

A NEW SPECIES OF *STENOPUS* (CRUSTACEA: DECAPODA: STENOPODIDAE) FROM THE INDO-WEST PACIFIC, WITH A REDEFINITION OF THE GENUS

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ABSTRACT . – A new species of stenopodid shrimp of the genus *Stenopus*, *S. goyi*, is described on the basis of material from Taiwan, Philippines, Sri Lanka and the Maldives Islands. The new species is very unusual in that the dactyli of the fourth and fifth pereopods bear one to three unguis. The colouration of the new species is also unique in the genus. The uniunguiculate or biunguiculate dactyli of the ambulatory pereopods were generally considered as a constant character in stenopodid shrimps and are used for generic diagnosis in the family, but variations in the number of unguis are found in *S. goyi*, new species, sometimes even among pereopods of the same specimen. The genus *Stenopus* is rediagnosed to accommodate the new species. Revised keys to the genera of Stenopodidae and species of *Stenopus* are provided.

KEY WORDS. – Stenopodidea, Stenopodidae, *Stenopus goyi*, new species, Indo-Pacific, taxonomy.

INTRODUCTION

Shrimps of the genus *Stenopus* Latreille, 1819, inhabit mainly shallow rocky reefs of tropical and warm temperate waters in the world oceans, and at present, consist of 10 species (Goy, 1992). Most species of *Stenopus* are very colourful, and have thus been frequently reported in popular articles and often appear in the aquarium trade (Calado et al., 2003). An unidentified stenopodid species has been reported as “*Stenopus* sp.” in some picture guidebooks (e.g. Debelius & Baensch, 1992; Debelius, 1999). It is similar to *Stenopus hispidus* (Olivier, 1811) in the general colouration, but the detailed markings are different. Recently, we had a chance to examine two specimens of this undescribed species collected from Taiwan and the Philippines. Further specimens from Sri Lanka and the Maldives from the aquarium trade were also available for this study. Examination of the specimens revealed that this species shows a very unusual variation in the armature of the dactyli of fourth and fifth pereopods from simple to triunguiculate. The number of unguis on the dactyli has been used as diagnostic characters in differentiating genera of the family (see Holthuis, 1946, 1955, 1993). Except

for the variable number of dactylar unguis, the present form has a general appearance very similar to the species of the genus *Stenopus* (ie. carapace and pleon densely spinose, pigmented cornea). Thus, we assign it to *Stenopus* and the generic diagnosis of *Stenopus* is emended to accommodate this form. A revised key to the genera of Stenopodidae is provided. The present form is hence described as a new species of *Stenopus* herein.

The specimens examined are deposited in the collection of the Coastal Branch of Natural History Museum and Institute, Chiba (CMNH), the National Taiwan Ocean University, Keelung (NTOU), Nationaal Natuurhistorisch Museum, Leiden (RMNH), and the Senckenberg Museum, Frankfurt, Germany (SMF). The measurements given are postorbital carapace length (CL). The sex of specimens was determined by the position of the gonopores. Counts of the marginal spines of the telson include those on the lateral margin, the posterolateral angle (where dorsolateral carina terminates) and the posterior margin. Counts of teeth on the lateral margins of the antennal scale and uropods include the terminal tooth.

TAXONOMY

Stenopus Latreille, 1819

Byzenus Rafinesque, 1814: 23.

Stenopus Latreille, 1819: 71; Holthuis 1946: 5; 1955: 143; Schram 1986: 284; Holthuis 1993: 315.

Embryocaris Ortmann, 1893: 85.

Type species. – *Palaemon hispidus* Olivier, 1811. Gender: masculine.

Diagnosis. – Small to medium sized shrimp. Body slender, subcylindrical. Rostrum long, compressed, directed forward, dorsally and ventrally dentate, lateral surface usually armed with spines. Carapace densely covered with scattered spines of various sizes; cervical groove distinct, very deep at dorsum of carapace; strong antennal, hepatic and supraorbital spines present; pterygostomial angle spinose. Pleonal somites densely spinose; tergum of third somite broadly triangular produced in posteromedian part, usually with unarmed area. Telson elongate, lance-shaped; lateral margin unarmed or armed with a strong spine at midlength; posterolateral angle with 1 spine; posterior margin somewhat rounded, occasionally bearing small median spine; dorsolateral carinae bearing rows of spines. Eyes well developed with globular, pigmented cornea; eyestalks with small spines, submarginal spines overhanging cornea. Antennular peduncle with strong, acute stylocerite; mesial margin of first segment with broad, subrectangular process. Antennal scale narrow, with toothed lateral margin, dorsal surface with 1 or 2 longitudinal carinae often bearing rows of small spines, ventral surface with or without row of spines. Mandible with fused molar and incisor processes; palp 3-articulated. Maxillule with simple setose endopod; distal endite truncate, proximal endite suboval. Maxilla with slender endopod; distal and proximal endites each bilobed; scaphognathite slender, well developed. First maxilliped with 2 or 3 segmented endopod; distal endite broad, proximal endite small, bilobed; exopod well developed; epipod well developed, bilobed; 1 arthrobranch present. Second maxilliped with 7-segmented endopod; propodus with 1–3 prominent ventral hooks proximally; exopod well developed; small epipod bearing podobranch and 1 arthrobranch present. Third maxilliped with normal endopod; propodus with grooming apparatus; carpus, merus and ischium spinulate; exopod well developed; small epipod, 1 pleurobranch and 2 arthrobranches present. First three pairs of pereopods chelate. First pereopod with well-developed grooming apparatus on carpus and propodus. Third pereopod largest, stout. Fourth and fifth pereopods long, slender; dactyli terminating in acuminate unguis, usually each with 1 subterminal unguis on flexor margin, but sometimes unarmed or with 2 subterminal unguis; propodi and carpi often subdivided, with ventral rows of movable spines. Pleopods biramous except for first pair, without appendices internae; protopodite ventrally with spines. Uropodal exopod and endopod laterally serrated; dorsal surfaces with 2 median carinae often bearing rows of many small spines. Eggs small and numerous.

Species included. – Eleven species are included: *Stenopus chrysexanthus* Goy, 1992, *S. cyanoscelis* Goy, 1984, *S. devaneyi* Goy, 1984, *S. earlei* Goy, 1984, *S. hispidus*, *S. pyrrsonotus* Goy & Devaney, 1980, *S. scutellatus* Rankin, 1898, *S. spinosus* (Risso, 1827), *S. tenuirostris* de Man, 1888, *S. zanzibaricus* Bruce, 1976, and *Stenopus goyi*, the new species described herein.

Distribution. – Tropical and warm temperate regions in the Mediterranean Sea, Indo-Pacific and Atlantic Oceans; from subtidal to 250 m (Holthuis, 1952).

Remarks. – At present, four genera are recognized in the family Stenopodidae: *Engystenopus* Alcock & Anderson, 1894, *Odontozona* Holthuis, 1946, *Richardina* A. Milne-Edwards, 1881, and *Stenopus*. The shape and armature of the dactyli of the ambulatory pereopods are considered to provide diagnostic characters of generic significance (e.g. Holthuis, 1993). *Engystenopus* and *Richardina* have simple dactyli, whereas *Odontozona* and *Stenopus* have biunguiculate dactyli. However, the newly discovered species in the present study has the dactyli of the ambulatory pereopods varying from uniunguiculate to triunguiculate. Variation is seen even among pereopods of a single specimen.

