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Deep-water Squat Lobsters (Crustacea: Decapoda: Anomura) from India Collected by the FORV *Sagar Sampada*

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Abstract Deep-water squat lobsters collected during five cruises of the Fishery Oceanographic Research Vessel *Sagar Sampada* off the Andaman and Nicobar Archipelagos (299–812 m deep) and three cruises in the southeastern Arabian Sea (610–957 m deep) are identified. They are referred to each one species of the families Chirostylidae and Sternostylidae in the Superfamily Chirostyloidea, and five species of the family Munidopsidae and three species of the family Munididae in the Superfamily Galatheoidea. Of altogether 10 species of 5 genera dealt herein, the *Uroptychus* species of the Chirostylidae is described as new to science, and *Agononida* aff. *indocerta* Poore and Andreakis, 2012, of the Munididae, previously reported from Western Australia and Papua New Guinea, is newly recorded from Indian waters. The new species named *Uroptychus sampadae* is closely related to *U. indicus* Alcock, 1901, but differentiated from the latter species in the characters that 1) the antennal scale is relatively long, distinctly overreaching the distal end of cornea and terminating slightly short of the antennal article 5, 2) the posterior plate of telson is much longer than the anterior plate, and 3) the ultimate spine of the P2 dactylus flexor margin is slightly larger than the penultimate spine and very slightly larger than the antepenultimate spine.
Key words: Chirostyloid, galatheoid, taxonomy, new species, new record, Indian Ocean.

Introduction

The Indian Exclusive Economic Zone is known to have a moderately diverse squat lobster fauna comprising 59 species of 13 genera in 3 families. They are referred to 13 species of 2 genera in the superfamily Chirostyloidea and 46 species of 11 genera in the superfamily Galatheoidea (Baba *et al.*, 2008; Komai *et al.*, 2019). However, many of the published taxonomic literature from Indian waters are restricted to the British era (Wood-Mason and Alcock, 1891; Henderson, 1893; Alcock, 1894, 1901; Alcock and Anderson, 1894, 1895, 1896, 1899a, 1899b; Anderson, 1896; McArdle, 1901; Alcock and McArdle, 1901, 1902; Alcock and MacGilchrist, 1905; MacGilchrist, 1905; Kemp and Sewell 1912; Balss, 1913a). Recently, Ahyong (2014) reviewed the taxonomic and zoogeographical status of *Munidopsis serricornis* (Lovén, 1852) from the Indo-West Pacific regions and described 6 new species including *M. alcocki* from Indian waters.

The Centre for Marine Living Resources and Ecology, Kochi, India, has conducted extensive faunistic surveys in deeper waters of the Indian Exclusive Economic Zone under the aegis of the Ministry of Earth Sciences, Government of India.

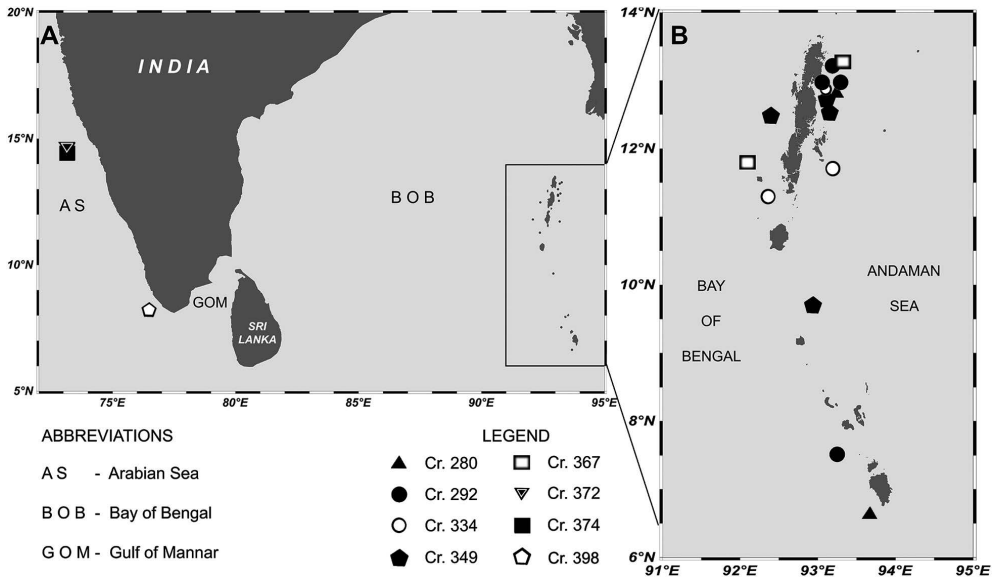

Fig. 1. A: Map of India indicating sampling stations in the Arabian Sea and in the vicinity of the Andaman and Nicobar Archipelagos (inset). B: Sampling locations in the Andaman Sea.

The surveys were funded by "Monitoring and Modelling of Marine Ecosystems" and "Resource Exploration and Inventorization System" research projects; in recent years resulting in moderately large collections of crustaceans. The present study provides taxonomic accounts of 10 species of deep-water squat lobsters collected from the Arabian Sea, the Bay of Bengal and the Andaman Sea (Fig. 1) using the Fisheries Oceanographic Research Vessel *Sagar Sampada*. All the specimens examined are deposited in the Centre for Marine Living Resources and Ecology, Ministry of Each Sciences, Government of India.

Abbreviations used in this paper. cl: Length of carapace in median line excluding rostrum. G1 and G2: First and second gonopods. Mxp1 and Mxp3: First and third maxillipeds. P1, P2, P3 and P4: First to fourth pereopods, respectively.

Taxonomy

Family Chirostylidae Ortmann, 1892
Genus ***Uroptychus*** Henderson, 1888
Uroptychus sampadae sp. nov.
(Figs. 2A, 5–6)

Material examined. Holotype: Female (cl 7.80 mm, IO/SS/ANO/00043), Eastern Arabian Sea, northwest off Honnavar, western coast of India, 14.37°N, 73.03°E, 957 m deep, 9 April 2018, HSDT (CV), FORV *Sagar Sampada*, coll. Vinay P. Padate.

Paratype: Male (cl 6.28 mm, IO/SS/ANO/00046), eastern Arabian Sea, northwest off Honnavar, western coast of India, 14.39°N, 73.03°E, 957 m deep, 28 February 2018, HSDT (CV), FORV *Sagar Sampada*, coll. Vinay P. Padate.

Non-type specimens: Five males (cl 4.79–8.54 mm, IO/SS/ANO/00002); Five females (cl 4.96–7.53, IO/SS/ANO/00003), same data as paratype.

Diagnosis. Moderately large species (cl 4.79–8.54 mm in total 12 specimens examined); cl sub-

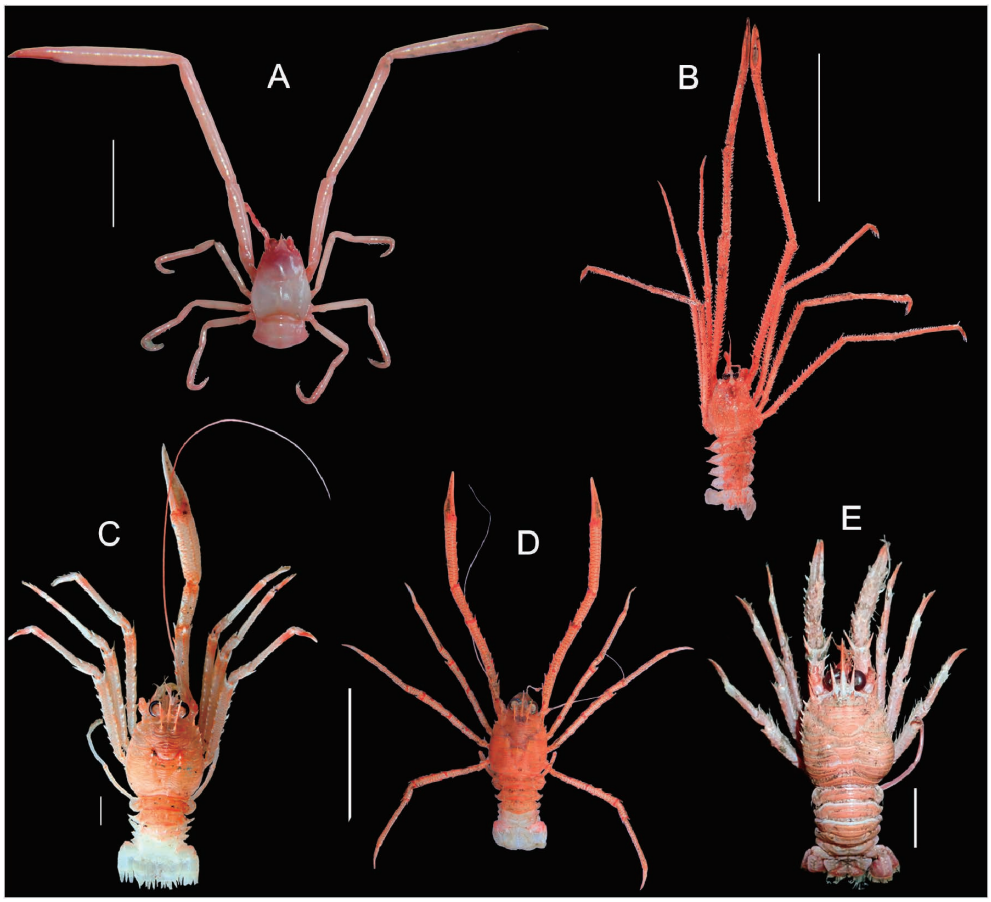

Fig. 2. Habitus, dorsal view. A: *Uroptychus sampadae* sp. nov., holotype, female (IO/SS/ANO/00043, cl 7.80 mm). B: *Sternostylus investigatoris* (Alcock and Anderson, 1899), female (IO/SS/ANO/00005, cl 15.0 mm). C: *Agononida* aff. *indocerta* Poore and Andreakis, 2012, female (IO/SS/ANO/00027, cl 19.8 mm). D: *A. prolixa* (Alcock, 1894), female (IO/SS/ANO/00031, cl 14.0 mm). E: *Munida andamanica* Alcock, 1894, male (IO/SS/ANO/00044, cl 15.0 mm). Scale: 10 mm for A; 50 mm for B–E.

equal to width, anterolateral spine overreaching lateral orbital spine; rostrum one-third cl; eyes elongate (length 1.76 times width), reaching three-fourths rostral length; antennal article 2 with distolateral spine, article 5 unarmed, antennal scale 4.5 times as long as wide, distinctly overreaching eye, slightly short of end of antennal article 5. Posterior plate of telson 2.62–2.66 times as long as posterior plate. Ultimate spines of P2–P4 dactylar flexor margins slightly larger than penultimate spines, very slightly larger than antepenultimate spine.

Description of holotype. Carapace (excluding rostrum) subequal (0.99 times) to width, greatest width 1.86 times distance between anterolateral spines. Dorsal surface (Fig. 5A) smooth, barely setose, gastric region gently convex, separated from cardiac region by faint depression. Lateral margins distinctly convex posteriorly, with somewhat elevated ridge along posterior three-fourths; anterolateral spine small, overreaching tip of lateral orbital spine.

Rostrum (Fig. 5A–B) broad triangle, directed anteroventrally, its length 0.72 times width, length 0.32 times cl, width 0.52 times carapace width at posterior carapace margin; dorsal surface slightly concave at base; lateral margins concave. Lateral orbital spine minute, not reach-

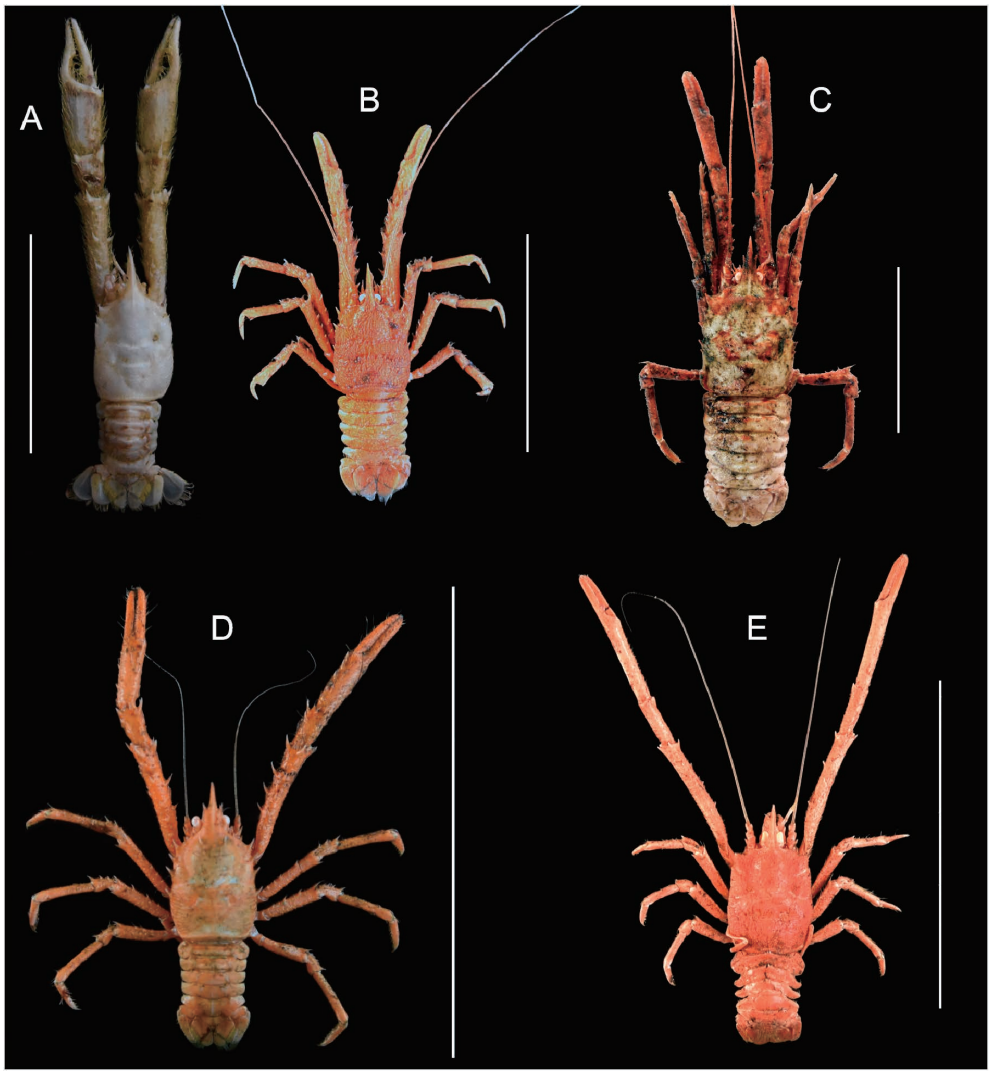

Fig. 3. Habitus, dorsal view. A: *Munidopsis dasypus* Alcock, 1894, male (IO/SS/ANO/00006, cl 21.2 mm). B: *M. levis* (Alcock and Anderson, 1894), male (IO/SS/ANO/00007, cl 20.2 mm). C: *M. regia* Alcock and Anderson, 1894, female (IO/SS/ANO/00018, cl 30.0 mm). D: *M. trifida* Henderson, 1885, male (IO/SS/ANO/00019, cl 16.8 mm). E: *M. wardeni* Anderson, 1896, male (IO/SS/ANO/00023, cl 19.0 mm). Scale: 50 mm for A–E.

ing level of anterolateral spine.

