

SCLEROCRANGON GASUYEBI YOKOYA SYNONYMIZED
WITH *SCLEROCRANGON SALEBROSA* (OWEN)
(DECAPODA, CARIDEA, CRANGONIDAE)

BY

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ABSTRACT

The taxonomic status of *Sclerocrangon gasuyebi* Yokoya, 1933 is re-assessed. From a careful examination of the original description and the extant syntype of *Sclerocrangon gasuyebi* combined with the study of additional material, *S. gasuyebi* is relegated as a junior subjective synonym of *S. salebrosa* (Owen, 1839). A lectotype is proposed for *S. gasuyebi* in the interest of nomenclatural stability and *S. salebrosa* is redescribed and illustrated. Brief notes on morphological variation in this species are also provided.

RÉSUMÉ

Le statut systématique de *Sclerocrangon gasuyebi* Yokoya, 1933 est réévalué. A partir d'un examen approfondi de la description originale et du syntype existant de *Sclerocrangon gasuyebi*, combiné à l'étude de matériel supplémentaire, *S. gasuyebi* est relégué au statut de synonyme subjective junior de *S. salebrosa* (Owen, 1839). Un lectotype est proposé pour *S. gasuyebi* dans l'intérêt de la nomenclature et *S. salebrosa* est redécrite et illustrée. Des notes brèves sur la variation morphologique de cette espèce sont aussi fournies.

INTRODUCTION

Sclerocrangon gasuyebi Yokoya, 1933 is one of several obscurely diagnosed species of crangonid shrimp. It was described by Yokoya (1933) on the basis of three specimens from the Sea of Japan collected during an extensive survey on fishery resources around Japan conducted from S.S. "Soyo-Maru". The three specimens came from three different stations: station 602, one female, north of Sado Island from a depth of 205 m; station 628, one male, south-west of Oga

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Peninsula, Akita Prefecture, from a depth of 148 m; and station 652, one young specimen, Tsugaru Strait, from a depth of 110 m. Yokoya (1933) gave a rather detailed description of his new species, but he did not mention its affinities. Later, Urita (1942) suggested a close relationship between *S. gasuyebi*, *S. salebroso* (Owen, 1839) and *S. boreas* (Phipps, 1774), and discussed differences among the three taxa. Igarashi (1969) reported *S. gasuyebi* from Aniwa Bay, Sakhalin and Kitami-Monbetsu, Sea of Okhotsk. However, Zarenkov (1965) suggested that *S. gasuyebi* might be synonymous with *S. boreas*, although he did not provide further details. Komai & Amaoka (1991) also questioned the validity of *S. gasuyebi* and showed that the specimens reported by Igarashi (1969) actually represented *S. salebroso*. Furthermore, Komai (1994) suggested the possibility that *S. gasuyebi* might be synonymous with *S. salebroso* and stressed the necessity for a re-examination of the type material of *S. gasuyebi*.

During the course of a revisionary study of the Crangonidae of East Asian waters, we have re-examined one of the three syntypes of *S. gasuyebi* (from station 602) deposited in the collection of the Kitakyushu Museum and Institute of Natural History, Kitakyushu, Japan. The other two syntypes (stations 628 and 652) could not be located, and hence are presumed to be no longer extant. We have found that the extant female syntype is quite different from the original description of *S. gasuyebi* and that it should belong to *S. boreas*. After careful examination of the original description, we concluded that Yokoya (1933) used the male specimen from station 628 for his description. Therefore, we propose that the specimen described and illustrated is designated as the lectotype of *S. gasuyebi*. Further examination of the additional material from the Sea of Okhotsk has revealed that the differences discussed by Urita (1942) in distinguishing *S. gasuyebi* and *S. salebroso* could be within the range of intraspecific variation of a single species. As a result, we consider that *S. gasuyebi* and *S. salebroso* are conspecific, with *S. salebroso* having priority. *Sclerocrangon salebroso* is redescribed and illustrated herein.

MATERIALS AND METHODS

The specimens examined in this study are deposited in the following institutions: Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University, Hakodate (HUMZ); Kitakyushu Museum and Institute of Natural History, Kitakyushu (KMNH); National Fisheries University, Shimonoseki (NFU). Postorbital carapace length (cl), is used as an indication of size of the specimens examined. The abbreviation "ovig." indicates ovigerous female(s). The drawings were made with the aid of a drawing tube mounted on an Olympus SZH stereomicroscope.

The following specimens have been examined in this study:

Sclerocrangon boreas (Phipps, 1774): paralectotype of *Sclerocrangon gasuyebi* Yokoya, 1933 (herein designated), "Soyo-Maru", stn 602, north of Sado Island, Sea of Japan, 205 m, 9 August 1930, 1 female (cl 14.9 mm, dry) (KMNH).

