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Caridina ngankeeae sp. nov., a new species of freshwater shrimp (Decapoda: Caridea: Atyidae) from Hong Kong

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Abstract

A new species of freshwater atyid shrimp, *Caridina ngankeeae* **sp. nov.**, is described from Hong Kong, southern China. The dorsally armed rostrum, the large number of spiniform setae on the uropodal diaeresis, the relatively long stylocerite and the distally deeply excavated pereiopod 1 carpus indicate a close relationship with the *C. serrata* Stimpson, 1860 species group and allied species primarily distributed in southern China and northern to central Vietnam. The new species can be distinguished from congeners by characteristics of the rostrum, pereiopods, and male first and second pleopods.

Key words: biodiversity, Crustacea, ornamental shrimp, southern China, taxonomy

Introduction

Hong Kong habitats are comprised of hilly terrains, flat lowlands, islands and peninsulas, giving rise to an extensive though poorly developed stream/river system and a long coastline. The high habitat heterogeneity supports a rich assemblage of both primary freshwater and amphidromous shrimps, including 10 atyid species (Lee 1993; Chow *et al.* 2018) and eight species of *Macrobrachium* (Palaemonidae) (Chow *et al*. 2022a). Some of the primary freshwater atyid shrimp species in Hong Kong are susceptible to local extinction due to their highly restricted distribution and small, isolated populations (Ma *et al.* 2021). Moreover, due to their striking, striped appearance, some species are also threatened by illegal harvesting for the ornamental trade (Chow *et al.* 2022b), such as *C. logemanni* Klotz & von Rintelen, 2014 and *C. trifasciata* Yam & Cai, 2003. An unusually blue, potentially ornamental population of atyid shrimp was encountered in the northern New Territories (Fig. 1) by Mr. Alex Hua Bin Liu, who brought the unidentified shrimp to our attention, which we collected in 2021. At first sight, the species appeared to be one of the colour morphs of *C. serrata* Stimpson, 1860 recorded in Hong Kong, though with subtle differences. As *C. serrata* is known in Hong Kong only from Lantau Island and Hong Kong Island (Fig. 1) (Ma *et al.* 2021), this discovery would have markedly extended the local range of this geographically restricted and near threatened species. However, morphological examination shows that the species is not *C. serrata* but new to science. Given its potential commercial value in combination with the generally high endemicity and restricted distribution of primary freshwater atyids observed in Hong Kong, the new species warrants conservation attention.

Materials and methods

Type specimens examined are deposited in the Simon F.S. Li Marine Science Laboratory, The Chinese University of Hong Kong (CUHK-LMT). The abbreviation ‘pocl’ stands for post-orbital carapace length.

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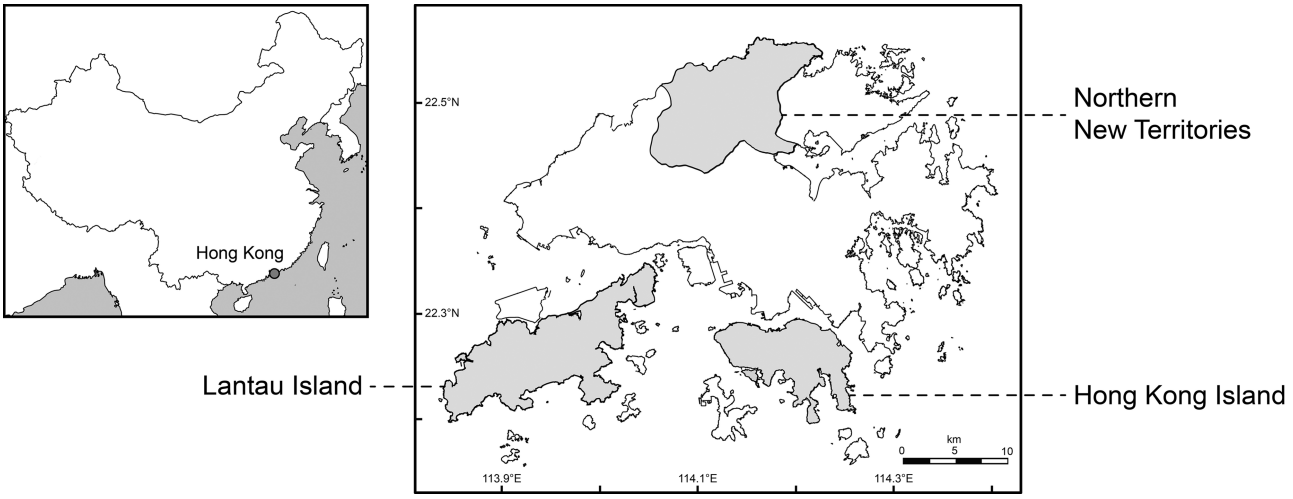

