Bull. Natl. Mus. Nat. Sci., Ser. A, **34**(4), pp. 183–195, December 22, 2008

A New Species of the Crangonid Shrimp Genus *Rhynocrangon* (Crustacea, Decapoda, Caridea) from Northern Japan

Tomoyuki Komai[1] and Hironori Komatsu[2]

[1] Natural History Museum and Institute, Chiba, 955–2 Aoba-cho, Chuo-ku, Chiba, 260–8682 Japan
E-mail: komai@chiba-muse.or.jp
[2] Department of Zoology, National Museum of Nature and Science,
3–23–1 Hyakunin-cho, Shinjuku-ku, Tokyo, 169–0073 Japan
E-mail: h-komatu@kahaku.go.jp

Abstract A new species of the rare crangonid genus *Rhynocrangon*, *R. rugosa* sp. nov., is described and illustrated on the basis of material from northern Japan. Morphologically, it appears close to *R. alata*, but can be easily distinguished from the latter in the shape of the rostrum, the lack of middorsal teeth on the carapace, and the vertically depressed branchiostegal tooth on the carapace. The phylogenetic position of *Rhynocrangon* is briefly discussed. An identification key to the species of the genus is also provided.

Key words: Crustacea, Decapoda, Caridea, Crangonidae, *Rhynocrangon*, new species, Japan, taxonomy.

The crangonid genus *Rhynocrangon* Zarenkov, 1965 was established for two rare species which had been previously assigned to *Sclerocrangon* G. O. Sars, 1883: *R. sharpi* (Ortmann, 1895) (type species) and *R. alata* (Rathbun, 1902) (Zarenkov, 1965). Both species are distributed in the northern North Pacific ranging from the Sea of Japan to the northwestern coast of North America (Ortmann, 1895; Rathbun, 1902, 1904; Kobjakova, 1937; Vinogradov, 1950; Butler, 1980; Wicksten, 1980; Kim and Natsukari, 2000). Until now, in Japanese waters, only *R. sharpi* has been recorded (Kim and Natsukari, 2000).

During a recent faunal survey off the northeastern part of Japan, several specimens referable to this rare genus were collected. Detailed examination revealed that the specimens represent an undescribed species closely related to *R. alata*. This new species, representing only the third in the genus, is herein described and illustrated in detail. The phylogenetic position and the taxonomy of the genus are briefly discussed.

Material and Methods

The material examined in this study is deposited in the Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ), the National Museum of Nature and Science, Tokyo (NSMT), the Natural History Museum and Institute, Chiba (CBM), and the Natural History Museum of Los Angeles County, Los Angeles (LACM). The abbreviation cl refers to postorbital carapace length. For detailed observation of the surface structure on the integument, the specimens (including dissected appendages) were stained with a methylene blue solution.

For comparative purpose, the following specimens were examined.

Rhynocrangon alata (Rathbun, 1902) (Fig. 6). LACM-Cr 1949.002.1, 1 male (cl 3.6 mm), Friday Harbor, Puget Sound, 27 August 1949, coll. J. L. Mohr.

Rhynocrangon sharpi (Ortmann, 1895). HUMZ-C 11, 1 ovigerous female (cl 10.2 mm), off Miyako, Iwate Prefecture, 150–200 m, March 1984, commercial trawler, coll. T. Komai; HUMZ-C 1132, 1 male (cl 5.4 mm), off

Wakkanai, northern Hokkaido, depth not recorded, 23 March 1987, dredge, coll. Hokkaido Wakkanai Fisheries Experimental Station; HUMZ-C 1547, 1 female (cl 8.9 mm), off Miyako, Iwate Prefecture, ca. 150 m, January 1985, commercial trawler, coll. T. Komai; HUMZ-C 1548, 1 female (cl 8.9 mm), similar locality, 9 January 1986, commercial trawler, coll. T. Komai.

Rhynocrangon sp. LACM Cr 1934.001.1, 1 female (cl 4.3 mm), Pacific Grove, Monterey District, California, depth not recorded, Burch station 3710, 20 August 1937, det. M. Wicksten (1980) as *Sclerocrangon alata*.

Taxonomy

Genus ***Rhynocrangon*** Zarenkov, 1965
Rhynocrangon rugosa sp. nov.

(Figs. 1–5)

[New Japanese name: Karuishi-ebijyako]

Material examined. Holotype. NSMT-Cr 18232, ovigerous female (cl 7.6 mm), RV *Wakataka-maru*, 2007 cruise, stn B150, off Kuji, Iwate Prefecture, northeastern Japan, 40°14.98′N, 142°06.64′N to 40°13.31′N, 142°7.38′E, 156 m, 14 October 2007, otter trawl, coll. H. Komatsu and K. Hasegawa.

Paratypes. NSMT-Cr 18233, 3 ovigerous females (cl 6.8–7.9 mm), same data as holotype; CBM-ZC 9475, 1 female (cl 6.2 mm), 2 juveniles (cl 2.3, 2.4 mm), off Usujiri, southern Hokkaido, 15–30 m, volcanic pebbles and coarse sand, 19 August 1993, dredge, coll. F. Muto; HUMZ-C 1117, off Usujiri, 1 male (cl 3.0 mm), 4 females (cl 3.0–3.6 mm), off Usujiri, 10–20 m, 15 November 1989, dredge, coll. T. Komai; CBM-ZC 3829, 2 females (cl 2.4, 2.7 mm), off Ohmu, Hokkaido, Sea of Okhotsk, 43°38.579′N, 143°14.268′E, 57 m, sand, 22 August 1996, sledge, coll. J. Sasaki.

Diagnosis. Rostrum depressed dorsoventrally, arched over eyes, abruptly narrowing distally to upturned or vertically erect terminal projection, with clearly delimited anterolateral angles; dorsal surface concave with strongly raised lateral margins. Carapace wider than long postorbitally, with blunt, broad, roughly sculptured middorsal ridge; middorsal teeth absent or reduced to tiny blunt tubercle; no teeth on branchial region posterior to hepatic tooth; branchiostegal tooth laterally depressed. Pleon rather abruptly tapering posteriorly at fourth and fifth somites, second and third somites strongly inflated in ovigerous females; middorsal carina distinct but blunt, on first somite knob-like, on third somite markedly elevated posteriorly in males; terga of first and second somites devoid of sharp transverse ridges posteriorly. Telson only with 1 pair of dorsolateral spines, no posterolateral spines; posterior margin rounded. First pereopod unarmed on ventromesial margin.

Description. *Ovigerous females*. Body (Fig. 1) very stout. Integument well calcified, firm; surface fairly sculptured.