Pterygostomian flap (Fig. 5B) smooth on surface, anterior margin convex, terminating in minute spine, anterior height 1.38 times posterior height.

Sternum (Fig. 5C) excavated, anteriorly broad triangular, ending in acute spine, surface somewhat ridged in midline, with small spine in center. Sternal plastron (Fig. 5C) gradually broadened posteriorly, length 0.91 times sternal width. Sternite 3 strongly depressed, anterior margin relatively narrow and excavated in broad V-shape with narrow median notch flanked by small spine; anterolateral angle sharply produced. Sternite 4 longer than wide; anterolateral margin convex, moderately divergent posteriorly, anteriorly produced into 2 distinct spines, followed by posteriorly diminishing serrations; posterolateral margin 0.52 times as long as anterolateral margin. Sternite 5 anterolateral margin strongly con-

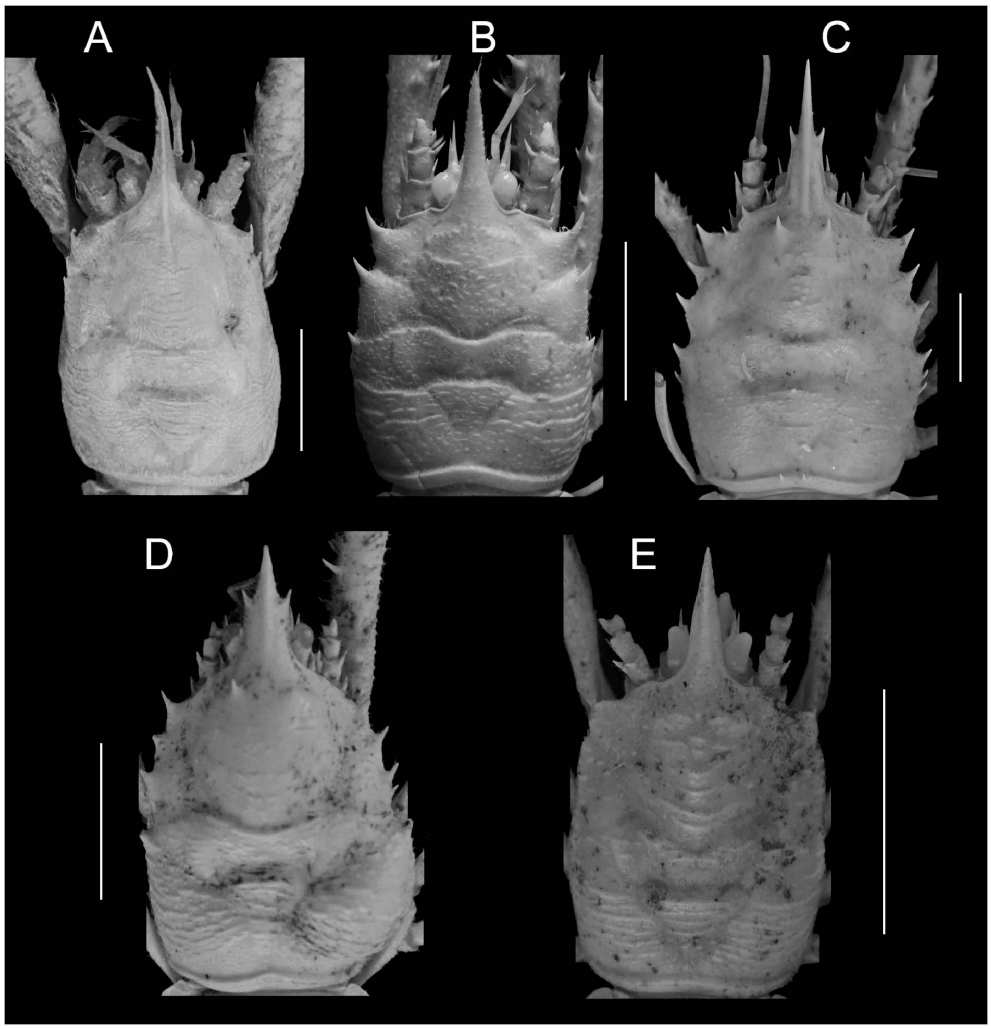

Fig. 4. *Munidopsis* species, carapaces in dorsal view. A. *M. dasypus* Alcock, 1894, male (IO/SS/ANO/00006, cl 21.2 mm). B: *M. levis* (Alcock and Anderson, 1894), male (IO/SS/ANO/00007, cl 18.5 mm). C: *M. regia* Alcock and Anderson, 1894, female (IO/SS/ANO/00012, cl 28.0 mm). D: *M. trifida* Henderson, 1885, female (IO/SS/ANO/00020, cl 19.0 mm). E: *M. wardeni* Anderson, 1896, female (IO/SS/ANO/00026, cl 12.0 mm). Scale: 10 mm for A–E.

vex anteriorly, 1.22 times as long as posterolateral margin of sternite 4.

Abdomen (Fig. 5A, D) smooth, glabrous. Somite 1 gently convex from anterior to posterior. Somite 2 tergite width 3.73 times length; pleuron posterolaterally blunt angular, lateral margins concave, moderately divergent posteriorly. Pleuron of somite 3 with bluntly angular lateral tip. Telson length 0.50 times width (Fig. 5D); posterior plate distinctly emarginate on posterior margin, length 2.62 times anterior plate length.

Eyestalk (Fig. 5A–B) elongate (length 1.76 times width), reaching distal fourth of rostrum; mesial and lateral margins gently concave. Cornea slightly dilated, length 0.56 times that of remaining eyestalk.

Ultimate article of antennule 2.52 times longer than high. Antennal peduncle (Fig. 5F) distinctly overreaching distal end of cornea. Antennal scale 4.46 times as long as wide, wider than article 5,

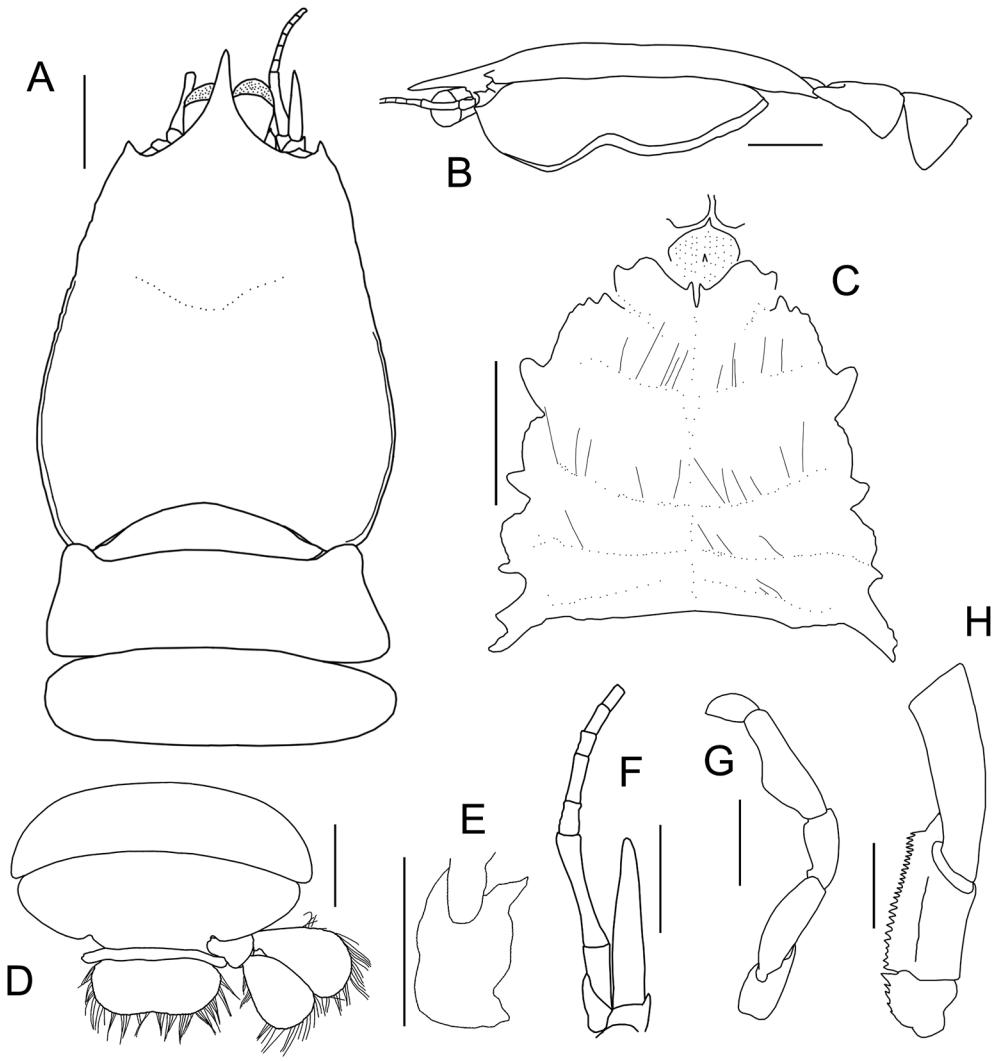

Fig. 5. *Uroptychus sampadae* sp. nov., holotype, female (IO/SS/ANO/00043, cl 7.80 mm). A: Carapace and anterior 3 abdominal somites in dorsal view. B: Carapace, pterygostomian flap and anterior 3 abdominal somites in lateral view. C: Basal part of Mxp1, excavated sternum and sternal plastron in ventral view. D: Posterior 2 abdominal somites, telson and right uropods in dorsal view. E: Right basal antennular article. F: Right antennal peduncle with proximal portion of flagellum and antennal scale. G: Left Mxp3 in lateral view. H: Left Mxp3 ischium, merus and carpus in ventral view. Scale bars: 2 mm for A–D, G; 1 mm for E–F, H.

distinctly overreaching eye, slightly short of end of antennal article 5. Article 2 with small distolateral spine; article 4 length 1.61 times width, unarmed; article 5 length 2.37 times that of article 4, its width 0.82 times height of antennular ultimate article, unarmed. Flagellum of 18 segments.

Mxp1 with bases close to each other. Mxp3 (Fig. 5G–H) barely setose on lateral surface. Basis with 5 denticles on mesial ridge. Ischium with 25 denticles on crista dentata, flexor margin distally not rounded. Merus length 2.23 times that of ischium, moderately thick, flexor margin with sharp ridge unarmed at distal third; mesial face setose. Carpus unarmed.

P1 massive, cylindrical, 5.63 times cl. Ischium dorsoventrally depressed, bearing short triangular spine ventrally. Merus with smooth dorsal and ventral surfaces; length 0.98 times cl. Carpus

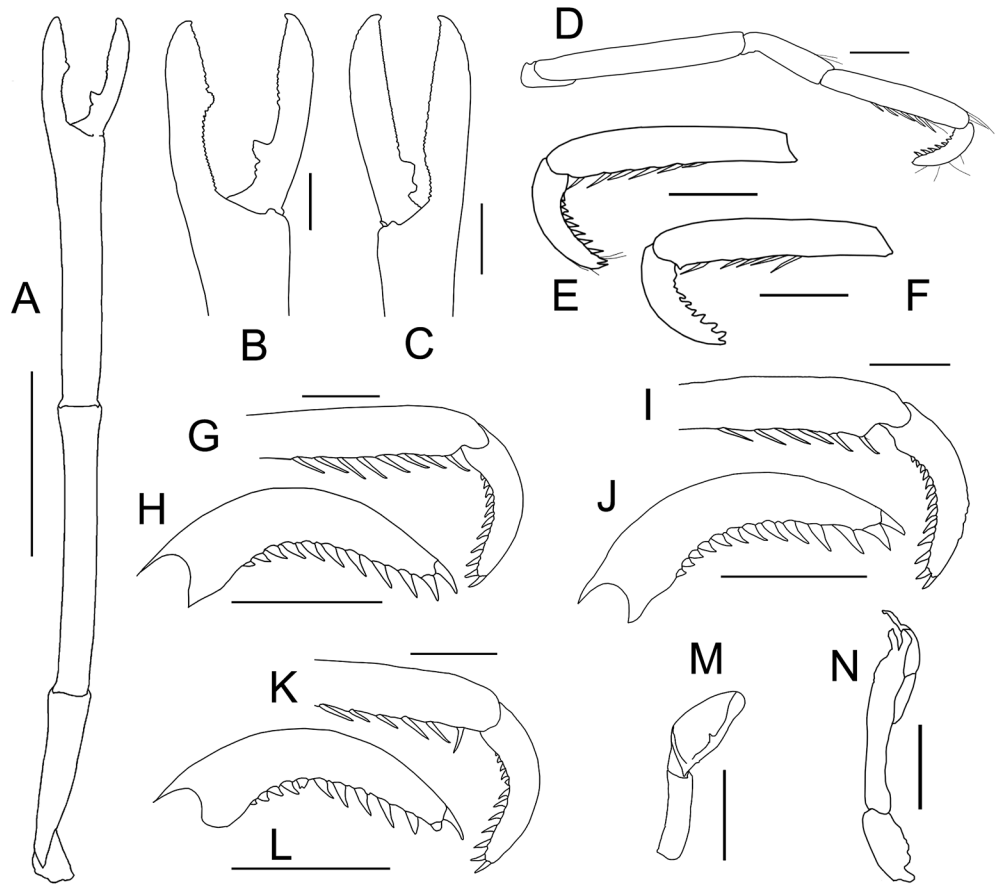

Fig. 6. *Uroptychus sampadae* sp. nov., male (IO/SS/ANO/00002, cl 7.51 mm). A: Left cheliped. B: left cheliped fingers. — Female (IO/SS/ANO/00003, cl 6.72 mm). C: Right cheliped fingers. — Holotype, female (IO/SS/ANO/00043, cl 7.80 mm). D: Right P2. E: Left P3 propodus and dactylus. F: Left P4 propodus and dactylus. — Female (IO/SS/ANO/00003, cl 7.53 mm). G: Right P2 propodus and dactylus. H: Right P2 dactylus. I: Right P3 propodus and dactylus. J: Right P3 dactylus. K: Right P4 propodus and dactylus. L: Right P4 dactylus. M–N: G1 and G2. Scale bars: 10 mm for A; 2 mm for B–L; 1 mm for M–N.

