

East Asian Cymonomid Crabs (Crustacea: Brachyura)

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Shane T. Ahyong and Peter K.L. Ng (2017) Cymonomid crabs are small cryptic deep-water brachyurans occurring worldwide. Six species have been reported from East Asia: one from both Taiwan and Japan (*C. andamanicus* Alcock, 1905) and five from Japan only (*C. curvirostris* Sakai, 1965, *C. japonicus* Balss, 1922, *C. sagamiensis* Sakai, 1983, *C. soela* Ahyong and Brown, 2003, *C. umitakae* Takeda, 1981). *Cymonomus curvirostris*, *C. japonicus*, *C. sagamiensis* and *C. umitakae* were described from Japanese waters, but *C. andamanicus* and *C. soela* have much more distant type localities - the Andaman Sea and southeastern Australia, respectively. We review all previous records of *Cymonomus* from East Asia, describe two new species, and clarify the status of records of *C. andamanicus* and *C. soela* from the region. Records of *C. andamanicus* and *C. soela* from East Asia are referable to two new species occurring in both Taiwan and Japan. The identities of *C. japonicus* and *C. sagamiensis* are fixed by neotype selection; *C. sagamiensis* is made a junior objective synonym of *C. umitakae*. Six species of *Cymonomus* are now recorded from Japan, of which two also occur off Taiwan. We also report on cymonomids collected by Taiwanese research vessels in the South China Sea (Dongsha and Macclesfield Bank) of which four species were collected, including *C. hakuhoae* Takeda and Moosa, 1990, not previously found in Japan or Taiwan. A key to the species of *Cymonomus* from East Asia and the South China Sea is included.

Key words: Crustacea, *Cymonomus*, Crab, Taiwan, Japan, South China Sea, Seamount.

BACKGROUND

Cymonomids are small, rare, cryptic podotreme crabs having elongate, usually immovable eyestalks, a quadrate carapace without functional orbits, reduced, sub-dorsal pereopods 4 and 5, and a pleotelson in both sexes (Tavares 1993a, b; Ahyong et al. 2009). Most cymonomids occur in deep outer shelf or slope waters below 200 m depth. Five genera and 39 species are known worldwide, with new species regularly discovered, especially from the Indo-West Pacific (e.g., Ng et al. 2008; Ahyong 2008; Ahyong and Ng 2009 2011; Ahyong 2014). The cymonomid crabs of East Asia are poorly known, with six species of the genus *Cymonomus* A. Milne-Edwards, 1880,

reported from the region: one from both Taiwan and Japan (*C. andamanicus* Alcock, 1905) and five from Japan only (*C. curvirostris* Sakai, 1965, *C. japonicus* Balss, 1922, *C. sagamiensis* Sakai, 1983, *C. umitakae* Takeda, 1981, and *C. soela* Ahyong and Brown, 2003) (Sakai 1976; Takeda 2001; Ho et al. 2004; Ahyong et al. 2009). *Cymonomus curvirostris*, *C. japonicus*, *C. sagamiensis* and *C. umitakae* were described from Japanese waters, but *C. andamanicus* and *C. soela* have much more distant type localities, namely the Andaman Sea and southeastern Australia, respectively. We herein review all previous records of *Cymonomus* from East Asia, describe two new species, and clarify records of *C. andamanicus* and *C. soela* from the region. We also report cymonomid specimens

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collected from the South China Sea by Taiwanese research vessels. Herein, we record seven species of *Cyonomus*, of which two are new to science.

MATERIALS AND METHODS

Terminology and size descriptors follow Ah Yong and Ng (2009). Carapace length (cl) is measured along the dorsal midline and includes the rostrum. Postrostral carapace length (pcl) excludes the rostrum. Carapace width (cw) is the greatest width of the carapace.

Specimens are deposited in the National Taiwan Ocean University, Keelung (NTOU); Australian Museum, Sydney (AM); Natural History Museum and Institute, Chiba (CBM); Zoological Reference Collection of the Lee Kong Chian Museum of Natural History, National University of Singapore (ZRC); Wakayama Prefectural Museum of Natural History, Japan (WPMNH); and National Science Museum, Tokyo (NSMT).

RESULTS

Systematics

Cyonomidae Bouvier, 1898

Cyonomus chani sp. nov.

(Figs. 1, 7A)

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Cyonomus sp. 4. - Nagai 1994: 53, pl. 1, fig. 9.

Cyonomus andamanicus. - Ho et al. 2004: 647, fig. 1H. - Ah Yong et al. 2009: 179-180 (part), fig. 135-136.

Cyonomus soela. - Takeda et al. 2005: 108-109, fig. 2.

Type material: HOLOTYPE: NTOU, female (cl 8.7 mm, pcl 7.9 mm, cw 9.0 mm), SW of Kaohsiung, Taiwan, 22°15.594'N, 120°02.156'E, 945-1052 m, TAIWAN 2006, stn CP362, RV *Ocean Researcher 1*, 23 August 2006.

Paratypes: ZRC 2004.0761, 1 female (cl 8.4 mm, pcl 9.0 mm, cw 9.4 mm), NE of Su-Ao, Taiwan, 24°47.5'N, 122°17.4', 1134 m, TAIWAN 2000, stn CP61, RV *Fishery Researcher 1*, 4 August 2000; NTOU, 1 female (cl 8.3 mm, pcl 7.6 mm, cw 8.5 mm), Dongsha, northern South China Sea, 20°17.971-15.914'N, 116°07.966-07.987'E, 795-822 m, DONGSHA 2014, stn CP4130, RV *Ocean Researcher 1*, 2 May 2014.

Other material examined: JAPAN: NSMT Cr16341, 1 male (cl 8.7 mm, pcl 8.1 mm, cw 8.8 mm; with rhizocephalan parasite), 1 female (cl

8.0 mm, pcl 7.4 mm, cw 8.3 mm), W of Amami-Oshima Island, Ryukyu Islands, 28°40.30'N, 127°06.16'E to 28°39.24'N, 127°05.78'E, 747-772 m, RV *Hakuho-Maru*, KH-05-01, st. OT-07, ORE beam trawl, coll. H. Watabe, 13 May 2005.

Description: Carapace quadrate, almost square, lateral margins faintly convex; regions weakly indicated; without prominent anterolateral spines; lower pterygostomian region swollen; surfaces sparsely setose. Dorsal and lateral surfaces coarsely granulate. Fronto-orbital margin (excluding rostrum and lateral projections) advanced slightly beyond anterolateral margins; exceeding half anterior carapace width (about 0.6); outer orbital processes pointed, directed anteriorly, situated below plane of rostrum, laterally spinulate or granulate, reaching beyond midlength but not apex of rostrum. Rostrum small, shorter than half-length of eyestalks; 0.07-0.11 pcl; triangular, apex acute, margins straight, minutely granular laterally and dorsally. Eyestalks distinctly divergent, slender, ventrally flattened, width at midlength about one-fourth length, fused to carapace below rostral base but demarcated from frontal margin; reaching apex of antennular peduncle article 1; minutely granular; cornea apparently vestigial, not pigmented. Epistome with blunt tubercle mesial to base of antennules, blunt lobe mesial to base of antenna, and pointed tubercle flanked by small granules at base of rostrum.

Antennular peduncle 0.80-0.90 pcl (female), 0.90 pcl (feminized male; with rhizocephalan parasite); articles minutely granular. Basal antennal article fused to epistome; articles 2-4 minutely granular; article 5 smooth.

Maxilliped 3 ischiobasis subquadrate, surface sparsely granular, spinular distally, with longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus shorter than ischiobasis, length twice width; tapering distally to rounded apex; surface sparsely granular or spinulate; margins spinulate. Dactylus smooth; propodus and carpus spinulate or coarsely granulate. Exopod sparsely granular, reaching beyond carpo-meral articulation but not reaching merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granular. Carpus finely granular, dorsal margin with several spines, 1 or 2 distinctly longer. Palm surfaces finely granular; extensor margins sparsely spinulate. Dactylus longer than upper palm length; proximal dorsal half with small spines and granules; with faint longitudinal carina on outer