Okuno (2003) had recently revised the generic characters of *Odontozona* when describing a new species to include the dorsolateral row of spines on the ischium of the third maxilliped, which was considered previously as a diagnostic character of *Stenopus*. Specimens of Stenopodidea, particularly those from the deep sea, are often difficult to collect. With more material of this family found in recent years, many key characters previously used become inadequate for proper generic diagnosis. A revised key for the family Stenopodidae is given below to accommodate the present new species as well as recent discoveries in the diversity of this family. It should be pointed out that *O. edwardsi* (Bouvier, 1908), *O. foresti* Hendrickx, 2002, and *O. spongicola* (Alcock & Anderson, 1899) appear closer to *Richardina* rather than *Odontozona*. Thus, in the following key these three species are tentatively removed from *Odontozona*.

KEY TO THE GENERA OF STENOPODIDAE

1. Pleonal terga covered with dense spines *Stenopus*
– Pleonal terga without spines 2
2. Carapace smooth, or covered with regularly spaced spines but without distinct cincture of spines along posterior margin of cervical groove *Engystenopus*
– Carapace with distinct cincture of spines along posterior margin of cervical groove 3
3. Sixth pleonal somite with short transverse row of small spines posterolaterally
..... *Odontozona* (excluding the three species below)
– Sixth pleonal somite without row of spines 4
4. Dactyli of fourth and fifth pereopods short, biunguiculate
..... *O. edwardsi*, *O. foresti* and *O. spongicola*
– Dactyli of fourth and fifth pereopods relatively long and slender, uniunguiculate *Richardina*

***Stenopus goyi*, new species**
(Figs. 1–5)

Stenopus sp. – Baensch & Debelius, 1992: 561, unnumbered fig.;
Debelius 1999: 120, unnumbered fig.

Material examined. – Holotype: male (CL 7.1 mm), Donggang fishing port, Pingtung County, Taiwan, commercial trawler, 15 Nov.1991, (RMNH-D 42374).

Other material examined. – **Philippine:** PANGLAO 2005, Stn. CP 2379, 8°39.9'N 123°20.2'E, 72.0–68.7 m, 4.2 m beam trawl, 28 May 2005, 1 ovigerous female (CL 14.2 mm), (NTOU). **Sri Lanka:** from aquarium trader, details unknown, Nov.1985, 1 female (CL 7.3 mm) (SMF 12341). **Maldive Islands:** Ari Atoll,

from aquarium trader, details unknown, 1 female (CL 11.7 mm) (CMNH-ZC 02258).

Description of holotype male. – Rostrum (Figs. 2A, 3A) moderately long, 0.7 of CL, straight, somewhat compressed laterally; dorsal margin sharply carinate, armed with 6 strong teeth, proximal tooth situated posterior to orbital margin; lateral surface armed with 2 spines in proximal half, ventrolateral carina sharp, merging to orbital margin; ventral carina obsolete, armed with 4 teeth in distal half. Carapace (Figs. 2A, 3A) with postrostral median carina extending to gastric region; surface densely covered with numerous spines of various sizes, curved, directed anterodorsally for those on gastric and cardiac regions, directed anteroventrally for those

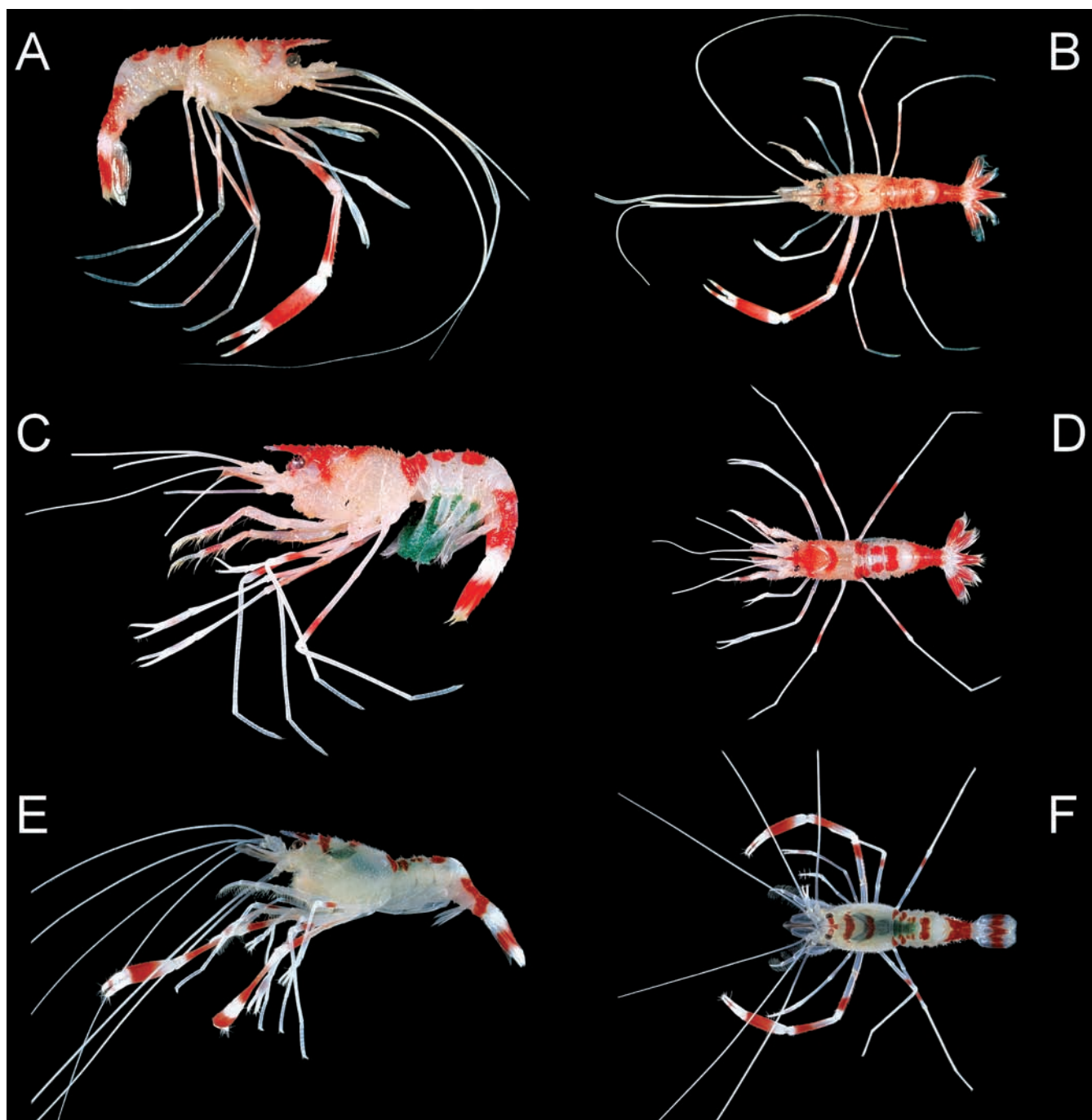


Fig. 1. *Stenopus goyi*, new species: A–B, Taiwan, holotype male CL 7.1 mm (RMNH-D 42374); C–D, Philippines, ovigerous female CL 14.2 mm (NTOU); E–F, Maldive Islands, female CL 11.7 mm (CMNH-ZC 02258). A, C, E, lateral view. B, D, F, dorsal view.