length 2.06 times merus length, with smooth and barely setose dorsal and ventral surfaces. Palm length 6.07 times width, 0.92 times carpus length, distally sparsely setose. Fingers moderately broad, ending in incurved small spine, feebly crossing when closed; movable finger 0.41 times palm length; opposable margin with 2 blunt proximal processes arising from broad base, distal one larger, proximal process occupying the notch of fixed finger when closed; fixed finger slightly sinuous on opposable margin, notched proximally.

P2–P4 covered with sparse long setae, slender, unarmed except for distal 2 articles (Fig. 6D for P2). Meri cylindrical; P3 merus length 0.99 times P2 merus length, P4 merus length 0.84 times P3 merus length; P3 merus width 0.96 times P2 merus width, P4 merus width 0.87 times P3 merus width; merus length–width ratio, 6.81 on P2, 6.04 on P3, 5.71 on P4; P2 merus length 0.84 times cl, 1.42 times P2 propodus length; P3 merus length subequal to propodus length (Fig. 6E); P4 merus length 0.93 times P4 propodus length. Carpi successively shorter posteriorly (P3 carpus 0.88 times P2 carpus length, P4 carpus 0.72 times P3 carpus length), carpus–propodus length ratio, 0.60 on P2, 0.44 on P3, 0.36 on P4. Propodus shorter on P2 than on P3 and P4;

length-breadth ratio, 5.23 on P2, 7.16 on P3, 5.91 on 4; flexor margin almost straight, terminal (movable) spine single, preceded by 5 spines each on distal six-tenths of length on P2–P4. P2 dactylus shorter than carpus (dactylus–carpus length ratio 0.84), P3–P4 dactyli longer than carpi (1.05 on P3, 1.39 on P4), dactylus–propodus length ratio, 0.51 on P2, 0.46 on P3, 0.49 on P4, curving at mid-length; flexor margins with 10 triangular, obliquely directed, proximally diminishing spines; ultimate spine larger than penultimate, very slightly larger than antepenultimate; extensor margin with row of plumose setae.

Eggs orange coloured, 25 in number, 0.89 mm diameter.

Coloration in fresh (Fig. 2A). Anterior one-third of carapace deep pink, posterior two-thirds whitish, abdomen, chelipeds and pereiopods pale pink, cheliped fingers deep pink.

Notes on paratype. Differing from the holotype in the following points. Carapace (excluding rostrum) slightly longer (1.04 times) than greatest width, greatest width 1.71 times distance between anterolateral spines; pterygostomian flap anterior height 1.27 times posterior height; sternum length 0.96 times width, thoracic sternite 5 anterolateral margin length 1.41 times posterolateral margin of sternite 4; abdomen relatively wider (tergite 2 width 4.62 times length); antennal scale relatively stouter (length 3.72 times width), antennal article 5 relatively shorter (length 1.96 times length of article 4); P2–P3 meri relatively longer (merus length 3.50 and 4.07 times cl, respectively) and stouter (merus length 5.72 and 4.73 times merus width). P2 and P3 with 6 and 5 propodal flexor spines, respectively; dactylar flexor spines 10 each.

Notes on non-type specimens. All the 5 non-type males have the intact carapaces, but all the appendages are detached and missing. The cl is subequal (1.00 times) to, or slightly longer than (1.07 times), the greatest width of the carapace. In the largest male measuring 8.54 mm in cl, antennal scale overreaches the antennal article 5, while in the other males, the antennal scale is short of the terminal end of the antennal article 5.

In the case of 5 females, 2 specimens measuring 5.62 and 6.72 mm in cl have the intact carapaces, length subequal (0.98) to, or slightly more than (1.08 times) the greatest width, and 3 specimens measuring 4.96, 6.19 and 7.53 mm in cl have the broken carapaces, with the chelipeds missing. The antennal scale is similar to that of the holotype female. 4 specimens (4.96, 5.62, 6.19 and 7.53 mm in cl) have the intact P2–P4. Among these, the largest female (7.79 mm in cl) possesses 7, 6 and 6 propodal flexor spines on P2–P4, respectively (Fig. 6G, I, K); dactylar flexor margins with 11, 12 and 13 spines, respectively (Fig. 6G–L). The smaller 3 specimens have 6, 5–6 and 5–6 propodal flexor spines on P2, P3 and P4, respectively; dactylar flexor margins with 7–9 spines on P2, 9 on P3 and 9–10 on P4. The fifth female (6.72 mm in cl) having 6 propodal and 10 dactylar flexor spines on P4; P2–P3 missing. Specimens measuring 5.62, 6.72 and 7.53 mm in cl are ovigerous. The male G1 and G2 are as illustrated in Fig. 6M–N.

Etymology. The name *sampadae* honours the sampling vessel FORV *Sagar Sampada* (Treasure of the sea in Hindi), India's only deep-water Fisheries and Oceanographic Research Vessel that was used to collect these specimens.

Remarks. Following the comprehensive key to the species of the circum-global chirostyloid genus *Uroptychus* Henderson, 1888, provided by Baba (2018), *Uroptychus sampadae* sp. nov. is closely related to *U. denticulisquama* Baba, 2018, *U. indicus* Alcock, 1901, *U. tafeanus* Baba, 2018, and *U. taylorae* McCallum and Poore, 2013, owing to the absence of lateral spines on the carapace except the anterolateral spine, and the presence of a row of flexor marginal spines, including paired terminal spines on the P2–P4 propodi. The new species (along with *U. denticulisquama*, *U. indicus* and *U. taylorae*) differs from *U. tafeanus* in the presence of a median notch on the thoracic sternite 3. The new species (along with *U. indicus* and *U. taylorae*) differ from *U. denticulisquama* in the absence of subterminal spine on the ventromesial margin of the P1 ischium, and the P2 ischium with a

smooth ventromesial margin.

The new species and *U. indicus* clearly differ from *U. taylorae* McCallum and Poore, 2013, in lacking distomesial spine on the antennal acicle 5. Secondly, these 3 species differ in the relative length of the antennal scale and the width of the antennal article 5. In the new species, the antennal scale reaches just short of terminal end of the article 5 (Fig. 5F), the article 5 is comparatively wider (scale width 1.61–1.66 times article 5 width); in *U. taylorae*, the antennal scale reaches the second article of flagellum (McCallum and Poore, 2013: Fig. 9E), the article 5 is slender (scale width 2.5 times article 5 width; McCallum and Poore (2013)). Judging from the figure of *U. indicus* syntype provided by Baba (2018: Fig. 217D), the relative width of the antennal article 5 is comparable to that of the new species.

The new species clearly differs from *U. indicus* in having a relatively longer antennal scale (Fig. 5A) distinctly overreaching the distal end of cornea, terminating slightly short of antennal article 5 (versus "antennal scale not overreaching eye, terminating in distal third of article 5 in the latter species). Secondly, in the new species, the posterior plate of telson (Fig. 5D) is much longer than anterior plate (length 2.62–2.66 times anterior plate length) as compared to *U. indicus* (approximately 1.90 times posterior plate length (lengths estimated from the illustration of Baba (2018: Fig. 217C)). Thirdly, the ultimate spine of the P2 dactylus flexor margin (Fig. 6G–H) is slightly larger than the penultimate spine, and very slightly larger than the antepenultimate spine. Moreover, the antepenultimate spine (Fig. 6G–H) is almost equidistant from the penultimate as well the distal spines (versus the antepenultimate spine is relatively more remote from the penultimate than from the distal quarter in the latter; Baba, 2018: Fig. 217G–H).

In addition to the above, the new species differs from *U. gracilimanus* (Henderson, 1885) in having paired terminal spines on the P2–P4 propodi (versus single terminal spine in the latter species; Baba (2018: Fig. 98H–K)).

The new species differs from *U. psilus* Baba, 2018, in having the anterolateral carapace spine (Fig. 5A) overreaching the lateral orbital spine (versus anterolateral spine not overreaching orbital spine in the latter; Baba, 2018: Fig. 215A), the antennal peduncle (Fig. 5A) distinctly overreaching distal end of cornea (versus antennal peduncle terminating in distal end of cornea in the latter; Baba, 2018: Fig. 215A), the antennal scale length 1.60–1.70 times width (versus antennal scale length 2.0 times width in the latter), the cheliped ischium (Fig. 6A) without ventromesial spine (versus ventromesial spine present in the latter; Baba, 2018: Fig. 215I), the cheliped merus (Fig. 6A) unarmed (versus cheliped merus with spinose ventral surface in the latter; Baba, 2018: Fig. 215I), the ultimate spine of the P2–P4 dactylar flexor margins (Fig. 6G–L) slightly larger than the penultimate spine, very slightly larger than the antepenultimate spine (versus ultimate spine very slightly smaller than or subequal to penultimate spine, subequal to antepenultimate spine in the latter; Baba, 2018: Fig. 216A–D).

The new species differs from the Atlantic species *U. nitidus* (A. Milne-Edwards, 1880) in lacking armature on the dorsal surface of carapace (Fig. 5A) (versus dorsal carapace with a pair of granulate epigastric ridges in the latter; Baba and Wicksten, 2017: Fig. 1A–B), the relatively shorter rostrum, 0.32 times cl, directed anteroventrally (Fig. 5B) (versus 0.40–0.50 times cl, distinctly upcurved distally in the latter; Baba and Wicksten, 2017: Fig. 1B), the abdominal somite 2 relatively wider (3.73–4.62 times length) (versus width 2.3–2.5 times length in the latter), and the posterior plate of telson relatively longer (2.62–2.66 times) than the anterior plate (versus posterior plate length 1.4–2.2 times anterior plate length).

Distribution. Eastern Arabian Sea, northwest off Honnavar, at 950–960 m deep.

Family Sternostylidae Baba, Ahyong and Schnabel, 2018

Genus ***Sternostylus*** Baba, Ahyong and Schnabel, 2018

Sternostylus investigatoris

(Alcock and Anderson, 1899)

(Figs. 2B, 7)

Ptychogaster investigatoris Alcock and Anderson, 1899a: 24 [Type locality: Andaman Sea, 405 fms (741 m) deep]; 1899b: pl. 45 fig. 1.—Alcock, 1901: 281.—Alcock and McArdle, 1902: pl. 58 fig. 4.—Kemp and Sewell, 1912: 25.

Chirostylus investigatoris (Alcock and Anderson, 1899).—Doflein and Balss, 1913: 132, figs. 1–2.—Tirmizi, 1964: 386, figs. 1–2.

Gastroptychus investigatoris (Alcock and Anderson, 1899).—Zarenkov and Khodkina, 1981: 86, fig 3.—Baba, 1988: 15, fig. 5; 2005: 213.—Baba *et al.*, 2008: 22.—McCallum and Poore, 2013: 10, figs. 1, 11A.

Sternostylus investigatoris (Alcock and Anderson, 1899).—Osawa and Higashiji, 2019: 320, figs. 1–2.

Material examined. Bay of Bengal, FORVSS stn. 29289, 7.53°N, 93.25°E, 580 m deep, HSDT (CV), 3 ♂♂ (cl 12.9–16.4 mm, IO/SS/ANO/00004), 11 December 2011; FORVSS stn. 349I01, 12.48°N, 92.39°E, 576 m deep, HSDT (CV), 1 ♀ (cl 15.0 mm, IO/SS/ANO/00005), 4 April 2016.

