

Studies on the hippolytid shrimps from Japan—VI.*

The genus *Spirontocaris* BATE

By

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In 1906 CALMAN defined the genus *Spirontocaris* as the species bearing a mandible with an incisor process and a two-jointed palp, a seven-jointed carpus on the second pereopod and no arthrobranch on any pereopod, and considered that the genera, *Birulia*, *Eualus*, *Heptacarpus*, *Hetairocaris*, *Hetairus* were synonymous with *Spirontocaris*. The subsequently many authors, except for Russian authors, have followed him. In the course of his revision of the family Hippolytidae, HOLTHUIS (1947) redefined the genus *Spirontocaris* s.l. and divided it into six genera, *Birulia*, *Eualus*, *Heptacarpus*, *Lebbeus*, *Spirontocaris* s.s. and *Thoralus*, partly adopting the Russian classification. In agreement with HOLTHUIS' generic criteria, *Spirontocaris* is used here in a restricted sense, which is characterized by having two or more supraorbital spines, a process on the eyestalk and an exopod on the third maxilliped.

The following seven species have been obtained from Japan and its adjacent waters; *S. arcuata* RATHBUN, *S. arcuatoides* KOBJAKOVA, *S. murdochi* RATHBUN, *S. ochotensis* (BRANDT), *S. pectinifera* (STIMPSON), *S. prionoia* (STIMPSON) and *S. spinus* (SOWERBY). The specimens are preserved mostly at the Zoological Laboratory, Kyushu University (ZLKU), partly at the Tokyo University of Fisheries (TUF) and also at the National Science Museum, Tokyo (NSMT). The initials given in the parentheses after the name of the institutions are used in the material source of this paper to indicate these institutions.

Genus *Spirontocaris* BATE, 1888

Spirontocaris BATE, 1888, pp. 576, 595.

Spirontocaris CALMAN, 1906, p. 32 (in part).

Spirontocaris HOLTHUIS, 1947, pp. 7, 36.

Spirontocaris HOLTHUIS, 1955, p. 103.

Definition Rostrum well developed, upper margin dentate, lower margin dentate in most species but unarmed in a few species. Carapace smooth with 2-4 supraorbital spines and one antennal spine. Pterygostomial angle usually pointed as spiniform but

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rarely rounded. Abdomen rounded; pleura smooth or pectinate; dorsal end of third somite more or less produced posteriorly. Telson with more than three pairs of dorsal spines. Eye well developed with a prominent process on inner basal part of eyestalk. Carpus of second pereopod with seven joints. Meri of last three pereopods with a row of some outer spines. Mandible consisting of incisor process and two-jointed palp. Pleurobranchs on all pereopods. Podobranch on second maxilliped only, epipods on all maxillipeds and on first, first and second, or on first three pereopods. Exopods on all maxillipeds. Arthrobranchs absent.

Type species *Cancer spinus* SOWERBY.

Remarks The process on the eyestalk is present in all the species examined but its importance has not been fully appreciated, although it seems to be one of the important generic characters. Moreover, almost all the species are now known to show distinct sexual dimorphism. In general females are larger and stouter than males. The teeth of the rostrum and carapace, their secondary teeth and the abdominal pectinations, if present, are more prominent in females than in males. These features have also been frequently been ignored.

HOLTHUIS (1947) listed 17 species with one subspecies in his monograph. The following seven species and two subspecies have been added by KOBJAKOVA and KUBO from the North West Pacific Ocean; *S. brashnikovii*, *S. makarovi makarovi* and *S. spinus laevidens* (KOBJAKOVA, 1936), *S. makarovi spatula* (KOBJAKOVA, 1937), *S. crassirostris* (KUBO, 1951), *S. gurjanovae* (KOBJAKOVA, 1955) and *S. arcuatooides*, *S. microdentata*, *S. urupensis* (KOBJAKOVA, 1962).

Of these *S. crassirostris* proves to be a male of *S. pectinifera*, after a reexamination of the holotype of that species. During the present study three specimens of *S. arcuatooides* are found from Toyama Bay, Sea of Japan. *S. gurjanovae* and *S. urupensis* differ readily from the other members of the present genus by the peculiar features of the rostrum and carapace, especially the absence of a tooth on the lower margin of the rostrum. The remaining species and subspecies are rather obscure in their specific status, because they are chiefly separated by small differences of the rostrum and shape and length of the carapace, which are not good distinguishing characters in some species of this genus. Some of them are closely related to one another or to the other known species.

Among the species of *Spirontocaris* that have two supraorbital spines, rounded abdominal pleura and epipods on the first three pereopods, HOLTHUIS (1947) in his key, distinguished three groups of species. The species of each group are not further differentiated in the key and according to HOLTHUIS might well represent a single variable species. The first of these groups is the *phippisii* group including *S. arcuatooides*, *S. dalli*, *S. mororani*, *S. ochotensis*, *S. onagawaensis* and *S. phippisii*. By the shape of the rostrum this group was subdivided into two subgroups; one is the *phippisii* subgroup which bears a more or less a triangular rostrum and the other is the *ochotensis* subgroup with a small subcircular rostrum (KOBJAKOVA, 1936). The second is the *spinus* group including *S. arcuata*, *S. brevidigitata*, *S. spinus* and *S. truncata*. The last is the *lilljeborgii* group with *S. lilljeborgii* and *S. murdochi*. The Russian subspecies, *S. spinus laevidens* may belong to the *spinus* group, *S. brashnikovii* and *S. microdentata* to the *phippisii* subgroup and *S. makarovi makarovi* and *S. m. spatula* to the *ochotensis* subgroup.

The specimens collected from Japan and its adjacent waters were referred to the following seven known species: *S. arcuata* RATHBUN, *S. arcuatoides* KOBJAKOVA, *S. murdochi* RATHBUN, *S. ochotensis* (BRANDT), *S. pectinifera* (STIMPSON), *S. prionota* (STIMPSON) and *S. spinus* (SOWERBY). DOFLEIN (1902) reported *S. phippisii* (KRÖYER) from Nemuro, Yesso [Hokkaido], but there is no specimen referring to the *phippisii* subgroup in the present material.

S. pectinifera and *S. prionota* are readily distinguished from the other members of the present genus by the presence of three or four supraorbital spines, and they are separated from each other by the presence or absence of the pectinations of the abdominal pleura. An examination of a considerable number of specimens referred to the *ochotensis* subgroup gives the conclusion that *S. mororani*, *S. onagawaensis*, *S. makarovi* and *S. m. spatula* were all synonymous with *S. ochotensis*.

S. arcuata is rather easily distinguished from the other species of the *spinus* group by the length of the stylocerite, the shape of the rostrum. *S. murdochi* and *S. spinus* are closely related to each other. The position of the posterior dorsal tooth on the carapace and the shape of the dorsal end of the third abdominal somite are not good distinctive characters in these two species, though the dactyli of the last three pereopods are different in length. Through the courtesy of Dr. J. A. ALLEN of the Dove Marine Laboratory, Dr. P. TULKKI of the Archipelago Research Institute and Dr. H. J. SQUIRES of the Fisheries Research Board of Canada, some Atlantic specimens of *S. spinus* and *S. lilljeborgii* could be examined. There are no distinct differences between the Asian and Atlantic specimens of *S. spinus*. Moreover the two Asian subspecies, *S. spinus laevidens*, *S. s. intermedia*, and another species, *S. brevidigitata*, are also probably identical with *S. spinus*. *S. lilljeborgii* is rather easily distinguished from *S. murdochi* and *S. spinus* by the position of the posterior dorsal tooth on the carapace and especially from the latter species by the slender dactyli of the last three pereopods. In *S. murdochi* the dactyli of the last three pereopods are slender as in *S. lilljeborgii*, but their spinations are different from each other. The posterior dorsal tooth on the carapace of *S. murdochi* is not so anterior as in *S. lilljeborgii*.

The species of *Spirontocaris* not listed in HOLTHUIS' (1947) monograph are as follows:

S. arcuatoides KOBJAKOVA, 1962, southern Kurile Islands, Sea of Japan, depth 4–80 m.

S. brashnikovi KOBJAKOVA, 1936 (= *Spirontocaris dalli* BRASHNIKOV, 1907). Sea of Okhotsk, northern Sea of Japan, depth 2–37 m.

S. gurjanovae KOBJAKOVA, 1955, northern Kurile Islands, depth 100 m.

S. microdentata KOBJAKOVA, 1962, Kurile Islands, depth 18 m.

S. urupensis KOBJAKOVA, 1962, southern Kurile Islands, depth 5–7 m.

Some species written under the genus *Spirontocaris* s.l. do not belong to that genus in the restricted sense but to the other genera. URITA (1942) gave a new name *Spirontocaris makarofi* and its new subspecies, *S. m. speciosa* as a substitute for *Hetairus zebra* MAKAROV which species is now referred to *Lebbeus fasciatus* (KOBJAKOVA). URITA's species and subspecies from Sakhalin are rather different from the typical *L. fasciatus*. The details of these *Lebbeus* species, however, will be mentioned in a future paper. *Spirontocaris antarcticus* HALE (1941) and *Spirontocaris saldanha* BARNARD (1947) are referred to the genus *Lebbeus*, as already pointed out by YALDWYN (1965) and KENSLEY (1974),

respectively. While *Spirontocaris sinensis* YU (1931) and *Spirontocaris spathulirostris* YOKOYA (1933) were treated under the species incertae by HOLTHUIS (1947) possibly belonging to the genera *Eualus* or *Heptacarpus*. Both have been referred to the genus *Eualus* by LIU (1955) and KOBJAKOVA (1958), respectively.

