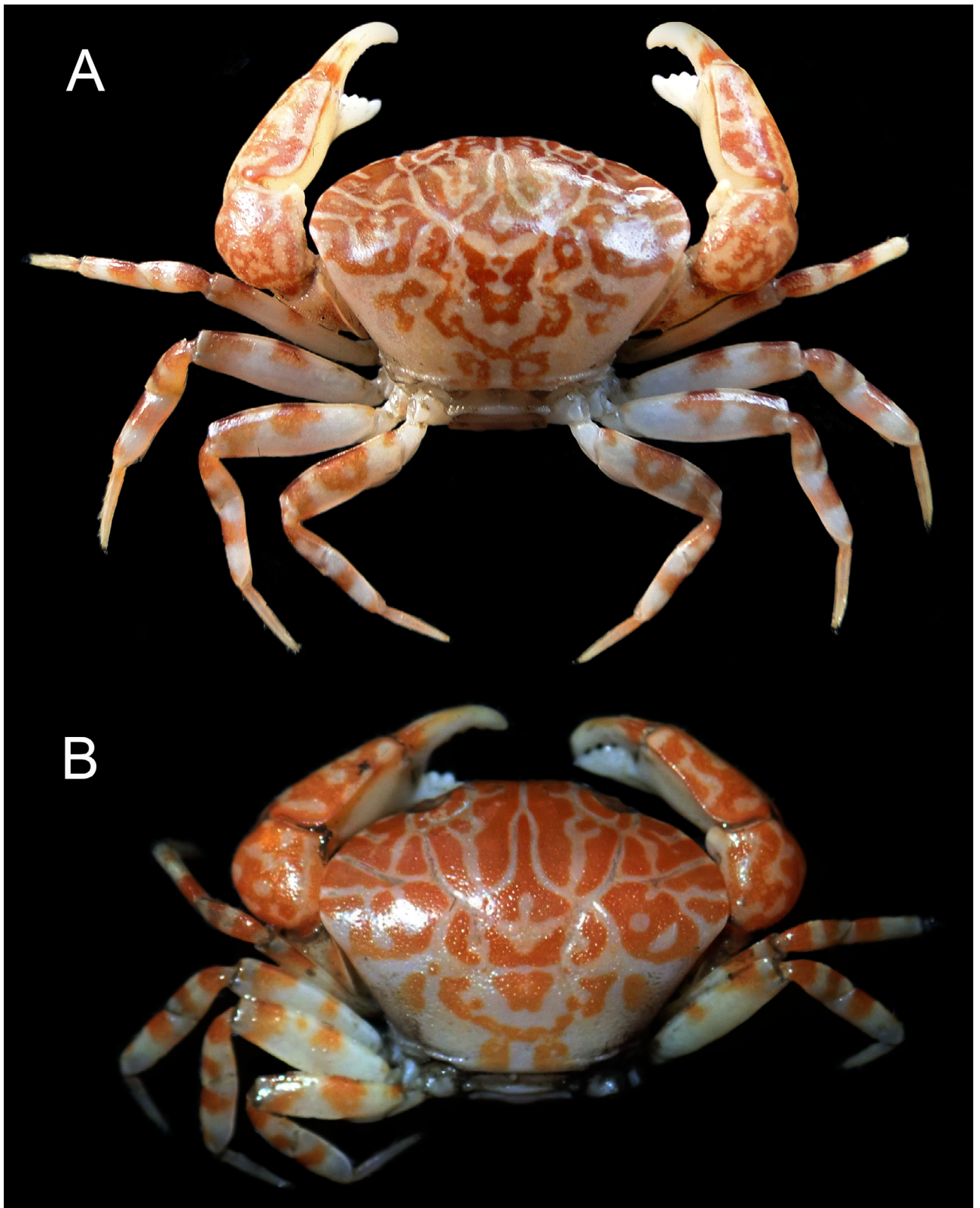
Male thoracic sternum (Figs. 1C, 2D) smooth, glabrous, pitted in some parts. Sternites 1, 2 completely

fused, triangular; distinct suture present between sternites 2/3; suture between sternites 3/4 medially interrupted with only lateral parts distinct as lateral notches, median part replaced with transversely curved furrow; sutures between sternites 4/5, 5/6, 6/7 interrupted medially in sterno-pleonal cavity; suture between sternites 7/8 complete. Sternite 4 broad, without externally visible median longitudinal line. Lateral margins of sternites 2–4 finely granulated. Exposed portions of sternites 5–7 smooth, broad, relatively short. Very small part of sternite 8 exposed between pleonal somite 2 and P5 coxa when pleon closed over sterno-pleonal cavity. Episternites 5–7 without shallow sulci separating them from main portion of respective sternites; episternite 7 broad, nearly as wide as anterior part. Sternopleonal cavity moderately deep; tubercles of sternopleonal lock placed anteriorly on sternite 5 near suture with sternite 4; within cavity median longitudinal line absent at level of sternites 4–6, present but interrupted on anterior level of sternite 7, complete at level of sternite 8.



**Figure 3.** *Pulcratis amabilis* n. sp., holotype, male, 15.3 × 11.3 mm (CASAU), Pazhayar fish port. Left G1 (A, B): A, pleonal view; B, sternal view; distal tip of left G1 (D, E): D, pleonal view; E, sternal view. Left G2 (C): pleonal view. Scale bar: A–C = 1.0 mm; D, E = 0.5 mm.





**Figure 4.** *Pulcratis amabilis* n. sp., fresh coloration. **A**, holotype, male, 15.3 × 11.3 mm (CASAU); **B**, paratype, female, 12.5 × 9.1 mm (CASAU).