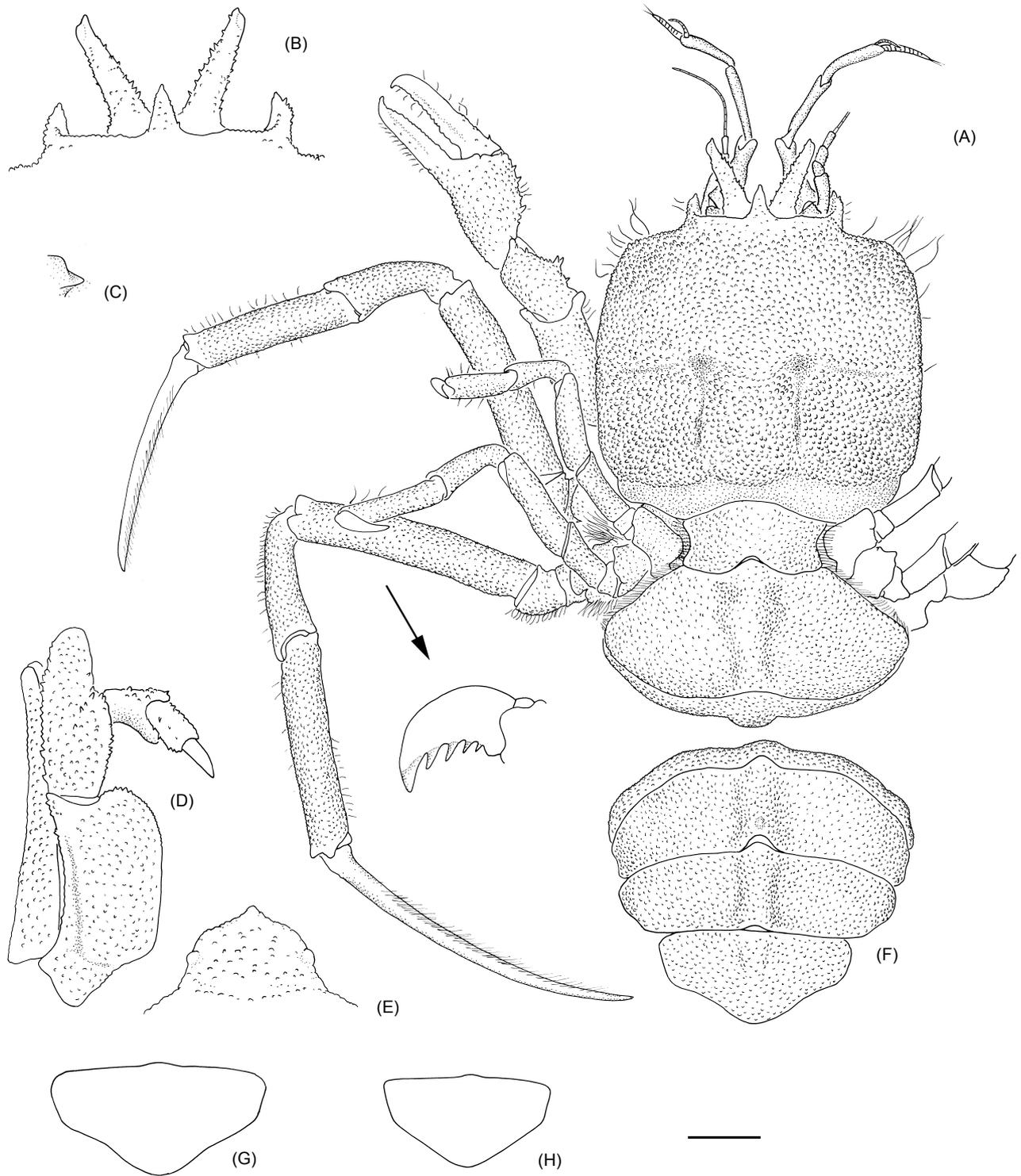


Fig. 1. *Cymonomus chani* sp. nov. A-F: female holotype, cl 8.7 mm, pcl 7.9 mm, cw 9.0 mm, SW of Kaohsiung, Taiwan, CP362 (NTOU); G: female paratype, cl 9.1 mm, pcl 8.3 mm, cw 9.5 mm, NE of Su-Ao, Taiwan, stn CP61 (ZRC 2004.0761); H: female, cl 8.1 mm, pcl 7.5 mm, cw 8.3 mm, Japan (NSMT Cr16341). A, dorsal habitus; B, fronto-orbital region; C, right basal antennal lobe; D, right maxilliped 3; E, thoracic sternite 3; F, abdomen, posterior; G, H, telson. Scale bars: A, F-H = 2.0 mm; B = 1.3 mm; C = 0.6 mm; D, E = 1.0 mm.

surface, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles finely granular. Pereopod 3 longest; merus 0.91-1.02 pcl (female), 0.95 pcl (feminized male; with rhizocephalan parasite). Dactyli broadly curved, unarmed, without longitudinal rib, setose. Pereopod 3 dactylus as long as combined length of propodus and carpus.

Pereopods 4 and 5 minutely granular, sparsely setose; longer than merus of pereopod 3; dactyli markedly shorter than propodi, falcate, with corneous apex and 4-7 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, about 1.6 × wider than long; lateral margins divergent posteriorly, surface granulate. Margins of sternites 4 and 5 granulate.

Female abdomen with margins and surface finely granular; telson immovably fused to abdominal somite 6 forming pleotelson, suture or demarcations absent; pleotelson broadly pentagonal, length 1.8 (Japan) to 1.9-2.1 (Taiwan) × width, apex broadly rounded.

Egg diameter 1.1 mm.

Etymology: Named after our friend and colleague Tin-Yam Chan, for his major contributions to carcinology and for making available many of the specimens studied herein.

Remarks: *Cyonomus chani* sp. nov. superficially resembles “short-rostrum” species, such as *C. mainbaza* Ahyong, 2014 (Mozambique Channel), and *C. andamanicus* Alcock, 1905, to which it was tentatively referred (as *C. andamanicus*) by Ho et al. (2004) and Ahyong et al. (2009). *Cyonomus chani*, however, does not belong to the *C. delli* group (see below under Remarks of *C. cognatus* sp. nov.), which includes *C. andamanicus*, and whose members have a short rostrum but also short, stout, eyestalks. Instead, *C. chani* appears morphologically closest to *C. mainbaza* Ahyong, 2014, sharing the slender, strongly divergent eyestalks, but is readily distinguished by the absence of the basal antennal spine (Fig. 1C), subparallel carapace margins (versus posteriorly divergent), distinctly coarser dorsal carapace granulation (versus finely granulate), and divergent lateral margins of sternite 3 (versus subparallel) (Figs. 1A, E) (cf. Ahyong 2014: fig. 1A, E).

The previous record of *C. soela* from the Ryukyus (Takeda et al. 2005) is referable to *C.*

chani. The female specimen from the Ryukyus agrees well with the Taiwanese and Dongsha specimens differing only in having a proportionally slightly narrower abdomen. The accompanying male carries a rhizocephalan externa under the abdomen and is strongly feminised, with proportional antennular peduncle and pereopod lengths similar to those of females. Nagai (1994) reported *C. chani* as *Cyonomus* sp. 4, from off Shionomisaki, Wakayama Prefecture, Japan, at 650 m.

Distribution: Northern South China Sea, Taiwan and Japan (Ryukyu Islands); 650-1134 m.

***Cyonomus cognatus* sp. nov.**

(Figs. 2, 7B, C)

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Cyonomus quadratus andamanicus. - Sakai 1976: 37, pl. 8: fig. 1.

Cyonomus sp. 1 [*C. quadratus andamanicus* Alcock, 1905 sensu Sakai 1976]. - Nagai 1994: 51, pl. 1, fig. 6.

Cyonomus sp. 2. - Nagai 1994: 51, pl. 1, fig. 7.

Cyonomus andamanicus. - Ahyong et al. 2009: 179-180 (part), fig. 134.

Type material: HOLOTYPE: NTOU, male (cl 7.2 mm, pcl 6.4 mm, cw 7.0 mm), E of Su-Ao, Taiwan, 24°28.59'N, 122°12.66'E, 490-1027 m, TAIWAN 2003, stn CP214, RV *Ocean Researcher 1*, 27 August 2003.

Other material examined: JAPAN: WPMNH #45, 1 female (cl 6.8 mm, pcl 6.1 mm, cw 7.3 mm), Kumano Sea, trawl, 300 m, 1978.

SOUTH CHINA SEA, SE OF MACCLESFIELD BANK: ZRC, 1 spent female (cl 6.5 mm, pcl 5.9 mm, cw 6.4 mm), summit of V bis Seamount, 15°04.3820-05.1589'N, 116°31.1860-32.4237'E, 534-552 m, hard rocky bottom, NanHai 2014, stn DW4100, 1 January 2014; ZRC, 1 male (damaged, pcl 5.4 mm, cw 5.6 mm), 1 ovigerous female (cl 8.3 mm, pcl 7.5 mm, cw 7.9 mm), V bis seamount, 15°04.5841-03.3720'N, 116°31.5257-31.2470'E, 339-533 m, hard rocky bottom, NanHai 2014 stn DW4102, 2 January 2014; AM P100611, 1 ovigerous female (cl 10.1 mm, pcl 9.2 mm, cw 9.9 mm), NanHai 2014 stn DW4102.

Description of holotype: Carapace quadrate, almost square, lateral margins gently divergent posteriorly; regions weakly indicated; with 1-3 small anteriorly directed anterolateral spines in addition to other surface ornamentation; lower pterygostomial region swollen; surfaces sparsely setose; carapace slightly more inflated in females