Rostrum (Fig. 2A–B) about 0.3 times as long as carapace including terminal projection, broad, in dorsal view generally subrectangular (somewhat narrowed anteriorly), strongly arched over eyes; distolateral angles well defined, rounded; dorsal surface concave with lateral sides strongly elevated as blunt ridges; terminal projection short, acute, notably upturned; ventrolateral surface concave to accommodate eyes.

Carapace (Figs. 1, 2A–B) postorbitally wider than long, surface with covering of short setae. Middorsal ridge broad, roughly and irregularly sculptured; no clearly differentiated teeth on dorsal midline, but tiny tubercle(s) occasionally present on epigastric position and/or at midlength of carapace. Shallow depression present on either side of middorsal ridge. Hepatic ridge thick, strongly diverging against dorsal horizontal plane of carapace, terminating in small acute or subacute tooth (=hepatic tooth); surface roughly eroded. Branchial ridge thick, its surface strongly and roughly eroded with a reticulate pattern of small depressions. Branchial region somewhat inflated, also with reticulate pattern of small de-

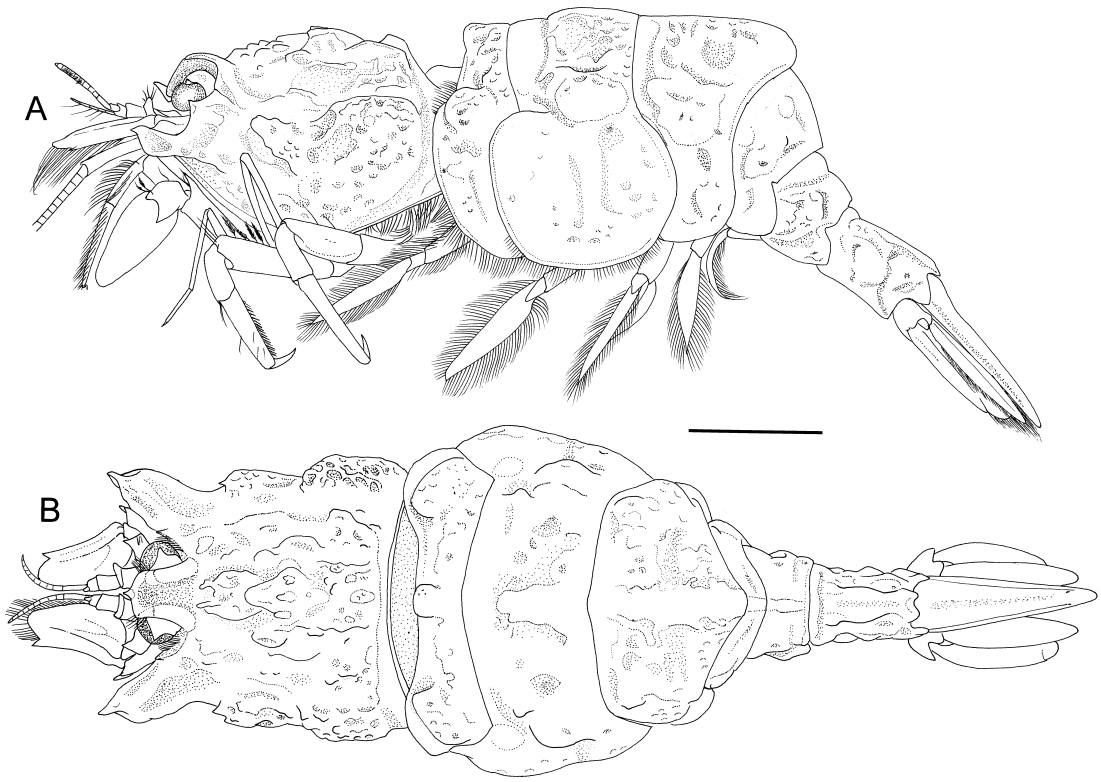

Fig. 1. *Rhynocrangon rugosa* sp. nov., holotype, ovigerous female (NSMT-Cr 18232, cl 7.6 mm), habitus, lateral and dorsal views (antennal flagellum partially omitted). Scale bar: 5 mm.

pressions. Orbital margin generally concave, with small cleft. Postorbital suture present. Antennal tooth small, subacute. Branchiostegal tooth strong, somewhat twisted, bearing blunt median ridge on dorsal surface; distal part compressed vertically with shallow depression laterally, tapering in small acute point dorsodistally. Pterygostomial margin hidden by branchiostegal tooth, with tiny tooth.

Thoracic sternum posteriorly widening; ventral surface concave, median teeth on sixth to eighth somites completely reduced; third sternite with 2 lobes divided by deep median notch; fourth sternite with sharp median keel.

Pleon (Fig. 1) wider than carapace at second somite, abruptly narrowed posteriorly at fourth to fifth somites, second and third somites strongly inflated. First somite with roughly eroded tergite; middorsal ridge rounded, knob-like; prominent, rounded elevation laterally on tergite; pleuron slightly sculptured, margin rounded. Second somite extremely wide, with low, wide, rather irregularly delineated middorsal ridge; tergite with prominent depression on either side of middorsal ridge and with low lateral elevation, otherwise irregularly sculptured; pleuron slightly sculptured, rounded marginally. Third somite with weakly to somewhat elevated, broad middorsal ridge; in lateral view, dorsal profile of somite abruptly sloping in posterior 0.25; tergite with shallow, broad transverse sulcus on either side of middorsal ridge and eroded with scattered small depressions; posterodorsal margin somewhat produced posteriorly; low, rounded elevations present on tergite laterally; pleuron rounded marginally. Fourth somite short, much decreasing in height toward posterior, with low, blunt middorsal ridge; tergite with low, rounded lateral elevation; posterodorsal margin smooth; pleuron with rounded posteroventral margin. Fifth somite with low,