Chelipeds (P1) (Figs. 1A, 2B) robust in both males and females, subequal, surfaces glabrous, smooth to slightly punctate or pitted; outer surface of chela finely punctate, with low row of granules on subventral margin which continues into and throughout length of fixed finger; fingers shorter than palm, dorsal margin of dactylus with distinct crest, cutting edges each with several large, sharp-edged, triangular teeth, fingertips pointed; dorsal margin of palm with well-developed transverse lamellar crest extending inward, lamellar crest broadest proximally near articulation with carpus; inner margin of carpus with well-developed lamelliform tooth which appresses on broadest part of transverse crest on palm; dorsal, ventral margins of merus strongly cristate.

Ambulatory legs (P2–P5) (Figs. 1A, 2C) moderately long, robust, P3, P4 longest; merus distinctly cristate throughout entire length of dorsal margin, but only on proximal half of ventral margin; carpus with low dorsal crest; propodus with low dorsal, ventral crests; dactylus styliform, ending distally in simple chitinized claw, with well-defined longitudinal row of supple setae on flexor margin, 2 such rows on extensor margin (dorsal and ventral surfaces), but otherwise unarmed. Dactylo-propodal locking mechanism absent.

Male pleon (Figs. 1C, 2D) relatively broad, short, apex of telson reaching past imaginary transverse line connecting sterno-coxal condyles of P1; lateral margins distinctly concave; somite 1 slightly broader than somite 2; somites 3–5 completely fused without trace of sutures; somite 6 subquadrate, width-to-length ratio = 1.2, lateral margins slightly concave; telson subtriangular, basal width subequal to median length, lateral margins slightly concave, apex widely rounded.

G1 (Fig. 3A, B, D, E) gently curving laterally from base to tip; with distinct papilliform process on inner subdistal margin; sternal surface with numerous short, sharp granules covering most of distal half of G1; tip lamelliform, with seven long, plumose setae. G2 (Fig. 3C) short, sigmoid in shape; terminal segment about one-third length of subterminal segment. Penis emerging from gonopore on P5 coxa positioned anterior to coxo-sternal condyle.

*Female morphology.* Female morphology similar to that of male except for sexual characters. Female sternopleonal cavity setose at level of sternite 4;

sternopleonal lock not well developed, tubercles absent in adult; vulvae moderately large, placed anteriorly on sternite 6, abutting against suture with sternite 5. Pleon subovate in outline, lateral margins distinctly convex; somites freely articulated, somites 3–6 progressively longer, somite 6 largest, lateral margins convex; telson semi-circular, lateral margins slightly convex, apex broadly rounded.

*Color in life.* Base color off-white, interspersed with orange, both forming reticulated patterns on carapace and chelipeds; fingers of chela off-white. Orange splotches on off-white ambulatory legs, forming banded pattern on ambulatory meri, carpi, and propodi. Ventral and internal surfaces off-white (Fig. 4). Live coloration very similar to that of *P. reticulatus* (cf. Ng and Huang 1997: fig. 8D, E).

*Remarks.* *Pulcratis amabilis* n. sp. is superficially similar to *P. reticulatus* Ng and Huang, 1997, in the general form of the carapace and pereopods, as well as the live coloration. Several consistent morphological differences, however, distinguish *P. amabilis* n. sp. from *P. reticulatus*: (1) the carapace outline is much rounder, with the front less produced, the posterolateral margins straight, and the lateral angle marking the juncture of the antero- and posterolateral margins more rounded (Figs. 1A, 2A) [vs. carapace outline more fan-shaped, with the front more produced, the posterolateral margins slightly concave, and the lateral angle more acute in *P. reticulatus*; Fig. 2E (cf. Ng and Huang, 1997: figs. 8D, E, 10A, B)]; (2) the P1 carpus and the palm of the chela are relatively more inflated, and the proximo-internal angle (superior margin) of the palm is more rounded in *P. amabilis* (Figs. 1A, 2B) [vs. P1 carpus and palm less inflated, proximo-internal angle of palm more angular in *P. reticulatus*; Fig. 2F (cf. Ng and Huang, 1997: fig. 10E)]; (3) the ambulatory legs, particularly the meri and propodi, are shorter and stouter, sometimes slightly, as between the male holotypes of both species, or more distinctly, as between the female paratypes (Figs. 1A, 2C) [vs. ambulatory legs longer and more slender; Fig. 2G (cf. Ng and Huang, 1997: figs. 8D, E, 11E)]; (4) the male telson is relatively broader, median length/basal width ratio = 1.04 (Fig. 1C, 2D) [vs. the male telson is relatively narrower in *P. reticulatus*, median length/basal width ratio = 1.27; Fig. 2H (cf. Ng and Huang,



1997: fig. 11C)]; (5) the G1 is relatively stouter, and more bent at the subdistal region, the subterminal papilliform branch is also stouter (Figs. 3A, B, D, E) [vs. G1 more slender, relatively straighter or less curved at subdistal region, and the subterminal branch smaller in *P. reticulatus* (cf. Ng and Huang, 1997: fig. 11F–H)]; and (6) the G2 terminal segment is slightly longer (Fig. 3C) [vs. G2 terminal segment slightly shorter in *P. reticulatus* (cf. Ng and Huang, 1997: fig. 11I)].

*Pulcratis amabilis* n. sp. is the first representative of the genus to be recorded from the Indian Ocean, the only other species of the genus, *P. reticulatus*, being found in the South China Sea. Currently, the new species is only known from the waters off the coast of southeastern India (Tamil Nadu) in the Bay of Bengal, eastern Indian Ocean, and occurring at depths of 50–100 m on muddy to silty bottoms.

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