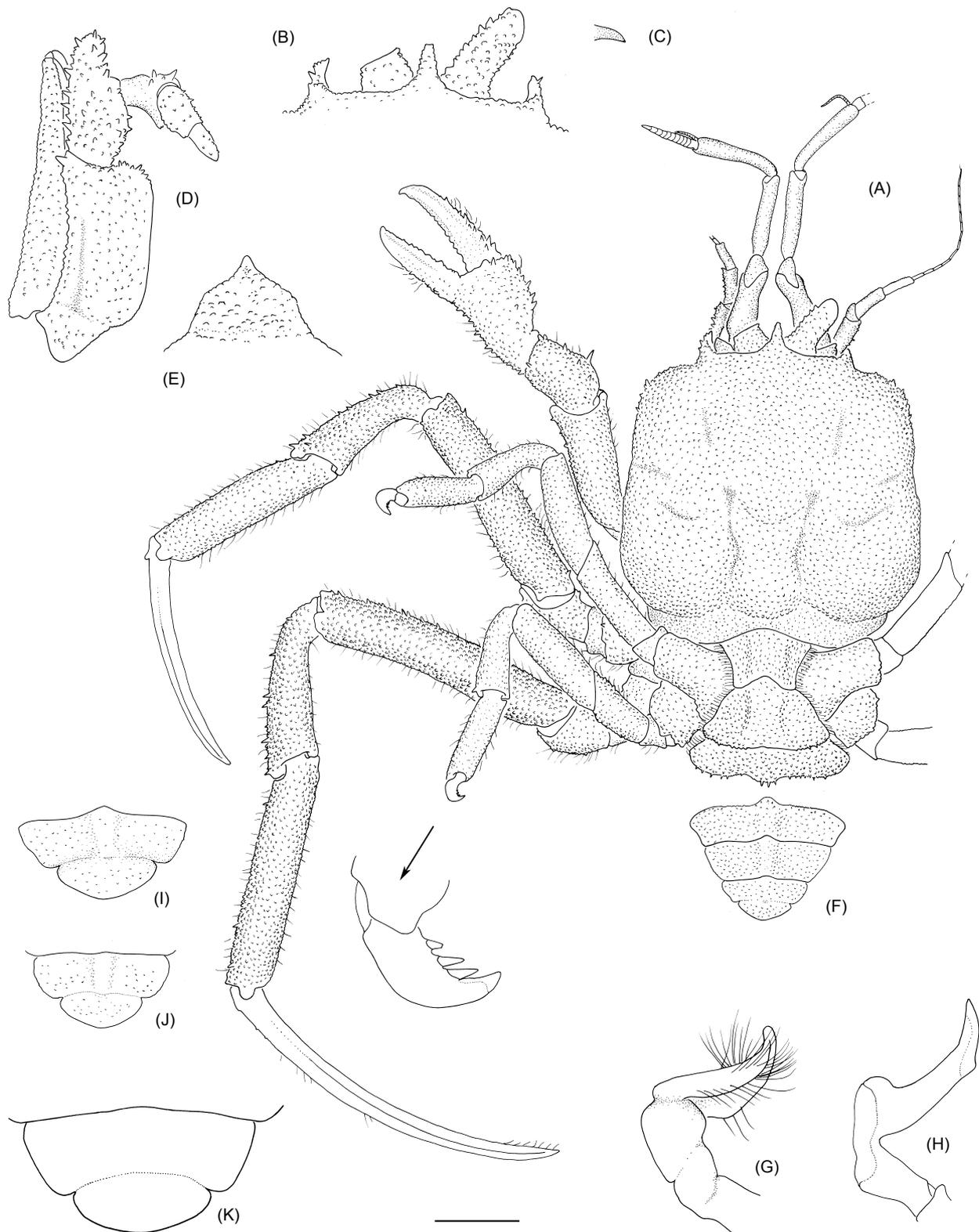


Fig. 2. *Cymonomus cognatus* sp. nov. A-I: male holotype, cl 7.2 mm, pcl 6.4 mm, cw 7.0 mm, E of Su-Ao, Taiwan, stn CP214 (ZRC 2014.0159); J: male, pcl 5.4 mm, cw 5.6 mm, SE of Macclesfield Bank, stn DW4102 (ZRC); K: ovigerous female, cl 10.1 mm, pcl 9.2 mm, cw 9.9 mm, SE of Macclesfield Bank, stn DW4102 (AM P100611). A, dorsal habitus; B, fronto-orbital region; C, right basal antennal spine; D, right maxilliped 3; E, thoracic sternite 3; F, abdominal somites 4-5 and pleotelson. G, right gonopod 1, abdominal view; H, right gonopod 2, abdominal view; I-K, pleotelson. Scale bars: A, F, K = 2.0 mm; B = 1.3 mm; C = 0.5 mm; D, E, G, H-J = 1.0 mm.

than males. Dorsal and lateral surfaces entirely covered with minute granules, with granules becoming larger and more elongate anterolaterally. Fronto-orbital margin (excluding rostrum and lateral projections) advanced slightly beyond anterolateral margins; exceeding half anterior carapace width (about 0.6); outer orbital processes, pointed, directed anteriorly, situated below plane of rostrum, laterally spinulate or granulate, reaching midlength of rostrum. Rostrum small, about half-length of eyestalks; 0.10-0.11 pcl; triangular, apex acute, margins concave, minutely granular laterally and dorsally. Eyestalks distinctly divergent, flattened, stout, width at midlength exceeding one-third length, fused to carapace below rostral base but demarcated from frontal margin; reaching anteriorly beyond midlength of antennular peduncle article 1; minutely granular; cornea apparently vestigial, not pigmented. Epistome with blunt tubercle mesial to base of antennules, small spine mesial to base of antenna, with pointed tubercle flanked by small granules at base of rostrum.

Antennular peduncle 0.98-1.00 pcl (male), 0.80-0.88 pcl (female); articles minutely granular. Basal antennal article fused to epistome; articles 2-4 irregularly granular or spinular; article 5 minutely granular.

Maxilliped 3 ischiobasis subquadrate, surface sparsely granular, spinular distally, with longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus shorter than ischiobasis, length twice width; tapering distally to rounded apex; surface sparsely granular or spinulate; margins spinulate. Dactylus, propodus and carpus spinulate or coarsely granulate. Exopod sparsely granular, reaching beyond carpo-meral articulation but not exceeding merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granular, with occasional longer spinules. Carpus finely granular, dorsal margin with 3 or 4 spines, 1 distinctly longer. Palm surfaces with fine granules and few scattered acute granules, flexor and extensor margins irregularly spinulate. Dactylus longer than upper palm length; proximal dorsal two-thirds with spines and granules; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles finely granular; propodus, carpus and merus with serrated granules and scattered spinules on extensor margins. Pereopod 3 longest; merus 1.01-1.11 pcl (male), 0.89-0.98 pcl

(female). Dactyli broadly curved, finely granular, with longitudinal rib, though slightly less distinct proximally; sparsely setose. Pereopod 3 dactylus about as long as combined length of propodus and carpus.

Pereopods 4 and 5 minutely granular, sparsely setose; longer than merus of pereopod 3; dactyli markedly shorter than propodi, falcate, with corneous apex and 4 or 5 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior one-third of carapace.

Thoracic sternite 3 pentagonal, about 1.6 × wider than long; lateral margins divergent posteriorly, surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen with margins and surface finely granular or minutely spinulate; telson immovably fused to abdominal somite 6 forming pleotelson; demarcation indicated by notch in lateral margins and shallow, complete or near complete transverse groove in males, by distinct, complete transverse groove in females; telson proportions similar in both sexes, width twice length, apex broadly rounded.

Gonopod 1 distal article cannulate, forming copulatory tube, with long distal setae. Gonopod 2 with articles fused, L-shaped; distomesial margin slightly hollowed, apex acute.

Etymology: The specific name, *cognatus*, Latin, meaning related or kindred, alludes to the strong similarities between the new species and its regional congeners *C. diogenes* and *C. delli*.

Remarks: Ahyong et al. (2009) reported *Cymonomus cognatus* sp. nov. from Taiwan, provisionally as *C. andamanicus* Alcock, 1905. *Cymonomus cognatus* belongs to the *C. delli* group, an assemblage of species within the genus characterised by: a small, triangular rostrum that is distinctly shorter than the eyestalks; short, stout, relatively broad, ventrally flattened eyestalks; a relatively swollen carapace with a finely granular surface and margins, rounded anterolateral and slightly divergent lateral margins; and a pleotelson with a partial to full demarcation between abdominal somite 6 and the telson (yet to be confirmed in *C. andamanicus*). This group includes *C. andamanicus* Alcock, 1905 (Andaman Sea), *C. cubensis* Chace, 1940 (Caribbean Sea), *C. delli* Griffin and Brown, 1976 (southern Australia), and *C. diogenes* Ahyong and Ng, 2009 (southern Philippines). It should be noted that *C. cubensis* and *C. delli* were previously placed in *Cymonomoides* Tavares, 1993a, together with *C.*

guinotae Tavares, 1991 (type species; Brazil) and *Cymonomoides fitoi* Lemaitre and Bermúdez, 2000 (Caribbean Sea) on the basis of the 7-segmented abdomen. Members of the *C. delli* group, however, do not appear to be closely related to the type species of *Cymonomoides*, differing in rostral (well-developed versus obsolete) and eye form (short, broad and stout versus slender, elongate). The clear demarcation of the telson from somite 6 in *Cymonomoides* and some members of the *C. delli* group is most parsimoniously interpreted as plesiomorphic. Moreover, the demarcation between the telson and abdominal somite 6 in species of the *C. delli* group varies from mere notches in the lateral margins to a distinct groove across the pleotelson making the taxonomic effectiveness of this feature questionable (Ahyong and Ng 2009). Pending further study, *Cymonomoides* is restricted to the American *C. guinotae* and *C. fitoi*.

Cymonomus cognatus appears to be morphologically closest to *C. delli* from southern Australia and *C. diogenes* from the Philippines. *Cymonomus cognatus* resembles *C. delli* in having similar walking leg morphometrics, but is distinguished by proportionally more elongate antennular peduncles (1.0 pcl in males, 0.8-0.9 pcl in females versus 0.9 pcl in males, 0.7-0.8 pcl in females), a narrower thoracic sternite 3 (width 1.6 × length versus 1.8 × length; Fig. 2E), and in the slightly greater fronto-orbital width (0.6 × anterior carapace width or greater versus about half; Fig. 1A). *Cymonomus cognatus* resembles *C. diogenes* in fronto-orbital proportions (0.6 carapace width or greater) (Fig. 2A) and length of the maxilliped 3 exopod (reaching distally beyond the mero-carpal articulation; Fig. 2D), but differs in the shorter pereopod 3 merus (1.0-1.1 pcl versus 1.4 pcl in males; 0.9-1.0 pcl versus 1.1-1.2 in females) and the presence of a longitudinal rib on the pereopod 2 and 3 dactyli (rib absent in *C. diogenes*). The new species resembles *C. andamanicus* in the similar fronto-orbital width and thoracic sternite 3 proportions, but differs in having a longer maxilliped 3 exopod, reaching distally beyond the mero-carpal articulation (Fig. 2D) versus reaching almost to level of mero-carpal articulation (Alcock et al. 1907: pl. 79 fig 2a). Additionally, *C. cognatus* possesses anterolateral spines (which *C. andamanicus* apparently lacks).

The specimens of *C. cognatus* from the South China Sea comprise females and one damaged male. The male corresponds well to the holotype, though the transverse groove demarcating the telson from abdominal somite 6 is more distinct

than in the holotype. In the holotype, the groove separating the telson from somite 6 is shallow and indistinct, especially medially. In the South China Sea male, the groove is also shallow, though defined throughout its length. In females, the pleotoelson groove is well-defined.

Nagai (1994) reported female *C. cognatus* from southeastern Japan, from the Kumano Sea (~300 m depth) as "*Cymonomus* sp. 1", and males off Shionomisaki (~400 m depth) under the name "*Cymonomus* sp. 2". The dry female specimen from the Kumano Sea is damaged, lacking chelipeds, pereopods 3-4 and the abdomen, but what remains agrees well with *C. cognatus*. The specimen figured and reported by Sakai (1976: pl. 8 fig. 1) as *C. andamanicus* from Mimase, Tosa Bay, at 250 m depth, corresponds in all respects to *C. cognatus*.

Distribution: Southern Japan and Taiwan to Macclesfield Bank, South China Sea; 250 to 490-1027 m.

***Cymonomus curvirostris* Sakai, 1965**

(Figs. 3, 7D)

Cymonomus granulatus curvirostris Sakai, 1965: 19-20, fig. 2, pl. 10 fig 1. [type locality: SW of Jogashima, Japan]. - Griffin and Brown 1976: 252. - Sakai 1976: 36, pl. 7 fig. 3. - Nagai 1989: 43.

Cymonomus curvirostris. - Takeda 2001: 223. - Ahyong and Brown 2003: 1372, 1374. - Ng et al. 2008: 32.

Type material: HOLOTYPE: NSMT-Cr R3850, ovigerous female (cl 3.3 mm, pcl 3.0 mm, cw 3.3 mm), 2.5 miles SW of Jogashima Light House, Sagami Bay, 100 m, 6 Dec 1961.