Sclerocrangon salebrosa (Owen, 1839): Sea of Okhotsk, 57°38'N 141°00'E, 121 m, 12 October 1976, 6 females (cl 19.7-27.3 mm), 1 ovig. (cl 30.2 mm), 1 male (cl 22.6 mm) (HUMZ-C 219); data unknown, 1 ovig. (cl 27.3 mm) (HUMZ-C 220); Benjinskii Bay, Sea of Okhotsk, 61°30'N 158°53'E, 60 m, 2 ovig. (cl 33.8, 36.2 mm) (HUMZ-C 221); data unknown, 1 male (cl 15.3 mm) (NFU 530-2-1710).

RESULTS AND DISCUSSION

As mentioned before, the type material of *S. gasuyebi* was originally composed of three syntypic specimens from the Sea of Japan. The female specimen from station 602 (north of Sado Island) was located in the collection of the KMNH where the material studied by Yokoya (1933) is now deposited (Komai, 1996). Despite our effort, the other two syntypes could not be located. We assume, therefore, that the two other syntypes are no longer extant. Examination of the extant syntype, now in dry condition, has revealed that it actually represents *S. boreas*, which is characterized by the possession of three median teeth on the carapace (the middle tooth is often further divided into two) and the presence of only one pleural ventral tooth on the first to fifth abdominal somites. In his original description, Yokoya (1933) clearly mentioned that "there are two teeth and two tubercles, the latter two are on the gastric region, and sometimes they are very insignificant, while the former two are on the cardiac region and prominent" and that "pleura are provided with two points in the anterior three, while those of the succeeding two abdominal somites are three pointed". Further, Yokoya (1933) illustrated the outer antennular flagellum which distinctly overreaches the distal margin of the scaphocerite. Generally in the species of *Sclerocrangon*, the outer antennular flagellum overreaches the distal margin of the antennal scaphocerite by 0.40-0.50 of its length in males, whereas in females it only reaches up to or slightly overreaches the margin. Therefore, the sex of the specimen illustrated by Yokoya should be male. The specimen from station 652 (Tsugaru Strait) was said to be a "young specimen", and, given the obvious size difference, there is no possibility that the specimen from station 652 represents the one illustrated. From the evidence given, we assume that Yokoya's (1933) original description and illustration of *S. gasuyebi* was based on the male specimen from station 628 (off Oga Peninsula). In the interest of nomenclatural stability, the specimen described and illustrated is designated herein as the lectotype of *S. gasuyebi*. As a result of this nomenclatural action, the extant syntypic specimen becomes a paralectotype.

Urita (1942) discussed differences between *S. gasuyebi* and *S. salebrosa*, although he did not indicate that he examined the type material of *S. gasuyebi* himself. He considered that *S. gasuyebi* differed from *S. salebrosa* in the following respects: the carapace is not spiny and is provided with two spines and two tubercles on the median carina in *S. gasuyebi*, while it is spiny and provided with two blunt spines on the median carina in *S. salebrosa*; the pleuron of the fourth abdominal somite has three points (= ventral teeth) in *S. gasuyebi*, as opposed to two points in *S. salebrosa*; the palm of the first pereopod is one and two-thirds (= about 1.67 times) as long as wide in *S. gasuyebi*, while 1.50 times as long in *S. salebrosa*. In order to ascertain the significance of these differences, we have examined 12 specimens identified as *S. salebrosa* (see Materials and Methods). The identification was made in comparison with the original description by Owen (1839), as the type material of *S. salebrosa* could not be located in the collection of the Natural History Museum, London (P. F. Clark, pers. comm.), where the "Blossom" material studied by Owen (1839) was most probably deposited. Although Yokoya (1933) did not mention the presence of numerous small tubercles on the carapace and abdomen in his descriptive text, his figure clearly depicts the carapace and abdomen which are at least partially covered with small tubercles.

TABLE I

Scerocrangon salebrosa (Owen, 1839). Variation in proportion of the palm of the first pereopod and armature of the fourth abdominal pleuron. PL: length of palm of first pereopod; PW, width of palm of first pereopod; L, left; R, right; b, broken

Specimen	CL	PL/PW	No. of ventral teeth on 4th abdominal pleura
HUMZ-C 219			
female	20.3	1.72	L2 R3
female	19.7	1.63	L3 R3
female	22.7	1.59	L3 R2
female	26.7	1.72	L3 R3
female	25.9	1.67	L3 R3
female	27.3	1.67	L3 Rb
ovig.	30.2	1.63	L3 Rb
male	22.6	1.96	L3 R3
HUMZ-C 220			
ovig.	27.3	1.80	L3 R3
HUMZ-C 221			
ovig.	33.8	1.60	L2 R3
ovig.	36.2	1.63	Lb R3
NFU 530-2-1710			
male	15.3	1.80	L3 R3