Remarks. Ptychogaster investigatoris, originally described as a distinct species from *P. hendersoni* Alcock and Anderson, 1899, and figured twice (Alcock and Anderson, 1899b: Pl. 45 fig. 1; Alcock and McArdle, 1902: Pl. 58, fig. 4), was distinguished from the latter species by "the relatively shorter carapace whose length equalled the combined length of first five and half of last abdominal somite"; the unarmed third abdominal somite; and the telson with the anterior plate slightly narrower than the posterior plate, its length greater than half the length of the latter (Alcock, 1901). The Indonesian specimens collected during the *Galathea Expedition* and reported by Doflein and Balss (1913) differed from the *Investigator* specimens in the armature of the second (only median spine) and third (presence of spinule on the margin separating tergum and pleuron) abdominal somites. Tirmizi (1964) reported this species from the *John Murray Expedition* collection in the Maldives, and attributed the differences among the Indian and Indonesian specimens to intraspecific variations. In addition, she provided a detailed description of the armature of the thoracic sternites and structure of male pleopods (Tirmizi, 1964: Figs. 1–2). Zarenkov and Khodkina (1981: Fig. 3) reported that the specimens from the Marcus-Necker Rise in the mid-Pacific differed from the holotype in the armature of fourth sternite, fifth tergite, and merus of Mxp3. The examination of the *Albatross Expedition* specimens by Baba (1988) suggested that the ratio of the lengths of the anterior and posterior telson plates is highly variable. The published reports (Tirmizi, 1964; Baba, 1988: Fig. 5b) have emphasized on the distinctness of the armature of the third thoracic sternite (2 spines behind anterior margin), as well as the fourth sternite bearing 3 pairs of submedian spines on either side of median longitudinal groove and 2 spines on the lateral margin. McCallum and Poore (2013: Fig. 1A–C) reported a comparatively more spinose carapace, particularly the gastric region, and the fourth thoracic sternite, as well as presence of spines on the fifth sternite for the specimens from off northwest Australia. Osawa and Higashiji (2019: Fig. 2E) reported the presence of a proximal spine on the Mxp3 carpus in a Japanese specimen. The present specimens agree with the description of the holotype, as well as the pattern of sternal armature depicted by Tirmizi (1964) and Baba (1988). In addition, the present specimens (Fig. 7H) agree with Osawa and Higashiji (2019) in possessing a small dorsoproximal spine on the Mxp3 carpus. The present specimens differ from the northwest Australian specimens in possessing a relatively less spinose carapace (Fig. 7A), and the fourth thoracic sternite (Fig. 7C), as well as the absence of spines on the fifth sternite (Fig. 7C).

Distribution. Maldives, off SW India, Andaman Sea, Western Australia, Indonesia, Philippines, south Japan, and Marcus-Necker Rise in the central Pacific; 390–1500 m in bathymetric range (Baba *et al.*, 2008; McCallum and Poore,

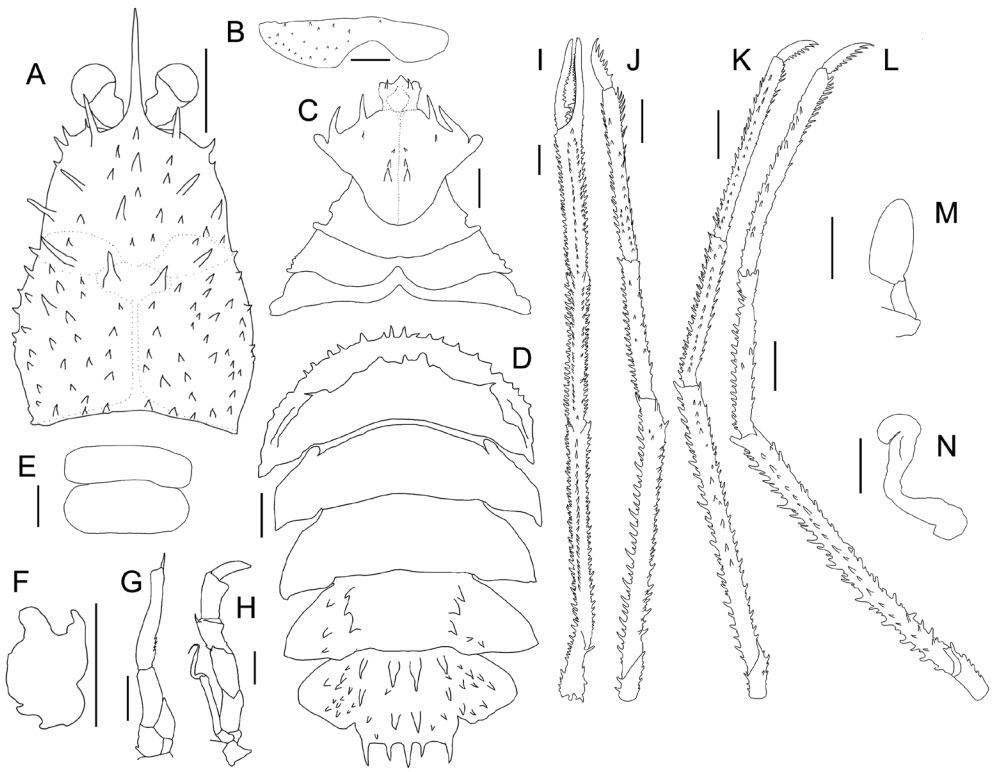

Fig. 7. *Sternostylus investigatoris* (Alcock and Anderson, 1899), male (IO/SS/ANO/00004, cl 16.4 mm). A: Carapace. B: Pterygostomian flap. C. Thoracic sternum. D: Abdomen. E: Telson. I: Cheliped. J–L: P2–P4. M–N: G1 and G2. — Female (IO/SS/ANO/00005, cl 15.0 mm). F: Basal antennular article. G: Antennal peduncle. H: Mxp3. Scale bar: 5 mm for A, G, I–L; 2 mm for B–F, H, M–N.

2013; Osawa and Higashiji, 2019). The bathymetric range of the present material is 576–580 m.

Family Munididae Ahyong, Baba, Macpherson and Poore, 2010
Genus ***Agononida*** Baba and de Saint Laurent, 1996
Agononida aff. ***indocerta*** Poore and Andreakis, 2012
(Figs. 2C, 8)

Munida incerta Henderson, 1888.—Tirmizi and Javed, 1993: 100, figs. 43–44.

Munida sp.—Jones and Morgan, 1994: 135, 1 fig.

Agononida sp. cf. *squamosa* (Henderson, 1885).—Jones and Morgan, 2002: 135, 1 fig.

Agononida sp. aff. *incerta* (Henderson, 1888).—Poore *et al.*, 2008: 18 (part).

Agononida indocerta Poore and Andreakis, 2012: 5 (in key), 19, figs. 2H–J, 3D, 10 [Type locality: Western Australia, 12°36.1′S 123°25.5′E, 419–403 m deep]; 2014: 204 (in key), 210, figs. 2d, 5.—Macpherson *et al.*, 2020: 17.

Material examined. Andaman Sea, FORVSS stn. 349I04, 9.66°N, 92.92°E, 362 m deep, HSDT (CV), 1 ovig. ♀ (cl 19.8 mm, IO/SS/ANO/00027), 6 April 2016.

Remarks. Tirmizi and Javed (1993) reported *Munida incerta* Henderson, 1888 collected during the International Indian Ocean Expedition in the Bay of Bengal. The illustrations (Tirmizi and Javed, 1993: Figs. 43–44) indicated a "broad" pterygostomian flap with "anterior margin rounded", "boat-shaped" third thoracic sternite with crenulated anterior margin, tergite of the second abdominal somite bearing 3 right and 1 left submedian spines, tergite 4 bearing 1 pair each of submedian and lateral spines; basal antennular article with 1 distomesial and 3 lateral

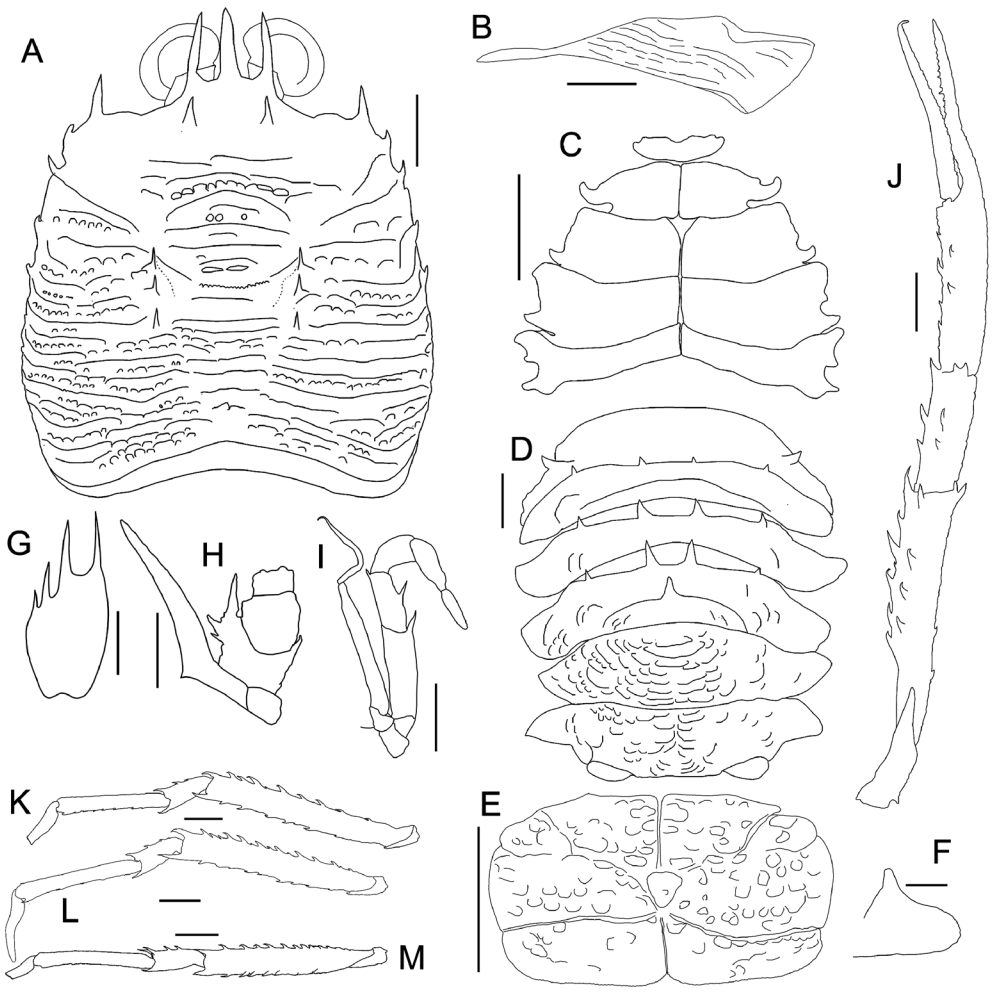

Fig. 8. *Agononida* aff. *indocerta* Poore and Andreakis, 2012, female (IO/SS/ANO/00027, cl 19.8 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. F: Telson anterolateral margin. G. Basal antennular article. H: Antennal peduncle. I: Mxp3. J: Cheliped. K–M: P2–P4. Scale bar: 5 mm for A–E, G–M; 1 mm for F.

spines; basal antennal article bearing elongated spine, second article bearing 3 mesial spines; Mxp3 merus with 1 median spine on inner margin and small distolateral spine. Jones and Morgan (1994) illustrated a colour photograph *Munida* sp. from Australian waters, subsequently identified as *Agononida* sp. cf. *squamosa* (Jones and Morgan, 2002). Poore and Andreakis (2012) revised the taxonomy of the *Agononida incerta* species complex and recognized 4 new species, including *Agononida indocerta* Poore and Andreakis, 2012 (Poore and Andreakis, 2012: Fig. 10A–B), which was diagnosed by a "telson with anterolateral margin concave, smooth over anterior 70%, remainder prominent, widest well anterior to transverse suture and narrower adjacent to transverse suture, with crenellate margin" and "pereopod 4 merus usually with spines proximally on upper face". Subsequently, Poore and Andreakis (2014: Fig. 5a, c) updated the description of the anterolateral margin of telson and revealed the telson anterolateral margin to be "concave over anterior 70–75%, smooth initially and becoming microtuberculate, with dorsal

sharp secondary ridge more obvious in larger specimens; posterior quarter not separated from anterior section by deep notch, with irregular crenellate margin, widest well anterior to transverse suture and narrower adjacent to transverse suture". Both the above papers considered the *M. incerta* reported by Tirmizi and Javed (1993) to be conspecific with *A. indocerta* based on the shape of the telson anterolateral margin illustrated by the latter.

The present specimen, an ovigerous female, agrees with the illustrations and brief description provided by Tirmizi and Javed (1993), as well as the concave shape of the anterolateral margin of the telson (Fig. 8F). However, it differs from *A. indocerta* in lacking facial spines on P4 merus.

Distribution. Western Australia and Papua New Guinea; 150–754 m in bathymetric range (Poore and Andreakis, 2014; Macpherson *et al.*, 2020). This is the first record from Indian waters indicating westward and northward range extensions. The bathymetric range of the present specimen is 360–370 m.

Agononida prolixa (Alcock, 1894)
(Figs. 2D, 9)

Munida squamosa var. *prolixa* Alcock, 1894: 322 [Type locality: Andaman Sea, "RIMSS *Investigator*" stn. 115, 11°31′40"N, 92°46′40"E, 188–220 fms (344–403 m) deep]; 1901: 244. — Alcock and Anderson, 1894: 166; 1895: pl. 13 fig. 3. — Doflein and Balss, 1913: 142.

Agononida prolixa (Alcock, 1894). — Ahyong and Poore, 2004: 14. — Baba, 2005: 234 (in key), 236 (synonymy). — Baba *et al.*, 2008: 51 (synonymy).

Material examined. Andaman Sea, FORVSS stn. 29234, 13.22°N, 93.18°E, 299 m deep, HSDT (CV), 2 ♂♂ (cl 17.4–21.5 mm, IO/SS/ANO/00028), 27 November 2011; FORVSS stn. 334I17, 12.78°N, 93.11°E, 328 m deep, HOTMN, 1 ♂ (cl 17.4 mm, IO/SS/ANO/00029), 18 January 2015; FORVSS stn. 349II05, 12.54°N, 93.15°E, 300 m deep, HSDT (CV), 1 ♂ (cl 16.2 mm, IO/SS/ANO/00030), 1 ♀ (cl 14.0 mm, IO/SS/ANO/00031), 10 April 2016; FORVSS stn. 29238, 13.00°N, 93.11°E, 308 m deep, HSDT (CV), 2 ♂♂ (cl 18.04 mm, carapace of second male missing, IO/SS/ANO/00045), 28 November 2011.