FIGURE 1. Location of Hong Kong in China and map of Hong Kong with three of the major regions highlighted: northern New Territories, Lantau Island and Hong Kong Island.

Taxonomy

Atyidae De Haan, 1849

Caridina H. Milne Edwards, 1837

Caridina ngankeeae sp. nov.

(Figs. 2–4)

Type material. *Holotype*: CUHK-LMT-CAR408-4, male (pocl 3.0 mm), northern New Territories, Hong Kong (exact location stored with type material to protect the natural population), leg. J.C.F. Chan, 30.XI.2021. *Paratypes*: CUHK-LMT-CAR408, 1 male (pocl 2.5 mm), 10 females (pocl 2.8–3.6 mm), same collection data as holotype.

Description. Rostrum (Fig. 2A) straight, slightly directed downwards, tip slightly directed upwards, reaching to end of basal article to slightly beyond end of second article of antennular peduncle, 0.35–0.50 × pocl; rostral formula 5–6 + 6–11/2–5, teeth large on dorsal margin, small on ventral margin. Inferior orbital angle fused with antennal spine. Pterygostomial angle rounded, subrectangular, slightly produced forward. Eyes well developed, with globular cornea. Antennular peduncle 0.5–0.6 × pocl, basal article 2.2–2.4 × as long as second article, second article 1.3–1.4 × as long as third article. Stylocerite usually reaching to end of basal article of antennular peduncle, rarely slightly exceeding beyond viz. 0.2 length of second article, or slightly falling short of basal article viz. 0.9 length of basal article. Scaphocerite (Fig. 2B) 2.8–3.0 × as long as wide.

Sixth abdominal somite 0.4–0.5 × pocl, 0.8–0.9 × as long as telson. Telson (Fig. 2C) 2.2–2.6 × as long as proximal wide, with 4 pairs of short spiniform setae dorsal and one pair of short spiniform setae dorsolateral, posterior margin (Fig. 2D) convex with a median projection and 4 or 5 pairs of spiniform setae, sublateral pair slightly shorter than lateral and inner pairs. Pre-anal carina (Fig. 2E) rounded, without spine, with few setae. Uropodal diaeresis (Fig. 2F) with 18–22 movable spiniform setae, outermost ones conspicuously longer than lateral angle.

Mandible (Fig. 2G) with incisor process ending in irregular teeth; molar process truncated, grinding surface grooved. Maxillule (Fig. 2H) with lower lacinia broadly rounded; upper lacinia elongate, with numerous cuspidate setae on inner margin; palp with few simple setae. Maxilla (Fig. 2I) with upper endites subdivided; palp slender; scaphognathite tapering posteriorly. First maxilliped (Fig. 2J) with palp ending in short projection. Second maxilliped (Fig. 2K) with well-developed podobranch. Third maxilliped (Fig. 2L) with 2 arthrobranches, ultimate article subequal to penultimate. First pereiopod with arthrobranch. Pleurobranchs present on all pereiopods. Epipods present on third maxilliped and first four pereiopods.

First pereiopod (Fig. 3A) chela 1.85–2.05 × as long as wide, 1.5–1.7 × as long as carpus; tips of fingers rounded, without hooks, fingers 0.8–0.9 × as long as palm; carpus strongly excavated distally, 1.2–1.4 × as long as wide,