Therefore, Urita's statement that the carapace is "not spiny" should be attributed to a misinterpretation. It has been found that the configuration of the median carina on the carapace is considerably variable (fig. 2A-C). In the specimens here examined, the anterior one-third of the median carina on the carapace varies from nearly smooth to having one or two low protuberances or tubercles. The pleuron of the fourth abdominal somite is usually armed with three teeth (table I; figs. 1, 2D), but the number of teeth can vary from left to right (table I). In three specimens, there are only two ventral teeth on either side. The proportion of the palm of the first pereopod is here represented by the ratio "length of palm"/"minimal width of palm proximal to the fixed finger". The calculated ratio varies from 1.60-1.96 in the specimens examined (table I). The ratio calculated from Urita's (1942, text-fig. 10C) figure is 1.75. Thus, the ratios given by Urita (1942) could be within the range of variation of a single species. Our observation indicates that the supposed differences are not reliable in distinguishing the two taxa. Further, both taxa have been recorded from the Sea of Japan and the Sea of Okhotsk (Igarashi, 1969). The overlap of distributions may also support that the two taxa are conspecific.

The range of variability in all the features that supposedly differentiate *S. gasuyebi* and *S. salebrosa* indicates that they are the same species, and that *S. salebrosa* (Owen, 1839) should take priority over *S. gasuyebi* Yokoya, 1933.

TAXONOMIC ACCOUNT

Sclerocrangon salebrosa (Owen, 1839) (figs. 1-3)

Crangon salebrosus Owen, 1839: 88, pl. 27 fig. 1 (type locality: Kamchatka); Stimpson, 1860: 25; Kinahan, 1862: 46 (list); M. Sars, 1862: 180; Kingsley, 1899: 715 (key).

Crangon (Crangon) salebrosus: Brandt, 1851: 114.

Crangon (Sclerocrangon) salebrosus: Ortmann, 1895: 177; Doflein, 1900: 323; Balss, 1914: 66.

Sclerocrangon salebrosus: G. O. Sars, 1883: 7; Sharp, 1893: 127; Urita, 1942: 34, fig. 10; Igarashi, 1969: 10, pl. 11 fig. 31, pl. 18 fig. 60.

Sclerocrangon salebrosa: Birula, 1907: 18 (key); Brashnikov, 1907: 91, pl. 2 fig. 4; De Man, 1920: 252 (list); Derjugin & Kobjakova, 1935: 142 (list); Kobjakova, 1936: 190 (list), 201 (list), 212 (list), 224 (key); 1937: 93 (list), 94 (list), 133; Makarov, 1940: 133; Vinogradov, 1947: 93; 1950: 218, pl. 20 fig. 87; Kobjakova, 1955: 151, pl. 37 fig. 4; 1958: 244 (list); Zarenkov, 1965: 1766 (list); Holthuis, 1980: 153; Miyake, 1982: 188 (list); 1992: 188 (list); 1998: 189 (list); Adrianov & Kussakin, 1998: 265 (list).

Sclerocrangon gasuyebi Yokoya, 1933: 41 (part.), fig. 22 (type locality: southwest of Oga Peninsula, Akita Prefecture, Sea of Japan; herein restricted by lectotype designation); Urita, 1942: 35; Igarashi, 1969: 10, pl. 11 fig. 30, pl. 18 fig. 59.

Sclerocrangon sarebrosa [sic]: Komai & Amaoka, 1991: 35 (key); Komai et al., 1992: 195 (list); Komai, 1994: 83.

Description. — Integument (fig. 1) firm, covered with short setae except for major carinae and tubercles. Rostrum (figs. 1, 3A) 0.35-0.40 times as long as