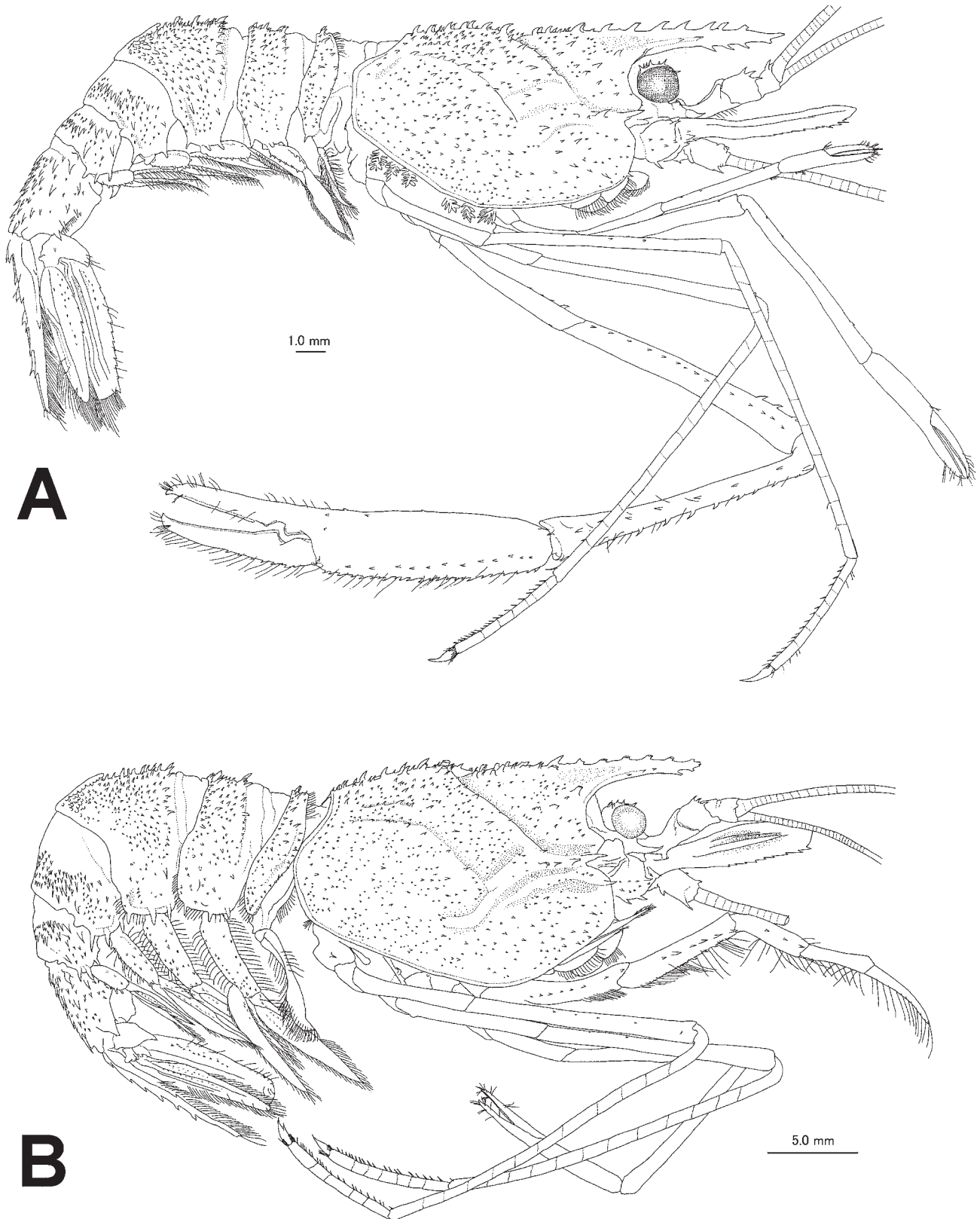


Fig. 2. *Stenopus goyi*, new species, lateral view: A, Taiwan, holotype male CL 7.1 mm (RMNH-D 42374). B, the Philippines, ovigerous female CL 14.2 mm (NTOU).

on branchiostegal and branchial regions; gastric region with 4 pairs of postrostral submedian spines, each spine stout, curved anteriorly; postorbital region with a few stout spines and many scattered spinules, directed anteriorly; orbital margin concave, suborbital angle weakly produced, with 1 minute spinule; antennal spine very strong, submarginal, followed posteroventrally by thick hepatic carina which bearing 3 stout spines and row of some spinules; anterolateral margin rounded, broadly convex; pterygostomial angle with small spine directed anteroventrally; branchiostegal region with rather few spines; cervical groove distinct; postcervical groove present, but obscured around midline, and only lateral part distinct. Lateral part between cervical and postcervical grooves with 1 additional short groove parallel to hepatic carina.

Epistome (Fig. 3F) anteriorly triangular, with 2 long submedian blunt spines adjacent to small rounded midpoint; a pair of small spines present proximolaterally; labrum normal.

Sixth thoracic sternite (Fig. 3D) with pair of triangular lobes, marginally setose, each terminating in spine, each lateral margin armed with 2 spines; seventh sternite with pair of broad, trapezoid lobes, each distolateral angle produced, terminating anteriorly in strong spine, lateral margin armed with 4 small spines, anteromesial margin with 2 small spines; eighth sternite with pair of triangular lateral lobes, each distolateral angle produced anteriorly, terminating in strong spine, lateral margin armed with 2 small spines, anteromesial margin with 2 small spines.

First 3 pleonal somites (Figs. 2A, 3B) armed with numerous, scattered small spines, those on terga directed anteriorly and those on pleura directed anteroventrally; maximum width of second somite 0.6 of CL. First pleonal somite divided into 2 sections by deep transverse carina extending onto pleuron; posteroventral angle of pleuron ending in acute tooth. Second to fifth pleura truncate ventrally, anterior and posterior angles each ending in large blunt tooth, midpoint of ventral margin with blunt process. Third tergum with rather broad, flat middorsal plate, each lateral margin irregularly incised. Fourth and fifth somites (Figs. 2A, 3C) covered with numerous spines of various sizes, dorsal spines directed posteriorly, lateral spines directed posterolaterally; median carina and anterolateral parts of tergum unarmed; fifth somite with some strong lateral spines directed posterolaterally. Sixth somite covered with rather stout spines directed posteriorly and some very strong lateral spines directed posterolaterally. Telson (Fig. 3C) lanceolate, 2.9 times longer than wide; lateral margin slightly constricted near base, armed with large submarginal spine and 1 large spine arising at midlength on right side only; posterolateral angle terminating in minute spine; posterior margin unarmed; dorsal surface with pair of large proximal spines and 2 dorsolateral carinae slightly diverging posteriorly, each bearing 4 (left) or 7 (right) small, posteriorly directed spines and additional inner row of 4 weaker spines proximally.

Eyes (Fig. 4A) well developed; corneas subequal in length to eyestalk, distinctly faceted and pigmented; dorsal surface of eyestalk armed with many small spines, submarginal spines long, partially overhanging cornea.