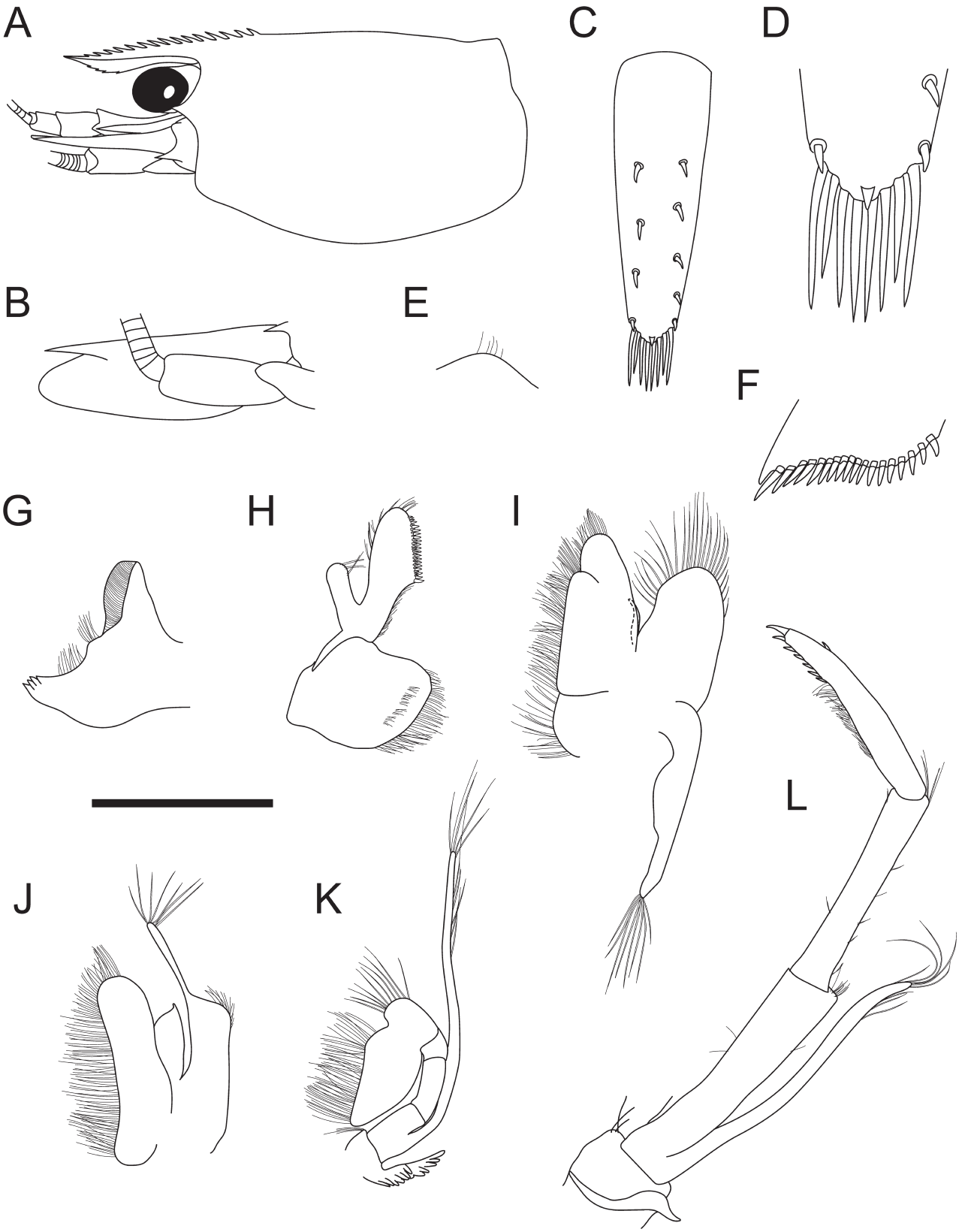

FIGURE 2. *Caridina ngankeeae* **sp. nov.**: A–F, holotype male, pocl 3.0 mm (CUHK-LMT-CAR408-4); G–L, paratype female, pocl 3.6 mm (CUHK-LMT-CAR408-1). A, cephalothorax, lateral view; B, scaphocerite; C, telson; D, same, distal margin; E, pre-anal carina; F, uropodal diaeresis; G, mandible; H, maxillule; I, maxilla; J, first maxilliped; K, second maxilliped; L, third maxilliped. Scale bar: A = 1.8 mm; B, C = 1 mm; G–L = 0.8 mm; D, F = 0.4 mm; E = 0.3 mm.