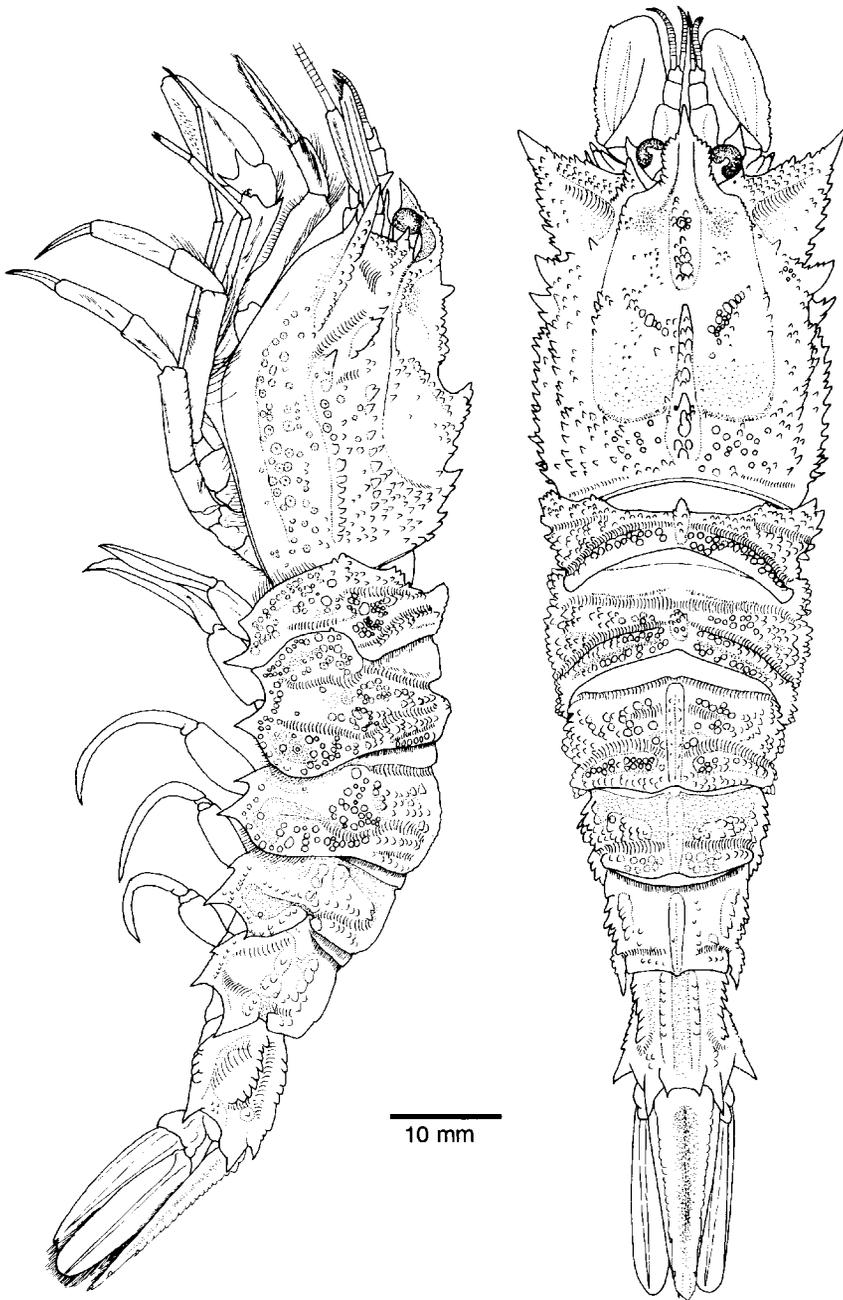


Fig. 1. *Sclerocrangon salebrosa* (Owen, 1839). Female from the Okhotsk Sea (cl 25.9 mm, HUMZ-C 219). Entire animal in dorsal view (right) and lateral view (left), setae mostly omitted.

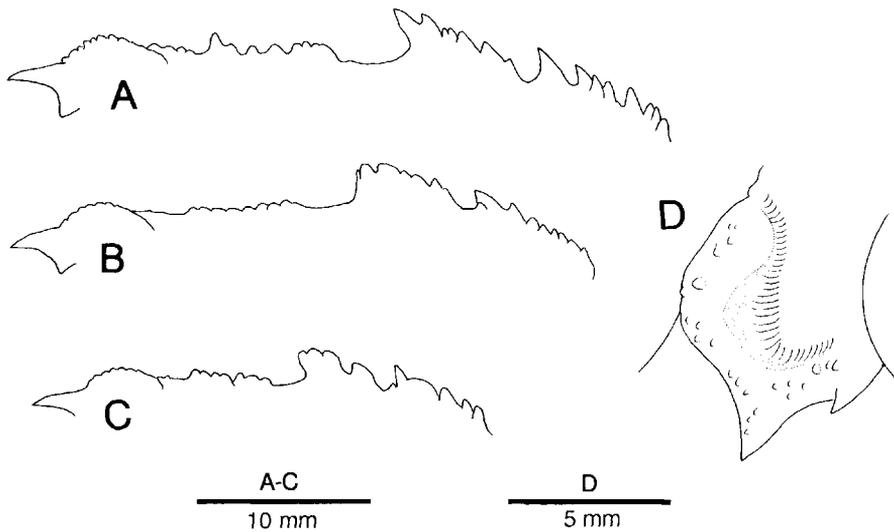


Fig. 2. *Sclerocrangon salebrosa* (Owen, 1839). A-C, dorsal outline of carapace in lateral view, showing variation of armature; D, right pleuron of fourth abdominal somite, lateral. Females from the Okhotsk Sea (A, cl 30.2 mm; B, cl 26.9 mm; C, cl 20.3 mm; D, cl 22.7 mm; HUMZ-C 219).

carapace, somewhat depressed dorsoventrally, arched over eyes, weakly directed ventrally, abruptly tapered in anterior 0.30-0.40, terminating in acute spine; dorsal surface with two deep grooves extending to gastric depressions; lateral margin not markedly elevated, distinctly denticulate; midventral projection distinct, directed ventrally. Carapace (figs. 1, 2A-C) 1.0-1.1 times as long as wide (becoming proportionally wider with increasing overall body size); surface partially covered with numerous spiniform tubercles (hepatic and gastric region nearly smooth or with sparse, minute tubercles); median carina (fig. 2A-C) broad, its anterior 0.40-0.50 low, sometimes with 1 or 2 low tubercles or elevations, each composed of some small tubercles; posterior 0.40-0.50 of median carina with 2 major teeth, each bearing single or double row of small tubercles (sometimes spiniform) on dorsal margin; postorbital carina low, continuous with lateral margin of rostrum, partially marked by row of spiniform tubercles, but without spine at anterolateral corner; upper branchial carina beginning somewhat posterior to hepatic spine, composed of row of spiniform tubercles; lower branchial carina low, composed of row of spiniform tubercles (sometimes elongate), terminating anteriorly in prominent spine; branchiostegal carina high, with row of spiniform tubercles; subbranchial carina low, sometimes obsolete, with double row of spiniform tubercles; hepatic spine large, directed anterolaterally, defined inferiorly by moderately deep hepatic groove; gastric region shallowly depressed below, anteriorly with deep depressions on either side of median carina; broad obliquely transverse ridge composed of single or double row of tubercles extending from base of larger median tooth;