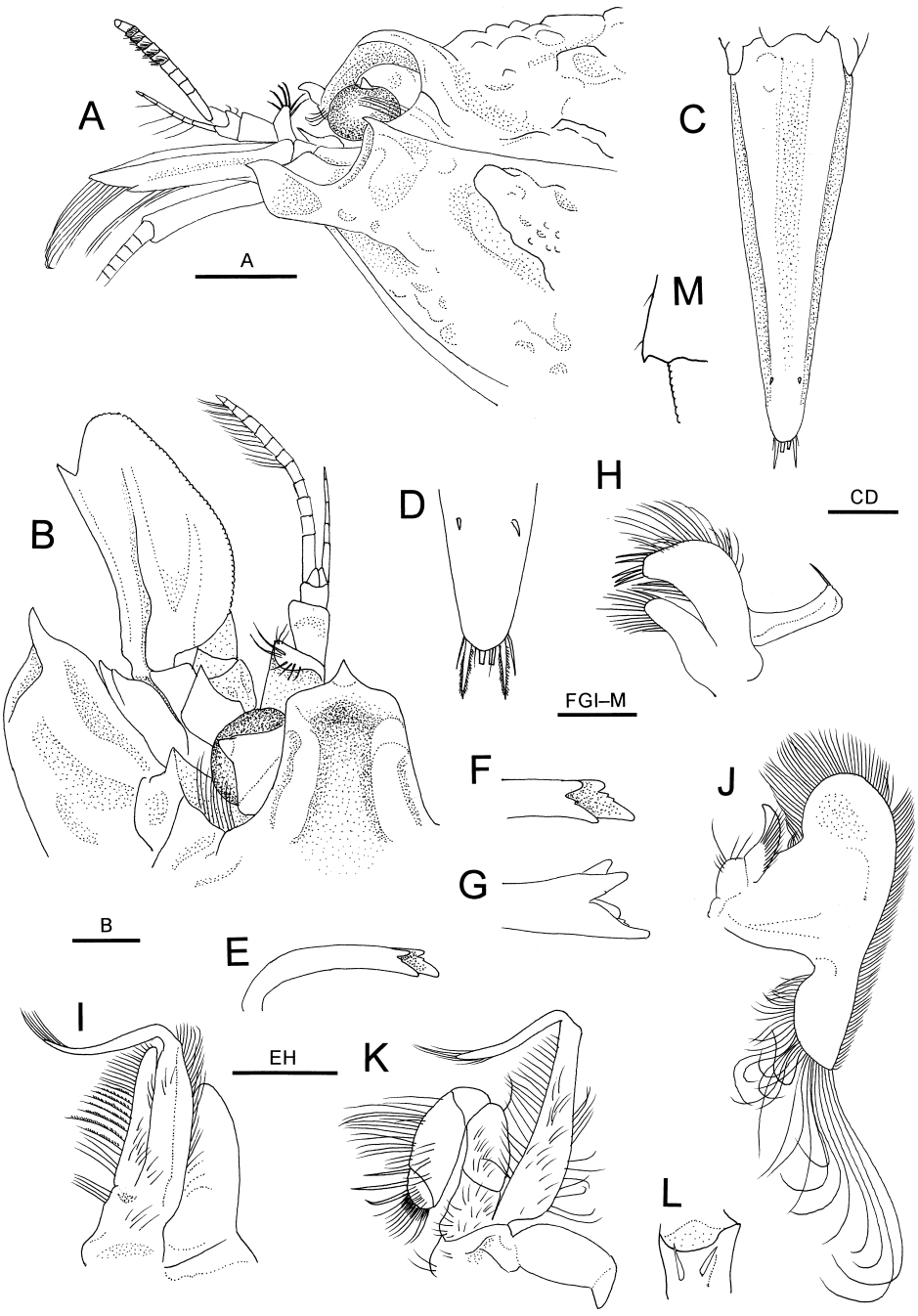

Fig. 2. *Rhynocrangon rugosa* sp. nov., holotype, ovigerous female (NSMT-Cr 18232, cl 7.6 mm). A, anterior part of carapace and cephalic appendages, lateral view (short setae on surface of carapace omitted); B, anterior part of carapace (left), left cephalic appendages, dorsal view (setae partially omitted); C, telson, dorsal view; D, posterior part of telson, dorsal view; E, left mandible, outer view; F, G, distal part of left mandible, outer and inner views, respectively; H, left maxillule, outer view; I, left first maxilliped, outer view; J, left maxilla, outer view; K, left second maxilliped, outer view; L, distal part of antepenultimate of third maxilliped, ventral view; M, posterolateral tooth of exopod of uropod, dorsal view. Scale bars: 2 mm for A; 1 mm for B, C, E, H–K; 0.5 mm for D, F, G, L, M.

rather broad middorsal ridge; tergite and pleuron somewhat sculptured, posteroventral margin rounded or obtusely angled. Sixth somite about 1.7 times longer than fifth somite; submedian ridges separated by faint median sulcus, posteriorly produced as 2 rounded lobes, dorsal surfaces nearly flat, lateral margins sinuous; lateral surface fairly sculptured; posterolateral process large, roundly triangular; posterolateral angle blunt or subacute. Telson about 1.9 times longer than sixth somite, gradually tapering to rounded posterior margin, with shallow median sulcus; dorsolateral ridges distinctly delineated, with 1 pair of spinules arising at posterior 0.15; posterior margin with 2 pairs of setulose stout setae.

Median prominences on first to fourth pleonal sternites completely reduced; fifth sternite divided in 2 divisions by transverse groove, both strongly calcified, anterior division rounded, posterior division showing as blunt transverse ridge. Sixth sternite strongly calcified, very slightly concave, with scattered short setae; preanal teeth small.

Cornea (Fig. 2A–B) as wide as eyestalk, width about 0.2 of carapace length, darkly pigmented; eye-stalk stout, dorsal part partially visible in lateral view, with prominent triangular projection dorsally.

Antennular peduncle (Fig. 2A–B) stout, falling short of midlength of antennal scale; first segment with dorsodistal margin strongly raised and produced dorsally; stylocerite generally oblong, anterolateral angle produced in acute tooth, anterior margin concave, posterolateral angle well delineated; distal two segments combined much shorter than first segment; second segment widened distally, with slightly produced anterolateral angle; third segment very short; dorsal flagellum longer than peduncle, consisting of 10–12 articles; ventral flagellum short, about half length of outer flagellum, consisting of 5 or 6 articles. Antenna (Fig. 2A–B) with very stout basicerite bearing 2 unequal distolateral teeth (ventral tooth longer than dorsal tooth), overlapped by branchiostegal tooth on carapace in lateral view; antennal scale about half length of carapace, about 2.1 times longer than wide, lateral margin concave, distolateral tooth exceeded by well-produced, rounded lamella; dorsal surface of antennal scale with covering of short setae and with 3 longitudinal ridges; carpocerite (=fifth segment of antennal peduncle) rather slender, subcylindrical, falling far short of distal margin of antennal scale; flagellum exceeding twice length of carapace, slender, naked.