First segment of antennular peduncle (Fig. 4B, C) subequal in length to second and third segments combined; dorsal surface with rectangular process proximomesially, lateral margin with distinct stylocerite, ventral surface with some small spines distomesially and proximomesially; second segment longer than wide, distolateral angle armed with 2 long spines, midpoint of dorsal surface with spine, ventrodistal angle with 1 strong spine, ventromesial margin with row of 4 small spines; third segment shortest, almost as long as wide in dorsal view, with or without strong spine distally, ventrodistal angle with 1 strong spine; lateral flagellum uniramous, about 3.0 times longer than carapace, composed of numerous articles, each article bearing many short and long setae on distal margin; mesial flagellum also setose, subequal to, but more slender than lateral flagellum.

Antennal peduncle (Fig. 4D, E) with many spines of different size; first segment with several spines; mesial margin provided with a distinct lamella-like process; antennal scale 3.7 times longer than wide, narrowing proximally; lateral margin concave at basal part, armed proximally with 1 or 2 spines; distal part of antennal scale straight, armed with 10 acute teeth, including terminal tooth; lamella slightly tapering, mesial margin slightly convex; dorsal surface with lateral and median longitudinal carinae and a few small spines proximomesially; ventral surface with median longitudinal carina bearing row of few small spines; flagellum 8.5 times longer than carapace, articles bearing short and long setae on distal margins.

Mandible (Fig. 4F, G) robust, with short, fused molar and incisor processes; palp 3-articulated. Maxillule (Fig. 4H) with slender, simple, setose endopod; distal endite truncate, subequal in length to suboval proximal endite. Maxilla (Fig. 4I) with long, slender endopod; both distal and proximal endites deeply bilobed; scaphognathite short, subtriangular. First maxilliped (Fig. 4J) with 3-articulated endopod, proximal segment longer than broad, intermediate segment about half length of first segment, third segment slender, tapering, about half length of second segment, with minute simple terminal seta; distal endite broad, mesial margin concave, setose; proximal endite small, bilobed; exopod with well developed flagellum; epipod large, bilobed. Second maxilliped (Fig. 4K) with 7-segmented endopod; dactylus suboval, longer than wide; propodus subequal in length to dactylus, armed with prominent hook ventrally; carpus short, widened distally; merus 2.6 times of carpal length; ischium and basis fused; coxa lobate; exopod with long, slender flagellum; epipod small, elongate; arthrobranch and podobranch present. Third maxilliped (Fig. 4L) composed of 7 segments, overreaching tip of antennal scale by lengths of distal half of carpus, propodus and dactylus; dactylus tapering distally; propodus subequal in length to dactylus,

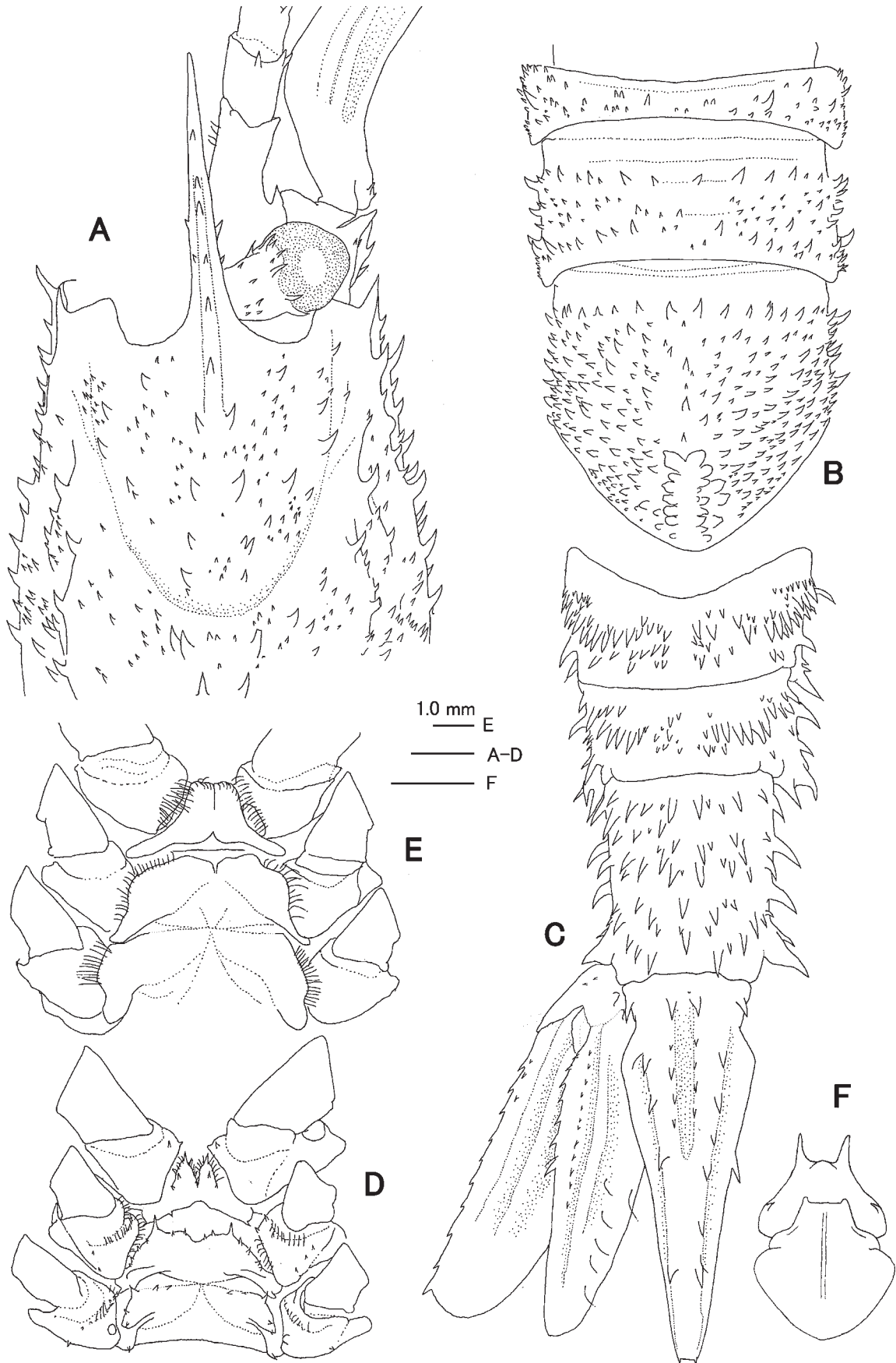


Fig. 3. *Stenopus goyi*, new species: A–D, F, Taiwan, holotype male CL 7.1 mm (RMNH-D 42374). E, the Philippines, ovigerous female CL 14.2 mm (NTOU). A, anterior part of carapace and cephalic appendages, dorsal view. B, first to third pleonal somites, dorsal view. C, fourth to sixth pleonal somites, telson and left uropod, dorsal view. D–E, thoracic prominences on sixth to eighth somites. F, epistome and labrum.