Other material examined: CBM-ZC 6450, 1 male (cl 3.0 mm, pcl 2.6 mm, cw 2.8 mm), 1 ovigerous female (cl 3.7 mm, pcl 3.1 mm, cw 3.7 mm), Sagami Bay, off Misaki, Miura, Kanagawa Prefecture, 35°08.09'N, 129°32.92'E, 240-418 m, sand, dredge, RV *Rinkai-maru*, University of Tokyo, coll. T. Komai, 27 February 2002.

Description: Carapace quadrate, almost square, lateral margins slightly convergent anteriorly; regions weakly indicated; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces almost glabrous. Carapace surface densely covered with rounded tubercles; anterolateral and lateral surfaces with rounded or globular tubercles and granules, club-shaped or stalked, sometimes with minute apical point; tubercles largest anterolaterally; central carapace surface densely covered with rounded tubercles,

almost entirely obscuring regions. Fronto-orbital margin (excluding rostrum and lateral projections) not advanced beyond anterolateral margins; width about half anterior carapace width; outer orbital processes elongate, directed anteriorly, situated below plane of rostrum, covered with club-shaped or stalked tubercles, as long as rostrum. Rostrum slender, apex blunt, with or without stalked tubercle, tuberculate or with slender projections laterally and dorsally; slightly longer than half length of eyestalks; 0.10-0.19 pcl. Eyestalks

strongly divergent, flattened, fused to carapace below rostral base but demarcated from frontal margin; covered with stalked tubercles; reaching anteriorly to apex of basal antennular peduncle article. Epistome smooth except for blunt tubercle mesial to base of antennule, with small spine mesial to base of antenna.

Antennular peduncle 0.95 pcl (male), 0.75 pcl (female); articles minutely granular. Basal antennal article fused to epistome; articles 2-4 with globose tubercles or elongate; article 5 smooth.

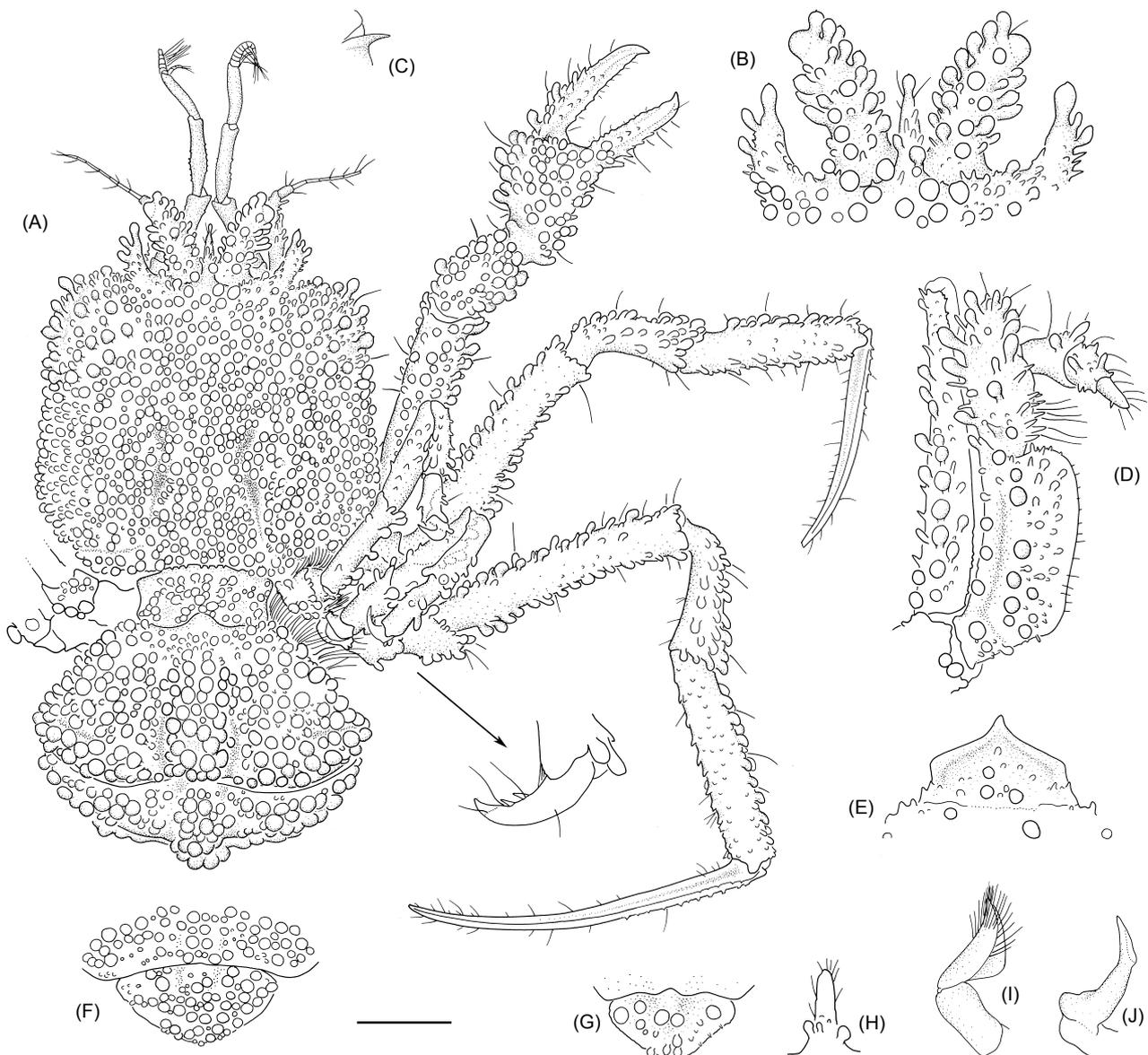


Fig. 3. *Cymonomus curvirostris* Sakai, 1965, Japan, CBM ZC 6450. A-F: female, cl 3.7 mm, pcl 3.1 mm, cw 3.7 mm; G-J: male, cl 3.0 mm, pcl 2.6 mm, cw 2.8 mm. A, dorsal habitus; B, fronto-orbital region; C, right basal antennal spine; D, right maxilliped 3; E, thoracic sternite 3; F, abdomen, posterior; G, telson; H, rostrum; I, right gonopod 1, abdominal view; J, right gonopod 2, abdominal view. Scale bars: A, F = 1.0 mm; B, D, E, H-J = 0.5 mm; C = 0.25 mm.

Maxilliped 3 ischiobasis subquadrate, sparsely granular, with globose tubercles; ischiobasial demarcation indistinct. Merus slightly shorter than ischiobasis, almost 3.0 × longer than wide; tapering distally to rounded apex; surface and margins covered with globose and club-shaped tubercles. Dactylus, propodus and carpus sparsely spinulate or tuberculate. Exopod slightly exceeding merus of endopod; covered with globose and club-shaped tubercles.

Chelipeds sparsely setose; all articles densely covered with globose and club-shaped tubercles. Dactylus longer than upper palm length; with proximal dorsal granules or spinules in addition to small globose tubercles; occlusal surfaces of dactylus and pollex with scattered setae, with distinct gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus with globose and club-shaped tubercles; on merus and propodus most pronounced along extensor and flexor margins; on carpus covering extensor margin and dorsal surface. Pereopod 3 longest, merus 1.11 pcl (male), 0.91-0.93 pcl (female). Dactyli broadly curved, extensor margin minutely granulate or spinulate proximally; with longitudinal rib, unarmed on pereopod 2, proximally spinulate on pereopod 3. Pereopod 3 dactylus as long as combined length of propodus and carpus.

Pereopods 4 and 5 with globose and club-shaped tubercles, and minute spinules, sparsely setose; longer than merus of pereopod 3; dactyli markedly shorter than propodi, falcate, flexor margin with 2 or 3 spinules. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, about 1.7 × wider than long; lateral margins divergent posteriorly, surface with small globose tubercles and granules, margins of sternites 4 and 5 with large, globose tubercles.

Abdomen densely covered with globose and club-shaped tubercles, and scattered spinules. Female pleotelson triangular, length about half width, apex rounded. Male pleotelson, length greater than half width.

Gonopod 1 distal article cannulate, forming copulatory tube, with long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 0.86-1.16 mm.

Remarks: *Cyonomus curvirostris* Sakai, 1965, *C. kapala* Ah Yong and Brown, 2003, *C. liui* Ah Yong and Ng, 2011, *C. marivenae* Ah Yong

and Ng, 2009, and *C. trifurcus* Stebbing, 1920, are herein referred to as the *C. curvirostris* group. The presence of large, globular pedunculate tubercles on the dorsal and the ventral surfaces of the cephalothorax, abdomen and pereopods distinguishes the members of the *C. curvirostris* group from all other congeners. *Cyonomus curvirostris* is readily distinguished from *C. kapala* (southeastern Australia) by the presence in the latter of a massive rounded boss on each branchial region (Fig. 3A versus Ah Yong and Brown 2003: fig. 1) and from *C. trifurcus* (South Africa) by relatively short rostrum, shorter than the eyestalk in the former versus overreaching the eyestalk in the latter; Fig. 3A, B versus Barnard 1950: fig. 74A, C). The Japanese species differs from *C. marivenae* (Philippines) by the ornamentation of the central surface of the carapace (entirely tuberculate versus smooth in *C. marivenae*; Fig. 3A, Ah Yong and Ng 2009: fig. 6A).

Cyonomus curvirostris is morphologically closest to *C. liui* from the Philippines, but is readily distinguished by the proportionally wider female pleotelson (Fig. 3F) (length half width versus two-thirds width in *C. liui*; Ah Yong and Ng 2011: fig. 3F), the shorter maxilliped 3 merus which does not overreach the exopod (Fig. 3D) (distinctly overreaching the exopod in *C. liui*; Ah Yong and Ng 2011: fig. 3D), and much more extensive, more prominent tuberculation on the carapace, abdomen and the pereopod 2-3 meri (Fig. 3A; cf. Ah Yong and Ng 2011: fig. 3A). In *Cyonomus curvirostris*, the surfaces of the carapace and abdomen are almost entirely covered with tubercles (Figs. 3A, F) (more sparsely distributed in *C. liui*; Ah Yong and Ng 2011: fig. 3A, F) and the flexor and extensor margins of the pereopod 2-3 meri are entirely lined with club-shaped tubercles (Figs. 3A, F) (only sparsely so in *C. liui*; Ah Yong and Ng 2011: fig. 3A, F).