All the known species of the genus *Spirontocaris* may be distinguished by the following key, which depends largely upon those given by HOLTHUIS (1947) and VINOGRADOV (1950).

- 1 Carapace with 3 or 4 supraorbital spines. Epipods on first three pereopods 2
 - Carapace with 2 supraorbital spines 3
- 2 Lateral margins of abdominal pleura pectinate *S. pectinifera* (STIMPSON)
 - Lateral margins of abdominal pleura entire *S. prionota* (STIMPSON)
- 3 Epipods on first pereopod only..... *S. sica* RATHBUN
 - Epipods at least on first and second pereopods 4
- 4 Epipods on first and second pereopods 5
 - Epipods on first, second and third pereopods 6
- 5 Rostrum longer than carapace, ending in a slender spine
 - *S. holmesi* HOLTHUIS
 - Rostrum shorter than carapace, more or less truncate *S. snyderi* RATHBUN
- 6 Pleura of first and second abdominal somites acute *S. lamellicornis* (DANA)
 - Pleura of first three abdominal somites rounded 7
- 7 Posterior dorsal tooth on carapace situated on anterior two-thirds of carapace
 - 8
 - Posterior dorsal tooth on the carapace situated on posterior third of carapace ...12
- 8 Rostrum with teeth on upper and lower margins 9
 - Rostrum without lower blade or tooth on lower margin
 - *S. urupensis* KOBJAKOVA
- 9 Rostrum subcircular with bifid or trifid apex 10
 - Rostrum triangular, with a single pointed apex 11
- 10 Anterior supraorbital spine much larger than posterior one. Outer terminal spine of antennal scale longer than lamella *S. arcuatoides* KOBJAKOVA
 - Anterior supraorbital spine as large as or somewhat smaller than posterior one. Outer terminal spine of antennal scale as long as lamella.....
 - *S. ochotensis* (BRANDT)
- 11 Rostrum not reaching end of antennal scale and upper and lower blades ill developed..... *S. phippisii* (KRÖYER)
 - Rostrum reaching to tip or beyond antennal scale and rostral blades moderately developed *S. dalli* RATHBUN, *S. brashnikovi* KOBJAKOVA, *S. microdentata* KOBJAKOVA
- 12 Lower margin of rostrum unamed *S. gurjanovae* KOBJAKOVA
 - Rostrum with teeth on upper and lower margins 13
- 13 Dactyli of last three pereopods long, about half as long as propodus 14
 - Dactyli of last three pereopods short, less than one-third length of propodus:....
 - 15
- 14 Posterior dorsal tooth on carapace situated on posterior third of carapace. North Atlantic species *S. liljeborgii* (DANIELSSEN)
 - Posterior dorsal tooth on carapace extending nearly to posterior margin. North Pacific species *S. murdochi* RATHBUN
- 15 Rostrum abruptly truncate apically..... *S. truncata* RATHBUN
 - Rostrum normal, not abruptly truncate 16
- 16 Stylocerite extending to end of antennular peduncle *S. arcuata* RATHBUN
 - Stylocerite reaching second segment of antennular peduncle.....
 - *S. spinus* (SOWERBY)

The genus has been reported from northern waters only: North Pacific including Sea of Okhotsk, Bering Sea and Sea of Japan, North Atlantic and Arctic Ocean.

Spirontocaris arcuata RATHBUN, 1902
(Fig. 1 *a-h*)

- Spirontocaris arcuata* RATHBUN, 1902a, p. 893.
Spirontocaris arcuata RATHBUN, 1904, p. 9 (list), 57 (key), 64, fig. 20, pl. 3 fig. 4.
Spirontocaris arcuata DERJUGIN and KOBJAKOVA, 1935, p. 142 (list).
Spirontocaris arcuata KOBJAKOVA, 1936, p. 221 (key), figs. 4, 5.
Spirontocaris arcuata KOBJAKOVA, 1937, p. 125, fig. 7.
Spirontocaris arcuata HOLTHUIS, 1947, p. 7 (list), 37 (key).
Spirontocaris arcuata VINÓGRADOV, 1950, p. 200 (key), fig. 35.
Spirontocaris arcuata KOBJAKOVA, 1955, p. 149, pl. 36, fig. 2.
Spirontocaris arcuata KOBJAKOVA, 1958, p. 227.
 ?*Spirontocaris arcuata* KOBJAKOVA, 1962, p. 245, fig. 3.

Sea of Okhotsk

Off Kavran, West Kamchatka, gill net, depth 120–170 m, July 1969, M. AMIO leg. — 1 ♀ (NSMT—Cr. 5037).

Description Body large and stout (Fig. 1*a*). Rostrum short and deep; upper margin bearing five large teeth with some minute secondary teeth on their posterior margin; lower margin of rostrum with four moderate teeth just below prominent rostral apex. Midaxis of rostrum curved upwards; lower blade below midaxis well developed and broader than upper blade. Carapace carinate along almost all dorsal margin; five large teeth present on middorsal carina, of which the posterior tooth is situated just before posterior margin of carapace and the anterior tooth situated behind orbit and provided with three small secondary teeth; two supraorbital spines equally well developed, antennal and pterygostomial spine also prominent; postorbital angle obtusely pointed.

Abdomen dorsally smooth; third somite not distinctly produced posteriorly. Pleura of fourth to sixth somites pointed posteriorly. Telson 1.6 times as long as sixth somite, with four pairs of dorsal spines; posterior margin pointed at middle, with three pairs of spines (Fig. 1*b*).

Eye moderate in size; cornea as long as stalk, with a distinct ocellus on line between cornea and stalk, and rounded process present on middle of inner surface of stalk (Fig. 1*c*). Antennular peduncle short, reaching rostral apex; stylocerite long and stout, overreaching antennular peduncle; second and third segments subequal in length, each with a stout marginal spine (Fig. 1*d*). Antennal scale 2.7 times as long as broad and reaching beyond rostral apex by its distal third; outer terminal spine stout and long, overreaching with its entire length beyond lamellar part (Fig. 1*e*). Basicerite with two outer spines; carpocerite reaching proximal third of scale.

Third maxilliped stout, reaching tip of antennal scale. First pereopod stout, reaching rostral apex. Second pereopod reaching with chela and distal joint of carpus beyond antennal scale; carpus subdivided into seven joints. Merus of third pereopod with six or seven spines on outer surface (Fig. 1*f*); propodus four times as long as dactylus, with a series of about 20 spinules on posterior margin (Fig. 1*g*). Merus of fourth pereopod

with five or six outer spines; propodus about 3.5 times as long as dactylus. Fifth pereiopod with three spines on outer surface of merus; propodus 3.3 times as long as dactylus (Fig. 1*h*). Dactyli of last three pereiopods with five spinules on posterior margin.

Uropod as long as telson; outer margin of exopod ending in two spines, outer spine immovable and inner spine movable.