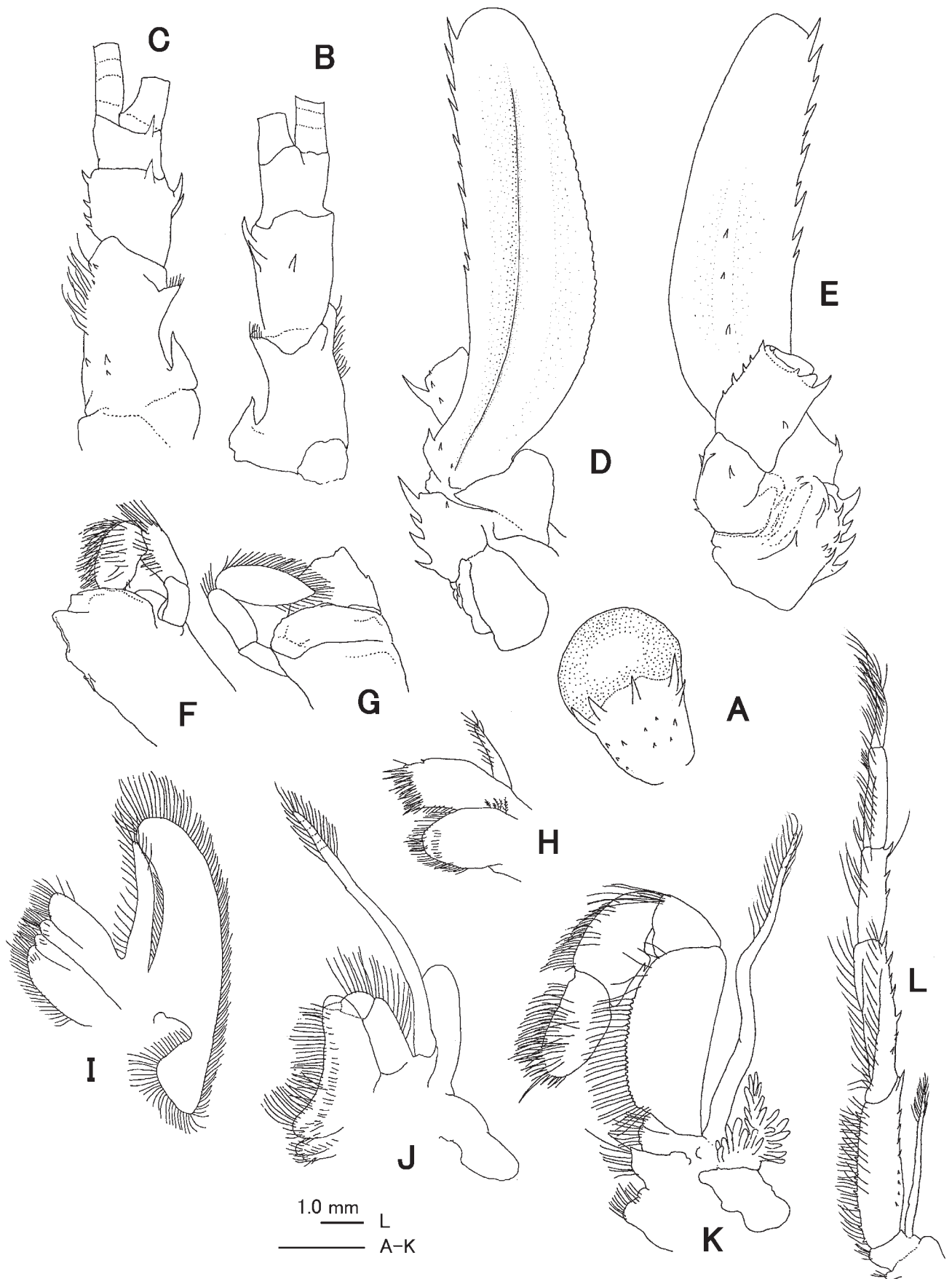


Fig. 4. *Stenopus goyi*, new species, Taiwan, holotype male CL 7.1 mm (RMNH-D 42374): A, left eye. B, left antennule, dorsal view. C, same, ventral view. D, left antenna, dorsal view. E, same, ventral view. F, left mandible, outer view. G, same, inner view. H, left maxillule, outer view. I, left maxilla, outer view. J, left first maxilliped, outer view. K, left second maxilliped, outer view. L, left third maxilliped, lateral view.

with grooming apparatus on distomesial surface; carpus subequal in length to propodus, with distolateral row of 3 spines; merus 1.7 times longer than carpus, armed with lateral row of 7 spines, distalmost spine strongest; ischium subequal to merus in length, compressed laterally, armed with dorsolateral row of 9 spines, distalmost spine strongest, and with mesial row of 8 spines; exopod with short flagellum, reaching distal margin of ischium.

First pereopod (Fig. 5A, B) slightly overreaching tip of antennal scale; fingers slender, half length of chela; palm subcylindrical, unarmed; grooming apparatus consisting of setal patches on proximal portion of palm and distal portion of carpus (Fig. 5B); carpus longest, 1.2 times longer than chela, slightly widened distally, armed with 3 small, widely spaced spines on dorsal margin; merus 0.8 times carpal length, unarmed; ischium 0.8 times meral length, obliquely articulated with merus.

Second pereopod (Fig. 5C) generally similar to first pereopod but distinctly longer, overreaching antennal scale by half length of carpus; fingers about half length of chela; palm subcylindrical, unarmed; carpus longest, 1.3 times longer than chela, slightly widened distally, armed with 3 small, widely spaced spines on dorsal margin; merus 0.8 times carpal length, armed with small subdistal spine on dorsal margin; ischium 0.6 times meral length, unarmed.

Third pereopod (Fig. 5D, E) robust, overreaching antennal scale by length of chela and carpus; chela 1.7 times longer than carapace length; dactylus about 0.6 times as long as palm, terminating in curved corneous claw, cutting edge armed proximally with stout, triangular tooth, remaining parts entire, armed with row of 8 teeth on proximal half of dorsal surface; fixed finger slightly deflexed, terminating in curved corneous claw crossing tip of dactylus, cutting edge armed proximally with large blunt teeth opposed into depression of movable finger, both ventral and lateral surfaces unarmed; palm subcylindrical, 3.3 times longer than wide, dorsolateral surface armed with 2 rows of 12 and 24 small spines as well as many scattered short setae, ventral surface armed with some small spines on distal half, lateral surface with few tiny spines; carpus 0.7 times chela length, slightly widened distally, about 6.0 times longer than maximum width, armed laterally with 2 rows of 9 and 12 spines, ventrally with row of 3 spines on distal half; merus subequal to carpal length, armed dorsally with row of 4 strong spines distally, laterally with row of 15 small spines, mesial surface with row of 5 spines, distalmost spine strongest; ischium 0.7 times meral length, armed dorsally with 4 spines, distalmost spine strongest.

Fourth and fifth pereopods (Fig. 5F–I) similar, very long and slender. Fourth pereopod reaching tip of antennal scale by length of distal three segments. Fifth pereopod overreaching tip of antennal scale by length of dactylus, propodus and distal half of carpus. Dactyli relatively long, stubby proximally, becoming more slender distally, 2.7 times longer than wide, uniunguiculate; propodi 4.0 times dactylar length, each subdivided into 7 articles, with row of

16–20 movable spines on ventral margins; carpi 2.6 times longer than propodi, each obliquely subdivided into 12–13 articles, 2 or 3 movable spines at distoventral extremities; ischia and meri combined subequal to carpal length, armed dorsally with few widely spaced small spines, ischia 0.6 times meral length.