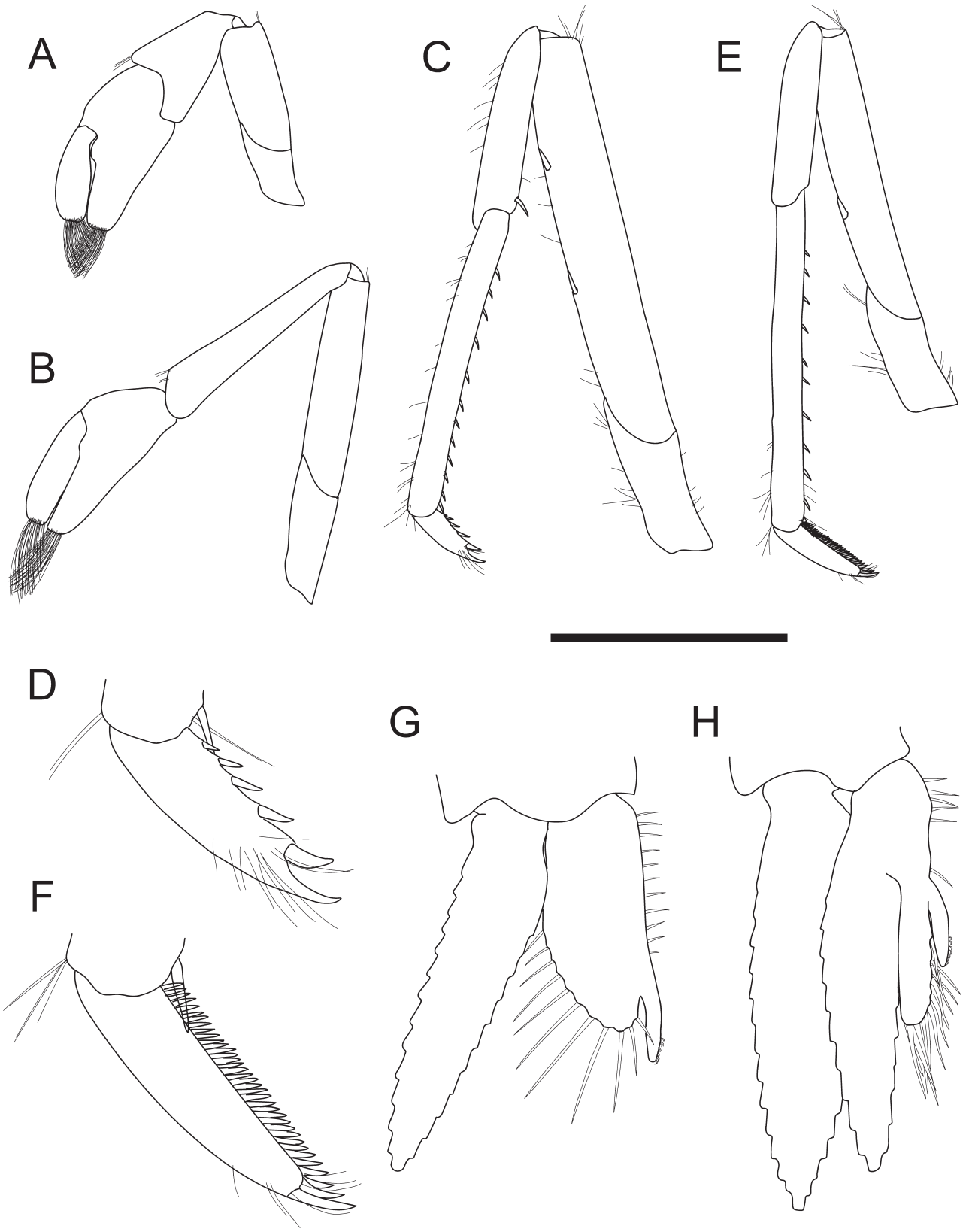

FIGURE 3. *Caridina ngankeeae* **sp. nov.**, holotype male, pocl 3.0 mm (CUHK-LMT-CAR408-4). A, first pereiopod; B, second pereiopod; C, third pereiopod; D, same, dactylus; E, fifth pereiopod; F, same, dactylus; G, male first pleopod; H, male second pleopod. Scale bar: A, B = 1 mm; C, E = 0.8 mm; G, H = 0.4 mm; D, F = 0.25 mm.