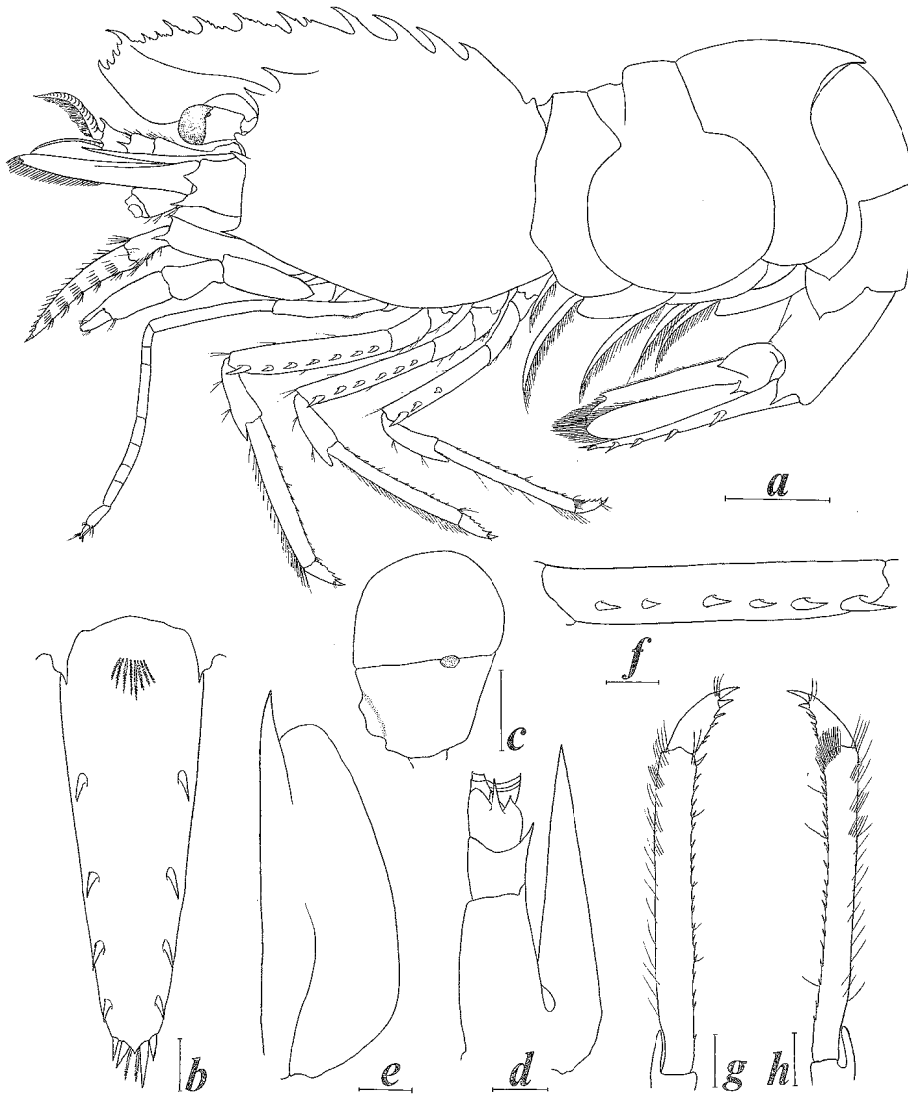


Fig. 1. *Spriontocaris arcuata* RATHBUN, female from West Kamchatka; *a*, animal in lateral view, *b*, telson, *c*, eye, *d*, antennular peduncle, *e*, antennal scale, *f*, merus of third pereiopod, *g*, dactylus and propodus of third pereiopod, *h*, dactylus and propodus of fifth pereiopod. Scale for *a* represents 4 mm and scales for *b-h* represent 1 mm.

Remarks The present species belongs to the *spinus* group, and is rather easily distinguished from the other members of this group by the characters shown by RATHBUN (1902a) and KOBJAKOVA (1936), such as the short and deep rostrum, the upper line of the carapace and rostrum in profile forming a single curve, without a sinus, and the dactyli of the last three pereopods short, with stout, curved spinules on the posterior margin. Moreover the stylocerite is much longer than those of the other members; in *S. arcuata* it extends over the end of the antennular peduncle, while it reaches only the end of the second segment of the antennular peduncle in the other species.

KOBJAKOVA (1962) described with some doubts a single female from the northern Kurile Islands under the name *S. arcuata*. It, however, seems to be highly aberrant form, and differs from the typical *S. arcuata* in the length of the stylocerite and the presence of a submedian carina on either side of the carapace. At the same time KOBJAKOVA (1962) created a new species, *S. arcuatoides*, from the southern Kurile Islands, it is related to *S. arcuata* as implied by the name, but differs from the latter in the shape of the supraorbital spines and the length of the stylocerite as mentioned below.

Size A single female specimen is 10.5 mm in carapace length and 6.7 mm in rostrum length. RATHBUN's type (female) is rather larger than the present specimen, the length of carapace including rostrum is 20 mm and the rostrum proper is 8.0 mm in length.

Distribution Washington Sound, Strait of Juan de Fuca, 48 fms (RATHBUN, 1902a, 1904); from Pribilof Is. to Strait of Juan de Fuca, 3–350 fms (RATHBUN, 1904); Aleutian Is. and eastward to Port Etches, 3–80 fms (RATHBUN, 1904); N and NE of Sea of Okhotsk and W of Kamchatka, 42–287 m (KOBJAKOVA, 1937); continental side of Sea of Japan, 3–110 m (KOBJAKOVA, 1937); Kurile Is., 20–287 m (KOBJAKOVA, 1958).

Spirontocaris arcuatoides KOBJAKOVA, 1962

(Fig. 2 a–j)

Spirontocaris arcuatoides KOBJAKOVA, 1962, p. 244, fig. 2.

Sea of Japan

Off Uozu, Toyama Bay, 80 m, March 18, 1976, M. HORII leg. – 2 ovig. ♀♀ (NSMT–Cr. 5186), 1 ovig. ♀ (Horii's collection).

Description Body moderate and robust (Fig. 2a). Upper margin of rostrum with 7 or 8 teeth; end of upper margin pointed as an apex; lower margin with 2–4 teeth; foremost tooth of lower margin situated just below rostral apex, forming bifid appearance. Carapace longer than rostrum; dorsal carina with four rather large teeth; anterior supraorbital spine much larger and longer than posterior one which is followed by distinct carina. Antennal and pterygostomial spine well developed; suborbital angle rather strongly pointed (Fig. 2b).

Second abdominal somite with short transverse groove on dorsal surface; third abdominal somite produced posteriorly; pleura of fourth to sixth somites pointed posteriorly. Telson dorsally flattened with four pairs or four or five spines on dorsal surface; posterior margin pointed at middle with three pairs of spines (Fig. 2c).

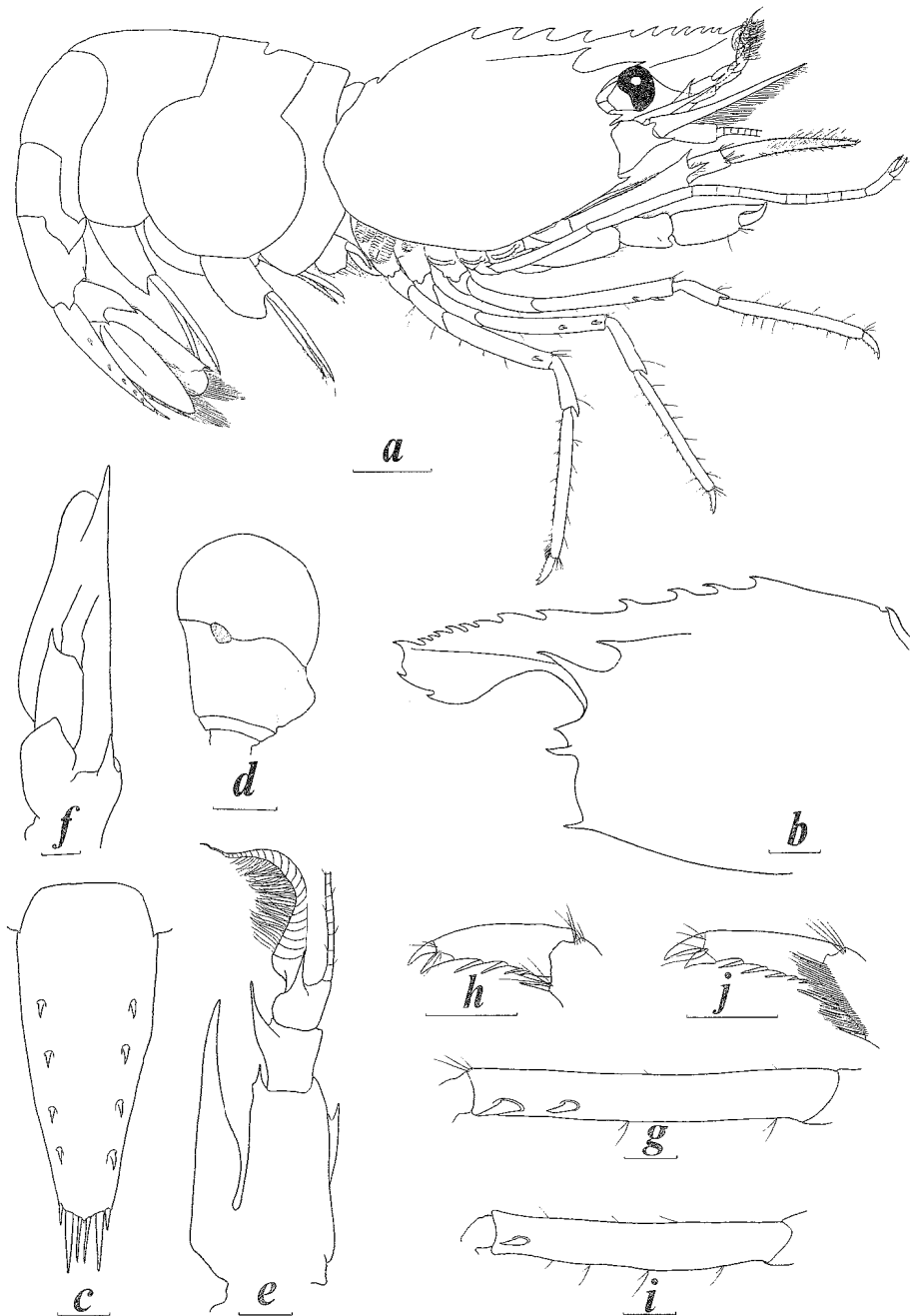


Fig. 2. *Spirontocaris arcuatoides* KOBJAKOVA, ovigerous females from Toyama Bay; *a*, animal in lateral view, *b*, carapace and rostrum, *c*, telson, *d*, eye, *e*, antennular peduncle, *f*, antennal scale, *g*, merus of third pereiopod, *h*, dactylus of third pereiopod, *i*, merus of fifth pereiopod, *j*, dactylus of fifth pereiopod. Scale for *a* represents 2 mm and scales for *b-j* represent 0.5 mm.