Remarks. Macpherson (1993: 427, Remarks of *M. analoga* Macpherson, 1993) suggested *M. squamosa* var. *prolixa* Alcock, 1894 might be a distinct species based on examination of two *Investigator* specimens because the variety differed from *M. analoga* and *M. squamosa* Henderson, 1885, in having a blunt distal spine on the mesial margin of the second antennal segment, and 3 instead of 4 spines on the branchial margin of the carapace. Ahyong and Poore (2004: 14, Remarks of *M. squamosa*), on the basis of examination of another *Investigator* specimen, agreed with Macpherson's (1993) observations and recognized *M. squamosa* var. *prolixa* as a full species status. The present specimens (Fig. 9), also from the Andaman Sea as the type material, agree with the above-mentioned characters.

Distribution. Arabian Sea, Gulf of Mannar, southern Bay of Bengal, and Andaman Sea; 238–1232 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present material is 299–328 m.

Genus ***Munida*** Leach, 1820

Munida andamanica Alcock, 1894
(Figs. 2E, 10)

Munida militaris var. *andamanica* Alcock, 1894: 321 [Type locality: Andaman Sea, "RIMSS *Investigator*" stn. 115, 11°31′40″N, 92°46′40″E, 188–220 fms (344–403 m) deep]. — Alcock and Anderson, 1895: pl. 13 fig. 2.

Munida militaris var. *curvirostris* Henderson, 1885. — Henderson, 1888: 139 (part).

Munida andamanica Alcock, 1894. — Alcock, 1901: 242. — Lloyd, 1907: 2. — Kemp and Sewell, 1912: 25. — Balss, 1913b: 17. — Doflein and Balss, 1913: 143. — Parisi, 1917: 1. — Yokoya, 1933: 63. — Takeda, 1982: 51, fig. 152. — Miyake, 1982: 149, pl. 50 fig. 1. — Baba, 1982: 103; 1988: 85; 2005: 90, 254 (in key), 258, figs. 33–35. — Baba in Baba *et al.*, 1986: 169, 289, fig. 119. — Tirmizi and Javed, 1993: 115, figs. 50–53. — Komai, 2000: 354 (in list). — Poore *et al.*, 2008: 19. — Baba *et al.*, 2008: 85 (synonymy). — Macpherson *et al.*, 2020: 34.

Munida curvatura Benedict, 1902: 253, fig. 5 [Type locality: Off Manazuru Zaki, Honshu, Japan, 280 m deep].

Munida curvirostris Henderson, 1885. — Baba and

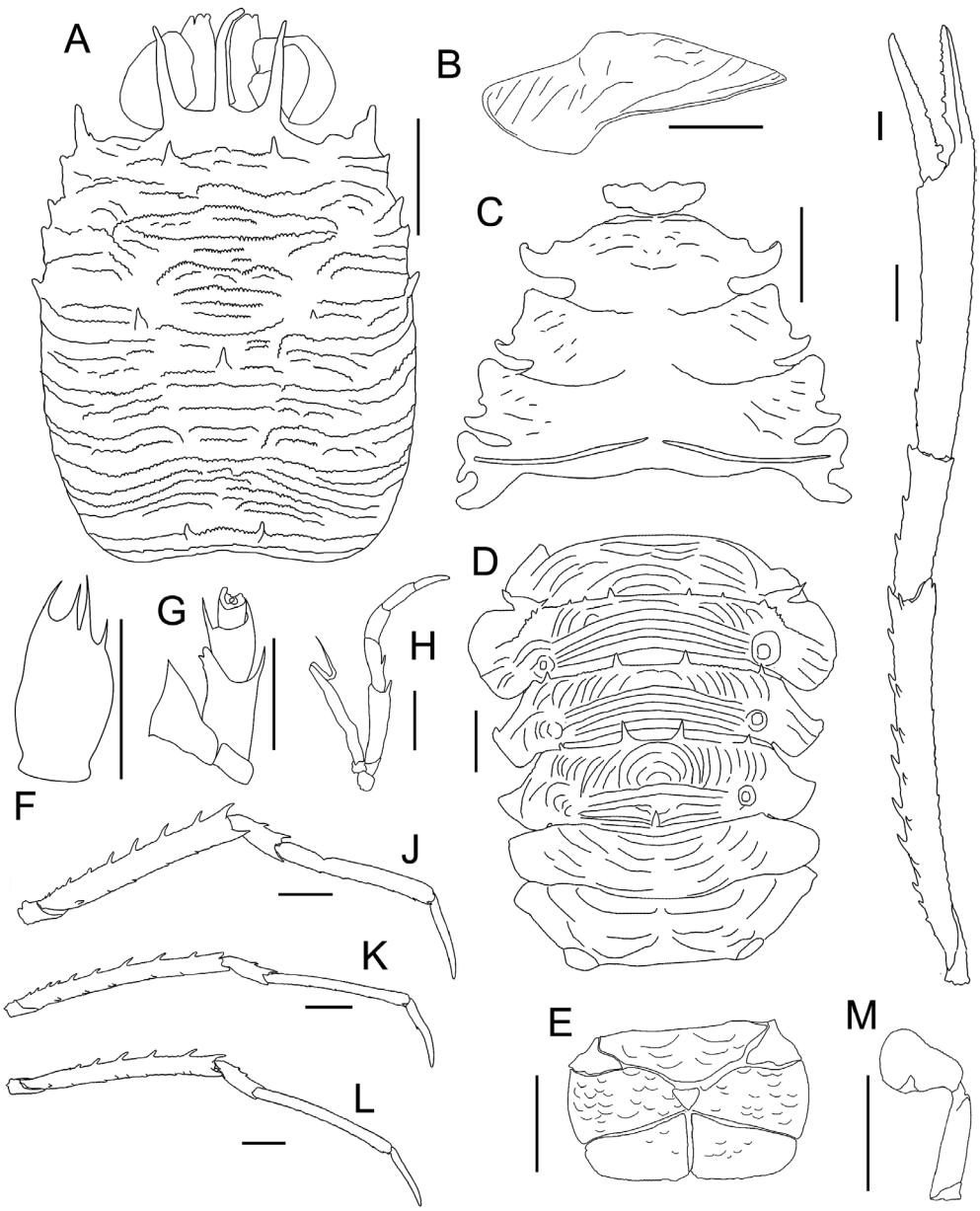

Fig. 9. *Agononida prolixa* (Alcock, 1894), male (IO/SS/ANO/00028, cl 21.5 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. F: Basal antennular article. G: Antennal peduncle. H: Mxp3. I: Cheliped. J–L: P2–P4. M: G2. Scale bar: 5 mm for A–M.

Macpherson, 1991: 538 (part).—Baba, 1994: 9.

Not *Munida andamanica* Alcock, 1894.—Tirmizi, 1966: 198, figs. 17–19 (Material from Zanzibar area, 640 m deep = *M. africana* Balss, 1913; the identity of the other material from the Gulf of Aden in 457–1022 m deep and the Maldives in 456 m deep remains questionable; see Macpherson and de Saint Laurent, 2002).

Material examined. Andaman Sea, FORVSS stn. 28016, 12.83°N, 93.21°E, 441 m, Expo, 4 ♂♂ (cl 14.0–18.9 mm, IO/SS/ANO/00032), 3 ♀♀ (cl 18.0–20.0 mm, IO/SS/ANO/00033), 17 September 2010; FORVSS stn. 334I17, 12.78°N, 93.11°E, 328 m, HOTMN, 2 ♂♂ (1

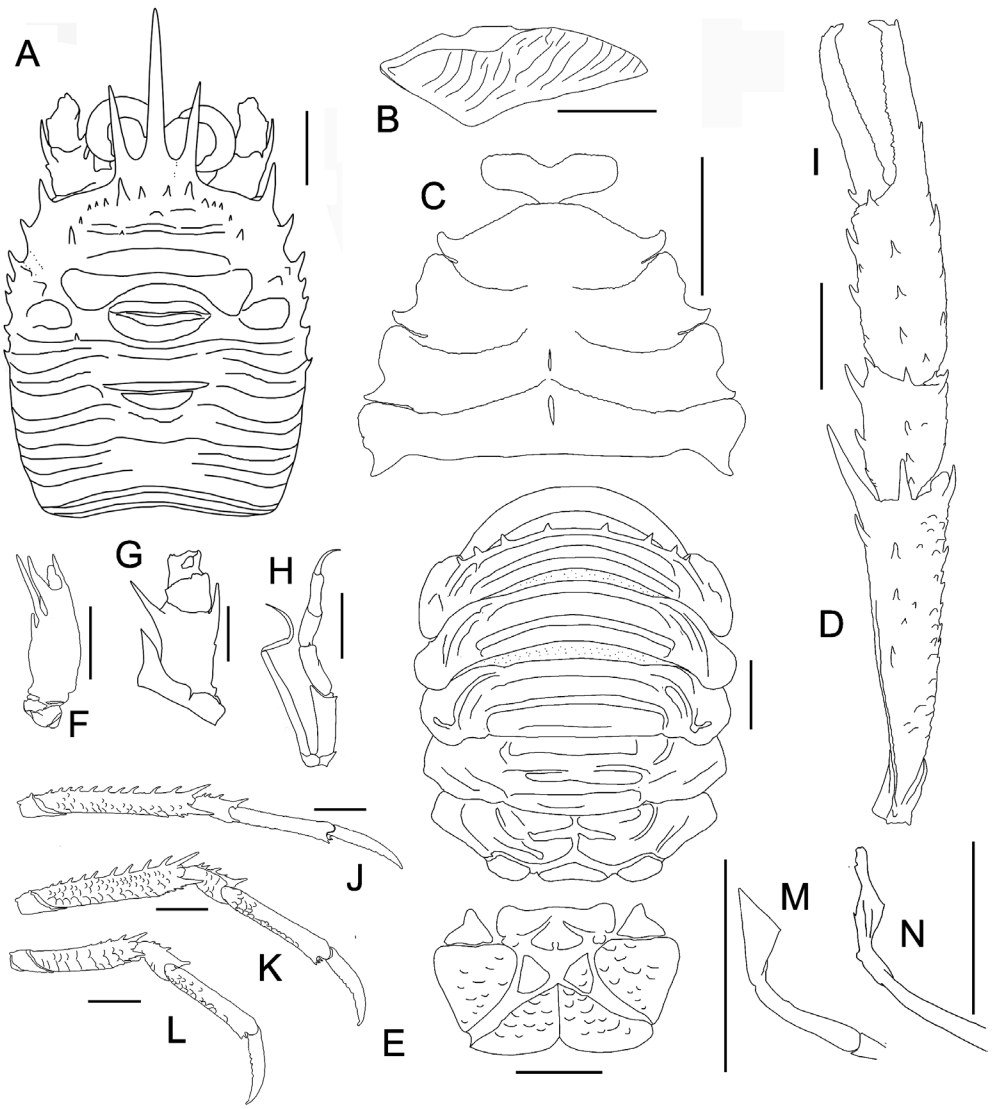

Fig. 10. *Munida andamanica* Alcock, 1894, female, (IO/SS/ANO/00033, cl 20.0 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. F: Basal antennular article. I: Cheliped. J–L: P2–P4. — Male (IO/SS/ANO/00034, cl 12.8 mm). G: Antennal peduncle. H: Mxp3. — Male (IO/SS/ANO/00032, cl 18.9 mm). M–N: G1 and G2. Scale bar: 5 mm for A–N.

damaged) (cl 19.0 mm, IO/SS/ANO/00037), 1 ♀ (cl 14.5 mm, IO/SS/ANO/00038), 18 January 2015; FORVSS stn. 349II06, 12.74°N, 93.11°E, 332 m, HSDT (CV), 1 ♂ (cl 19.0 mm, IO/SS/ANO/00039), 10 April 2016.

Bay of Bengal, FORVSS stn. 28037, 6.64°N, 93.68°E, 321 m, Expo, 1 ♂ (cl 12.8 mm, IO/SS/ANO/00034), 24 September 2010; FORVSS stn. 334I11, 11.28°N, 92.38°E, 530 m, HOTMN, 2 ♂♂ (cl 14.8–20.3 mm, IO/SS/ANO/00035), 1 ♀ (cl 16.5 mm, IO/SS/ANO/00036), 15 January 2015.

Arabian Sea, FORVSS stn. 39801, 8.24°N, 76.49°E, 610 m, HSDT(CV), 1 ♂ (cl 15.0 mm, IO/SS/ANO/00044), 29 February 2020.

Remarks. Munida andamanica Alcock, 1894, originally described from the Andaman Sea and figured by Alcock and Anderson (1895: Pl. 13

fig. 2), has been frequently reported from the Indian Ocean (Alcock, 1901; Lloyd, 1907; Kemp and Sewell, 1912; Doflein and Balss, 1913; Tirmizi and Javed, 1993; Poore *et al.*, 2008) and the western Pacific Ocean (Henderson, 1888; Benedict, 1902; Balss, 1913b; Parisi, 1917; Yokoya, 1933; Baba, 1982, 1988, 1994; Takeda, 1982; Miyake, 1982; Baba in Baba *et al.*, 1986; Baba and Macpherson, 1991). Baba (2005: Figs. 33–35) extensively studied this species with regards to the variability in the form and number of secondary striae on the carapace and abdomen, rostral lengths, and proportions and armatures of ambulatory legs based on examination of material collected during various expeditions. The morphology of the present specimens (Fig. 10) agrees with the description of the holotype as well as Baba's account (2005).

Distribution. Off Zanzibar, Mozambique, Arabian Sea, Maldives, Andaman Sea, Indonesia, Philippines, Japan, and western and eastern Australia; 141–1360 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present material is 321–530 m.

Family Munidopsidae Ortmann, 1898
Genus ***Munidopsis*** Whiteaves, 1874
Munidopsis dasypus Alcock, 1894
(Figs. 3A, 4A, 11)

Munidopsis dasypus Alcock, 1894: 329 [Type locality: Bay of Bengal, "RIMSS *Investigator*" stn. 112, 13°47′30″N, 92°36′E, 561 fms (1026 m deep)]; 1901: 252.—Alcock and Anderson, 1894: 167; 1895: pl. 13 fig. 9.—Alcock and MacGilchrist, 1905: pl. 70 fig. 3.—MacGilchrist, 1905: 245.—Baba, 1988: 139 (in key), 154, fig. 60; 2005: 148, 283 (in key), 287 (synonymy).—Komai, 2000: 359 (in list); 2011: 21, figs. 8–10.—Macpherson, 2007: 59.—Osawa *et al.*, 2008: 42, fig. 2A.—Baba *et al.*, 2008: 139 (synonymy).—Baba *et al.*, 2009: 225, fig. 203.—Poore *et al.*, 2008: 21.—Taylor *et al.*, 2010: 10, figs. 3, 5F.—Osawa *et al.*, 2013: 263, figs. 8H, I, 11D–G.