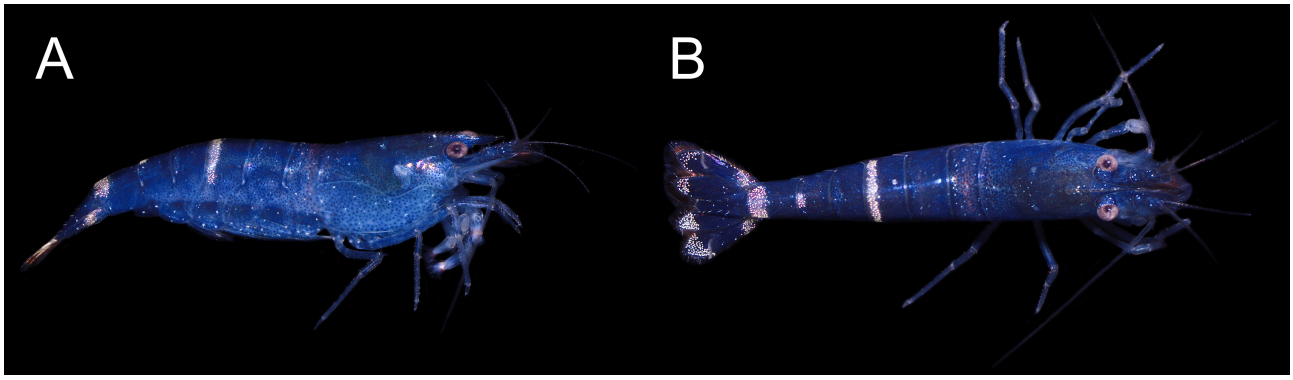

FIGURE 4. Life colouration of *Caridina ngankeeae* **sp. nov.**: A, habitus; B, dorsal view. Photographs by Lai Him Chow.

0.9–1.0 × as long as merus; merus 2.1–2.6 × as long as wide, longer than ischium. Second pereiopod (Fig. 3B) chela 2.20–2.45 × as long as wide, 0.75–0.85 × as long as carpus; tips of fingers rounded, without hooks, fingers 1.4–1.6 × as long as palm; carpus 4.4–4.9 × as long as wide, 1.05–1.15 × as long as merus; merus 3.65–4.65 × as long as wide, longer than ischium. Third pereiopod (Fig. 3C) slender, not sexually dimorphic; dactylus (Fig. 3D) with 4 or 5 accessory spiniform setae on flexor margin, 2.65–3.20 × as long as wide (terminal claw and accessory spiniform setae included); propodus 7.85–9.15 × as long as wide, 3.6–3.9 × as long as dactylus; carpus 4.05–4.45 × as long as wide, 0.65–0.70 × as long as propodus, about 0.5 × as long as merus; merus 5.2–6.2 × as long as wide, bearing 3 or 4 strong spiniform setae on posterior margin of outer surface; ischium with strong spiniform seta. Fifth pereiopod (Fig. 3E) slender; dactylus (Fig. 3F) with 32–43 spinuliform setae on flexor margin, 2.85–3.55 × as long as wide (terminal claw and accessory spinuliform setae included); propodus 9.25–10.70 × as long as wide, 2.90–3.35 × as long as dactylus; carpus 4.30–4.65 × as long as wide, 0.5–0.6 × as long as propodus, about 0.65 × as long as merus; merus 5.0–6.2 × as long as wide, bearing 2 or 3 strong spiniform setae on posterior margin of outer surface; ischium unarmed.

Endopod of male first pleopod (Fig. 3G) subtriangular, inner margin almost straight, outer margin convex, 2.4–2.5 × as long as basal wide, anterior region not or just feebly bent backwards, 0.60–0.65 × as long as exopod; appendix interna arising from about 0.7 of endopod, reaching beyond distal margin of endopod by 0.25–0.35 of its length. Appendix masculina of male second pleopod (Fig. 3H) slender, rod-shaped, 7.65–8.05 × as long as wide, with long spinuliform setae on inner and distal margin, few smaller spiniform setae on basal part, 0.60–0.65 × as long as endopod; appendix interna arising from about 0.45 of, and reaching to 0.75–0.85 of appendix masculina.