Eye moderate in size with a distinct ocellus on line between cornea and stalk; large rounded process present on inner side of stalk (Fig. 2*d*). Antennular peduncle falling short of rostral apex; stylocerite slender, reaching slightly beyond second segment of antennular peduncle; each segment with slender spine (Fig. 2*e*). Antennal scale reaching with distal third beyond rostral apex, about three times as long as broad; outer margin straight, ending in stout spine. Basicerite with two stout outer spines; carpoperite reaching to basal third of scale and with a terminal flap (Fig. 2*f*).

Third maxilliped reaching with one-fourth beyond antennal scale; antepenultimate segment with two stout spines on outer distal and upper distal end. First pereopod stout, reaching to rostral apex. Second pereopod slender, reaching with chela and distal joint of carpus beyond antennal scale; carpus subdivided into seven joints. Third pereopod reaching with dactylus beyond third maxilliped; fourth pereopod reaching to tip of antennal scale; fifth pereopod reaching with dactylus beyond rostrum. Each merus of third and fourth pereopods with two outer spines near distal articulation (Fig. 2*g*); merus of fifth pereopod with a single terminal spine (Fig. 2*i*). Propodi of last three pereopods with 15–18 small spines on posterior margin; dactyli of these pereopods with six spines on posterior margin (Fig. 2*h, j*).

Uropod longer than telson; protopod with stout spines on outer and inner terminal; outer margin of exopod ending in two spines.

Remarks The present specimens agree very well with the original description of *Spirontocaris arcuatoides* KOBJAKOVA. As mentioned by KOBJAKOVA (1962) the shape and size of two supraorbital spines are most characteristic in this species. However, *S. arcuatoides* seems to be more closely related to *S. ochotensis* than *S. arcuata*, because the size is not so large, the posterior dorsal tooth on the carapace is not situated so posteriorly and the outer spines on the merus of third pereopod are not so many as in *S. arcuata* and other species of the *spinus* group. From *S. ochotensis* it is readily distinguished by the unusually large supraorbital spines.

Size Three species examined are all ovigerous females, 5.8–6.5 mm in carapace length and 3.3–4.1 mm in rostrum length.

Distribution The species has been only known from shallow waters of the Kurile Islands. Shikotan I., 4–10 m, Shipotsu [Zelenii] I., 14 m, Kurile Islands (KOBJAKOVA, 1962).

Spirontocaris murdochi RATHBUN, 1902
(Fig. 3 *a–m*)

Spirontocaris murdochi RATHBUN, 1902a, p. 893.

Spirontocaris murdochi RATHBUN, 1904, p. 9 (list), 57 (key), 66, fig. 21, pl. 3 fig. 6.

Spirontocaris murdochi BRASHNIKOV, 1907, p. 140, fig. 14 a, b.

Spirontocaris murdochi BALSS, 1914, p. 46.

Spirontocaris murdochi DERJUGIN and KOBJAKOVA, 1935, p. 142 (list).

Spirontocaris murdochi KOBJAKOVA, 1936, p. 221 (key).

Spirontocaris murdochi KOBJAKOVA, 1937, p. 128.

- Spirontocaris murdochi* URITA, 1942, p. 13.
Spirontocaris murdochi HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris murdochi VINOGRADOV, 1950, p. 200 (key), fig. 37.
Spirontocaris murdochi KOBJAKOVA, 1955, p. 149, pl. 36 fig. 1.
Spirontocaris murdochi IGARASHI, 1969, p. 5, pl. 5 fig. 13.
Spirontocaris murdochi HAYASHI, 1976, p. 17.

Sea of Okhotsk

55°40'N, 155°11'E, dredge, depth 60 m, June 4, 1959, time 13:16, Hokuhomaru leg. — 1 ♂ (ZLKU No. 11104); 52°55'N, 155°37'E, dredge, depth 70 m, August 23, 1959, time 10:23, Hokuhomaru leg. — 1 ♀ (ZLKU No. 11108).

Hokkaido

Volcano Bay, Hokkaido, depth 80 m, May 18, 1968, T. IGARASHI leg. — 3 ♀♀ (ZLKU No. 13964), depth 50 m, August 1955, T. IGARASHI leg. — 1 ♀ (ZLKU No. 13974).

Description Body moderate (Fig. 3a). Rostrum rather deep, with 9–11 irregular teeth on upper margin; apex pointed, not distinctly overreaching distal extremity of lower margin of rostrum; lower margin with three or four teeth; midaxis nearly straight. Dorsal carina of carapace with three to five large teeth; two supraorbital and one antennal spine present; pterygostomial spine distinct in females, but very small on left side and absent on right side in the present male. Suborbital angle bluntly pointed (Fig. 3k).

Abdomen dorsally smooth; third somite produced posteriorly; pleura of fourth to sixth somites pointed posteriorly. Telson 1.5–1.6 times as long as sixth somite, with four pairs of dorsal spines; posterior margin not acutely pointed, with three pairs of spines.

Eye relatively small, with a distinct ocellus situated on line between cornea and eyestalk; stalk with a small lobular process on inner basal surface (Fig. 3b). Antennular peduncle falling short of end of rostral apex; stylocerite pointed, reaching distal end of second segment of antennular peduncle; second and third segments very short, each with a small marginal spine. Antennal scale about 2.5 times as long as broad and extending beyond rostral apex; outer terminal spine reaching beyond or falling short of lamella (Fig. 3c, j). Basicerite with two outer spines; carpocerite reaching to proximal third of scale.

Third maxilliped reaching just to tip of antennal scale. First pereopod short, rather robust, reaching end of antennular peduncle. Second pereopod slender, reaching with chela beyond antennal scale; carpus subdivided into seven joints. Merus of third pereopod with four to six spines on outer surface (Fig. 3d). Usually three outer spines on meri of fourth and fifth pereopods. Propodi of last three pereopods 2.2–2.4 times as long as dactylus (Fig. 3e–h).

Uropod as long as or slightly longer than telson, two pointed processes present on protopod. First male pleopod slender and tapering, with some retinaculae on inner distal end (Fig. 3l). Appendix masculina shorter than appendix interna and armed with many long, simple setae (Fig. 3m).

Remarks The present material was collected from Volcano Bay and the Sea of Okhotsk. The specimens (4 ♀♀) from Volcano Bay superficially differ from two specimens (1 ♂, 1 ♀) from the Sea of Okhotsk, from which all the pereopods are missing.