Munidopsis (Munidopsis) dasypus Alcock, 1894.—Tirmizi, 1966: 218, fig. 32.

Not *Munidopsis dasypus* Alcock, 1894.—Kensley, 1977: 176, fig. 10; 1981: 34 (in list).—Baba and Poore, 2002: 233, fig. 2 (= *Munidopsis kensleyi* Ahyong and Poore, 2004).

Material examined. Andaman Sea, FORVSS stn. 334I13, 11.72°N, 93.18°E, 812 m deep, HOTMN, 1 ♂ (cl 21.2 mm, IO/SS/ANO/00006), 16 January 2015.

Remarks. Munidopsis dasypus, described from the Bay of Bengal (Alcock, 1894) and figured twice (Alcock and Anderson, 1895: Pl. 13 fig. 9; Alcock and MacGilchrist, 1905: Pl. 70 fig. 3), was distinguished from other congeneric Indian species by the presence of epipod only on the cheliped (Alcock, 1901). Tirmizi (1966) reported the presence of minute lateral serrations on the rostrum, which was reported neither in the holotype (Alcock, 1894) nor the *Albatross* specimens (Baba, 1988). Baba (2005) examined the specimens collected during the *Galathea Expedition*, and commented on the variations in the number of lateral carapace spines in the *Albatross* specimens. Osawa *et al.* (2008: Fig. 2A) reported only carapace lateral spine (posterior to the anterolateral spine) in the Taiwanese specimen. Komai (2011: Fig. 10A–B) and Osawa *et al.* (2013: Fig. 8H–I) discussed the variation of the marginal armature on the carapace and pereopods in Japanese and Philippine specimens referred to *M. dasypus*. Komai (2011: Fig. 9F) reported the presence of only 2 spines on the ventral margin of Mxp3 merus.

The present specimen (Fig. 11) agrees with the description of the holotype and illustrations of Baba's *Albatross* specimens (Baba, 1988: Fig. 60a–e).

The South African specimens reported by Kensley (1977: Fig. 10) differed from the *Investigator* specimens in the absence of spine behind the anterolateral spine, and only 2 spines on the carapace posterior margin. Ahyong and Poore (2004: Figs. 10, 11) re-examined this material along with the additional Australian material, and considered that these differences warranted recognition as a distinct species, *M. kensleyi* Ahyong and Poore, 2004.

Distribution. Off South Africa, Madagascar, South Arabian coast, Gulf of Aden, Arabian Sea, Laccadive Sea, Andaman Sea, Indonesia, Philippines, Taiwan, off south and east Australia; 214–

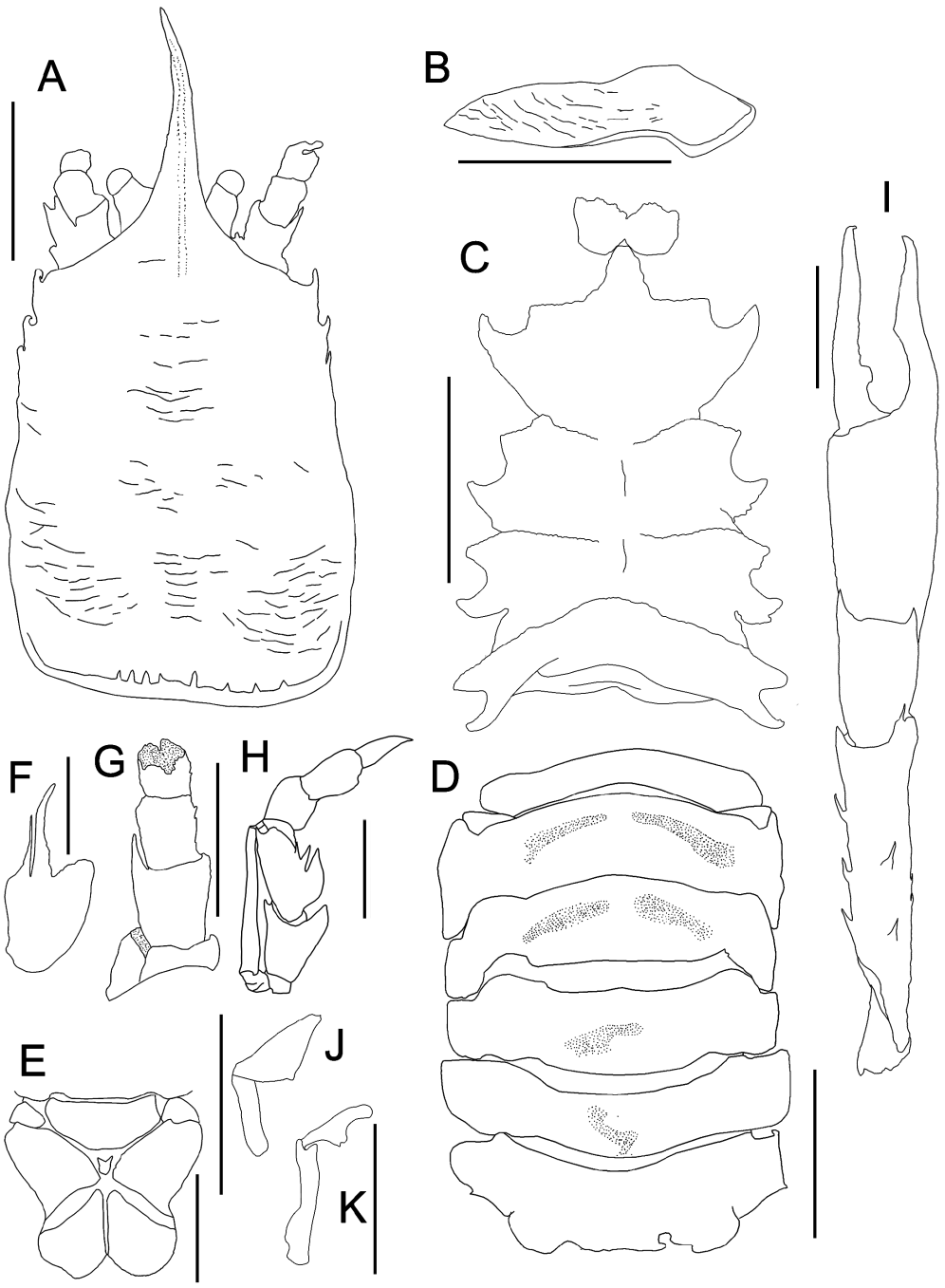

Fig. 11. *Munidopsis dasypus* Alcock, 1894, male (IO/SS/ANO/00006, cl 21.2 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. F: Basal antennular article. G: Antennal peduncle. H: Mxp3. I: Cheliped. J–K: G1 and G2. Scale bar: 5 mm for A, C–H, J–K; 10 mm for B, I.

1939 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present specimen is 810–820 m.

Munidopsis levis (Alcock and Anderson, 1894) (Figs. 3B, 4B, 12)

Bathyankyristes spinosus Alcock and Anderson, 1894: 174, pl. 9 fig. 2 [Type locality: Andaman Sea, off Ross Island, 485 m deep].—Alcock and McArdle, 1901: pl. 55 fig. 2.

Bathyankyristes levis Alcock and Anderson, 1894: 175 [Type locality: Laccadive Sea, "RIMSS *Investigator*" stn. 177, 13°47'49"N, 73°7'E, 636 fms (1164 m) deep].—Alcock and McArdle, 1901: pl. 55 fig. 3.

Munidopsis (Bathyankyristes) tenax Alcock, 1901: 273 (replacement name of *Bathyankyristes spinosus* Alcock and Anderson, 1894 preoccupied by *Galacantha spinosa* A. Milne–Edwards, 1880).—Tirmizi, 1966: 211, fig. 27.

Munidopsis (Bathyankyristes) levis (Alcock and Anderson, 1894).—Alcock, 1901: 274.

Munidopsis tenax Alcock, 1901.—Baba, 1988: 170, fig. 69.—Komai, 2000: 359 (in list).

Munidopsis levis (Alcock and Anderson, 1894).—Baba, 2005: 156, 281 (in key), 290 (synonymy), figs. 70–71.—Macpherson, 2007: 79.—Poore *et al.*, 2008: 21.—Baba *et al.*, 2008: 148 (synonymy).—Taylor *et al.*, 2010: 14, fig. 4.—Macpherson *et al.*, 2017: 55 (in Table 3).—Macpherson *et al.*, 2020: 105, fig. 18D.

Material examined. Arabian Sea, FORVSS stn. 37205, 14.39°N, 73.03°E, 957 m, HSDT (CV), 6 ♂♂ (cl 15.0–20.2 mm, IO/SS/ANO/00007), 7 ♀♀ (cl 11.0–18.0 mm, IO/SS/ANO/00008), 28 February 2018; FORVSS stn. 37410, 14.37°N, 73.03°E, 957 m, HSDT (CV), 4 ♂♂ (cl 13.0–19.0 mm, IO/SS/ANO/00009), 1 ♀ (cl 19.0 mm, IO/SS/ANO/00010), 9 April 2018.

Remarks. Alcock and Anderson (1894) described two closely resembling species, namely *Bathyankyristes spinosus* and *B. levis* (both figured by Alcock and McArdle, 1901: Pl. 55 figs. 2 and 3, respectively), which reportedly differed in the nature of the rostrum, the size of the cornea, the armature of the pereopods, and the distance between abdominal tergites. Alcock (1901) replaced the specific name *spinosus* (preoccupied by *M. spinosa* (A. Milne Edwards, 1880)) with *tenax*, and emphasized on the relative size of the rostrum and the corneal size to separate the two species. Tirmizi's examination (1966) of the *John Murray* specimens revealed one male from Zanzibar and a female the Maldives, to which she assigned the name *M. tenax*. The Zanzibar specimen resembled *M. levis* in having a longer rostrum, whereas the Maldivian specimen resembled the latter in having the shorter rostrum, and relatively less armature on the pereopods. Baba (1988) reported only 2 carapace lateral spines in the *Albatross* specimens. Baba's examination (2005) of *Th. Mortensen's Pacific Expedition* specimens revealed the characters resembling both *M. levis* (broad rostrum; Baba, 2005: Fig. 71A) and *M. tenax* (presence of a disto-lateral spine on the cheliped carpus). Further, in view of the lack of clarity in the original figures (Alcock and McArdle, 1901) for distinguishing the two species, Baba (2005) synonymized *M. tenax* with *M. levis*.

The morphology of the present specimens agreed with the original illustration of *M. levis* in the form of carapace (Fig. 12A), the relative size of the chelipeds, and the closer contact of the abdominal somites (Fig. 12D).

Distribution. Off Zanzibar, Madagascar, Maldives, Laccadive Sea, Andaman Sea, South China Sea, Philippines, Solomon Islands, and south Australia (Baba *et al.*, 2008); Papua New Guinea; 283–1164 m in bathymetric range (Baba *et al.*, 2008; Macpherson *et al.*, 2020). The bathymetric range of the present material is 950–960 m.

Munidopsis regia Alcock and Anderson, 1894 (Figs. 3C, 4C, 13)

Munidopsis regia Alcock and Anderson, 1894: 168 [Type locality: Gulf of Mannar, "RIMSS *Investigator*" stn. 151, 142–400 fms (260–732 m) deep]; 1895: pl. 11 fig. 1.— Baba, 1988: 160, fig. 63; 2005: 278 (in key), 293 (synonymy).—Komai, 2000: 359 (in list).— Macpherson, 2007: 96.— Baba *et al.*, 2008: 157 (synonymy).— Osawa *et al.*, 2013: 274, figs. 14I, 17C–F, 18A.