Etymology. Named after the late Dr. Ngan Kee Ng, who was dedicated to taxonomic research of brachyuran and anomuran crabs and atyid shrimps, as well as education of younger generations. She took part in early research that characterised the species group to which the new species belongs. This research is also the first to illuminate the atyid shrimp diversity of Hong Kong, stimulating subsequent exploration of the rich local atyid shrimp diversity.

Colouration. Body uniform dark blue in colour (Fig. 4). Posterior margin of third and sixth tergite with a white transverse band of about one-third of segment length. Posterior margin of fifth somite with a white spot at dorsal midline. Protopods and distal portion of exopods and endopods of uropods white in colour.

Ecology. The species was discovered in a small upland tributary flowing between crevices on the edge of a cascade; no shrimps were found in the main stream during the survey. Due to dense vegetation, most of the tributary was inaccessible; the small accessible portion had shallow water and strong water flow. Unlike its sympatric congener *C. cantonensis* Yu, 1938, the new species is more 'skittish' and light sensitive, quickly hiding under rocks when disturbed.

Distribution. Currently known only from one locality in the northern New Territories, Hong Kong (Fig. 1).

Remarks. The dorsally armed rostrum, the large number of spiniform setae on uropodal diaeresis, the relatively long stylocerite, and the stout, distally deeply excavated carpus of first pereiopod indicate a close relationship between *C. ngankeeae* **sp. nov.** and the *C. serrata* species group (*sensu* Cai & Ng 1999) and allied species, primarily distributed in southern China and northern to central Vietnam, which likely shared palaeo-confluences in basins in the now northern South China Sea during sea level drop in the past. On account of the short to medium rostrum armed with large teeth, the rostral formula, and the slender appendix masculina of male second pleopod, the new species resembles the most to the Vietnamese *C. pseudoserrata* Dang & Do, 2007 and *C. rubropunctata* Dang & Do,

2007. The new species is distinct from both Vietnamese species by having: 1) a shorter stylocerite (usually reaching to end of basal article of antennular peduncle versus reaching at least to middle of second article in *C. pseudoserrata* and *C. rubropunctata*); 2) first pereiopod fingers shorter than palm (versus as long as or longer than palm); and 3) subtriangular endopod of male first pleopod (versus subrectangular). Additional differences of *C. ngankeeae* **sp. nov.** from *C. pseudoserrata* include the more ventral rostral teeth (2–5 versus 1–2 in *C. pseudoserrata*), the proportionally longer carpus of the second pereiopod (chela 0.75–0.85 times as long as carpus versus 0.94 times), and stouter endopod of the male first pleopod (2.4–2.5 times as long as basal width versus about 2.8 times based on illustrations in the original description by Dang & Do (2007)) with the longer appendix interna (reaching clearly beyond distal margin of endopod versus reaching to or slightly beyond). From *C. rubropunctata*, *C. ngankeeae* **sp. nov.** also differs by having proportionally longer fingers of the second pereiopod (1.4–1.6 times as long as palm versus 1.05 times in *C. rubropunctata*), and the more slender carpus of the second pereiopod (4.4–4.9 times as long as wide versus 4.06 times).

Comparing with congeners recorded from Hong Kong or the nearby Guangdong Province in southern China, the characteristic subtriangular endopod of the male first pereiopod and the intermediate stylocerite reaching to the end of the basal article of the antennular peduncle of *C. ngankeeae* **sp. nov.** are similar to those of *C. breviata* Ng & Cai, 2000. However, the new species differs from *C. breviata* by a number of characters: 1) a longer rostrum with more teeth (reaching to the end of the basal article to the end of the second article of antennular peduncle, rostral formula 5–6 + 6–11/2–5 versus not reaching beyond the end of the basal article, rostral formula 0–2 + 0–8/0 in *C. breviata*); 2) the stouter chela and carpus of the first pereiopod (1.85–2.05 and 1.2–1.4 times as long as wide versus 2.3 and 1.7 times, respectively); 3) the stouter chela and carpus of the second pereiopod (2.20–2.45 and 4.4–4.9 times as long as wide versus 2.6 and 5.4 times, respectively); 4) proportionally shorter fingers of the first and second pereiopods (shorter than palm versus longer than palm, 1.4–1.6 times as long as palm versus 1.9 times); 5) the stouter propodus of the third and fifth pereiopods (7.85–9.15 and 9.25–10.70 times as long as wide versus 9.4 and 13 times, respectively) with the latter also proportionally shorter (2.90–3.35 times as long as dactylus versus 5 times); 6) the more slender endopod of the male first pleopod (2.4–2.5 times as long as basal width versus 2.1 times); and 7) the more slender appendix masculina of the male second pleopod (7.65–8.05 times as long as wide versus about 5.5 times based on illustration in the original description by Ng & Cai (2000)).