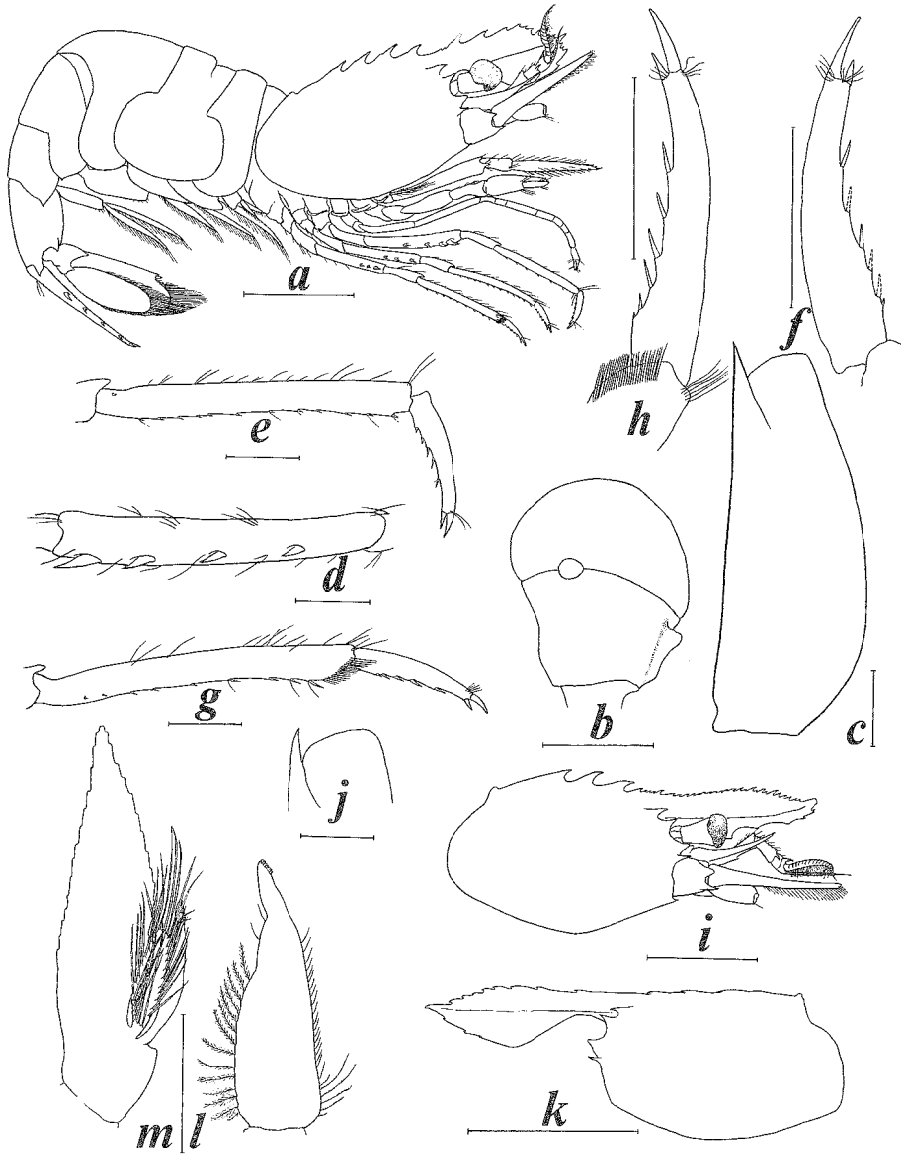


Fig. 3. *Spirontocaris murdochi* RATHBUN, *a-h*, females from Volcano Bay, *i, j*, female from Sea of Okhotsk, *k-l*, male from Sea of Okhotsk; *a*, animal in lateral view, *b*, eye, *c*, antennal scale, *d*, merus of third pereiopod, *e*, dactylus and propodus of third pereiopod, *f*, dactylus of third pereiopod, *g*, dactylus and propodus of fifth pereiopod, *h*, dactylus of fifth pereiopod, *i*, anterior part of body, *j*, apex of antennal scale, *k*, carapace and rostrum, *l*, male first pereiopod, *m*, male second pereiopod. Scales for *a, i, k* represent 5 mm and scales for *b-h, j, l, m*, represent 1 mm.

Spirontocaris murdochi RATHBUN is characterized by the long dactyli of the last three pereiopods and the short outer spine of the antennal scale (RATHBUN, 1902a and 1904; KOBJAKOVA, 1936 and 1937; VINOGRADOV, 1950). In the four females from Volcano Bay each dactylus of the last three pereiopods is slightly shorter than half length of the respective propodus, but the outer spine of the antennal scale extends a little beyond the lamellar part. As the specimens from the Sea of Okhotsk are badly mutilated and the length of the dactylus is therefore unknown. The female, however, is very similar to the figures of this species given by RATHBUN (1904), BRASHNIKOV (1907) and KOBJAKOVA (1955), in the dorsal margin of the carapace and rostrum, though the lower margin is rather broken, and moreover the specimen has a short outer spine on the antennal scale. The male apparently differs from these females in having a rather slender rostrum, much reduced dorsal teeth on the carapace and rostrum, and a very small pterygostomial spine on the right side and entirely lacking on the left side. The outer antennal spine is shorter than the lamellar part. RATHBUN (1904) described the differences between females and males of this species as follows: the male "is smaller

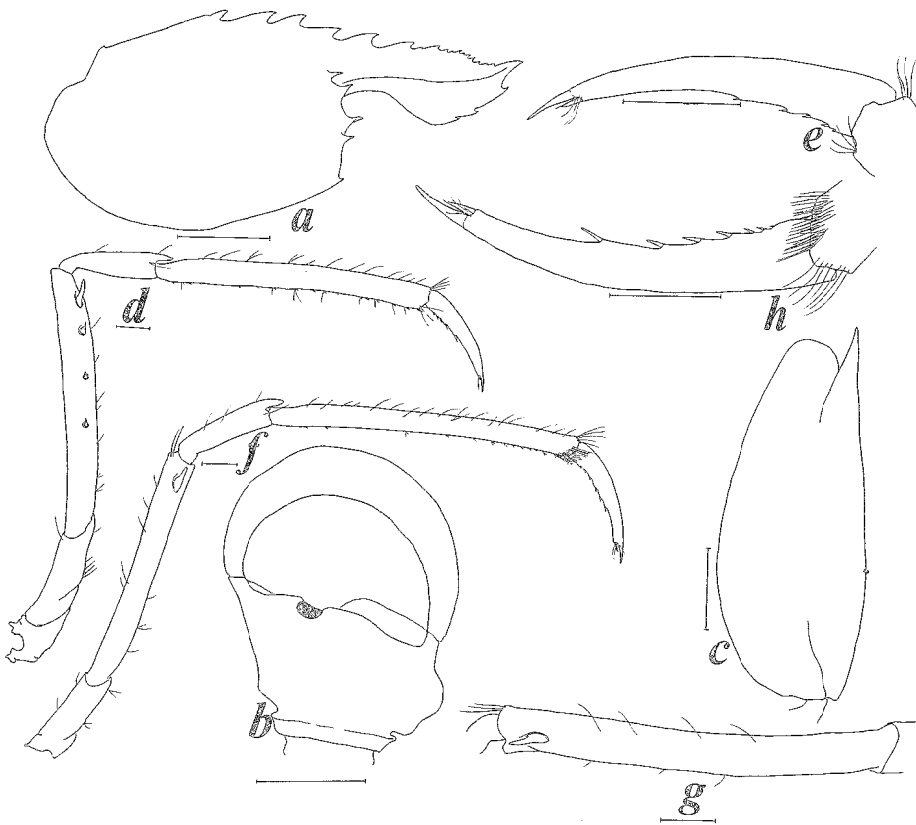


Fig. 4. *Spirontocaris lilljeborgii* (DANIELSSEN), specimens from Atlantic Ocean; *a*, carapace and rostrum, *b*, eye, *c*, antennal scale, *d*, third pereiopod, *e*, dactylus of third pereiopod, *f*, fifth pereiopod, *g*, merus of third pereiopod, *h*, dactylus of fifth pereiopod. Scale for *a* represents 5 mm and scales for *b-h* represent 1 mm.

and slender than the female, rostrum and antennules longer, dorsal teeth much reduced". KOBJAKOVA (1937) and VINOGRADOV (1950) mentioned the same facts about the male of the present species. The material examined differs readily from three species of the *phippisii* subgroup in having the rostrum not so slender and the posterior tooth on the carapace placed posteriorly, and it, therefore, may be referred to *S. murdochi*.

The Atlantic species, *S. lilljeborgii* (DANIELSSEN), is closely related to *S. murdochi*. Through the courtesy of Dr. ALLEN and Dr. TULKKI, several specimens of *S. lilljeborgii* collected from the northern Atlantic Ocean could be actually examined (Fig. 4a-h). *S. murdochi* differs from *S. lilljeborgii* in the following characters.

1) The posterior tooth on the carapace is situated more anteriorly in *S. lilljeborgii* than in *S. murdochi*.

2) The outer surface of the merus of the last pereopod is armed with a single subterminal spine in *S. lilljeborgii* and a row of three spines in *S. murdochi*.

3) The dactyli of the last three pereopods are about half as long as the propodus in both species, but they are more slender in *S. lilljeborgii* than in *S. murdochi* and the spinules on the posterior margin of the dactylus are much wider in *S. lilljeborgii* than in *S. murdochi*.

On the other hand, *S. murdochi* somewhat resembles to *S. spinus*. The shape of the dorsal end of the third abdominal somite is not a valid character separating *S. murdochi* from the Asian specimens of *S. spinus*, as well as the Atlantic specimens of that species examined, because it is a rounded, not distinctly produced process in both species. The position of the posterior tooth on the carapace is also not a good character for distinguishing these two species as shown by the European specimens of *S. spinus* and *S. lilljeborgii*, though the posterior tooth is placed rather more anteriorly in *S. murdochi* than in the Asian specimens of *S. spinus*. However *S. murdochi* readily distinguished from *S. spinus* by the length and shape of the dactyli of the last three pereopods; viz., these dactyli are more slender and longer in *S. murdochi* than in *S. spinus*; in the fifth pereopod, the dactylus is about half as long as propodus in *S. murdochi*, while it is one-third length in *S. spinus*.

Size The female specimens vary from 7.2–8.5 mm in carapace length and 5.2–6.1 mm in rostrum length. A single male is 6.7 mm in carapace length and 6.1 mm in rostrum length. The specimens in literature are rather larger, 11 mm (URITA, 1942), 9.5 mm (RATHBUN, 1902a), and 9–11 mm (BRASHNIKOV, 1907) in carapace length.