Mandible (Fig. 2E–G) typical of crangonids, distally divided in 4 teeth, inner margin of larger teeth faintly denticulate. Maxillule (Fig. 2H) with subovate coxal endite; basial endite curved, narrowed distally, truncate distal margin with several spines arranged in double row; endopod nearly straight, terminal lobe weakly produced, bearing 1 stout apical seta; setation as illustrated. Maxilla (Fig. 2J) with rudimentary coxal and basial endite, latter bearing sparse marginal setae; endopod stout, curved mesially, with numerous setae subproximally; scaphognathite very broad, anterior lobe rounded, posterior lobe somewhat elongate, broad, mesial margin convex, with numerous stiff setae becoming longer posteriorly (posterior setae greatly elongated). First maxilliped (Fig. 2I) with coxal and basial endites rudimentary, faintly divided by shallow concavity, former with some setae on mesial margin; endopod elongate, flattened, reaching base of exopodal flagellum, with setulose setae on mesial margin; exopod moderately stout, with narrow caridean lobe bearing plumose setae; epipod large, divided in 2 lobes. Second maxilliped (Fig. 2K) with rather stout endopod consisting of 6 segments (basis and ischium fused); dactylus sub-semicircular, with 3 elongate spines on mesial margin proximally and cluster of short stout setae on distal margin; propodus longest, with numerous stout setae on mesial margin; exopod tapering distally, with well developed flagellum; epipod large, produced laterally, without podobranch. Third maxilliped (Fig. 3A) with endopod consisting of 4 segments, overreaching antennal scale by half length of ultimate segment; ultimate segment about 1.5 times longer than penultimate segment, about 5.8 times longer than wide, terminating in

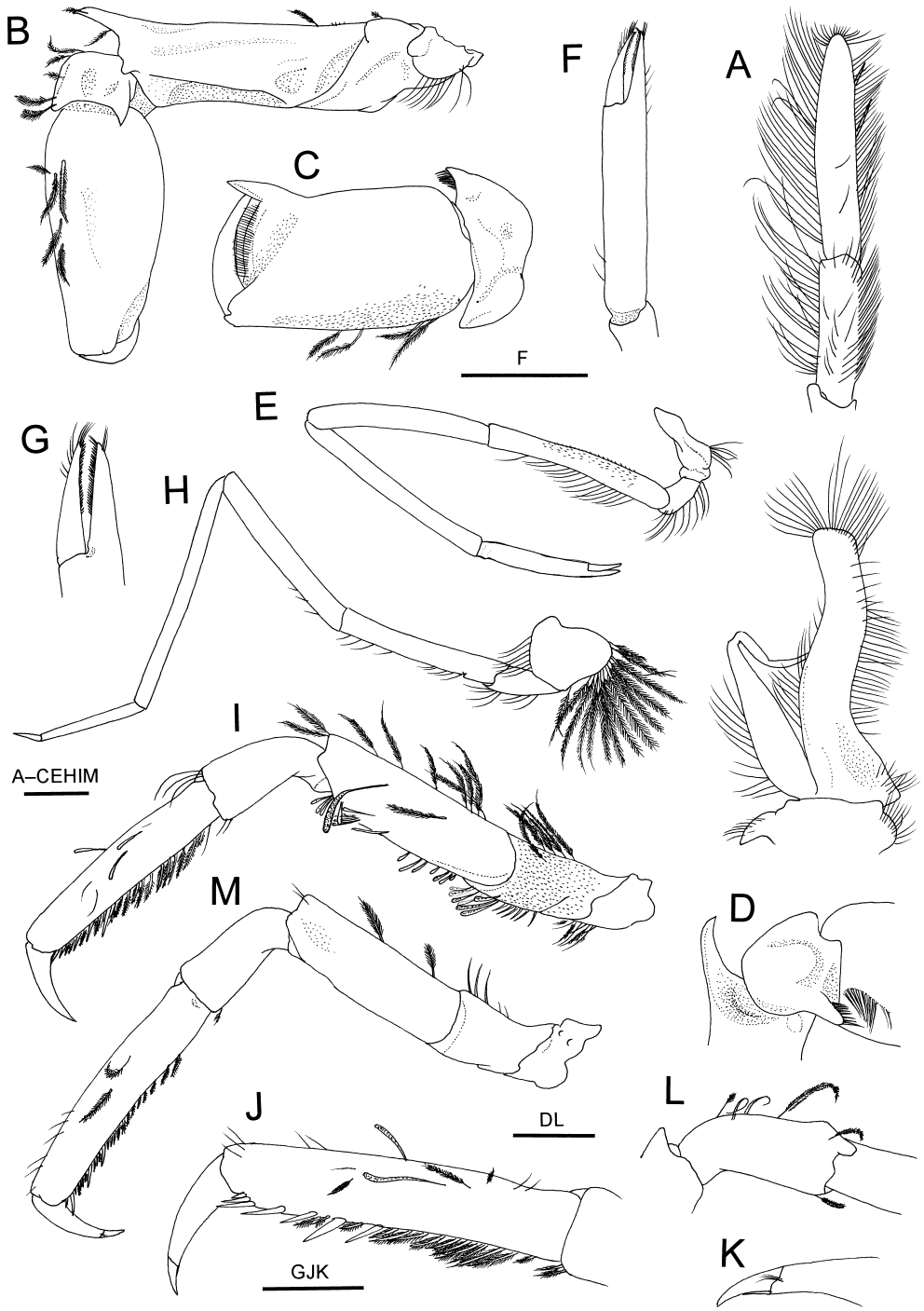

Fig. 3. *Rhynocrangon rugosa* sp. nov., holotype, ovigerous female (NSMT-Cr 18232, cl 7.6 mm), left thoracic appendages. A, third maxilliped, dorsal view; B, first pereopod, lateral view; C, subchela and carpus of first pereopod, dorsal view; D, proximal part of palm, carpus, and distal part of merus, mesial view; E, second pereopod, lateral view; F, chela of second pereopod; G, same, fingers; H, third pereopod, lateral view; I, fourth pereopod, lateral view, short pubescence on propodus to merus omitted; J, dactylus and propodus of fourth pereopod, lateral view; K, tip of dactylus of fourth pereopod, lateral view; L, carpus of fourth pereopod, mesial view; M, fifth pereopod, short pubescence omitted. Scale bars: 1 mm for A–F, H–J, L, M; 0.5 mm for G, K.

blunt tip, mesial margin with several elongate spines mixed with numerous stiff setae; antepenultimate segment sinuous, bearing 2 long subdistal spines adjacent to ventrodistal margin (Fig. 2K), proximomesial margin somewhat expanded; exopod tapering distally, reaching beyond midlength of antepenultimate segment, bearing well-developed flagellum; coxa stout, with small, acuminate epipod; general setation as figured.