Caridina ngankeeae **sp. nov.** is also similar to *C. trifasciata* Yam & Cai, 2003, *C. tetrazona* Chen, Chen, Zheng & Guo, 2020 and *C. macauensis* Zhou, Zhang, Wong & Huang, 2021 to a certain extent. The new species differs from *C. trifasciata* in the: 1) stouter carpus but more slender merus of the first pereiopod (1.2–1.4 and 2.1–2.6 times as long as wide versus 1.4–1.5 and 2.0–2.2 times, respectively, in *C. trifasciata*); 2) stouter chela, carpus and merus of the second pereiopod (2.20–2.45, 4.4–4.9 and 3.65–4.65 times as long as wide versus 2.8–3.0, 5.4–5.9 and 5.1–5.5 times, respectively); 3) proportionally shorter propodus of the third and fifth pereiopods (3.6–3.9 and 2.90–3.35 times as long as dactylus versus 4.2–4.6 and 4.5–4.8 times, respectively); 4) more spinuliform setae on the flexor margin of the dactylus of the fifth pereiopod (32–43 versus 29–30); 5) subtriangular endopod of the male first pleopod (versus subrectangular); and 6) more slender appendix masculina of the male second pleopod (7.65–8.05 times as long as wide versus about 4.8 times based on illustrations in the original description by Yam & Cai (2003)).

The new species can be distinguished from *C. tetrazona* in the: 1) stouter scaphocerite (2.8–3.0 times as long as wide versus 3.6 times in *C. tetrazona*); 2) stouter carpus of the first pereiopod (1.2–1.4 times as long as wide versus 1.5–1.8 times); 3) stouter chela and carpus of the second pereiopod (2.20–2.45 and 4.4–4.9 times as long as wide versus 2.6–3.2 and 4.9–5.9 times, respectively); 4) proportionally shorter propodus of the third and fifth pereiopods (3.6–3.9 and 2.90–3.35 times as long as dactylus versus 4.5–4.9 and 4.7–5.1 times, respectively); 5) more spinuliform setae on the flexor margin of the dactylus of the fifth pereiopod (32–43 versus 27–31); and 6) more slender appendix masculina of the male second pleopod (7.65–8.05 times as long as wide versus about 4.9 times based on illustration in the original description by Chen *et al.* (2020)).

The new species differs from *C. macauensis* in the: 1) longer rostrum (reaching to the end of the basal article to slightly beyond the end of the second article of the antennular peduncle versus never reaching beyond the basal article in *C. macauensis*); 2) stouter scaphocerite (2.8–3.0 times as long as wide versus 3.9–4.2 times); 3) stouter chela and carpus of the first pereiopod (1.85–2.05 and 1.2–1.4 times as long as wide versus 2.4–2.6 and 1.55–1.67 times, respectively); 4) proportionally longer carpus of the first pereiopod (0.9–1.0 times as long as merus versus 0.60–0.67 times); 5) stouter chela and carpus of the second pereiopod (2.20–2.45 and 4.4–4.9 times as long as wide versus 2.6–2.8 and 7.1–8.4 times, respectively); 6) proportionally longer chela of the second pereiopod (0.75–0.85

times as long as carpus versus 0.60–0.67 times); 7) proportionally shorter fingers of the second pereiopod (1.4–1.6 times as long as palm versus 1.8–2.2 times); 8) proportionally shorter propodus of the fifth pereiopod (2.90–3.35 times as long as dactylus versus 4.5–5.5 times); 9) more spinuliform setae on the flexor margin of the dactylus of the fifth pereiopod (32–43 versus 26–30); 10) stouter, subtriangular endopod of the male first pleopod (2.4–2.5 times as long as basal width versus subrectangular, 3.0–3.2 times); and 11) more slender appendix masculina of the male second pleopod (7.65–8.05 times as long as wide *versus* about 5.4 times based on illustration in the original description by Zhou *et al.* (2021)).

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