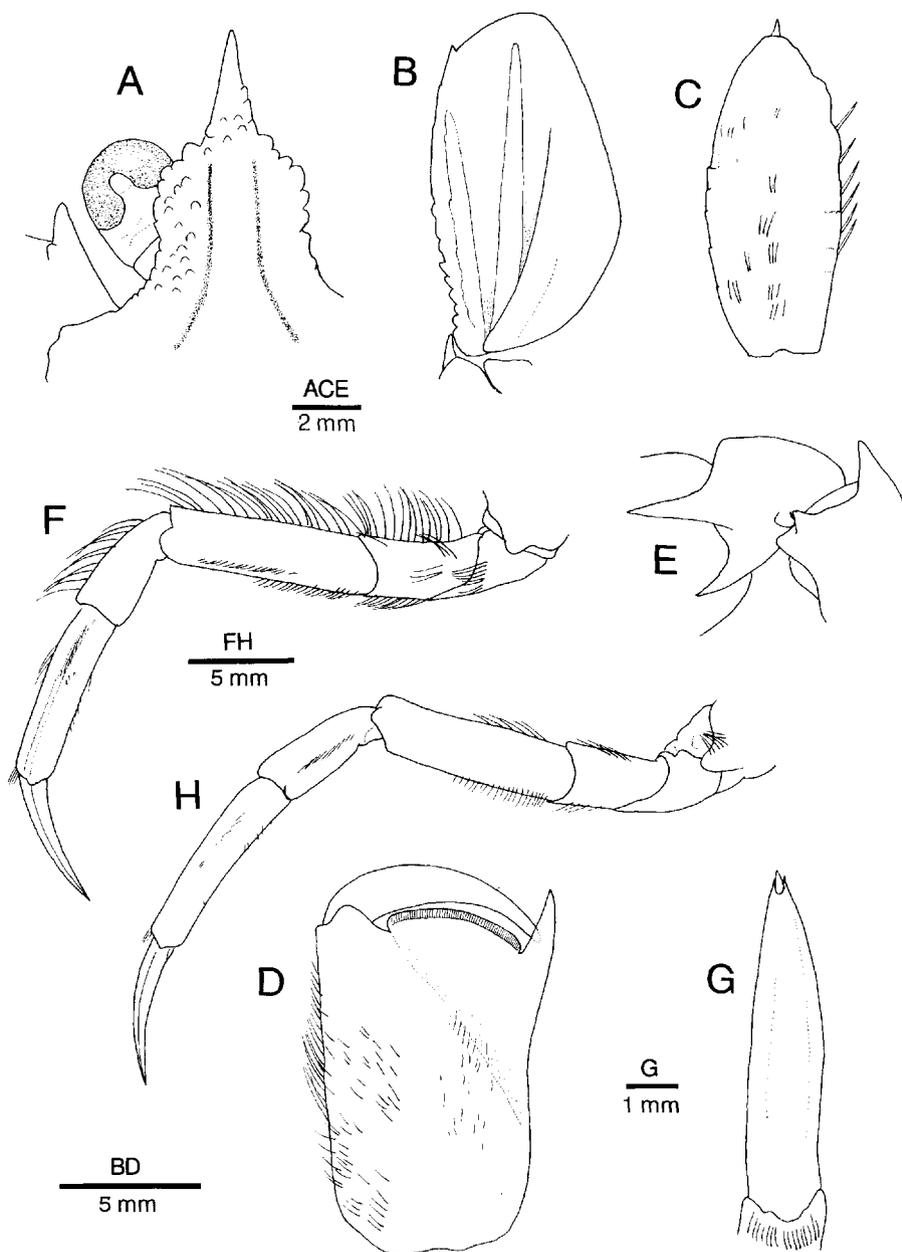


Fig. 3. *Sclerocrangon salebrosa* (Owen, 1839). Female from the Okhotsk Sea (cl 25.9 mm, HUMZ-C 219). A, rostrum and left eye, dorsal, setae omitted; B, left scaphocerite, dorsal, setae omitted; C, ultimate segment of third maxilliped, dorsal; D, chela of left first pereopod, dorsal; E, carpus and distal part of merus of first pereopod, lateral, setae omitted; F, left fourth pereopod, lateral; G, dactylus of left fourth pereopod, dorsal; H, left fifth pereopod, lateral.

anterior part of hepatic region deeply depressed below; antennal spine small, acute or subacute, followed posteriorly by row of small tubercles; branchiostegal spine moderately large, somewhat to strongly divergent anteriorly, reaching posterior 0.15-0.40 of scaphocerite; pterygostomial spine relatively long.