During preparation of the study, T. Komai forwarded us a colour photograph *C. curvirostris* collected recently from off Miura, Sagami Bay, Japan (CBM, ovigerous female, cl 3.6 mm, pcl 3.3 mm, cw 3.9 mm 35°06.81'N, 139°33.78'E to 35°06.63'N, 139°33.73'E, 292-375 m, dredge, RV *Rinkai-maru*, coll. T. Komai, 15 February 2017); the image is shown in Fig. 7D.

Distribution: Known only from southeastern Japan: Sagami Bay (100-418 m), off Cape Shionomisaki (140-150 m; Nagai 1989) and Tosa Bay (232-850 m; Takeda 2001).

***Cymonomus deforgesii* Ah Yong and Ng, 2009**
(Figs. 4, 7E)

Cymonomus sagamiensis. - Takeda 2001: 224.

Cymonomus sp. 3 cf. *valdiviae*. - Nagai 1994: 51, 53, pl. 1, fig. 8.

Cymonomus deforgesii Ah Yong and Ng 2009: 234, figs. 1, 7A, B
[type locality: E of Dingalan Bay, Luzon, Philippines].

Type material: HOLOTYPE: NMCR 29831, male (cl 6.2 mm, pcl 5.4 mm, cw 5.7 mm), E of Dingalan Bay, Luzon, Philippines, 15°00.93'N, 123°12.33'E, 1160-1184 m, AURORA 2007 stn CP 2681, 23 May 2007. PARATYPE: ZRC, 1 juvenile male (cl 3.1 mm, pcl 2.7 mm, cw 2.8 mm), off Aligbay Island, Bohol/Sulu Sea margin, 8°46.2'N, 123°16.1'E, 624-647 m, PANGLAO 2005, stn CP2384, 299 May 2005.

Other material examined: TAIWAN: ZRC, 1 male (cl 6.4 mm, pcl 5.5 mm, cw 6.0 mm), SW of Dongsha, 20°11.46-07.26'N, 116°20.14-21.51'E, 957-988 m, sandy bottom, trawl, ZhongSha 2015, stn CP4132, RV *Ocean Researcher 1*, 22 July 2015.

JAPAN: NSMT Cr13217, 1 male (cl 6.5 mm, pcl 5.6 mm, cw 6.4 mm), Tosa Bay, 842-861 m, RV *Kotoka-Maru*, stn K98-1-800, 20 Jan 1998; NSMT Cr13589, 1 ovigerous female (cl 7.2 mm, pcl 6.2 mm, cw 6.8 mm), Tosa Bay, 800 m, RV *Kotoka-Maru*, stn K00-5-800, 8 May 2000; WPMNH #46, 4 mature females (cl 7.4 mm, pcl 6.5 mm, cw 7.3 mm to cl 7.9 mm, pcl 6.8 mm, cw 7.2 mm), 1 juvenile female (cl 4.9 mm, pcl 4.0 mm, cw 4.4 mm), S of Shionomisaki, Kii Peninsula, Wakayama Prefecture, 700 m, October 1998.

Description: Carapace quadrate, almost square, lateral margins slightly divergent; regions weakly indicated, cervical groove distinctly more pronounced in males than females, broadly V-shaped; with slender conical anteriorly directed anterolateral spine and similar anterolaterally directed spine on lateral margin behind anterolateral spine; lower pterygostomian region swollen; anterior and anterolateral surfaces with long, fine, wiry setae, other surfaces with sparse, short fine setae. Dorsal and lateral surfaces entirely covered with minute granules, with granules becoming larger and more elongate anterolaterally. Fronto-orbital margin (excluding rostrum and lateral projections) advanced beyond anterolateral margins, more pronounced in males than females; exceeding half anterior carapace width; outer orbital processes slender, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, with acute apices, as long as or slight shorter than rostrum. Rostrum

slightly longer than half-length of eyestalks; 0.15-0.19 pcl; slender, tapering to acute apex, minutely granular laterally and dorsally. Eyestalks distinctly divergent, slender, flattened ventrally, granular and prominently spinulate, fused to carapace below rostral base but demarcation distinct, reaching anteriorly almost to end of antennular peduncle article 1; cornea apparently vestigial, not pigmented. Epistome surface with blunt tubercle mesial to base of antennules, small spine mesial to base of antenna, with small cluster of elongate granules at base of rostrum.

Antennular peduncle 1.21 pcl (male), 0.90-1.00 pcl (female); article 1 granular laterally or minutely spinular; article 2 minutely granular; article 3 smooth. Basal antennal article fused to epistome; articles 2-4 irregularly granular or spinular.

Maxilliped 3 ischiobasis subquadrate, sparsely granular and spinular, with longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischiobasis, length about 2.5 × width, tapering distally to rounded apex; surface and margins spinulate. Dactylus conical, unarmed; propodus and carpus spinulate. Exopod granular, reaching beyond carpo-meral articulation but not reaching end of merus of endopod.

Chelipeds (P1) equal in size and ornamentation, setose. Merus finely granular. Carpus finely granular, dorsal margin with 3 spines. Palm surfaces with fine granules and few scattered acute granules, flexor and extensor margins spinulate. Dactylus slightly longer than upper palm length; with proximal dorsal spines and granules; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus finely granular; propodus and carpus with bluntly spinular extensor margins; merus with bluntly spinular extensor and flexor margins. Pereopod 3 longest, merus 1.35-1.41 pcl (male), 0.99-1.09 pcl (female). Dactyli broadly curved, smooth, with longitudinal rib. Pereopod 3 dactylus as long as combined length of propodus and carpus.

Pereopods 4 and granular, minutely spinulate, sparsely setose; shorter than merus of pereopod 3; dactyli markedly shorter than propodi, falcate, with corneous apex and 4 or 5 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

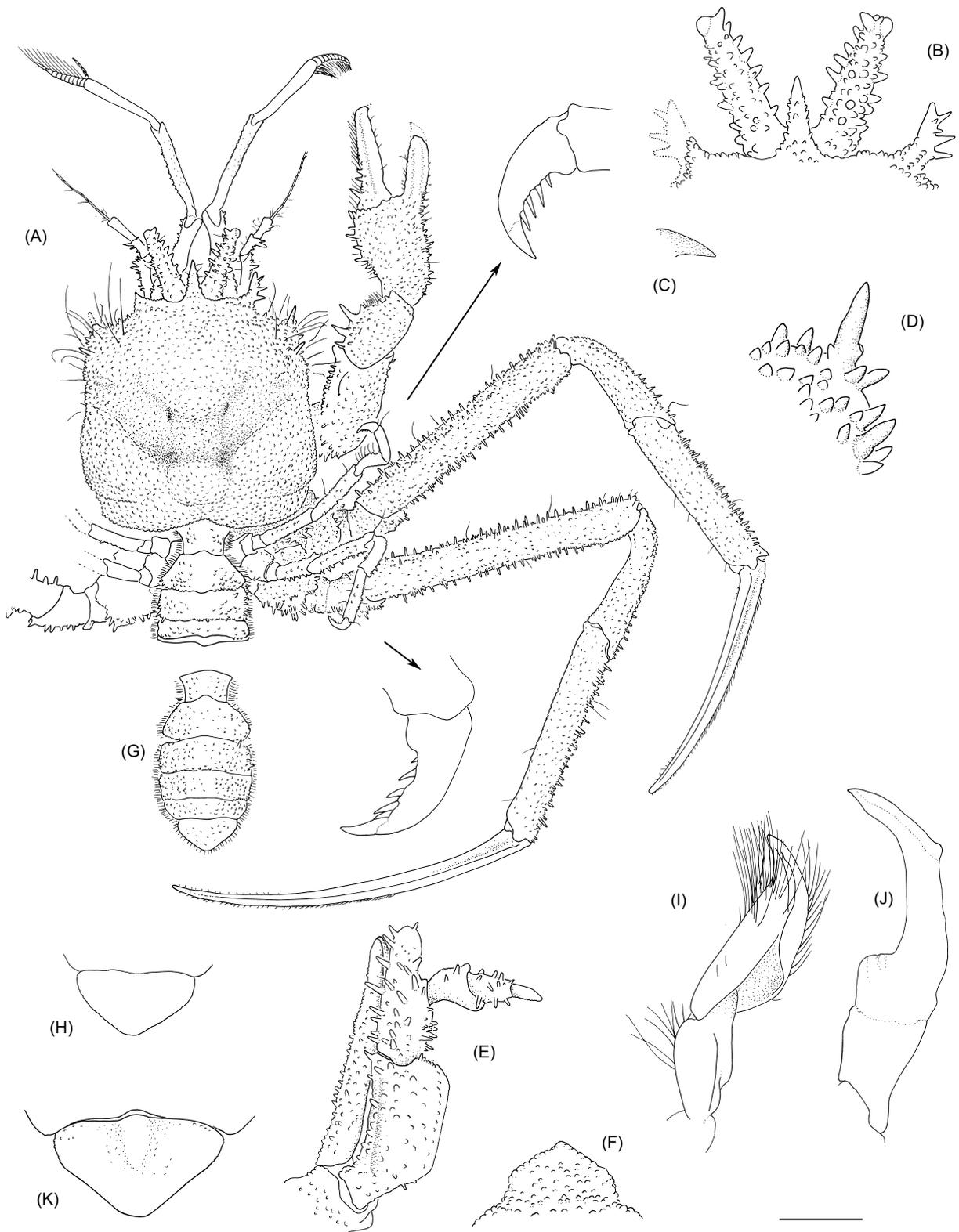


Fig. 4. *Cymonomus deforgesi* Ah Yong and Ng, 2009. A-J: male holotype, cl 6.2 mm, pcl 5.4 mm, cw 5.7 mm, Philippines, NMCR 29831. K: female, cl 7.9 mm, pcl 6.8 mm, cw 7.1 mm, Japan, WPNHM #46. A, dorsal habitus; B, fronto-orbital region; C, right basal antennal spine; D, carapace tubercles of right anterolateral corner; E, right maxilliped 3; F, thoracic sternite 3; G, abdomen; H, K, telson; I, right gonopod 1, abdominal view; J, right gonopod 2, abdominal view. Scale bars: A, G = 2.0 mm; B, E, F, H = 1.0 mm; C, D, I-K = 0.5 mm. (A-C, E, G, I, J modified after Ah Yong and Ng 2009: fig. 1).