First pereopod (Fig. 3B–C) very stout, subchelate, reaching distal margin of antennal scale by palm; dactylus reaching base of distomesial projection (thumb) when closed; palm about 1.8 times longer than wide, generally subquadrate in dorsal view, with lateral covering of short pubescence, several long plumose setae on lateral surface, and with submarginal row of thin setae along cutting edge; ventral surface of palm weakly convex; thumb strong, directed slightly distomesially, nearly reaching to level of distolateral angle of palm; cutting edge slightly oblique, bordered by thin chitinous plate; carpus much wider than long, cup-shaped, armed with dorsolateral and ventrolateral tooth; grooming apparatus consisting of patch of short setae on proximoventral portion of palm and stout setae on ventromesial projection of carpus; merus with strong, distally curved dorsodistal tooth, lateral surface with shallow longitudinal sulcus, ventrolateral margin forming distinct ridge separating lateral and ventral surface, ventral surface shallowly concave. Second pereopod (Fig. 3E) chelate, overreaching antennal scale by length of chela; dactylus (Fig. 3F–G) about 0.4 times as long as palm, cutting edge pectinated with slender spinules; fixed finger also with pectinated cutting edge; chela about 0.7 times as long as carpus; merus and ischium combined subequal in length to chela and carpus combined; ischium with row of stiff plumose setae on ventral margin; coxa with prominent projection on anterior surface. Third pereopod (Fig. 3H) relatively stout for crangonids, overreaching antennal scale by length of distal two segments; dactylus short, about 0.3 times as long as propodus; carpus elongate, 2.5 times longer than propodus; merus subequal in length to ischium; coxa large, with numerous long plumose setae on posterior margin. Fourth pereopod (Fig. 3I) stout, overreaching antennal scale by length of dactylus; dactylus (Fig. 3J–K) about 0.4 times as long as propodus, about 3.6 times longer than high, compressed laterally, curved, flexor surface narrowly sulcate, with subdistal accessory spinule closely appressed against unguis; propodus (Fig. 3J) about 5.6 times as long as high, somewhat compressed laterally, bearing 2 or 3 small spines on ventrodistal margin and 4 or 5 long spines in distal half of ventral surface, obscured by stout plumose setae on over entire length; carpus about half length of propodus, bearing distinct dorsodistal process mesially (Fig. 3L); merus about 3.3 times longer than wide; ischium distinctly shorter than merus; surface of propodus to ischium covered with short pubescence, lateral surface of propodus and dorsal and ventral margins of merus and ischium bearing short to long thick plumose setae. Fifth pereopod (Fig. 3M) similar to fourth pereopod, but stout plumose setae on ventral margin of propodus and long plumose setae on merus and ischium fewer.

Gill formula summarized in Table 1.

Pleopods becoming noticeably shorter posteriorly (Fig. 1); appendices internae absent. First pleopod with endopod 0.5–0.6 length of exopod, flattened, not tapering distally, terminating in rounded tip. Second to fourth pleopods with endopods subequal in length to exopods, noticeably curved outward. Fifth pleopod with very small endopod, about 0.2 length of exopod. Uropod (Fig. 1) with moderately stout protopod bearing subacute posterolateral projection; endopod rather narrow, falling short of telson; exopod shorter than endopod, with tiny posterolateral tooth (Fig. 2M); diaeresis present on exopod.

Non-ovigerous females. Body less stout than in ovigerous females. Sculpture of body surface less developed. Rostrum reaching nearly to level of tip of branchiostegal tooth, less arched than in ovigerous females. Carapace occasionally with trace of middorsal teeth. Thoracic sternum with 4 keel-like median teeth, anteriormost tooth on fifth somite directed forward, subconical, sharply

Table 1. Gill formula of *Rhynocrangon rugosa* sp. nov.

Thoracic somites	1	2	3	4	5	6	7	8
Appendages	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	1	1	1	1	1
Arthrobranchs	—	—	—	—	—	—	—	—
Podobranchs	—	—	—	—	—	—	—	—
Epipods	1	1	r	—	—	—	—	—
Exopods	1	1	1	—	—	—	—	—

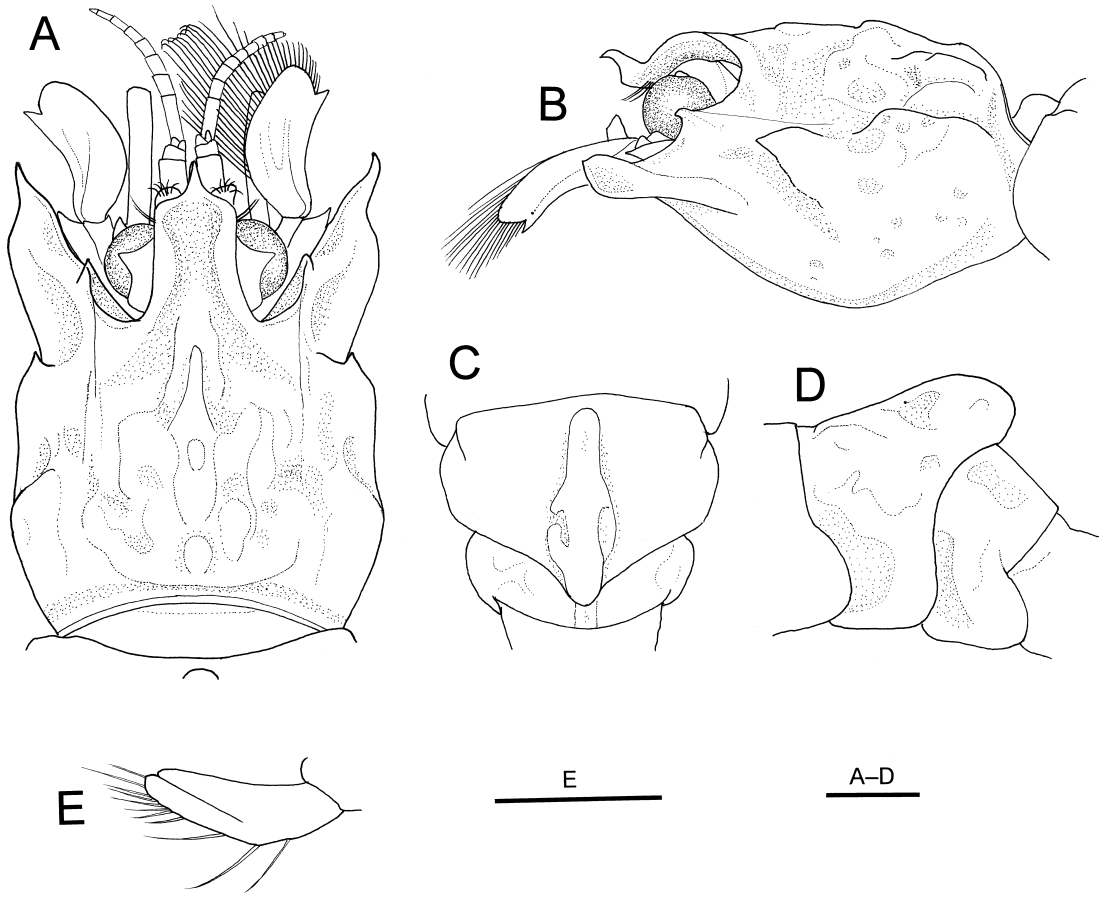

Fig. 4. *Rhynocrangon rugosa* sp. nov., paratype, male (HUMZ-C 1117, cl 3.0 mm). A, carapace and cephalic appendages, dorsal view; B, same, lateral view; C. third and fourth pleonal somites, dorsal view; D, same, lateral view; E, endopod and appendix masculina of left second pleopod, ventral view. Scale bars 1 mm for A–D; 0.5 mm for E.