Pleopods without appendices internae. First pleopod (Fig. 5L) uniramous, shortest; basipodite subrectangular, with 2 dorsal teeth and row of 8 ventral teeth; ramus fused to basipodite, lance-shaped. Second to fifth pleopods biramous. Second pleopod (Fig. 5M) with basipodite shorter than rami, dorsal surface armed with few small spines, ventral surface armed with row of 8 small spines. Third to fifth pleopods generally similar, decreasing in size posteriorly. Uropod (Fig. 3C) with protopodite stout, lateral margin terminating in acute process, dorsal surface with 1 or 2 strong spines; exopod broad, falling slightly short of posterior margin of telson, lateral margin nearly straight, with row of 10 acute teeth, including terminal acute tooth, dorsal surface with 2 smooth longitudinal carinae, lateral carina bearing row of 3 (left) or 7 (right) proximal spines on outer margin; endopod tapering distally, not reaching posterior margins of exopod and telson, proximal half of lateral margin armed with 7 acute teeth, decreasing in size proximally, dorsal surface with longitudinal carina, and some outer small spines that sometimes aligned in row.

Description of females. – Rostrum (Fig. 2B) 0.4–0.8 of CL; lateral surface armed with a few spines at midlength; ventral margin with 2–4 teeth subdistally. Carapace with strong submarginal branchiostegal spine, followed posteroventrally by thick branchial carina that bearing row of spinules. Sixth to eighth thoracic sternites (Fig. 3E) with paired, posteriorly widened prominences, ventral margins concave, anterior lobes of prominences rounded. Terga of first to fourth pleonal somites somewhat inflated in dorsal view, maximum width of second somite 0.6–0.8 of CL (Fig. 1D); first somite with pleural margin rounded; pleura of second to fourth somites truncate ventrally, but wider than those of male. Chela of third pereopod 1.3–1.5 times as long as carapace. Fourth and fifth pereopods with dactyli uniunguiculate or biunguiculate, sometimes even triunguiculate (Fig. 5J, K). Second to fifth pleopods rotated at 90° from the positions of male; exopodites and endopodites with irregular spaced spines on dorsal surfaces. Number of eggs 2,394; size 0.5–0.6 mm.

Colouration. – When alive, body (Fig. 1) generally whitish translucent with red patches and bands. Rostrum red, tip white; rostral base to gastric region faintly red, covered with transverse red band between cervical groove; posterodorsal margin of cervical groove red; posterior margin of carapace to third pleonal somite with 3 pairs of red dorsal patches, those on third somite fused; posterior half of fourth to sixth pleonal somites red; distal two-thirds of telson and uropods red; eyestalk red; antennal flagellae white; third pereopod whitish translucent with broad red bands at middles of fingers, palm, carpus and merus; other pereopods and third maxilliped whitish translucent, with subdistal red bands at meri. Eggs greenish.

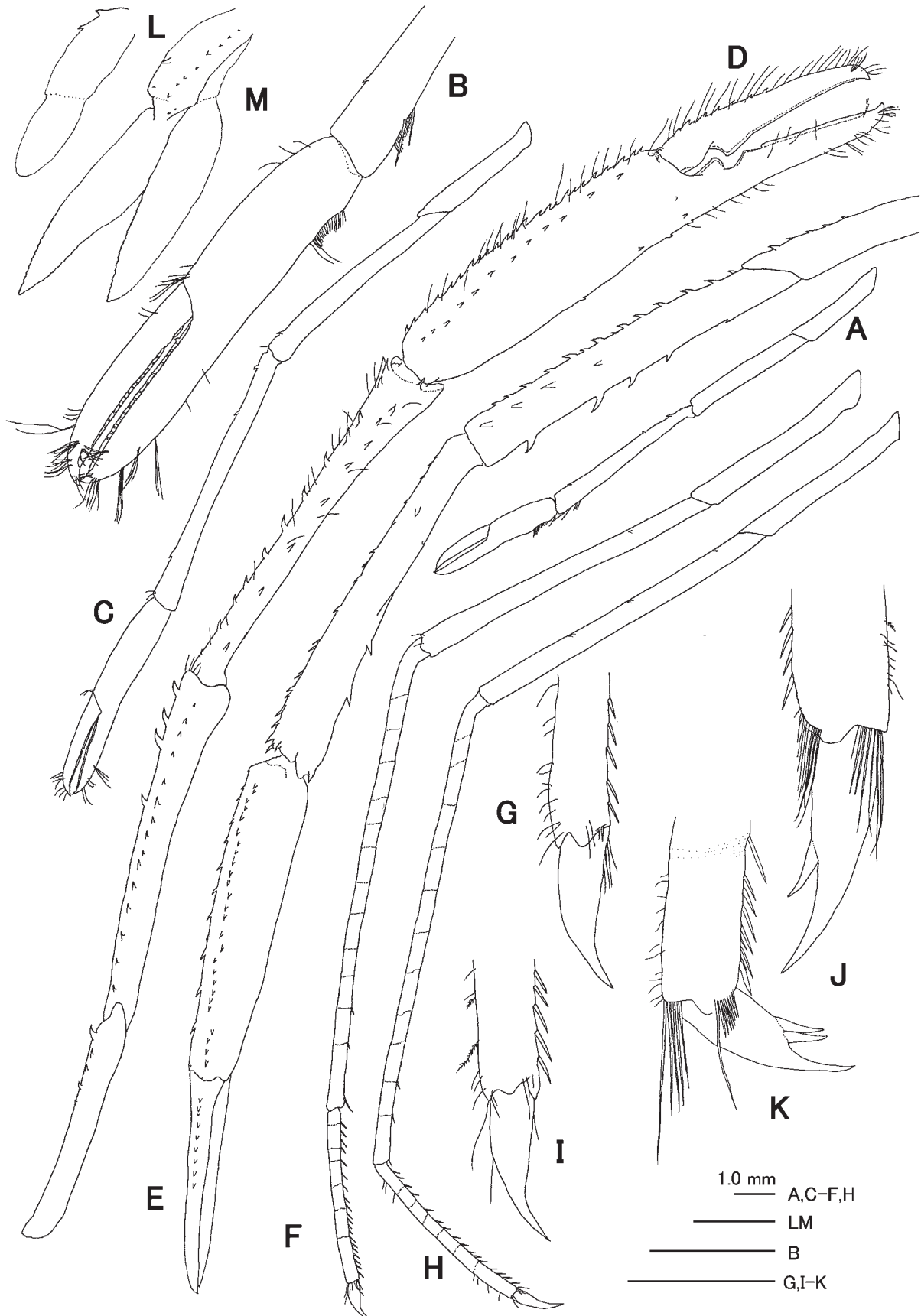


Fig. 5. *Stenopus goyi*, new species. A–I, L, M, Taiwan, holotype male CL 7.1 mm (RMNH-D 42374). J, the Philippines, ovigerous female CL 14.2 mm (NTOU). K, Maldives Islands, female CL 11.7 mm (CMNH-ZC 02258): A, left first pereopod, lateral view. B, chela of first pereopod, lateral view. C, second pereopod, lateral view. D, left third pereopod, lateral view. E, same, dorsal view. F, left fourth pereopod, lateral view. G, same, dactylus. H, left fifth pereopod, lateral view. I, same, dactylus. J, dactylus of right fifth pereopod. K, dactylus of left fourth pereopod. L, left first pleopod, ventral view. M, left second pleopod, ventral view.