Abdomen (figs. 1, 2D) strongly sculptured with deep transverse grooves and depressions and densely covered with blunt to acute tubercles except for grooves and depressed areas. First to fifth somites each with rather broad middorsal carina, that on first somite produced anterodorsally in prominent projection, that on second somite weakly to somewhat produced anterodorsally, those on third to fifth somites rather low; posterodorsal margin of terga slightly notched or emarginated medially in second to fourth somites, slightly produced medially in blunt process in fifth somite; pleura of first to third somites each with 2 ventral teeth, that of fourth somite (fig. 2D) with 2 or 3 ventral teeth (tooth on posterolateral margin sometimes absent), that of fifth somites always with 3 teeth ventrally. Sixth somite about 0.40 times as long as carapace; submedian carinae nearly parallel or slightly approximating posteriorly, each weakly tuberculate, terminating posteriorly in relatively large spine; lateral carina strongly tuberculate; lateroventral margin tuberculate; posterolateral process strong; posteroventral tooth moderately large. Telson deeply grooved in midline; dorsolateral ridges weakly tuberculate, with 3 pairs of spines (anteriormost pair arising from posterior 0.30 of telson length).

Eye (fig. 3A) small, cornea not wider than eye stalk; protrusion of eyestalk with low tubercle. Antennular peduncles (fig. 1) stout, becoming narrower anteriorly; stylocerite reaching or slightly overreaching midlength of basal segment; outer flagellum reaching or overreaching distal margin of scaphocerite by 0.15-0.20 \times length in females and by 0.50-0.60 \times length in males. Antennal scaphocerite (fig. 3B) 1.65-2.30 times as long as width (becoming proportionally broader with increase of body size); lateral margin slightly sinuous, denticulate in proximal 0.40-0.50, distolateral tooth small, falling far short of distal margin of blade.

Third maxilliped overreaching distal margin of scaphocerite by half length of ultimate segment; distal 2 segments broad, ultimate segment (fig. 3C) elongately oval, 2.09-2.41 times as long as broad.

First pereopod very stout, larger in males than in females, overreaching distal margin of scaphocerite by half length of palm in males, reaching it by distal end of palm in females; palm (fig. 3D) 1.60-1.96 times as long as minimal breadth; cutting edge transverse, with distinct notch just mesial to base of dactylus; carpus (fig. 3E) with 2 strong lateral spines; merus (fig. 3E) with strong dorsodistal spine. Second pereopod overreaching distal margin of scaphocerite by 0.30-0.40 \times length of chela. Third pereopod reaching or slightly overreaching distal margin of scaphocerite. Fourth pereopod (fig. 3F) stout, slightly falling short of distal margin of scaphocerite; dactylus (fig. 3G) about 0.80 times as long as propodus, with

simple terminal spine, its dorsal surface convex, lacking submarginal rows of setae; propodus with blunt ridge on lateral face. Fifth pereopod (fig. 3H) similar to fourth pereopod, reaching midlength of scaphocerite by tip of dactylus; propodus without lateral ridge.

Thoracic sternum with 4 strong, acute median teeth (anterior 3 teeth subequal in size, posteriormost tooth smaller) in non-spawning females and males; in spawning females posterior 3 teeth somewhat reduced to blunt projections, anteriormost tooth strong, acute. In non-spawning females and males, first to fifth abdominal sternites each with acute median tooth, becoming shorter posteriorly; in spawning females, median teeth reduced to blunt tubercles.

Pleopods typical of genus, lacking appendices internae in both sexes. First pleopod with endopod 0.40-0.50 times as long as exopod in females; in males endopod small, 0.25-0.30 times as long as exopod. Second pleopod in males with copulatory organ formed by reduced endopod and enlarged appendix masculina. Uropod (fig. 1) with both rami reaching posterior end of telson; exopod with small posterolateral tooth.

Variation. — As mentioned in the above description, *S. salebrosa* exhibits noticeable sexual dimorphism in the relative size of the first pereopod. The palm of the first pereopod is larger in males than in females. Such sexual variation has not been reported in other species of *Sclerocrangon*.

As is usual in crangonids (Chan, 1996), the body of males and young specimens is more slender than in spawning females. Further, the antennal scaphocerite and the ultimate segment of the third maxilliped become proportionally wider with the increase of body size as in *S. igarashii* Komai & Amaoka, 1991 (see Komai & Amaoka, 1991).

Colour. — Not known.