pointed, other teeth subacute or blunt. Antennule with dorsal flagellum consisting of 6 or 7 articles; ventral flagellum with 3 or 4 articles. Endopods of uropods varying in development ontogenetically, becoming longer with an increase in size; in juveniles, endopods very small, less than

0.3 length of exopods. Median prominence on first pleonal sternite tooth-like, slightly directed forward, acuminate; median prominences on second and third sternites directed ventrally, bluntly pointed, triangular in cross section, median prominence on fourth sternite stout, blunt, with flat anterior surface and sharply ridged posterior margin; fifth and sixth sternites similar to those of ovigerous females. Development of endopods of pleopods showing ontogenetic change, becoming more developed with growth.

Male. Similar to non-ovigerous females (cf. Fig. 4A–D). Middorsal carina on third pleonal somite strongly elevated particularly in posterior half (Fig. 4C–D), produced posterodorsally in rounded lobe in lateral view. Thoracic sternite with distinct median teeth, similar to non-ovigerous females. Corneal width 0.27 times of carapace length (Fig. 4A). Outer antennular flagellum (Fig. 4A) overreaching distal margin of antennal scale, consisting of 8 or 9 articles. Propodi of fourth and fifth pereopods devoid of stout plumose setae on ventral margin. Endopod of first pleopod small oval in shape; that of second pleopod (Fig. 4E) also small, showing as elongate triangular lobe; appendix masculina closely approximated to and slightly exceeding endopod, with several spiniform setae becoming denser distally; endopods of third and fourth pleopods tiny; fifth pleopod without endopod.

Variation. As is apparent from the above description, the sculpture of the body tends to become more pronounced with an increase of body size. A notable ontogenetic change is seen in the development of the pleopodal endopods. Only a single male specimen, which is much smaller than ovigerous females, is available for study. Nevertheless, a comparison with non-ovigerous females of similar size suggests that the middorsal carina on the third pleonal somite is much more strongly elevated in the male than in the females. Reduction of sternal armature in spawning molts is evident, as in other crangonids (cf. Chan, 1996; Komai, 1997a, b, 2004a, b, 2006, 2008; Komai and Kim, 2004).

Coloration in life. Body mottled with reddish brown, orangish brown and white; branchiostegal tooth of carapance with white middle band.

Fig. 5. *Rhynocrangon rugosa* sp. nov., holotype, ovigerous female (NSMT-Cr 18232, cl 7.6 mm). Habitus in lateral view.

Cornea gray. Pereopods brownish.

Distribution. So far known only from three localities in northern Japan, Ohmu and Usujiri (Hokkaido) and off Kuji, Iwate Prefecture; at depths of 10–156 m.

Habitat. The paratype specimens from Usujiri, Hokkaido, were collected from substrates mixed with volcanic pebbles (occasionally bearing calcareous algae) and coarse sand. The shrimps were kept alive for a short duration in an aquarium with the collected substrate. The similarity of the shrimps to the pebbels was remarkable, suggesting mimicry. Burrowing behavior was not observed.

Remarks. The new species is closer to *Rhynocrangon alata* than to *R. sharpi* in the general structure of the rostrum, the development of the armature of the carapace, and the sculpture of the pleon. *Rhynocrangon rugosa* sp. nov. can be readily differentiated from *R. alata* by the following characters.

(1) The rostrum of *R. rugosa* abruptly tapers to a terminal projection with distinctly formed anterolateral angles (Figs. 2A–B, 4A–B). On the other hand, the rostrum of *R. alata* gradually tapers distally to a terminal projection (Fig. 6A–B).

(2) In *R. rugosa*, middorsal teeth are absent or reduced to tiny tubercles (Figs. 1, 4A–B), whereas there is at least a sharp epigastric tooth in *R. alata* (Fig. 6A–B).

(3) The branchiostegal tooth is twisted and laterally depressed in *R. rugosa* (Figs. 2A–B, 4A–B), rather than only dorsoventrally flattened in *R. alata* (Fig. 6A–B).

(4) The middorsal carina of the third pleonal somite in males may be much more prominent in *R. rugosa* than in *R. alata* (cf. Fig. 4D and Fig. 6D).

(5) The posterior margin of the telson is rounded in *R. rugosa* (Fig. 2D), rather than acuminate in *R. alata* (Fig. 6E). Furthermore, there is a pair of posterolateral spines in *R. alata*, whereas such spines are absent in *R. rugosa*.

Rhynocrangon sharpi strongly differs from *R. alata* and *R. rugosa* sp. nov. in the laterally compressed, erect rostrum with a prominent dorsal tooth, the possession of three large, laterally compressed middorsal teeth, slender, strongly diverging branchiostegal teeth, the presence of two sharp lateral teeth on the branchial region posterior to the hepatic tooth, the sharply delimited transverse carina on the terga of the first and second pleonal somites, and the presence of a sharp middle tooth on the ventral margin of the merus of the first pereopod (see Kim and Natsukari, 2000).