Distribution. – Indo-West Pacific and known with certainty from Taiwan, the Philippines, Indonesia (Debelius, 1999), Maldives Islands and Sri Lanka. Recorded depths about 70 m and possibly to shallower depths (see Debelius, 1999).

Etymology. – This species is dedicated to Joseph W. Goy in recognition of his contributions to the taxonomy of Stenopodidea.

Remarks. – The new species is very unusual in the armature of the ambulatory dactyli varying from simple to triunguiculate. The number of ungues at the ambulatory dactyli was thought to be a constant character for all stenopodid shrimps before. In the holotype, all the dactyli of the ambulatory pereopods are simple (Fig. 5G, I). The ovigerous female from the Philippines (PANGLAO 2005, stn CP 2379) has simple dactyli except for the right fifth pereopod, of which the dactylus is biunguiculate (Fig. 5J). The female from Maldives, however, has biunguiculate dactyli except for the left fourth pereopod, of which the dactylus is triunguiculate (Fig. 5K). Apart from the shape of the dactyli of the ambulatory pereopods, *S. goyi*, new species is most similar to *S. earlei* from the Indo-West Pacific and *S. scutellatus* from the western Atlantic. Shared characters are: the dorsal spines on the antennal scale is absent or if present, relatively few; spines on the ventral surface of the chela of the third pereopod are absent or, if present, relatively few. In other *Stenopus* species, the antennal scales are armed dorsally with 1–5 rows of many small spines; the chela of the third pereopod has several rows of numerous spines on the ventral surface (except for *S. tenuirostris* which lacks ventral spine on the third chela). The presence of spines on the carpi of the first and second pereopods and on the uropodal endopod distinguishes *S. goyi*, new species, from *S. earlei*. *Stenopus earlei* has the carpi of the first and second pereopods and the uropodal endopod unarmed. The new species differs from *S. scutellatus* in the armature of the third chela and the carpi of the ambulatory pereopods. In *S. goyi*, new species, the third chela is unarmed or armed only with a few spines on the lateral surface; the carpi of the fourth and fifth pereopods are also unarmed, or at most armed with only a few spines. On the other hand, in *S. scutellatus* the mentioned parts all have numerous spines.

The colouration of the new species, although unique in the genus, is most similar to *S. hispidus* in having a basic pattern composed of a whitish background covered with red bands and patches. The colouration of these two species differs in details: 1) The posterior margin of the cervical groove is red in *S. goyi*, new species, instead of white as in *S. hispidus*; 2) The posterior margin of the carapace to the second pleonal somites bears two pairs of red dorsolateral patches in *S. goyi*, new species, but this part is whitish in *S. hispidus*; 3) The third pleonal somite bears two fused red dorsolateral patches in *S. goyi*, new species, instead of entirely red in *S. hispidus*; 4) The posterior margin of the fourth pleonal somite to the fifth somite is reddish in *S. goyi*, new species, but whitish in *S. hispidus*; 5) The middle part of the palm of the third pereopod is reddish in *S. goyi*, new species, but whitish in *S. hispidus*. Morphologically, the new species is

quite different from *S. hispidus* in the distolateral margin of the antennal scale being serrated (vs. entire in *S. hispidus*), the dorsal surface of the antennal scale and the palm of the third pereopod armed with fewer spines.

Poupin (1996) provided a colour photograph of a specimen of *Stenopus* species collected from Tuamotu, French Polynesia, at a depth of 190 m. The colour pattern of this Tuamotu specimen looks similar to those of *S. goyi*, new species, and *S. zanzibaricus*, particularly to the latter for the yellowish carapace and reddish antennal flagellae. Examination of Poupin's (1996) specimen (now heavily damaged and deposited in Muséum national d'Histoire naturelle, Paris) also showed that it is closer to *S. zanzibaricus* but differs from both *S. goyi*, new species, and *S. zanzibaricus* in the rostrum more upturned, cardiac spines stronger, and the third chela smooth. Moreover, the Tuamotu specimen is larger (CL 12 mm) and from deeper waters than other *S. zanzibaricus* reported. Whether the Tuamotu specimen represents a deeper form of *S. zanzibaricus* or even another new species will need more material of this form available for study. The following are revised keys to the species of *Stenopus*.

KEY TO THE SPECIES OF *STENOPUS* BASED ON MORPHOLOGY

1. Antennal scale with rows of spines on dorsal surface 4
 - Antennal scale without or with only a few spines on dorsal surface 2
2. First pereopod carpus armed with row of well spaced dorsal small spines 3
 - First pereopod carpus unarmed *S. earlei* (Indo-West Pacific)
3. Sixth pleonal somite with spines irregularly arranged
 - *S. goyi*, new species (Indo-West Pacific)
 - Sixth pleonal somite with spines arranged in oblique rows ...
..... *S. scutellatus* (Western Atlantic, Gulf of Mexico)
4. Fourth pleonal somite with small spines arranged in transverse rows 5
 - Fourth pleonal somite with irregularly arranged small spines 6
5. Third pleonal somite with narrow shield-shaped bare area posterodorsally; telson with 1 lateral spine; antennal scale serrated along entire lateral margin
 - *S. spinosus* (Mediterranean, Amphi-Atlantic, Gulf of Mexico)
 - Third pleonal somite without bare area posterodorsally; telson without lateral spines; antennal scale with subdistal lateral margin unarmed except for terminal tooth
..... *S. pyronotus* (Indo-West Pacific)
6. Fourth and fifth pereopod carpi and propodi not subdivided 7
 - Fourth and fifth pereopod carpi and propodi subdivided ... 8
7. Rostrum armed with 8 ventral teeth; telson with 3 or 4 lateral spines *S. chrysexanthus* (Indo-West Pacific)
 - Rostrum unarmed on ventral margin; telson with 1 lateral spine *S. zanzibaricus* (Indo-West Pacific)
8. Fourth pleonal somite without mesial bare area; fourth and fifth pereopods densely covered with dorsomesial spines on carpi, meri and ischia 9
 - Fourth pleonal somite with a large cross-like bare area mesially; fourth and fifth pereopods without or only with a few dorsomesial spines on carpi, meri and ischia 10

9. Exopod of third maxilliped without lateral spines; carpi of fourth and fifth pereopods armed with 2–6 movable distoventral spines *S. devaneyi* (Indo-West Pacific)
- Exopod of third maxilliped with lateral spines; carpi of fourth and fifth pereopods without distoventral movable spines *S. tenuirostris* (Indo-West Pacific)
10. Rostrum not exceeding second segment of antennular peduncle; third pleonal somite without bare area posterodorsally *S. hispidus* (circumtropical)
- Rostrum exceeding second segment of antennular peduncle; third pleonal somite with a narrow shield-like bare area posterodorsally *S. cyanoscelis* (Indo-West Pacific)