Distribution Off Robben I., Sea of Okhotsk (RATHBUN, 1902a), Arctic coast of Alaska, Kamchatka, Sea of Okhotsk, 13.5–28.0 fms (RATHBUN, 1902a and 1904), Chukchi Sea, Bering Sea, Tatar [Tatarskij] Strait, 12–244 m (KOBJAKOVA, 1937), Sakhalin, 20–25 fms (URITA, 1942), Taraika [Terpenija] Bay, 15–20 fms (BRASHNIKOV, 1907), Castri Bay (BALSS, 1914), Volcano Bay, Hokkaido (IGARASHI, 1969), off Niigata Pref., Sea of Japan, 130 fms (HAYASHI, 1976).

Spirontocaris ochotensis (BRANDT, 1851)
(Fig. 5 a–j)

- Hippolyte ochotensis* BRANDT, 1851, p. 120, pl. 5 fig. 17.
Hippolyte ochotensis STIMPSON, 1860, p. 34 (103).
Spirontocaris mororani RATHBUN, 1902b, p. 43, fig. 16.
Spirontocaris ochotensis RATHBUN, 1904, p. 9 (list), 57 (key), 71, fig. 26.
Spirontocaris ochotensis BRASHNIKOV, 1907, p. 142, fig. 15.
Spirontocaris mororani KEMP, 1914, p. 124 (list).
Spirontocaris ochotensis KEMP, 1914, p. 124 (list).
Spirontocaris mororani YOKOYA, 1930, p. 529, fig. 1.
Spirontocaris mororani YOKOYA, 1933, p. 23.
Spirontocaris makarovi spatula KOBJAKOVA, 1936, p. 221 (key).
Spirontocaris makarovi KOBJAKOVA, 1936, p. 221 (key).
Spirontocaris ochotensis mororani KOBJAKOVA, 1936, p. 222 (key), fig. 3.
Spirontocaris ochotensis mororani KOBJAKOVA, 1937, p. 124.
Spirontocaris makarovi spatula KOBJAKOVA, 1937, p. 125.
Spirontocaris ochotensis YOKOYA, 1939, p. 267, fig. 4.
Spirontocaris onagawaensis YOKOYA, 1939, p. 268, fig. 5.
Spirontocaris ochotensis URITA, 1942, p. 14.
 not *Spirontocaris makarovi* URITA, 1942, p. 18 fig. 3 (= ? *Hetairus fasciata* KOBJAKOVA)
Spirontocaris mororani HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris ochotensis HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris onagawaensis HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris ochotensis ochotensis VINOGRADOV, 1950, p. 202 (key), pl. 12 fig. 40.
Spirontocaris ochotensis mororani VINOGRADOV, 1950, p. 202 (key), pl. 12 fig. 42.
Spirontocaris makarovi spatula VINOGRADOV, 1950, p. 202 (key).
Spirontocaris ochotensis ochotensis KOBJAKOVA, 1958, p. 226.
Spirontocaris mororani KOBJAKOVA, 1958, p. 227.
Spirontocaris ochotensis mororani KOBJAKOVA, 1967, p. 233.

Hokkaido

Near Hokkaido, definite locality and date uncertain, Hokkaido Regional Fisheries Research Laboratory – 3 ♂♂, 1 ovig. ♀, 5 ♀♀ (TUF).

Northern Honshu

Aomori Bay, *Zostera* belt, small Danish seine, August 4, 1959, H. SANDO leg. – 1 ♂ (ZLKU No. 10135); August 5, 1959, H. SANDO leg. – 1 ♀ (ZLKU No. 10196); off Yushima, depth 10 m, muddy sand, June 19, 1963, H. SANDO leg. – 1 ♀ (ZLKU No. 10225); *Zostera* belt, small Danish seine, data uncertain, H. SANDO leg. – 1 ♂, 1 ♀ (NSMT-Cr. 5038); *Sargassum* belt, depth 1–2 m, August 14–15, 1958, H. SANDO leg. – 5 ♂♂, 3 ♀♀ (TUF).

Sōyō Maru Station 648, west of Tsugaru Strait, depth 247 m, August 23, 1930 – 1 ♂ (ZLKU Sōyō Maru collection).

Description Body moderate and robust (Fig. 5a). Upper margin of rostrum with 7–15 small teeth; lower margin with 3–7 teeth; apex bifid or trifid. Carapace longer than rostrum; dorsal carina with three or four equal teeth; two supraorbital spines, antennal and pterygostomial spine present on anterior margin of carapace; suborbital angle triangularly pointed (Fig. 5b, c).

Abdomen dorsally smooth; pleura of fourth to sixth somites pointed posteriorly.

Telson dorsally flattened with 4 or 5 pairs of dorsal spines; posterior margin pointed at middle with three pairs of spines (Fig. 5*d*).

Eye moderate in size, with a distinct ocellus on line between cornea and stalk; stalk longer than cornea and with a large rounded process (Fig. 5*e*). Antennular peduncle falling short of rostral apex; stylocerite pointed, reaching second segment of antennular peduncle. Second and third segments very short, each with a small marginal spine (Fig. 5*f*). Antennal scale reaching with distal third beyond rostrum, about 2.5 times

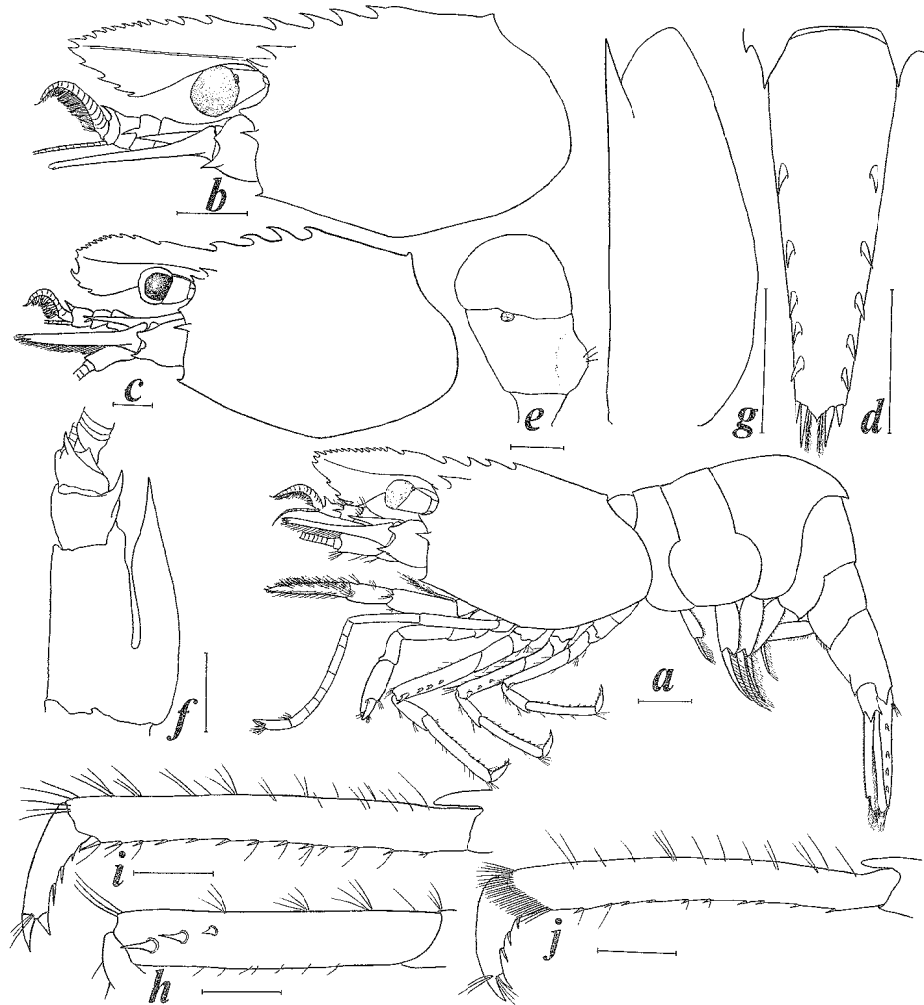


Fig. 5. *Spirontocaris ochotensis* (BRANDT). *a, c, e, h-j*, females from Aomori Bay, *b, d, g*, males from Aomori Bay, *f*, ovigerous female from Hokkaido; *a*, animal in lateral view, *b, c*, anterior part of body, *d*, telson, *e*, eye, *f*, antennular peduncle, *g*, antennal scale, *h*, merus of third pereiopod, *i*, dactylus and propodus of third pereiopod, *j*, dactylus and propodus of fifth pereiopod. Scales for *a-d, f, g* represent 1 mm and scales for *e, h-j* represent 0.5 mm.

as long as broad; outer margin straight, outer terminal spine as long as lamella (Fig. 5g). Basicerite with two outer spines; carpopocerite reaching middle of scale.

Third maxilliped reaching just tip of antennal scale. First pereopod stout reaching to end of antennular peduncle. Second pereopod slender, reaching with chela or chela and distal joint of carpus beyond antennal scale; carpus subdivided into seven joints. Merus of third pereopod with three or four outer spines (Fig. 5h), three outer spines on fourth pereopod, one or two outer spines on fifth pereopod. Dactyli of last three pereopods about one-third length of respective propodus (Fig. 5i, j).