Rhynocrangon was originally established for two species previously assigned to *Sclerocrangon* G. O. Sars, 1883, *R. alata* and *R. sharpi* (Zarenkov, 1965). Christoffersen (1988) revised classification of the family Crangonidae based on phylogenetic pattern inferred from morphological characters. According to his classification, *Rhynocrangon* is assigned to the subfamily Crangoninae, otherwise including *Argis* Krøyer, 1842, *Crangon* Fabricius, 1798, *Metacrangon* Zarenkov, 1965, *Mesocrangon* Zarenkov, 1965 (incertae cedis), *Neocrangon* Zarenkov, 1965, *Notocrangon* Coutière, 1900, and *Sclerocrangon*. The monophyly of *Rhynocrangon* was indicated by two synapomorphies, viz., the "nose-like" rostrum with concave dorsal surface, and the concave lateral margin of the antennal scale (Christoffersen, 1988). The present study, however, shows that these characters are variable in *Rhynocrangon*. As mentioned above, the structure of the rostrum is considerably different between *R. sharpi* and the other two species. In *R. sharpi*, the dorsal margin of the rostrum is sharply edged, and is never "nose-like" as in *R. alata* and *R. rugosa* sp. nov. (see Kim and Natsukari, 2000: fig. 2). The antennal scale with a concave lateral margin is also seen in species of *Argis* and *Metacrangon* (Komai, 1994, 1997b, unpublished data). Nevertheless, we found that the three species of *Rhynocrangon* share unique features of the fourth and fifth pereopods among the crangoniine taxa. In *Rhynocrangon*, the dactyli are laterally compressed, and bear a subterminal spinule on the flexor margin closely appressed against the unguis; the propodi are armed with a single row of spines, mixed with stout

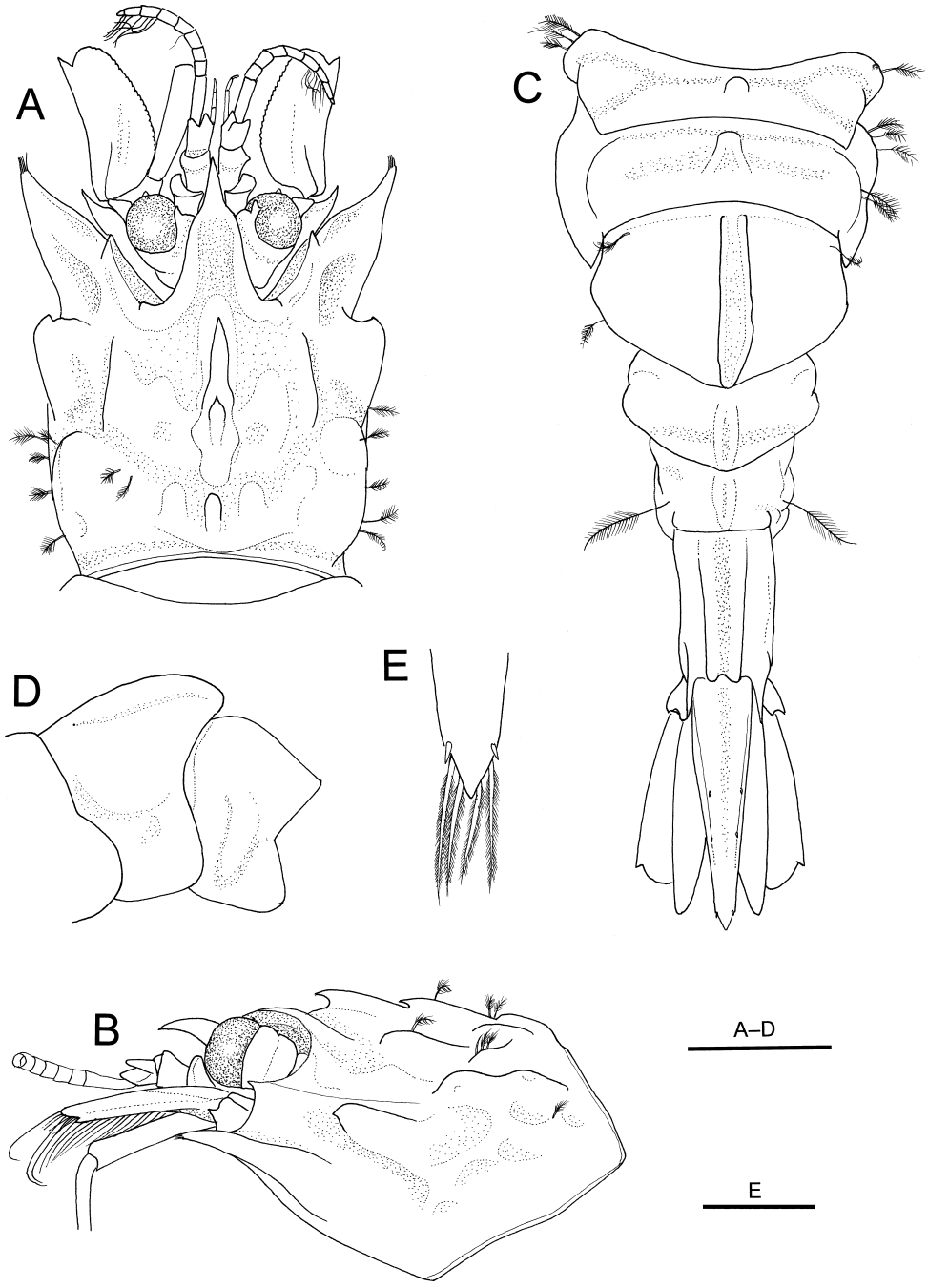

Fig. 6. *Rhynocrangon alata* (Rathbun, 1902), male (LACM-Cr 1949.002.1, cl 3.6 mm). A, carapace and cephalic appendages, dorsal view (setae partially omitted); B, same, lateral view; C, pleon and telson, dorsal view; D, third and fourth pleonal somites, lateral view; E, posterior part of telson, dorsal view. Scale bars: 2 mm for A–D; 0.5 mm for B.

plumose setae in adults; and the carpi are provided mesially with a dorsodistal process. In other crangoniine taxa, the dactyli of the fourth and/or fifth pereopods are flattened dorsoventrally, subspatulate (*Crangon*, *Mesocrangon*, *Notocrangon* and *Sclerocrangon*) or spatulate with modified dactylo-propodal articulations (*Argis* and *Metacrangon*), lacking a subterminal spinule arising from the flexor margins or surfaces; the propodi are devoid of spines on the ventral margin; and each carpus is devoid of a dorsodistal process (Komai, unpublished data). Observation of living specimens of *R. rugosa* sp. nov. suggests that the animal does not burrow in substrates. Dr. G. C. Jensen kindly informed us that *R. alata* and *R. sharpi* did not bury themselves in substarates too. Therefore, these characters of the ambulatory legs might represent adoption to the non-burrowing life, although indeed many crangonid species are known to burrow in soft substrates (e.g., Butler, 1980; Komai and Amaoka, 1992). Furthermore, the strongly inflated second and third pleonal somites in spawning molts and the strongly raised dorsodistal margin of the first segment of the antennular peduncle are also characteristic for *Rhynocrangon* species. These characters do seem to suggest the monophyly of *Rhynocrangon*. Although the sister group of *Rhynocrangon* was inferred to be *Sclerocrangon* by Christoffersen (1988), we could not identify a definite synapomorphy supporting the sister relationship.