Munidopsis triaena Alcock and Anderson, 1894: 168 [Type locality: Andaman Sea, 240–375 fms (439–

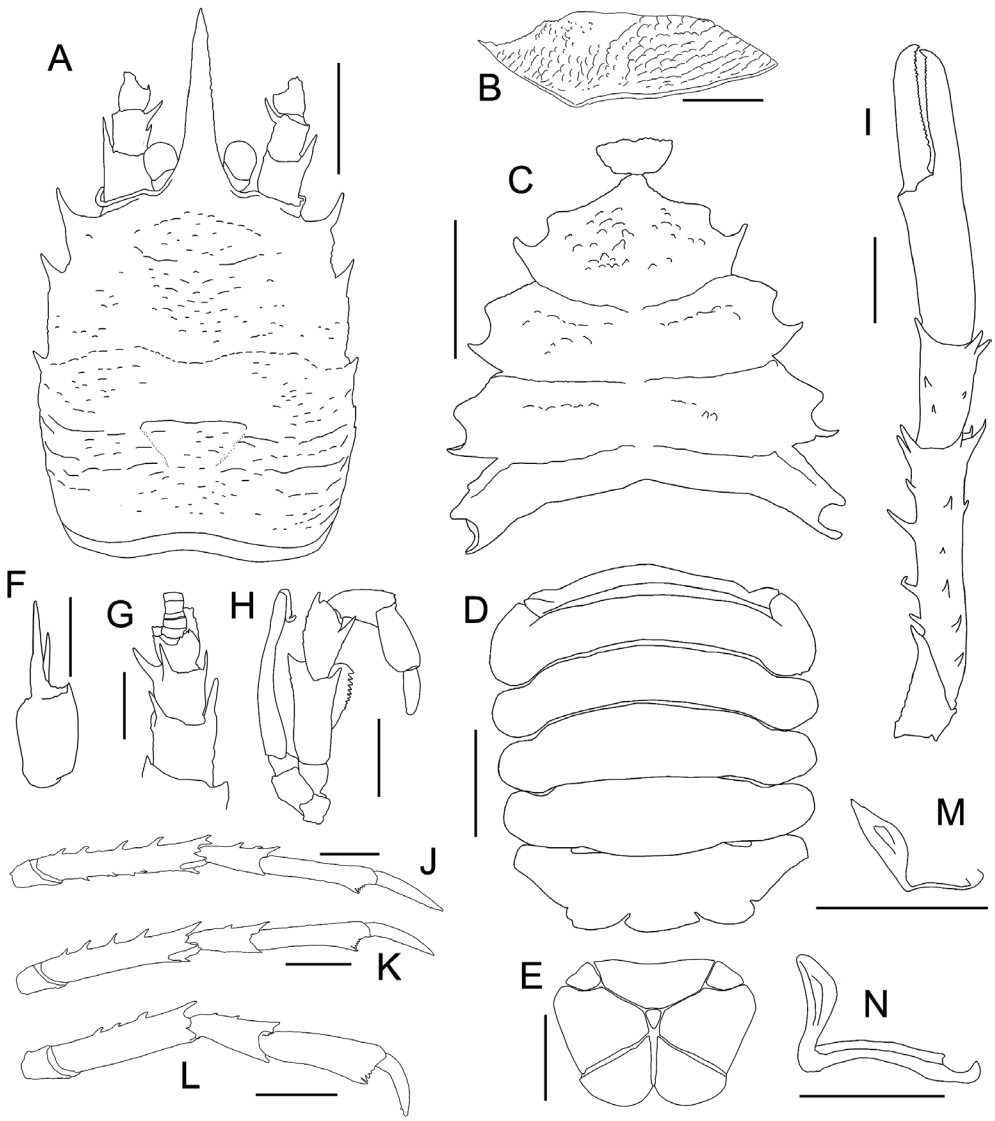

Fig. 12. *Munidopsis levis* (Alcock and Anderson, 1894), male (IO/SS/ANO/00007, cl 18.5 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. F: Basal antennular article. G: Antennal peduncle. H: Mxp3. I: Cheliped. J–L: P2–P4. M–N: G1 and G2. Scale bar: 5 mm for A–N.

686 m) deep]; 1895: pl. 11 fig. 5.

Munidopsis (Galathodes) regia Alcock and Anderson, 1894.—Alcock, 1901: 261.—Doflein and Balss, 1913: 156, fig. 23.—Tirmizi, 1966: 228, fig. 39.

Munidopsis (Galathodes) triaena Alcock and Anderson, 1894.—Alcock, 1901: 261.

Material examined. Andaman Sea, FORVSS stn. 28016, 12.83°N, 93.21°E, 441 m deep, Expo, 2 ♂♂ (cl 25.0 mm, IO/SS/ANO/00011), 4 ♀♀ (cl 25.0–28.0 mm, IO/SS/ANO/00012), 19 September 2010; FORVSS stn. 367II08, 13.27°N, 93.26°E, 635 m deep, HSDT (CV), 3 ♂♂ (cl 24.0–35.0 mm, IO/SS/ANO/00016), 1 ♀, cl 27.8 mm, IO/SS/ANO/00017), 26 November 2017.

Bay of Bengal, FORVSS stn. 28037, 6.64°N, 93.68°E, 321 m deep, Expo, 1 ♂ (cl 32.0 mm, IO/SS/ANO/00013), 1 ♀ (damaged, IO/SS/

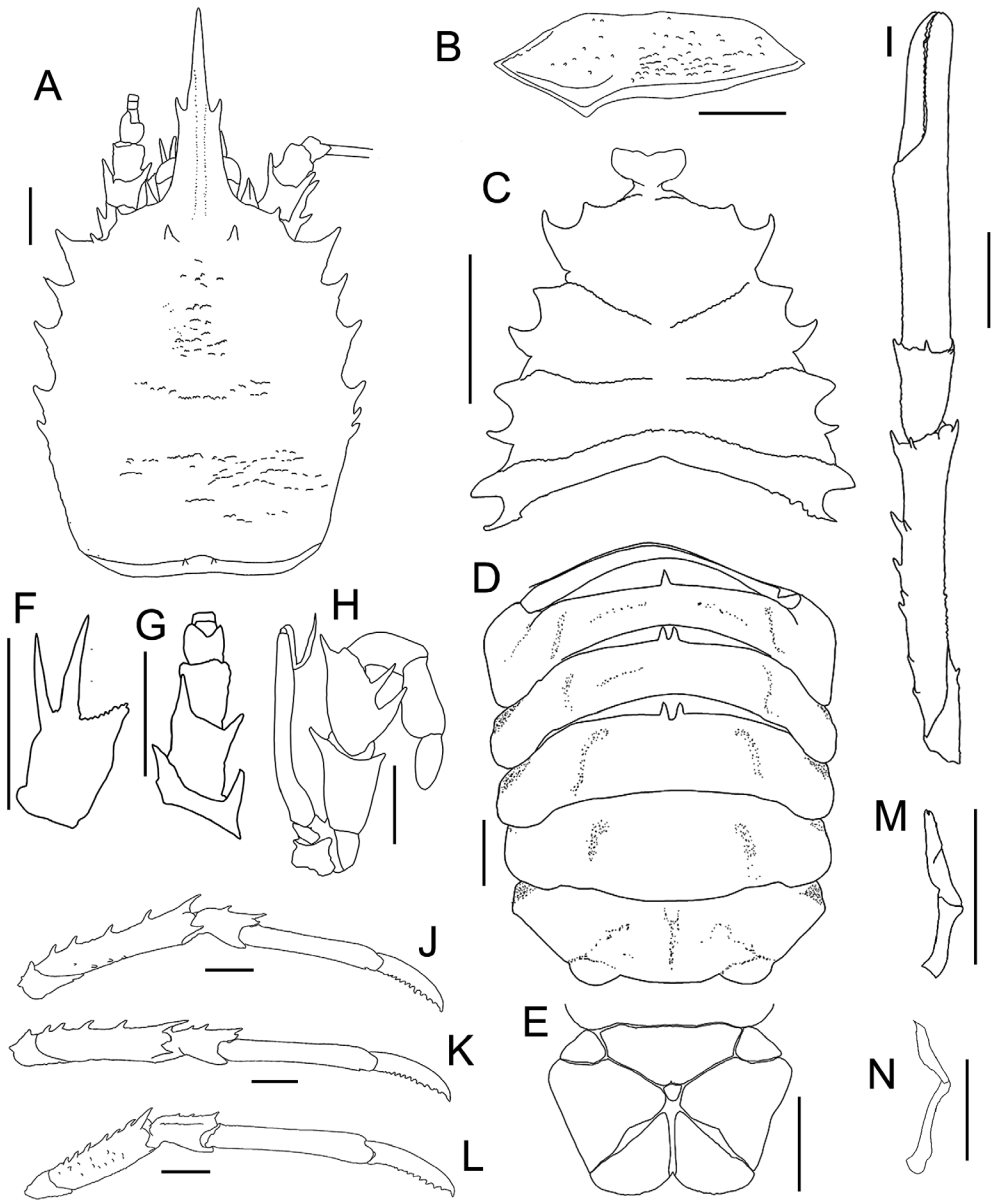

Fig. 13. *Munidopsis regia* Alcock and Anderson, 1894, female (IO/SS/ANO/00012, cl 28.0 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. I: Cheliped. J–L: P2–P4. —Male (IO/SS/ANO/00016, cl 32 mm). F: Basal antennular article. G: Antennal peduncle. H: Mxp3. —Male (IO/SS/ANO/00011, cl 25.0 mm). M–N: G1 and G2. Scale bar: 5 mm for A–N.

ANO/00014), 24 September 2010; FORVSS stn. 334I11, 11.28°N, 92.38°E, 530 m deep, HOTMN, 2 ♀♀ (cl 24.0–28.0 mm, IO/SS/ANO/00015), 15 January 2015; FORVSS stn. 367II15, 11.80°N, 92.09°E, 646 m deep, HSDT (CV), 1 ♀ (cl 30.0 mm, IO/SS/ANO/00018), 28 November 2017.

Remarks. Alcock and Anderson (1894) described two new forms resembling *Munidopsis trifida*, namely *M. regia* and *M. triaena* (both figured by Alcock and Anderson, 1895: Pl. 11 figs. 1 and 5, respectively), wherein *M. regia* report-

edly differed from the latter species in having a spinose posterior carapace (Alcock, 1901). The *Valdivia* specimens from off Sumatra recorded by Doflein and Balss (1913) reportedly differed from the *Investigator* specimens in having a less setose body, the absence of the anterior-most pair of gastric spines, the lack of spines on the posterior carapace margin, the abdominal tergites 2–3 of the larger specimen with only 1 spine (instead of 2 spines in the type specimens of *M. regia*), and the widely separated spines on the inner margin of the Mxp3 merus (Doflein and Balss, 1913: fig. 23). Further, they considered *M. triaena* to be younger individuals of *M. regia*, and synonymized it with the latter species. Tirmizi's report (1966) on the *John Murray* specimens collected in the Maldives (and fig. 39C therein) revealed closer morphological resemblance to the *Investigator* specimens with regards to the position of the spines on the ventral margin of the Mxp3 merus. Baba's examination (1988) of the *Albatross*' Philippine specimens revealed that although there was general resemblance to the type material of *M. triaena*, the presence of spines on the posterior carapace ridge was rather similar to the type material of *M. regia*, thereby approving the action of synonymizing the two species by Doflein and Balss (1913). Osawa *et al.* (2013: fig. 17C) depicted the presence of only 1 posterior branchial spine on the carapace of specimen collected during the PANGLAO 2005 expedition.

The present specimens (Fig. 13A) resemble the *Albatross* Philippine specimens in having a pair of epigastric spines and a median cardiac spinule, although these armatures do not agree with the characters of the holotype of *M. regia* and the *Valdivia* and *John Murray* material. They resemble the Philippine specimens in having 2 spines on the posterior carapace ridge. These specimens also resembled the holotype, as well as the *John Murray* and *Albatross* material, in having 2 closely spaced spines on the inner margin of the Mxp3 merus (Fig. 13H), and furthermore, the material reported by Osawa *et al.* (2013), in having more posterior branchial spines on the carapace.

Distribution. Gulf of Mannar, Maldives, Bay of Bengal, Andaman Sea, Philippines; 260–760 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present specimens is 321–646 m.

Munidopsis trifida Henderson, 1885
(Figs. 3D, 4D, 14)

Munidopsis trifida Henderson, 1885: 415 [Type locality: Straits of Magellan, Sarmiento Channel, "HMS *Challenger*" stn. 310, 400 fms (732 m) deep]; 1888: 156, pl. 16 fig. 2.—Alcock and Anderson, 1894: 168; 1899a: 18.—Anderson, 1896: 99.—Benedict, 1902: 329.—Lloyd, 1907: 2.—Yokoya, 1933: 66.—Miyake in Miyake and Nakazawa, 1947: 734, fig. 2121.—Haig, 1955: 40.—Baba, 1969: 52, figs. 6a, 7; 2005: 193, 278 (in key), 298 (synonymy).—Baba in Baba *et al.*, 1986: 179, 294, fig. 130.—Wicksten, 1989: 316.—Macpherson, 2007: 115.—Osawa and Takeda, 2007: 142, fig. 6A–B.—Osawa *et al.*, 2008: 51, fig. 6G.—Baba *et al.*, 2008: 167 (synonymy).—Baba *et al.*, 2009: 271, figs. 248–249.—Guzman and Sellanes, 2015: 299, fig. 11.—Macpherson *et al.*, 2017: 56 (in Table 3).—Macpherson *et al.*, 2020: 116.

Munidopsis (Galathodes) trifida Henderson, 1885.—Alcock, 1901: 260 .—Alcock and MacGilchrist, 1905: pl. 70 fig. 1.—Balss, 1913b: 20.—Tirmizi, 1966: 229, fig. 40A–E.

Munidopsis tomentosa Benedict, 1902: 329 (name proposed for Indian Ocean population).

Munidopsis trifida tomentosa Benedict, 1902.—Baba, 1969: 50, figs. 6b, 8.

Material examined. Arabian Sea, FORVSS stn. 37205, 14.39°N, 73.03°E, 957 m deep, HSDT (CV), 3 ♂♂ (cl 12.0–16.8 mm, IO/SS/ANO/00019), 5 ♀♀ (cl 7.0–19.0 mm, IO/SS/ANO/00020), 28 February 2018; FORVSS stn. 37410, 14.37°N, 73.03°E, 957 m deep, HSDT (CV), 1 ♂ (cl 12.0 mm, IO/SS/ANO/00021), 1 ♀ (cl 7.0 mm, IO/SS/ANO/00022), 9 April 2018.