Thoracic sternite 3 pentagonal, about 1.5 × wider than long; lateral margins slightly convergent, irregular, surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen of both sexes with margins and surface finely granular or minutely spinulate; pleotelson triangular, apex, bluntly rounded, length slightly exceeding half width.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Remarks: *Cymonomus deforgesii*, previously known only from the Philippines, is herein reported from the northern South China Sea (Dongsha) and Japan. The specimens agree in most respects with the holotype, although we note that the relatively pronounced, broad V-shaped cervical groove that crosses the carapace (most pronounced in males), not clearly indicated on the original illustration of the holotype, is distinct in the holotype and other males. *Cymonomus deforgesii* is redescribed and refigured here including additional features not illustrated in the original account of the species (Ahyong and Ng 2009). Adult females are recorded for the first time; they exhibit typical cyclodorippoid sexual dimorphism in the length of the walking legs as indicated by the proportionally shorter pereopod 3 merus: 1.4 pcl in males versus 1.0–1.1 pcl in females. Also, the carapace is somewhat more inflated in mature females than in males, making the cervical groove less pronounced and fronto-orbital region appear slightly less anteriorly produced. The telson shape is similar in both sexes, though proportionally larger than in males.

Takeda's (2001) *C. sagamiensis* from Tosa Bay (specimens examined herein) is clearly referable to *C. deforgesii* as is Nagai's (1994) *Cymonomus* sp. 3 cf. *valdiviae*.

Distribution: Philippines and now from the northern South China Sea (Dongsha) and southern Japan (off Shionomisaki; Tosa Bay); 577–1184 m.

***Cymonomus hakuhoae* Takeda and Moosa, 1990**

Cymonomus hakuhoae Takeda and Moosa, 1990: 59–61, fig. 3 [type locality: Flores Sea, Indonesia]. - Ng et al. 2008: 32. - Ahyong and Ng 2009: 239–242, figs. 4, 5, 7E, F.

Material examined: SOUTH CHINA SEA, SE OF MACCLESFIELD BANK: NTOU, 1 male (cl 4.5 mm, pcl 4.3 mm, cw 4.3 mm), V bis seamount, 15°04.5841–03.3720'N, 116°31.5257– 31.2470'E, 339–533 m, hard rocky bottom, NanHai 2014 str

DW4102, 2 January 2014.

Description: See recent redescription by Ahyong and Ng (2009).

Remarks: The present specimen of *C. hakuhoae* corresponds well to the recent redescription of the species (Ahyong and Ng 2009).

Distribution: Flores Sea (Indonesia), the Bohol Sea (Philippines) and now from near Macclesfield Bank, South China Sea; 339–647 m.

***Cymonomus japonicus* Balss, 1922**

(Fig. 5)

Cymonomus granulatus japonicus Balss, 1922: 117–118, fig. 5 [type locality: off Shionomisaki, Kii Peninsula, Japan; fixed by present neotype designation]. - Griffin and Brown 1976: 252. - Sakai 1976: 36, fig. 20. - Nagai 1991: 32, fig. 1b.

Cymonomus japonicus. - Takeda 2001: 224. - Ahyong and Brown 2003: 1372. - Ng et al. 2008: 32.

Type material: NEOTYPE: WPMNH #47 (part), female (cl 5.9 mm, pcl 4.6 mm, cw 5.0 mm), off Shionomisaki, Kii Peninsula, Wakayama Prefecture, Japan, 500 m, 1990.

Other material examined: JAPAN: WPMNH #47 (part), 4 males (cl 4.9 mm, pcl 3.8 mm, cw 3.8 mm to cl 5.2 mm, pcl 3.9 mm, cw 3.8 mm), collected with neotype.

Description: Carapace quadrate, almost square, lateral margins almost parallel; regions weakly indicated, cervical groove more pronounced in males than females, broadly V-shaped; with slender conical anteriorly directed anterolateral spine and similar anterolaterally directed spine on lateral margin behind anterolateral spine; lower pterygostomian region swollen; anterolateral surfaces with few scattered setae. Dorsal and lateral surfaces entirely covered with minute rounded granules, with granules becoming larger more elongate anterolaterally, conical or subcylindrical, not globose. Fronto-orbital margin (excluding rostrum and lateral projections) slightly advanced beyond anterolateral margins, more pronounced in males than females; exceeding half anterior carapace width; outer orbital processes slender, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, with acute apices, up to half rostral length. Rostrum slightly longer than eyestalks; 0.26–0.32 pcl; slender, tapering to acute apex, granular dorsally, minutely spinular laterally. Eyestalks distinctly divergent, stout, flattened, granular and prominently spinulate, fused to carapace

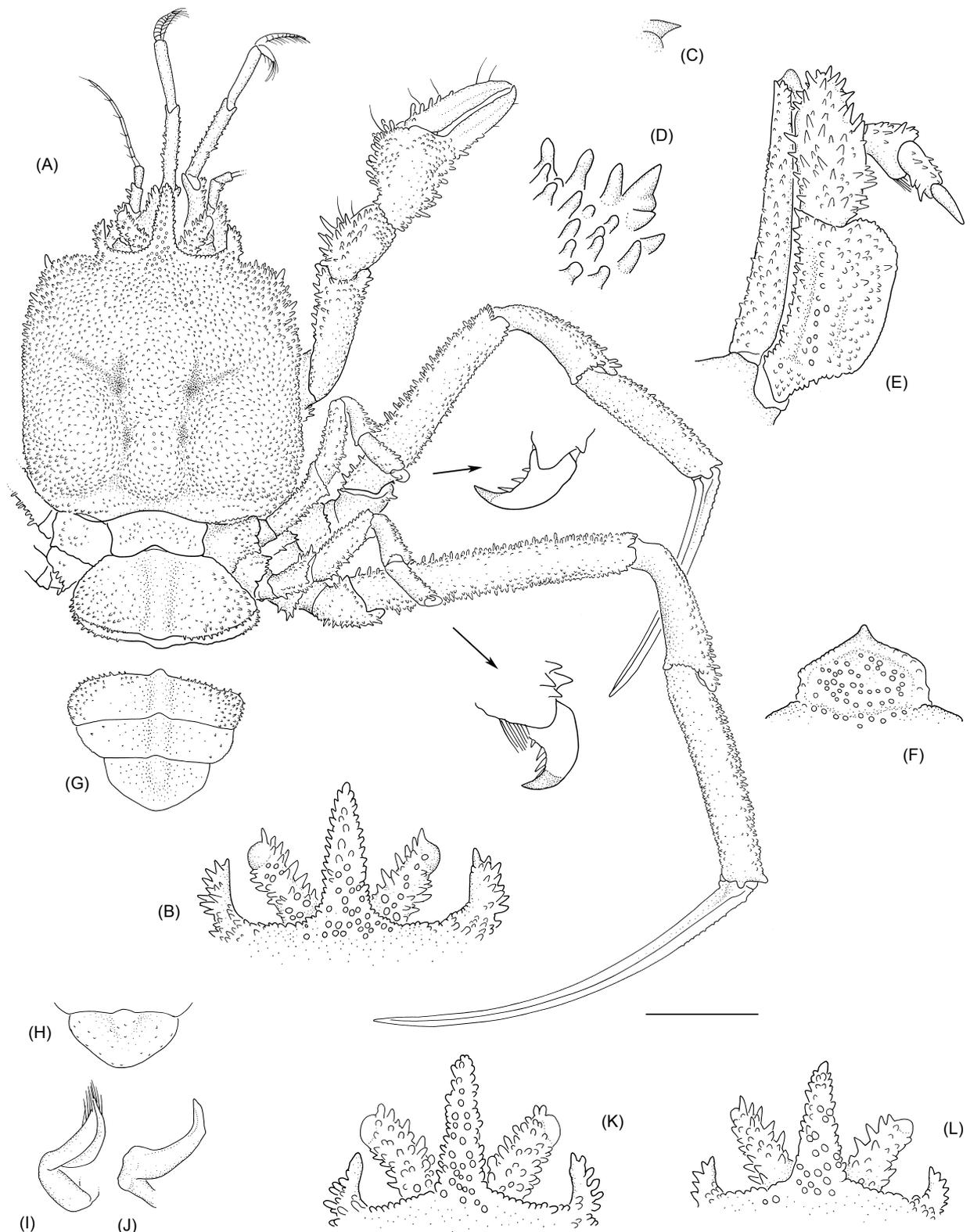


Fig. 5. *Cymonomus japonicus* Balss, 1922, Japan, WPMNH #47. A-G: female neotype, cl 5.9 mm, pcl 4.6 mm, cw 5.0 mm; H-J: male, cl 4.8 mm, pcl 3.7 mm, cw 3.8 mm; K: male, cl 4.0 mm, pcl 3.9 mm, cw 3.8 mm; L, male, cl 5.0 mm, pcl 3.9 mm, cw 3.8 mm. A, dorsal habitus; B, K, L, fronto-orbital region; C, right basal antennal spine; D, carapace tubercles of right anterolateral corner; E, right maxilliped 3; F, thoracic sternite 3; G, abdomen, posterior; H, telson; I, right gonopod 1, abdominal view; J, right gonopod 2, abdominal view. Scale bars: A, G = 2.0 mm; B, E, F, H-L = 1.0 mm; C, D = 0.5 mm.

below rostral base but demarcation distinct, reaching anteriorly to midlength of antennular peduncle article 1; cornea apparently vestigial, not pigmented. Epistome surface granulate, with blunt tubercle mesial to base of antennules, small spine mesial to base of antenna, with small cluster of elongate granules at base of rostrum.

Antennular peduncle 0.97-1.02 pcl (male), 0.79 pcl (female); articles 1 and 2 minutely spinular; article 3 minutely granular. Basal antennal article fused to epistome; articles 2-5 irregularly granular or spinular.