Butler (1980) recorded *R. alata* from British Columbia, Canada, accompanied by a detailed description. Examination of this description, however, revealed that his specimens substantially differs from the description by Rathbun (1904) and the comparative specimen from Puget Sound here examined in some details, including the possession of a conspicuous posterodorsal projection on the fourth and fifth pleonal somites. We have examined a single specimen from California (LACM 1934.001.1), identified as *R. alata* by Wicksten (1980). This specimen agrees closely with the description of Butler (1980), and we arrived at the conclusion that it represents an undescribed species. But a formal description is deferred in the hope that additional specimens in good condition will become available, as only a single, once dried specimen was available during the present study.

Etymology. Named from the Latin rugosus (=wrinkled), in reference to the characteristic sculpture of the body integument, used as an adjective.

Key to species of *Rhynocrangon*

1. Rostrum compressed laterally, not arched, erect; carapace with 3 prominent middorsal teeth and with 2 sharp teeth on branchial region posterior to hepatic tooth.....*R. sharpi*
— Rostrum depressed dorsoventrally, arched, directed forward; carapace at most with 2 small middorsal teeth; no teeth on branchial region posterior to hepatic tooth 2
2. Rostrum gradually tapering distally; carapace with 2 small middorsal teeth; branchiostegal tooth vertically compressed .....*R. alata*
— Rostrum abruptly tapering with distinct anterolateral angles; carapace without teeth on dorsal midline; branchiostegal tooth laterally depressed .....*R. rugosa* sp. nov.

Acknowledgments

We thank G. Davis (LACM), F. Muto (HUMZ, now National Research Institute of Far Seas Fisheries), K. Nakaya (HUMZ), J. Sasaki (Abashiri Fishery Experimental Station, Hokkaido) for loaning or donating specimens for study. The senior author wishes to thank the staff of the Usujiri Marine Biological Station, Hokkaido University, for generous help and assistance in the field. The junior author wishes to express cordial thanks to M. Itoh, T. Hattori, Y. Narimatsu, and all the staff of the RV *Wakataka-maru* of the Fisheries Research Agency for their support on board. Our thanks are also extended to S. De Grave of the Oxford University Museum of Natural History and G. C. Jensen of the School of

Aquatic and Fishery Science, University of Washington, for reviewing the manuscript and offering valuable comments for improvements.

References

Butler, T. H., 1980. Shrimps of the Pacific coast of *Canada. Canadian Bulletin of Fisheries and Aquatic Sciences*, (202): i–xii, 1–280, frontispiece, pls. 1–8.

Chan, T.-Y., 1996. Crustacea Decapoda Crangonidae: Revision of the three closely related genera *Aegaeon* Agassiz, 1846, *Pontocaris* Bate, 1888 and *Parapontocaris* Alcock, 1901, *In*: Crosnier, A. (ed.), *Résultats des Campagnes MUSORSTOM Volume 15. Mémoires du Muséum national d'Histoire naturelle*, (168): 269–336.

Christoffersen, M. L., 1988. Genealogy and phylogenetic classification of the world Crangonidae (Crustacea, Caridea), with a new species and new records for the south western Atlantic. *Revista Nordestina de Biologia*, **6**: 43–59.

Kim, J. N. and Y. Natsukari, 2000. Range extension of three crangonid shrimps (Decapoda, Caridea) to Japanese waters. *Crustacean Research*, (29): 35–44.

Kobjakova, Z. I., 1937. Systematisch Übersicht der Dekapoden aus dem Ochotskischen und Japanischen Meere. *Uchenie Zapiski Leningrad Universitet*, **15**: 93–154, pls. 1–3. (In Russian with German summary.)

Komai, T. 1994. The occurrence of *Argis crassa* (Rathbun, 1899) (Decapoda: Caridea: Crangonidae) from Hokkaido, Japan. *Benthos Research*, (46): 33–40.

Komai, T., 1997a. Revision of *Argis dentata* and related species (Decapoda: Caridea: Crangonidae), with description of a new species from the Okhotsk Sea. *Journal of Crustacean Biology*, **17**: 135–161.

Komai, T., 1997b. A review of the *Metacrangon jacqueti* group, with descriptions of two new species (Decapoda, Caridea, Crangonidae). *Zoosystema*, **19**: 651–681.

Komai T., 2004a. A new genus and new species of the family Crangonidae (Crustacea, Decapoda, Caridea) from the Southwestern Pacific. *Zoosystema*, **26**: 73–85.

Komai, T., 2004b. A new species of *Philocheras* Stebbing (Crustacea: Decapoda: Caridea: Crangonidae) from northeastern Australia. *Memoirs of the Queensland Museum*, **49**: 665–673.

Komai, T., 2006. A review of the crangonid genus *Lissosabinea* Christoffersen, 1988 (Crustacea: Decapoda: Caridea), with descriptions of three new species from the western Pacific. *Zoosystema*, **28**: 31–59.

Komai, T., 2008. A world-wide review of species of the deep-water crangonid genus *Parapontophilus* Christoffersen, 1988 (Crustacea: Decapoda: Caridea), with descriptions of ten new species. *Zoosystema*, **30**: 261–332.

Komai, T. and K. Amaoka, 1992. Redescription of *Argis hozawai* (Yokoya, 1939) from northern Japan (Crustacea, Decapoda, Crangonidae). *Proceedings of the Japanese Society of Systematic Zoology*, (48): 24–35.

Komai, T. and J. N. Kim, 2004. Shrimps of the crangonid genus *Paracrangon* Dana (Crustacea: Decapoda: Caridea) from the northwestern Pacific: taxonomic review and description of a new species from Japan. *Scientia Marina*, **68**: 511–536.

Ortmann, A. E., 1895. A study of the systematic and geographic distribution of the decapod family Crangonidae Bate. *Proceedings of the Academy of Natural Science of Philadelphia*, **47**: 173–197.

Rathbun, M. J., 1902. Descriptions of new decapod crustaceans from the west coast of North America. *Proceedings of the United States National Museum*, **24**: 885–905.

Rathbun, M. J., 1904. Decapod crustaceans of the northwest coast of North America. *Harriman Alaska Expedition*, (10): 1–190, pls. 1–10.

Vinogradov, L. G., 1950. Classification of shrimps, prawns and crabs from Far East. *Izvestia TINRO*, **33**: 179–358, pls. 1–53. (In Russian.)

Wicksten, M. K., 1980. Range extensions of four species of crangonid shrimps in the Eastern Pacific Ocean (Decapoda: Crangonidae). *Bulletin of the Southern California Academy of Science*, **79**: 38–41.

Zarenkov, N. A., 1965. Revision of the genera Crangon Fabricius and *Sclerocrangon* G. O. Sars (Decapoda Crustacea). *Zoologischeskii Zhurnal*, **44**: 1761–1775. (In Russian.)