Uropod as long as or slightly longer than telson; outer margin of exopod straight, with two terminal spines.

Remarks *Spirontocaris dalli* RATHBUN, *S. mororani* RATHBUN, *S. ochotensis* (BRANDT), *S. onagawaensis* YOKOYA and *S. phippisii* (KRÖYER) are classified by HOLTHUIS (1947) into one group, which is characterized by having two supraorbital spines, rounded pleura of the first three abdominal somites, epipods on the first three pereopods and dorsal teeth on the carapace not extending to the posterior third of it. The following Russian species are also included in this group, namely, *S. arcuatooides*, *S. brashnikovii*, *S. makarovi makarovi*, *S. makarovi spatula* and *S. microdentata*.

Of these *S. dalli*, *S. brashnikovii*, *S. microdentata* and *S. phippisii* differ from the other species of this group by the slender and rather long rostrum with the single pointed apex. Unfortunately no specimens are referred to any one of these four species. On the other hand, *S. arcuatooides*, *S. mororani*, *S. ochotensis*, *S. onagawaensis*, *S. makarovi makarovi* and *S. m. spatula* have a short and subcircular rostrum with the bifid or trifid apex, which does not reach the distal end of the antennal scale.

RATHBUN (1902b) created *S. mororani* from Hokkaido and compared it with *S. dalli*, which species was described originally in comparison with *S. ochotensis* (RATHBUN, 1902a and 1904). RATHBUN (1904) reported *S. ochotensis* and *S. dalli* from the North Pacific Ocean, but did not mention the comparison between these two species and their related species, *S. mororani*. I could not find any differences between the original descriptions of either *Hippolyte ochotensis* BRANDT and of *Spirontocaris mororani* RATHBUN, or moreover between RATHBUN's (1904) subsequent, more comprehensive, description of *S. ochotensis* and her original description of *S. mororani* (RATHBUN, 1902b). *S. ochotensis*, *S. mororani* and also *S. onagawaensis*, the last species of which was discovered later by YOKOYA (1939) from northern Japan, have been treated so far as distinct species or subspecies of *S. ochotensis*. The difference between these three species seems, at first, to be the number of teeth on the dorsal carina of the carapace, such as three in *S. ochotensis*, four in *S. mororani* and five or six in *S. onagawaensis*. KOBJAKOVA (1936 and 1937) treated *S. mororani* as a subspecies of *S. ochotensis* by these numerical differences only. BRASHNIKOV (1907), however, showed that *S. ochotensis* bears three or four spines on the carapace, based upon the material from the Sea of Okhotsk. Among 23 specimens examined, 12 specimens bear three teeth, the other 11 specimens bear four teeth on the dorsal carina of the carapace. VINOGRADOV (1950) followed KOBJAKOVA's classification and treated *S. mororani* as the subspecies of *S. ochotensis* according to the shape of midaxis of the rostrum as well as by the number of the rostral teeth, viz., in *S. mororani* as the subspecies of *S. ochotensis ochotensis* the rostrum has a slightly up-turned axis near the apex and is armed with 7–11 teeth

on the upper and 2–5 teeth on the lower margin, while in *S. o. mororani* the axis is straight and the rostral teeth are 9–14 on the upper margin and 3–7 on the lower margin. The axis of rostrum is usually straight in males and somewhat up-turned in females. I have no specimen bearing five or more teeth on the carapace as in the description of *S. onagawaensis* YOKOYA (1939), but this small numerical difference seems to be of no specific value. Thus these species are thought to be identical with one another.

In the case of *S. makarovi makarovi* and its subspecies, *spatula*, both original descriptions are very obscure (KOBJAKOVA, 1936), one indicated only in a key and the subsequent descriptions are also incomplete. According to KOBJAKOVA's and VINOGRADOV's keys, these two species have a short rostrum, reaching the end of the antennular peduncle, in which character they differ from *S. ochotensis* and its allied species. *S. makarovi makarovi* is distinguished from its subspecies by the number of teeth on the carapace, three or four in the former and four to six in the latter. As mentioned above, these rostral features bear no specific value. Among the material examined a single female collected from Aomori Bay at a depth of about 10 m, is referred to *S. makarovi spatula*, as far as the shape of the rostrum and carapace are concerned, but the other characters agree well with those of the other specimens of *S. ochotensis* collected from the same locality. This seems to be an only aberrant form of *S. ochotensis* and thus *S. makarovi makarovi* and *S. m. spatula* are treated here as synonymous with *S. ochotensis*. *S. ochotensis* differs from *S. arcuatooides* in having the normal, not so large, supraorbital spines as mentioned above.

Spirontocaris s.l. *makarovi* URITA is a substitute name for *Hetairus zebra* MAKAROV (1935) and entirely differs from the present species.

Size A single ovigerous female examined is 7.0 mm in carapace length and 5.2 mm in rostrum length. The largest male examined is 5.6 mm in carapace length and 4.7 mm in rostrum length.

Distribution Bering Sea to Sitka, 7.3–17 fms (RATHBUN, 1904); from Nunivak southward and along Aleutian Is. and Alaska Peninsula to Sitka, 5–20 fms (RATHBUN, 1904); Bering Sea and Sea of Okhotsk, 17–29 m (KOBJAKOVA, 1937); E of Kita Shiritoko Peninsula, 25.6 m (BRASHNIKOV, 1907); Sea of Okhotsk (BRANDT, 1851); Kunashiri [Kunasir] I., Shikotan [Shikota] I., Kurile Is., 4–33 m (KOBJAKOVA, 1958); Taraika [Terpenija] Bay, Sakhalin, 15 m (BRASHNIKOV, 1907); Siranushi [Dal'naja], 20 fms, Otomari [Korsakov], Sakhalin (URITA, 1942); Gulf of Peter the Great, 1.5–128 m (KOBJAKOVA, 1937); Possjet Bay, 1–27 m (KOBJAKOVA, 1967); Hakodate, Muroran, Hokkaido (STIMPSON, 1860; RATHBUN, 1902b); Mutsu Bay, 5–11 fms (YOKOYA, 1930); NE of Todosaki, Iwate Prefecture, 177 m (YOKOYA, 1933); Onagawa Bay, Miyagi Prefecture, 4.6–8.4 m (YOKOYA, 1939); W of Tsugaru Strait, 247 m (YOKOYA, 1933); N of Oga, Akita Prefecture, 145 m (YOKOYA, 1933).

Spirontocaris pectinifera (STIMPSON, 1860)(Fig. 6 *a* – *i*)

- Hippolyte pectinifera* STIMPSON, 1860, p. 35 (104).
Spirontocaris pectinifera BALSS, 1914, p. 42, figs. 23, 24.
Spirontocaris pectinifera KEMP, 1914, p. 124 (list).
Spirontocaris pectinifera YOKOYA, 1930, p. 528.
Spirontocaris pectinifera HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris crassirostris KUBO, 1951, p. 271, figs. 11, 12.
Spirontocaris crassirostris KUBO, 1965, p. 614, fig. 971.

Sea of Japan

Off Atsumi, Yamagata Prefecture, depth 58 m, July 14, 1958, Japan Sea Regional Fisheries Laboratory – 1 ♂, 3 ♀♀ (ZLKU No. 1315).

Pacific Ocean

Off Heta, Izu Peninsula, trawl net, depth 300 m, November 11, 1949 – 1 ♂ (holotype of *Spirontocaris crassirostris* KUBO, TUF).

East China Sea

37°30.0'N, 123°46.2'E, depth 70 m, March 9, 1964, time 05:15, H. YAMASHITA leg. – 2 ♂♂ (ZLKU); 33°09.2'N, 128°01.4'E, depth 158 m, June 18, 1964, time 14:38, H. YAMASHITA leg. – 1 ♂ (ZLKU); 37°30.0'N, 123°14.3'E, depth 68 m, January 29, 1965, time 08:53, H. YAMASHITA leg. – 1 ovig. ♀ (ZLKU); 37°30.0'N, 124°00.0'E, depth 70 m, February 2, 1966, time 02:30, H. YAMASHITA leg. – 1 ♂, 2 ovig. ♀♀, 1 ♀ (ZLKU); 37°33.7'N, 123°34.7'E, depth 70 m, February 2, 1966, time 04:57, H. YAMASHITA leg. – 1 ♂, 3 ♀♀ (ZLKU); 37°27.7'N, 124°27.6'E, depth 75 m, November 7, 1966, time 08:40, H. YAMASHITA leg. – 5 ♂♂, 2 ♀♀ (ZLKU); 37°45.0'N, 123°30.0'E, depth 68 m, November 7, 1966, time 10:16, H. YAMASHITA leg. – 1 ♀ (ZLKU); 37°45.0'N, 123°45.0'E, depth 67 m, November 7, 1966, time 12:06, H. YAMASHITA leg. – 1 ♂, 1 ♀ (ZLKU); 37°00.0'N, 124°15.0'E, depth 76 m, November 9, 1966, time 05:29, H. YAMASHITA leg. – 1 ♀ (ZLKU); 36°30'N, 124°45.0'E, depth 76 m, November 10, 1966, time 08:33, H. YAMASHITA leg. – 1 ♂, 2 ♀♀ (ZLKU); 36°00.0'N, 125°15.0'E, depth 66 m, November 11, 1966, time 22:09, H. YAMASHITA leg. – 1 ♂ (ZLKU).