Maxilliped 3 ischiobasis subquadrate, sparsely granular and spinular, with longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischiobasis, length about twice width, tapering distally to rounded apex; surface and margins spinulate. Dactylus conical, unarmed; propodus and carpus sparsely spinulate. Exopod sparsely granular, reaching beyond carpo-meral articulation but not reaching end of merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, setose. Merus finely granular proximally, spinose distally. Carpus granular, dorsal margin with 3 spines. Palm surfaces granular, flexor and extensor margins with tubular and club-shaped tubercles. Dactylus slightly longer than upper palm length; proximal dorsal half with club-shaped tubercles; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus finely granular; propodus and carpus with blunt spinular extensor margins; merus with blunt spinular extensor and flexor margins. Pereopod 3 longest, merus 1.15-1.28 pcl (male), 1.12 pcl (female). Dactyli broadly curved, smooth, with longitudinal rib. Pereopod 3 dactylus longer than combined length of propodus and carpus. Pereopods 4 and 5 coarsely granular, some small spines, sparsely setose; shorter than merus of pereopod 3; dactyli markedly shorter than propodi, falcate, with corneous apex and 2 or 3 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, about 1.5 × wider than long; lateral margins subparallel, irregular, surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen of both sexes with margins and surface finely granular or minutely spinulate; pleotelson or both sexes distally obtuse, bluntly

rounded, length slightly exceeding half width.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Remarks: *Cymonomus japonicus* was originally described as a subspecies of *C. granulatus* based on a single male collected from Haidashi Bank, Sagami Bay (600 m). To date, *C. japonicus* has been reported only twice since it was described in 1922: Takeda (2001) from Tosa Bay (528-537 m), and Nagai (1991) from off Shionomisaki (500 m). *Cymonomus japonicus* is the only known Japanese species with a 'long' rostrum, and on this basis (together with agreement with the brief type description and figure), the present specimens are identified with Balss' species. Other similar 'long' rostrum species, however, occur in the western Pacific, such as *C. indicus* Ihle, 1916, from Indonesia and a possibly undescribed species from the Solomon Islands (Ahyong, unpublished data); although distinct from the present Japanese material, the Indonesian and the Solomon Islands specimens also fit Balss' account of *C. japonicus*. Extensive searches over the past 15 years of museum collections in which Balss' material may be housed (Naturalis, Leiden; the Natural History Museum, London; Muséum national d'Histoire Naturelle, Paris; Zoologisches Museum an der Humboldt-Universität, Berlin; Natur-Museum und Forschungsinstitut Senckenberg, Frankfurt am Main; Zoologisches Institut and Zoologisches Museum, Hamburg; Zoologische Staatssammlung, Munich) failed to locate the holotype of *C. japonicus*; it must therefore be considered lost. To fix the identity of the species and allow us to clarify the taxonomy of allied taxa, we designate the largest specimen in the present series as the neotype of *C. japonicus* (female, cl 5.9 mm, pcl 4.6 mm, cw 5.0 mm; WPMNH #47). Although not from the original type locality (Sagami Bay), the neotype locality (Kii Peninsula) is geographically close to Sagami Bay and well within the expected range of the species.

Aside from normal sexual dimorphism, the most notable variation in the present series is the proportional length of the eyestalks (proportionally shortest in the largest specimens). The eyestalks anteriorly exceed the outer orbital processes by half the eyestalk length in the smallest individual to only slightly in the largest individual; the specimens otherwise agree well.

Cymonomus japonicus belongs to the

C. granulatus group (Dell 1971) in having an elongate rostrum that distinctly overreaches the eyes, and prominently developed, spinose outer orbital processes. Other species in the *C. granulatus* group are as *C. aequilonius* Dell, 1971 (New Zealand), *C. granulatus* (Norman in Wyville Thomson, 1873) (northeast Atlantic), *C. indicus* Ihle, 1916 (Indonesia), and *C. magnirostris* Tavares, 1991 (Brazil). *Cyonomus japonicus* is readily separated from *C. magnirostris* by the shorter maxilliped 3 exopod (Fig. 5E) (not overreaching the distal end of the merus versus distinctly overreaching the merus; Tavares 1991: fig. 8E) and shorter pereopod 5 (Fig. 5A) (merus reaching to midlength of carapace instead of anterior one-fourth; Tavares 1991: fig. 10F); and from *C. granulatus* by the slender versus triangular rostrum with basal width of about half the length (Fig. 5A, B, K, L; Mura and Cau 2003: fig. 2). From *C. indicus* and *C. aequilonius*, *C. japonicus* can be separated by the differences in the shape of the dorsal carapace tubercles (rounded versus polygonal or stellate in *C. indicus*). *Cyonomus japonicus* differs from *C. aequilonius* in having more pronounced, coarser surface granulation and in the shorter pereopod 4, reaching to the carapace midlength rather than anterior one-fourth (Fig. 5A; Ah Yong 2008: fig. 1F).

Distribution: Known only from southeastern Japan: Sagami Bay (600 m), Shionomisaki (500 m) and Tosa Bay (528-537 m); 500-600 m depth.

***Cyonomus umitakae* Takeda, 1981**

(Fig. 6)

Cyonomus umitakae Takeda, 1981: 38-39, fig. 1, 2 [type locality: E of Nojima-zaki, Bôshô Peninsula, Japan]. - Nagai 1991: 31, fig. 1a. - Takeda 2001: 224. - Ah Yong and Brown 2003: 1373. - Ng et al. 2008: 32.

Cyonomus sagamiensis Sakai, 1983: 4, pl. 8A. [type locality: E of Nojima-zaki, Bôshô Peninsula, Japan, by present neotype selection]. - Nagai 1989: 43. - Takeda 1997: 233. - Ah Yong and Brown 2003: 1373. - Ng et al. 2008: 32.

Type material: HOLOTYPE: NSMT-Cr7437, female (cl 2.9 mm, pcl 2.5 mm, cw 2.8 mm), E of Nojima-zaki, Bôshô Peninsula, 34°57.5-57.7'N, 140°07.5-07.4'E, 260-335 m, RV *Umitaka-Maru*, stn UM-79068, 7 August 1979.

Other material examined: JAPAN: NSMT Cr12943, 1 male (cl 4.0 mm, pcl 3.4 mm, cw 3.7 mm), Tosa Bay, Japan, 33°11.2'N, 133°35.0-34.3'E, 290-257 m, RV *Kotaka-Maru*, stn K98-6-300, 8 June 1998; WPMNH #48, 1 ovigerous female (cl 4.2 mm, pcl 3.9 mm, cw 4.6 mm), SE

of Kuroshima Island, Okinawa, 300 m, 25 March 1990; WPMNH #49, 2 males (cl 2.8 mm, pcl 2.3 mm, cw 2.5 mm to cl 3.1 mm, pcl 2.6 mm, cw 2.7 mm), 6 females (cl 2.6 mm, pcl 2.2 mm, cw 2.5 mm to cl 3.8 mm, pcl 3.2 mm, cw 3.8 mm; 2 specimens with rhizocephalan externa under abdomen), off Cape Shionomisaki, Kii Peninsula, Wakayama Prefecture, 300-350 m, trawl, 14 September 1990.

Description: Carapace quadrate, almost square, lateral margins subparallel; regions weakly indicated; anterolateral margins with 2 prominent slender spines, shorter spinules, acute granules in addition to longer dorsal spine near anterolateral corner; anterior carapace margin mesial to the anterolateral spines sloping posteriorly; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces sparsely setose. Dorsal surfaces covered with minute granules and spinules, spinules most elongate anterolaterally and posteriorly. Fronto-orbital margin (excluding rostrum and lateral projections) slightly advanced beyond anterolateral margins; slightly wider than half anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, laterally spinulate, with acute apices, as long as rostrum. Rostrum length slightly less than half to two-thirds length of eyestalks; 0.15-0.22 pcl; slender, sharply triangular, spinose dorsally and laterally; slightly deflected ventrally. Eyestalks slightly divergent, ventrally flattened, slightly movable; reaching anteriorly three-fourths length of antennular peduncle article 1; dorsal surface acutely granulate, lateral and mesial margins spinulate; cornea apparently vestigial, not pigmented. Epistome smooth except for blunt tubercle mesial to base of antennule, with small spine mesial to base of antenna.

Antennular peduncle 1.07-1.13 pcl (male), 0.81-0.87 pcl (female); articles 1 and 2 minutely granular; article 3 smooth. Basal antennal article fused to epistome; article 2 spinose; remaining articles smooth or minutely granular.

Maxilliped 3 ischiobasis subquadrate, surface sparsely granular, lateral margin with few acute granules or short spines; with shallow longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus shorter than ischiobasis, length about 2.3 × width (excluding spines); tapering distally to rounded apex; surface and margins spinulate. Dactylus, propodus and carpus spinulate. Exopod sparsely but coarsely granular,

distally overreaching merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granular, with few short distoventral spines. Carpus prominently spinose, spines long, slender. Palm prominently spinose, spines long, slender. Palm surfaces with long, slender spines, longest along flexor and extensor margins, extending onto pollex.

Dactylus longer than upper palm length; proximal two-thirds spinose; outer surface with faint longitudinal carina, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3, sparsely setose, granular and spinose; longest spines on extensor margins