Remarks. *Munidopsis trifida* Henderson, 1885, originally described from the Eastern Pacific Ocean, was differentiated from *M. latifrons* (A. Milne–Edwards, 1880) in having a pair of gastric spines on the carapace, and from *M. tridens* (A. Milne–Edwards, 1880) in having a narrow, sparsely setose carapace with transverse rugosi-

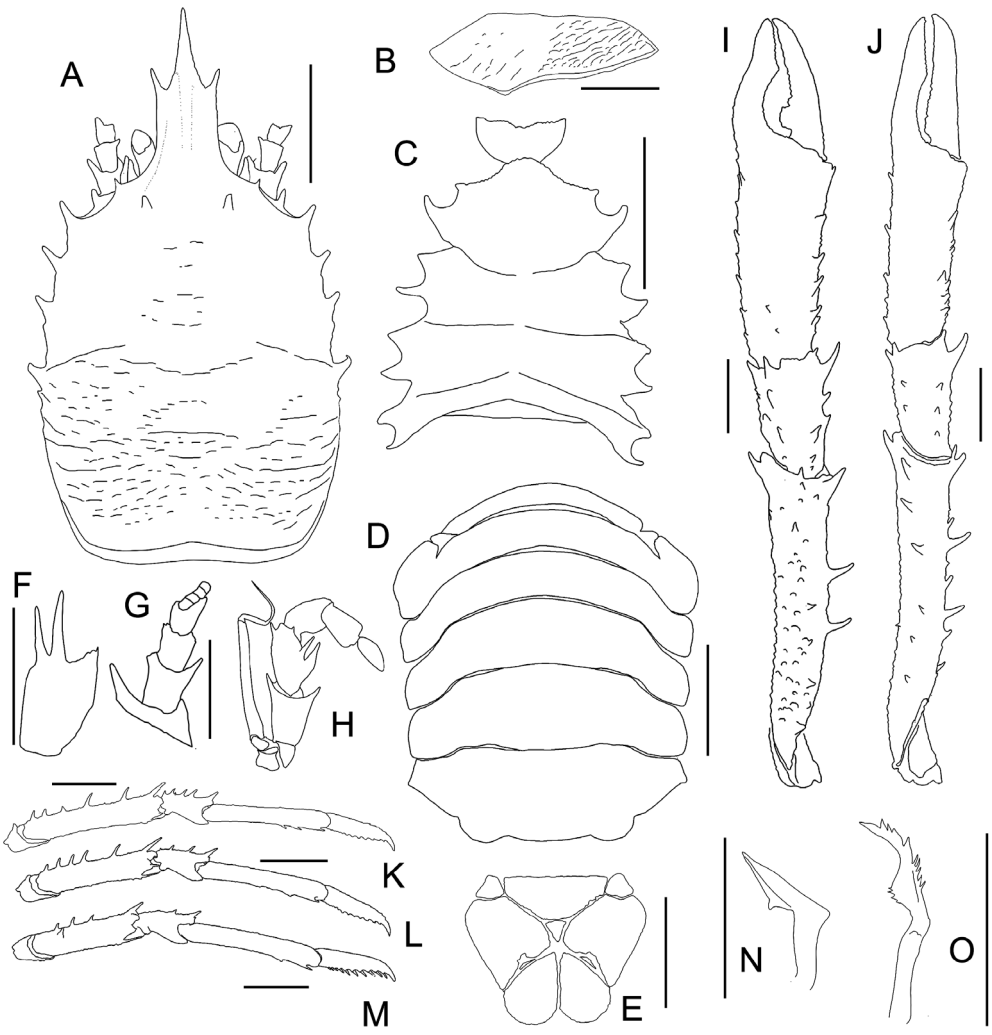

Fig. 14. *Munidopsis trifida* Henderson, 1885, male (IO/SS/ANO/00019, cl 16.8 mm), A: Carapace. F: Basal antennular article. G: Antennal peduncle. H: Mxp3. I: Cheliped. —Female (IO/SS/ANO/00020, cl 19.0 mm). B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. J: Cheliped. K–M: P2–P4. Scale bar: 5 mm for A–O.

ties, and the cheliped with comparatively more spinose merus and propodus (Henderson, 1888). This species was frequently reported (Alcock and Anderson, 1894, 1899a; Anderson, 1896; Alcock, 1901) and figured (Alcock and MacGilchrist, 1905: Pl. 70 fig. 1) from Indian waters, including the first description of the male cheliped (Alcock and Anderson, 1899a), which agrees well with those of the present specimens. Benedict (1902) commented on the denser setation of the *Investigator* specimens and proposed the new name, *M. tomentosa* for the Indian Ocean specimens as a distinct species. However, Balss (1913b) reported similarities in the setation between the Japanese specimens and the illustrations of the Indian specimen (Alcock and MacGilchrist, 1905), based on the result he ruled out separating the Pacific and Indian Ocean forms. Miyake in Miyake and Nakazawa (1947) reported the presence of 1 spine on the dorsomesial margin of the cheliped palm, but they did not comment on the carapace setation. Baba (1969) hesitantly recog-

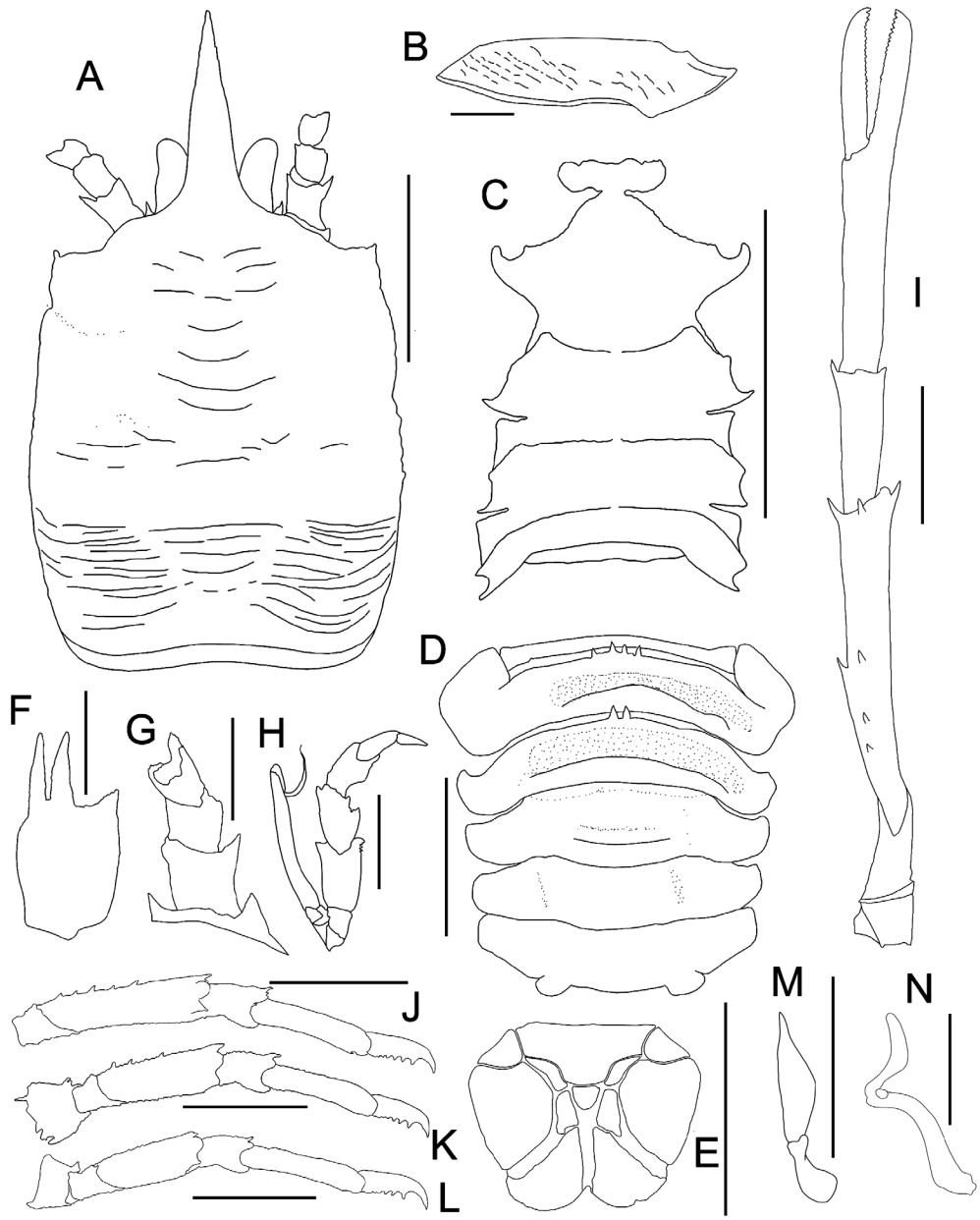

Fig. 15. *Munidopsis wardeni* Anderson, 1896, female (IO/SS/ANO/00026, cl 13 mm). A: Carapace. B: Pterygostomian flap. C: Thoracic sternum. D: Abdomen. E: Telson. I: Cheliped. J–L: P2–P4. —Male (IO/SS/ANO/00023, cl 19.0 mm). F: Basal antennular article. G: Antennal peduncle. H: Mxp3. M–N: G1 and G2. Scale bars: 5 mm for A–N.

nized two separate subspecies, namely *M. trifida trifida* and *M. trifida tomentosa* (Baba, 1969: Figs. 7 and 8, respectively), based on the differences in the third thoracic sternite, the Mxp3 merus, and the cheliped palm. Tirmizi (1966) reported that the Arabian form differed from the Indian specimens in the cheliped with 2 distal spines on the ischium, and the fingers slightly shorter than the cheliped palm, with occlusal margins apposed throughout their lengths. Subse-

quent studies on the specimens from Japan and Taiwan (Baba *et al.*, 1986; Baba, 2005; Osawa and Takeda, 2007: Fig. 6A–B; Osawa *et al.*, 2008: Fig. 6G) reported that they have relatively densely setose bodies and lack spines on the mesial margin of the cheliped palm. On the contrary, Macpherson (2007) reported the presence of a mesial row of spines on the cheliped palm in the specimens from Madagascar. Based on the Chilean material, Guzman and Sellanes (2015: Fig. 11d, g–h) reported the proportionally longer dactylus of the cheliped subequal to the palm length, and the presence of spines on the dorsal margin and mesial surface of the carpus as well as on the mesial surfaces of the P2–P4 carpi.

The present specimens resembled the Japanese specimens reported by Miyake in Miyake and Nakazawa (1947) in the absence of a mesial row of spines on the cheliped palm. However, they differed from the latter specimens in having 5–6 rows of spines on the dorsomesial margin of the cheliped palm (Fig. 14I–J) (versus presence of 1 spine on upper margin in the Japanese specimens), the longer dactyli of the P2–P4 0.61–0.67 times the propodal lengths (Fig. 14K–M) (versus "half" as long as propodus in the Japanese specimens). Moreover, the present specimens also differ from the Japanese specimens (Baba, 1969, 2005) in possessing a spine on the inner distal angle of the Mxp3 merus (Fig. 14H) (versus absent in the latters). Comparison of the present specimens with description of Chilean specimens (Guzman and Sellanes, 2015) revealed overall morphological resemblance between Indian and Chilean specimens, with the exception of relatively shorter cheliped fingers which are almost two-thirds as long as the palm (Fig. 14I–J) (versus as long as the palm in the Chilean specimens) and the absence of spines on the dorsal margin and mesial surface of the cheliped carpus as well as on the mesial surfaces of the carpi of the P2–P4 (Fig. 14I–M) (their spines are present in the Chilean specimens).

Distribution. Madagascar, off Arabia, Laccadive Sea, Andaman Sea, Indonesia, South China Sea, East China Sea, Japan, western Pacific, Straits of Magellan, and off Chile; 280–1270 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present specimens is 950–960 m.

Munidopsis wardeni Anderson, 1896
(Figs. 3E, 4E, 15)

Munidopsis wardeni Anderson, 1896: 99 [Type localities: Arabian Sea, "RIMSS *Investigator*" stn. 197, 9°34'57"N, 75°36'30"E, 406 fms (743 m) deep; 30 miles W of Middle Andaman Islands, 480–500 fms (878–915 m) deep].—Alcock and McArdle, 1901: pl. 55 fig. 1.—Lloyd, 1907: 2.—Baba, 2005: 282 (in key), 299 (synonymy).—Macpherson, 2007: 116, fig. 53.—Baba *et al.*, 2008: 169 (synonymy).

Munidopsis Wardeni Anderson, 1896.—Alcock, 1901: 257.

Munidopsis (Munidopsis) wardeni Anderson, 1896.—Tirmizi, 1966: 225, fig. 37A–C.

Munidopsis (Munidopsis) wardeni var. *mabahiss* Tirmizi, 1966: 226, figs. 37D–F, 38 [Type localities: Gulf of Aden, 1022 m deep; Maldives, 797 m deep].

Material examined. Arabian Sea, FORVSS stn. 37205, 14.39°N, 73.03°E, 957 m deep, HSDT (CV), 1 ♂ (cl 19.0 mm, IO/SS/ANO/00023), 3 ♀♀ (cl 11.0–17.8 mm, IO/SS/ANO/00024), 28 February 2018; FORVSS stn. 37410, 14.37°N, 73.03°E, 957 m deep, HSDT (CV), 1 ♂ (cl 16.0 mm, IO/SS/ANO/00025), 2 ♀♀ (cl 11.0–16.0 mm, IO/SS/ANO/00026), 9 April 2018.

Remarks. Anderson (1896) described *M. wardeni* (figured by Alcock and McArdle, 1901: Pl. 55 fig. 1), from the Arabian and Andaman Seas, and differentiated it from *M. stylirostris* Wood–Mason, 1891 in having the relatively longer male chelipeds; the flatter, wider and setose carapace with an anteriorly directed, short anterolateral spine, and with the prominent cervical groove bearing a spine posteriorly on the lateral margin; the relatively shorter and gently ventrally sloping rostrum with upcurved distal tip; the cylindrical, slightly curved eyes; two rows of spines on the dorsal surface of the cheliped merus; setose margins of the P2–P4; and medially spinose transverse carinae of the second and third abdominal somites. Tirmizi (1966) reported this species from the *John Murray* collection off Zanzibar;

the material has the indistinct cervical groove and lateral carapace spines. She also reported a new variety, *M. wardeni* var. *mabahissae* from the Gulf of Aden and Maldives, which differed from the full species in possessing the median spines on the posterior carapace margin, and a row of mid-dorsal spines on the gastric and cardiac regions. Macpherson (2007: Fig. 53A) studied additional specimens from the Gulf of Aden, and suggested that the differences in the carapace spination were intraspecific variations, and therefore reduced Tirmizi's variety (1966) to a synonym of *M. wardeni*. The present specimens (Fig. 15) from the Arabian Sea agree with the description and illustrations of the type material in the shape of the eye as well as the spination on the carapace and abdomen. They however differ from the Sri Lankan specimens reported by Macpherson (2007) in lacking the cardiac spines on the carapace (Fig. 15A).

Distribution. Off Zanzibar, Gulf of Aden, Maldives, Arabian Sea, Bay of Bengal and Andaman Sea; 412–1186 m in bathymetric range (Baba *et al.*, 2008). The bathymetric range of the present specimens is 950–960 m.

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