Distribution. — Bering Sea, Sea of Okhotsk, and Sea of Japan as far south as Peter the Great Bay on the continental coast and Wakasa Bay on the Japanese coast; at depths of 10-250 m (Urita, 1942; Holthuis, 1980). There is no record of this species from the Pacific coast of northern Japan.

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REFERENCES

- ADRIANOV, A. V. & O. G. KUSSAKIN, 1998. A check list of biota of the Peter the Great Bay, the Sea of Japan: 1-349. (Dalnauka, Vladivostok).
- BAISS, H., 1914. Ostasiatische Decapoden II. Die Natantia und Reptantia. In: F. DOFLEIN, Dekapoden, 7 (2) in: Beiträge zur Naturgeschichte Ostasiens. Abhandlungen der Bayerischen Akademie der Wissenschaften, München, (2) (suppl.) **10**: 1-101, 1 pl.
- BIRULA, A., 1907. Zoologische Ergebnisse der russischen Expeditionen nach Spitzbergen. Crustacea, Decapoda. Annuaire du Musée Zoologique de l'Académie Imperiale des Sciences de St.-Petersbourg, **11**: 1-68, 1 map.
- BRANDT, J. F., 1851. Krebse. In: A. T. MIDDENDORFF, Reise in den äussersten Norden und Osten Sibiriens während der Jahre 1843 und 1844 mit allerhöchster Genehmigung auf Veranstaltung der Kaiserlichen Akademie der Wissenschaften zu St. Petersburg ausgeführt und in Verbindung mit vielen Gelehrten herausgegeben, **2** (1): 77-148.
- BRASHNIKOV, V., 1907. Materiali po fauni Russkikh vostochnikh morei, sobrannie shkunoju "Storoz" v 1899-1902 gg. [Materials on the fauna of Russian Eastern Sea collected by the schooner "Storoz" during the year 1899-1902.] Zapiski Imperatorskoi Akademii Nauki, (Phiziko-Matematicheskoe Otdelenie) **20**: 1-185.
- 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: A. CROSNIER (ed.), Résultats des Campagnes MUSORSTOM, 15. Mémoires du Museum national d'Histoire naturelle, Paris, **168**: 269-336.
- DERJUGIN, K. M. & Z. I. KOBJAKOVA, 1935. Zur Decapodenfauna des Japanischen Meeres. Zoologischer Anzeiger, **112**: 141-147.
- DOFLEIN, F., 1900. Die dekapoden Krebse der arktischen Meere. In: F. RÖMER & F. SCHAUDINN (eds.), Fauna Arctica. Eine Zusammenstellung der arktischen Tierformen, mit besonderer Berücksichtigung des Spitzbergen-Gebietes auf Grund der Ergebnisse der Deutschen Expedition in das Nördliche Eismeer im Jahre 1898, **1**: 313-362.
- HOLTHUIS, L. B., 1980. FAO species catalogue, 1. Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. FAO Fisheries Synopsis, (125) **1**: i-xvii, 1-271.
- IGARASHI, T., 1969. A list of marine decapod crustaceans from Hokkaido, deposited at the Fisheries Museum, Faculty of Fisheries, Hokkaido University, I. Macrura. Contribution from the Fisheries Museum, Faculty of Fisheries, Hokkaido University, **11**: 1-15, pls. 1-20.
- KINAHAN, J. R., 1862. On the Britannic species of *Crangon* and *Galathea*; with some remarks on the homologies of these groups. Transactions of the Royal Irish Academy, **24**: 45-113.
- KINGSLEY, J. S., 1899. Synopses of North-American invertebrates. III. The Caridea of North America. The American Naturalist, **33** (393): 709-719.
- KOBIJAKOVA, Z. I., 1936. Zoogeographicheskii obzor fauny Decapoda Okhotskogo i Japonskogo morei. [Zoogeographical review of the Decapoda fauna from the Okhotsk and Japanese Seas.] Trudy Leningrad Obshestva Estestvoispitelei, **65**: 185-228.
- —, 1937. Desjatinogie raki (Decapoda) Okhotskogo i Japonskogo morei. [Systematic review of the Decapoda of the Okhotsk and Japanese Seas.] Uchenie Zapiski Leningrad Universitaet, **15**: 93-154.
- —, 1955. Otrjad Desjatinogie raki — Decapoda. In: E. N. PAVLOVSKII (ed.), Atlas bespozvonochnykh Dal'nevostochnykh morei SSSR. [Atlas of the invertebrates of the Far Eastern seas of the USSR.]: 146-157, pls. 34-41. (Akademia Nauk SSSR, Moscow-Leningrad).