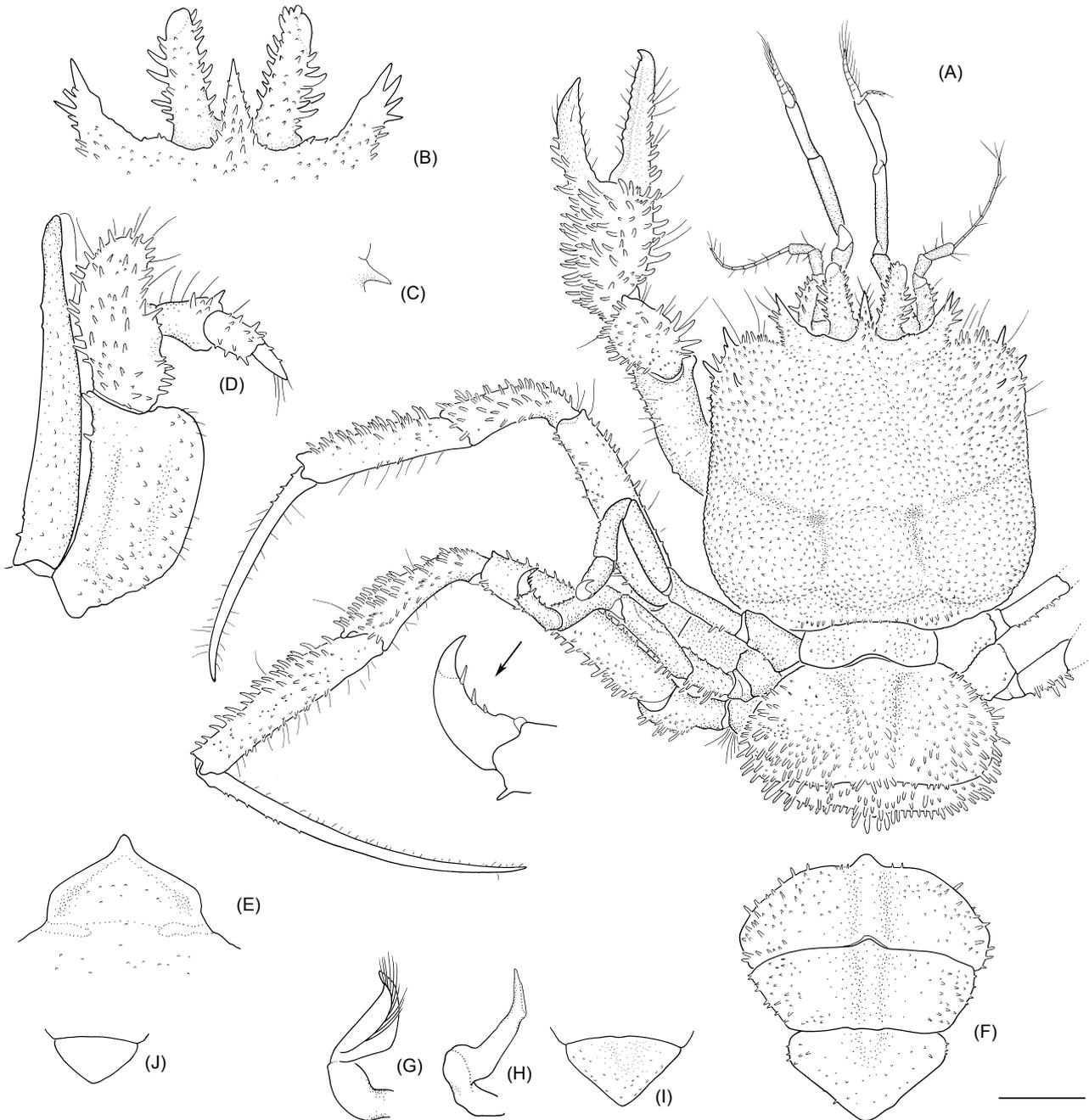


Fig. 6. *Cynomus umitakae* Takeda, 1981, Japan. A-F, female, cl 3.8 mm, pcl 3.2 mm, cw 3.8 mm, WPMNH #49; G-I: male, cl 3.1 mm, pcl 2.6 mm, cw 2.7 mm, WPMNH #49; J, female holotype, cl 2.9 mm, pcl 2.5 mm, cw 2.8 mm, NSMT Cr7437. A, dorsal habitus; B, fronto-orbital region; C, right basal antennal spine; D, right maxilliped 3; E, thoracic sternite 3; F, abdomen, posterior; G, right gonopod 1, abdominal view; H, right gonopod 2, abdominal view; I-J, telson. Scale bars: A, F, I, J = 1.0 mm; B-E, G, H = 0.5 mm.



Fig. 7. A, *Cymonomus chani* sp. nov., female holotype, pcl 7.9 mm, SW of Kaohsiung, Taiwan, NTOU; B, *Cymonomus cognatus* sp. nov., male holotype, pcl 6.4 mm, E of Su-Ao, Taiwan, NTOU; C, *Cymonomus cognatus* sp. nov., spent female, pcl 9.2 mm, SE of Macclesfield Bank, stn DW4102, AM P100611; D, *Cymonomus curvirostris* Sakai, 1965, ovigerous female, pcl 3.3 mm, off Miura, Sagami Bay, Japan, CBM (specimen not examined); E, *Cymonomus deforgesii* Ah Yong and Ng, 2009, male, pcl 5.5 mm, SW of Dongsha, stn CP4132, ZRC. Photos: A, B, C, E (T.Y. Chan), D (T. Komai).

and dorsal surfaces of propodus and carpus; merus extensor and flexor margins spinose, longest along proximal flexor margin, dorsal surfaces granular and with few small spines. Pereopod 3 longest, merus shorter than carapace, 0.91-0.98 pcl (males), 0.79-0.92 (females). Dactyli broadly curved, sparsely spinose proximally, otherwise smooth, without longitudinal rib. Pereopod 3 dactylus almost as long as combined length of propodus and carpus.

Pereopods 4 and 5 finely granular, and sparsely spinose; longer than pereopod 3 merus; dactyli markedly shorter than propodi, falcate, with corneous apex and 3 or 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 sparsely granular, about 1.7 × wider than long; sternite 3 pentagonal, lateral margins posteriorly subparallel. Margins of sternites 4 and 5 granulate.

Abdomen granulate and spinose, most prominent on somites 2 and 3, sparsely ornamented on somites 4 and 5; pleotelson subtriangular, sparsely granular or minutely spinose; margins straight to slightly convex, wider than long, width 1.6-1.7 × length (male), 1.8 (female); without any trace of demarcation between somite 6 and telson.

Gonopod 1 distal article cannulate, forming copulatory tube, apex slightly fluted, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Remarks: Takeda (1981) described *C. umitakae* on the basis of a single incomplete female, lacking all pereopods except the left cheliped. The series examined here enables a good characterisation of the species based on both sexes. The combination of slender, weakly divergent ocular peduncles, a slender sharp rostrum, sharply triangular outerorbital processes of similar length to the rostrum, the anterior carapace margin mesial to the anterolateral processes sloping posteriorly inwards, and prominently spinose carpi and propodi of pereopods 2 and 3 is shared by *C. umitakae* and *C. valdiviae* from off east Africa (Ahyong 2014). *Cymonomus umitakae* is readily distinguished from *C. valdiviae* by the more slender distal articles of the antennular peduncle (penultimate article length not more than twice width versus three times width in *C. valdiviae* and the proportionally shorter walking legs (0.79-0.89 pcl in females versus 0.94-

0.97 pcl in female *C. valdiviae*) (Fig. 6A, B; Ahyong 2014: fig. 3A).

Variation within the present series of *C. umitakae* is slight, chiefly evident in the dorsal spination of the carapace and marginal spination of the eyestalks and rostrum - most pronounced in the largest specimens. The telson of the smallest male is apparently yet to reach adult form, having less rounded anterolateral corners. Sexual dimorphism is as observed in other congeners in proportionally longer walking legs and antennules in males. Two females (WPMNH #49) are parasitized, having a rhizocephalan externa under the abdomen. The abdomen of the smallest male (pcl 2.3 mm, incompletely developed gonopods) is more evenly rounded than in adult males in which the telson is distinctly triangular.

Sakai (1983) described *Cymonomus sagamiensis* from the Kumano Sea, Mie Prefecture, based on a single dried carapace. Unfortunately, the description was extremely brief, and the figure rudimentary. Searches of Japanese museum collections over the past 15 years as well as the Natur-Museum und Forschungsinstitut Senckenberg, Frankfurt am Main, where some of Sakai's material is deposited failed to locate the holotype of *C. sagamiensis*; it is considered lost. Sakai (1983) considered *C. sagamiensis* to probably represent the species reported by him in 1976 as *C. andamanicus* (herein referred to *C. cognatus*). Sakai's (1976: pl. 8 fig. 1) figure, however, bears little resemblance to the holotype description of *C. sagamiensis* or figure (Sakai 1983: pl. 8A), especially in the short rostrum, and subparallel eyestalks. Rather, Sakai's (1983) figure resembles *C. umitakae*, unique in the Japanese fauna for its subparallel eyes, and strong anterolateral spines on the carapace. Indeed, Takeda (1997) also noted the similarity between *C. umitakae* and *C. sagamiensis*. We regard *C. sagamiensis* and *C. umitakae* as synonymous, and herein designate the holotype of the latter as the neotype of the former in order to stabilise the identity of Sakai's species. Thus, *C. sagamiensis* becomes an objective junior synonym of *C. umitakae*.

Distribution: Southeastern Japan, from E of Nojima-zaki, Suruga Bay and Tosa Bay to Okinawa; 219-500 m.

DISCUSSION

All species studied here for which both sexes are known (except *C. chani*, in which the only known male is parasitized) exhibit sexual dimorphism as reported by Ah Yong and Ng (2009) in the greater proportional lengths of the antennular peduncles and walking legs in males, apparently a typical feature of cymonomids, and cyclodorippoids in general. The proportional lengths of the antennules and walking legs in males are typically 10-30% greater than in females. In addition, adult female *Cymonomus* may also have a slightly more inflated carapace, making the carapace grooves less distinct than in males. These sexual differences must always be considered when identifying species of *Cymonomus*.

Seven species of *Cymonomus* are now known from East Asia between Japan and the South China Sea. Cymonomids all have comparatively narrow ranges (*i.e.*, none spans major ocean basins), but of the species known from the study area, *C. deforgesii* has the widest distribution, ranging from the southern Philippines to Japan, including the Dongsha Islands (northern South China Sea). Similarly, *C. hakuhoae* is also relatively widespread, but occurs further south, ranging from Macclesfield Bank to the Philippines and southern Indonesia. *Cymonomus cognatus* ranges from near Macclesfield Bank to Taiwan and Japan. *Cymonomus chani* is presently known only from Dongsha, Taiwan and Japan, whereas *C. curvirostris*, *C. japonicus* and *C. umitakae* are endemic to Japanese waters. None is endemic to Taiwan. Most specimens were taken from the outer shelf or slope, but those of *C. hakuhoae* and some specimens of *C. cognatus* were taken from seamounts in the South China Sea.

Key to species of *Cymonomus* from East Asia and the South China Sea

- 1. Carapace and pereopods covered with stalked, globose tubercles *C. curvirostris*
- Carapace and pereopods with simple granules or tubercles, not stalked 2
- 2. Rostrum longer than eyestalks *C. japonicus*
- Rostrum shorter than eyestalks 3
- 3. Pleotelson with demarcation between telson and somite 6 indicated by notches in lateral margins and transverse groove on surface (sometimes faint) *C. cognatus*
- Pleotelson lacking demarcation between telson and somite 6, neither with marginal notches nor transverse groove on surface 4
- 4. Rostrum distinctly shorter than outer orbital processes *C. hakuhoae*

- Rostrum as long as or longer than outer orbital processes .. 5
- 5. Cheliped palm outer surface with long spines. Eyestalks subparallel, slightly movable *C. umitakae*
- Cheliped palm outer surface with low tubercles or granules. Eyestalks divergent, immovable 6
- 6. Carapace anterolateral spines long, prominent *C. deforgesii*
- Carapace anterolateral spines low, inconspicuous *C. chani*

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