KEY TO THE SPECIES OF *STENOPUS* BASED ON COLOURATION

1. Body uniformly orange *S. spinosus*
- Body with striking colour pattern 2
2. Carapace purple *S. tenuirostris*
- Carapace not purple 3
3. Third maxilliped, fourth and fifth pereopods blue *S. cyanoscelis*
- Third maxilliped, fourth and fifth pereopods not blue 4
4. Pleon with 1 or 2 stripes 5
- Pleon with spots, patches or bands 6
5. Pleon with lateral red longitudinal stripes *S. earlei*
- Pleon with a middorsal broad, red longitudinal stripe *S. pyrsonotus*
6. Third pereopod blue on proximal segments *S. hispidus*
- Third pereopod not blue on proximal segments 7
7. Rostrum red 8
- Rostrum not red 9
8. Pleon white with dorsolateral red patches on first, second and third somites *S. goyi*, new species
- Pleon golden yellow with dorsolateral red spots *S. chrysexanthus*
9. Antennal flagellae red *S. zanzibaricus*
- Antennal flagellae white 10
10. Third to fifth pleonal somites with longitudinal row of 3 white spots dorsally and 2 larger red spots dorsolaterally *S. scutellatus*
- Pleon with red spots on second and third somites *S. devaneyi*

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LITERATURE CITED

- Alcock, A. & A. R. Anderson, 1894. Natural history notes from H. M. Indian marine survey steamer "Investigator," Commander C. F. Oldham, R. N., commanding. Series II, No. 14. An account of a recent collection of deep-sea Crustacea from the Bay of Bengal, Laccadive Sea. *Journal of the Asiatic Society of Bengal*, **63**(2): 141–185.
- Alcock, A. & A. R. Anderson, 1899. Natural history notes from H. M. Royal Indian Marine Survey Ship 'Investigator', commander T. H. Heming, R. N., commanding. Series III., No. 2. An Account of the deep-sea Crustacea dredged during the surveying-season of 1897–98. *Annals and Magazine of Natural History, series 7*, **3**: 1–27, 278–292.
- Bouvier, E. L., 1908. Sur les relations zoologiques des Crevettes de la tribu des Sténopidés. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, Paris*, **146**: 887–891.
- Bruce, A. J., 1976. Studies on Indo-West Pacific Stenopodidea. 1. *Stenopus zanzibaricus* sp. nov., a new species from East Africa. *Crustaceana*, **31**(1): 90–102.
- Calado, R., J. Lin, A. L. Rhyne, R. Araújo & L. Narciso, 2003. Marine ornamental decapods – popular, pricey, and poorly studied. *Journal of Crustacean Biology*, **23**: 963–973.
- Debelius, H., 1999. *Crustacea guide of the world. Shrimps, Crabs, Lobsters, Mantis Shrimps, Amphipods*. IKAN, Frankfurt. 321 pp.
- Debelius, H. & H. A. Baensch, 1992. *Meerwasser Atlas*. Mergus Verlag, Melle. 1215 pp.
- Goy, J. W., 1984. Diagnosis of three new *Stenopus* species. In: Debelius, H. (ed.), *Armoured Knights of the Sea*. Essen: Alfred Kernan Verlag. 120 pp.
- Goy, J. W., 1992. A new species of *Stenopus* from Australia, with a redescription of *Stenopus cyanoscelis* (Crustacea: Decapoda: Stenopodidea). *Journal of Natural History*, **26**(10): 79–102.
- Goy, J. W. & D. M. Devaney, 1980. *Stenopus pyrsonotus* a new species of stenopodidean shrimp from the Indo-West Pacific region (Crustacea: Decapoda). *Proceedings of the Biological Society of Washington*, **93**(3): 781–796.
- Hendrickx, M. E., 2002. A new deep water species of *Odontozona* Holthuis (Decapoda, Stenopodidae) from the southern Gulf of California, Mexico. *Crustaceana*, **75**: 405–412.

- Holthuis, L. B., 1946. Biological results of the Snellius Expedition XIV. Stenopodidae, Nephropsidae, Scyllaridae, and Palinuridae. *Temminckia*, **7**: 1–178.
- Holthuis, L. B., 1952. Crustacés Décapodes, Macrures. Expédition Océanographique Belge dans les Eaux Côtières Africaines de l'Atlantique Sud (1948–1949). *Résultats Scientifiques*, **3**(2): 1–88.
- Holthuis, L. B., 1955. The recent genera of the Caridean and Stenopodidean shrimps (Class Crustacea: Order Decapoda: Supersection Natantia) with keys to their determination. *Zoologische Verhandelingen*, **26**: 1–157.
- Holthuis, L. B., 1993. *The recent genera of the caridean and stenopodidean shrimps (Crustacea, Decapoda) with an appendix on the order Amphionidacea*. Nationaal Natuurhistorisch Museum, Leiden. 328 pp.
- Latreille, P. A., 1819. Salicoques, Carides. *Nouveau dictionnaire d'histoire naturelle a appliquée aux arts, à l'agriculture, à l'économie rural et domestique, à la médecine, etc., edition 2*, **30**: 68–73.
- Man, J. G. de, 1888. Bericht über die von Herrn Dr. J. Brock im indischen Archipel gesammelten Decapoden und Stomatopoden. *Archiv für Naturgeschichte*, **53**(1): 215–600.
- Milne-Edwards, A., 1881. Compte rendu sommaire d'une exploration zoologique faite dans l'Atlantique, à bord du navire le Travailleur. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Paris, **43**: 931–940.
- Okuno, J., 2003. A new species of the genus *Odontozona* Holthuis, 1946 (Crustacea: Decapoda: Stenopodidae) from submarine caves in southern Japan. *Natural History Museum Research*, **7**(2): 167–180.
- Olivier, A. G., 1811. Palémon: Palaemon. In: Olivier, A. G. (ed.), *Insects. Encyclopédie méthodique, d'Histoire naturelle*, **8**: 652–667.
- Ortmann, A., 1893. Decapoden und Schizopoden der Plankton-Expedition. *Ergebnisse der Hamburger Magalhaensischen Sammelreise*, 2(Gb): 1–120. pp. 1–120.
- Poupin, J., 1996. *Atlas des Crustacés marins profonds de Polynésie Française Récoltes du navire Marara (1986/1996)*. Service Mixte de Surveillance Radiologique et Biologique, Montlhéry. 59 pp.
- Rafinesque Schmaltz, C. S., 1814. *Précis des découvertes et travaux somiologiques de M. r. C. S. Rafinesque-Schmaltz entre 1800 et 1814 ou choix raisonné de ses principales découvertes en zoologie et en botanique, pour servir d'introduction à ses ouvrages futurs*. Royale Typographie Militaire, Palermo. 55 pp.
- Rankin, W. M., 1898. The Northrup collection of Crustacea from the Bahamas. *Annals of the New York Academy of Sciences*, **11**(12): 827–930.
- Risso, A., 1827. *Histoire naturelle des principales productions de l'Europe Méridionale et particulièrement de celles des environs de Nice et des Alpes Maritimes. Volume 5 Animaux Articulés, Annelides, Crustacés, Arachnides, Myriapodes et Insectes*. F.-G. Levrault, Paris, xiii + 403 pp., 10 pls.
- Schram, F. R., 1986. *Crustacea*. Oxford University Press, New York. xiv + 606 pp.