- —, 1958. Desjatinogie raki (Decapoda) rayona yuzhnykh Kuriliskikh Ostrovov. [Decapoda from the vicinity of the southern Kurile Islands.] *Issledovania Dal'nevostochnykh Morei SSSR*, **5**: 220-248.
- KOMAI, T., 1994. [Taxonomic synopsis of Caridea (Pandalidae, Hippolytidae, Crangonidae) occurring on continental shelf of the Sea of Japan]. *Contributions to the Fisheries Research in the Japan Sea Block*, **31**: 81-107. [In Japanese.]
- —, 1996. The crangonid shrimp, *Argis sadoensis* (Yokoya, 1933), a junior synonym of *Argis crassa* (Rathbun, 1899) (Decapoda, Caridea). *Crustaceana*, **69** (4): 542-545.
- KOMAI, T. & K. AMAOKA, 1991. A new species of the genus *Sclerocrangon* from Urup Island, Kurile Islands and east of Hokkaido (Crustacea, Decapoda, Crangonidae). *Proceedings of Japanese Society of Systematic of Zoology*, **44**: 26-37.
- KOMAI, T., S. MARUYAMA & K. KONISHI, 1992. A list of decapod crustaceans from Hokkaido, northern Japan. *Researches on Crustacea*, **21**: 189-205. [In Japanese with English abstract.]
- MAKAROV, V. V., 1940. Fauna Decapoda Beringova i Chukotskogo morci. [The decapod Crustacea of the Bering and Chukchees Seas.] *Issledovanija Dal'nevostochnykh morei SSSR*, **1**: 111-163.
- MAN, J. G. DE, 1920. Decapoda of the Siboga Expedition. IV. Families Pasiphaeidae, Styloactylidae, Hoplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Crangonidae and Glyphocrangonidae. *Siboga Expeditie Mon.*, **39** (a) (3): 1-318.
- MIYAKE, S., 1982. Macrura, Anomura and Stomatopoda. Japanese crustacean decapods and stomatopods in color (1st printing), **1**: i-vii, 1-261, pls. 1-56. (Hoikusha, Osaka). [In Japanese.]
- —, 1992. Macrura, Anomura and Stomatopoda. Japanese crustacean decapods and stomatopods in color (2nd printing) **1**: i-vii, 1-261, pls. 1-56. (Hoikusha, Osaka). [In Japanese.]
- —, 1998. Macrura, Anomura and Stomatopoda. Japanese crustacean decapods and stomatopods in color (3rd printing) **1**: i-vii, 1-261, pls. 1-56. (Hoikusha, Osaka). [In Japanese.]
- ORTMANN, A., 1895. A study of the systematic and geographic distribution of the decapod family Crangonidae Bate. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **47**: 173-197.
- OWEN, R., 1839. Crustacea. In: *The zoology of captain Beechey's voyage; compiled from the collections and notes made by captain Beechey, the officers and naturalist of the expedition, during a voyage to the Pacific and Bering Straits performed in His Majesty's ship Blossom, under command of captain F. W. Beechey, R.N.F.R.S. in the years 1825, 26, 27, and 28: 77-92.* (H. G. Bohn, London).
- PHIPPS, C. J., 1774. *A voyage towards the North Pole undertaken by His Majesty's Command*, **1773**: 1-235. (London).
- SARS, G. O., 1883. Oversigt af Norges Crustaceer med foreløbige Bemaerkninger over de nye eller mindre bekjendte Arter. *Forhandling i Videnskabs-Selskabet i Kristiania*, **1882** (18): 1-124, pls. 1-6.
- SARS, M., 1862. Bemaerkninger over Crangoninerne med Beskrivelse over to nye norske Arter. *Forhandling i Videnskabs-Selskabet i Kristiania*, **1861**: 179-187.
- SHARP, B., 1893. Catalogue of the crustaceans in the museum of the Academy of Natural Sciences of Philadelphia. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **1893**: 104-127.
- STIMPSON, W., 1860. Prodrömus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, C. Ringgold et J. Rodgers Ducibus, observavit et descripsit. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **12**: 22-47.
- URITA, T., 1942. Decapod crustaceans from Saghalien, Japan. *Bulletin of the Biogeographical Society of Japan*, **12**: 1-78.

- VINOGRADOV, L. G., 1947. Desjatinogije rakoobraznyye Okhotskogo morja. [Decapod crustaceans of the Sea of Okhotsk.] *Izvestija Tikhookeanskogo Nauchno-Issledovatel'skogo Instituta Rybnogo Khozjajstva i Okeanografiji*, **25**: 67-124.
- —, 1950. Opredeliteli krevetok, rakov, i krabov Dal'nego Vostoka. [Classification of shrimps, prawns, and crabs from Far East.] *Izvestija Tikhookeanskogo Nauchno-Issledovatel'skogo Instituta Rybnogo Khozjajstva i Okeanografiji*, **33**: 179-358.
- YOKOYA, Y., 1933. On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S. S. Soyo-Maru, during the year[s] 1923-1930. *Journal of the College of Agriculture, Tokyo Imperial University*, **12**: 1-222.
- ZARENKOV, N. A., 1965. Revisija rodov *Crangon* Fabricius i *Sclerocrangon* G. O. Sars (Decapoda, Crustacea). [Revision of the genera *Crangon* Fabricius and *Sclerocrangon* G. O. Sars (Decapoda, Crustacea).] *Zoologicheskii Zhurnal*, **44**: 1761-1775.

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