Description Body moderate in size (Fig. 6*a*). Rostrum subcircular in lateral view; upper margin with 5–30 teeth, of which the posterior two to four teeth are placed on carapace and armed with some secondary teeth; lower margin with two to five teeth; apex bifid or trifid. Carapace dorsally elevated, with usually three supraorbital spines; antennal and pterygostomial spine also well developed; suborbital angle triangularly pointed.

Abdomen dorsally smooth; first five pleura with three to nine marginal spines; sixth somite with a large spine on lateral surface near posterior margin (Fig. 6*a*, *b*). Telson dorsally sulcate with three or four pairs of spines; posterior margin pointed at middle, flanked by two pairs of spines, and posterolateral angles also pointed like posterior spines of telson (Fig. 6*c*).

Eye moderate in size; cornea with a distinct ocellus; eyestalk with stout, sharply pointed spine, which reaches middle of cornea (Fig. 6*d*). Antennular peduncle reaching rostral apex; first segment longer than distal two segments combined; stylocerite pointed, reaching a little beyond end of first segment; second segment with a large outer marginal spine; third segment about half as long as second segment, with a slender dorsal marginal

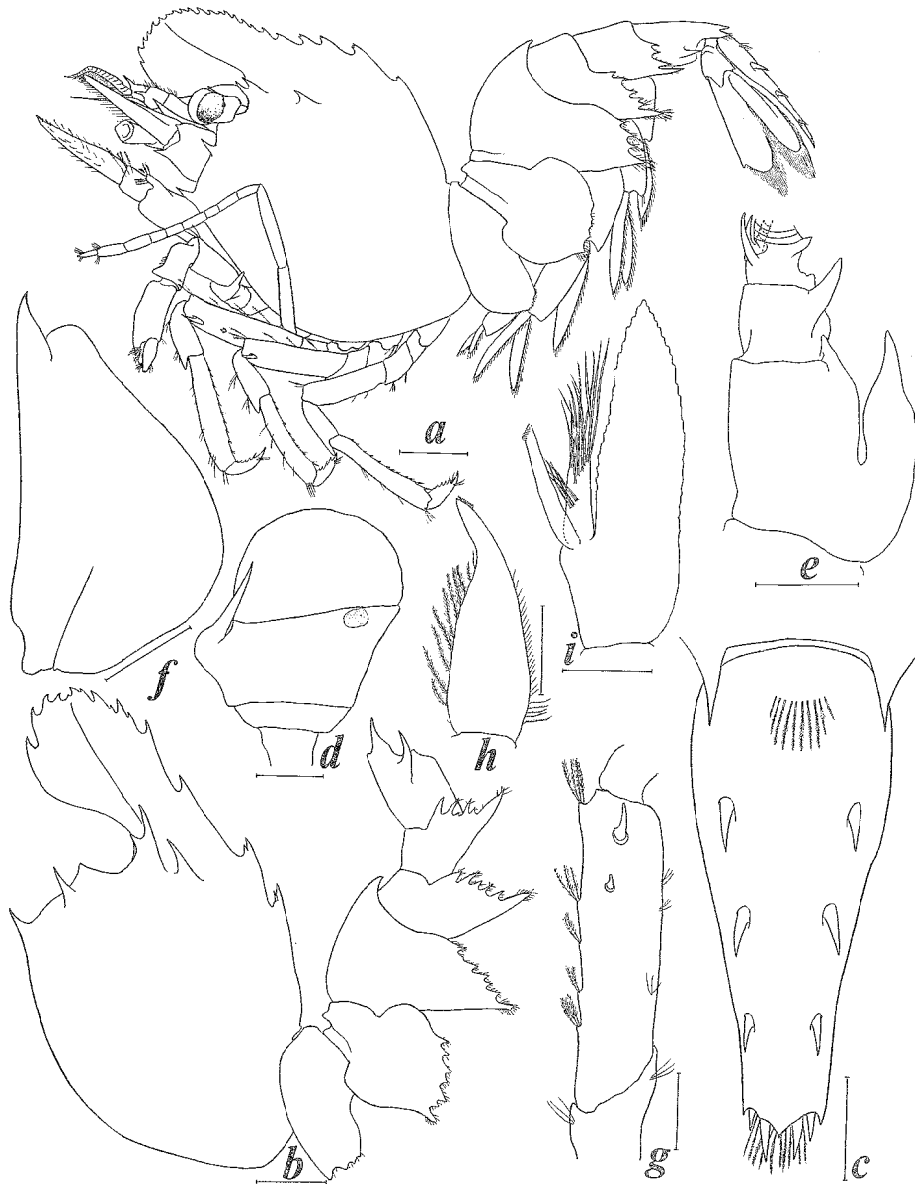


Fig. 6. *Spirontocaris pectinifera* (STIMPSON), *a, c-g* females from East China Sea, *b*, male from Yamagata Prefecture, *h, i*, male from East China Sea; *a*, animal in lateral view; *b*, body in lateral view, *c*, telson, *d*, eye, *e*, antennular peduncle, *f*, antennal scale, *g*, merus of third pereiopod, *h*, male first pleopod, *i*, male second pleopod. Scale for *a* represents 2 mm, scales for *b, c, e-g* represent 1 mm and scales for *d, h, i* represent 0.5 mm.

spine (Fig. 6e). Antennal scale roughly triangular in shape, about twice as long as broad, reaching with distal third beyond rostrum; outer margin straight or slightly concave, ending in a large spine, reaching beyond lamella by its entire length (Fig. 6f). Basicerite with two outer spines, lower more acute than upper; carpocerite reaching to proximal third of scale.

Third maxilliped reaching slightly beyond end of antennal scale. First pereopod stout, reaching just to end of antennular peduncle. Second pereopod slender, reaching with chela beyond antennal scale; carpus subdivided into seven joints. Merus of third pereopod with two or three outer spines (Fig. 6g); merus of fourth pereopod with a single subterminal spine and merus of fifth pereopod unarmed. Dactyli of these three pereopods with four or five spinules on posterior margin.

Uropod as long as telson; outer margin of exopod nearly straight or slightly convex, ending in two spines. Endopod of first pleopod tapering in males (Fig. 6h) and broad in females. Endopod of second pleopod in males with appendix interna and appendix masculina (Fig. 6i).

Remarks The present species is readily distinguished from the other species of this genus by having three supraorbital spines, the pectinated abdominal pleura and the sharply pointed spines on the eyestalk. On the other hand, this species shows the following sexually dimorphic characters.

1) There are 5–7 rostral teeth in males, while 8–13 in the young and 18–30 in mature females. The teeth on the carapace bear 1–5 secondary teeth in males and 3–7 similar teeth in females.

2) The carapace is more elevated in females than in males. The supraorbital spines are smaller in females than in males.

3) The marginal spines of the abdominal pleura are more acute and larger in males than in females.

4) The sternal spines of the abdomen are larger in males than in females, though in ovigerous females these spines disappear except for the preanal one.

5) Females are larger and stouter than males. The carapace length varies from 7.0 to 8.2 mm in ovigerous females, while 5.4 mm is the largest male examined.

These characters of females agree well with the description of *S. pectinifera* given by STIMPSON (1860) and figured by BALSS (1914). Those of males, however, agree curiously with the description of *Spirontocaris crassirostris* KUBO (1951), based upon a single male specimen taken from at a depth of 300 m off Heta, Izu Peninsula. Fortunately the holotype of *S. crassirostris*, which has been deposited at the Tokyo University of Fisheries, could be examined. There are no apparent differences between this holotype and the male specimens examined, and therefore, *S. crassirostris* is treated herewith as a synonym of *S. pectinifera*.

Size Ovigerous females vary from 7.0 to 8.0 mm and the largest male is 5.4 mm in carapace length.

Distribution The species was rather rarely reported in the literature but a considerable number of specimens were collected from the East China Sea at the depths from 66 to

158 m. Hakodate, Hokkaido (STIMPSON, 1860); Mutsu Bay, Aomori Prefecture (YOKOYA, 1930); Zushi, 80–130 m and Yokohama, Kanagawa Prefecture (BALSS, 1914); Heta, Izu Peninsula, 300 m (KUBO, 1951).

Spirontocaris phippisii (KRÖYER, 1841)

- Hippolyte Phippisii* KRÖYER, 1841, p. 575.
Hippolyte turgida KRÖYER, 1841, p. 575.
Hippolyte phippisii DOFLEIN, 1902, p. 637.
Spirontocaris phippisii RATHBUN, 1904, p. 70.
Spirontocaris phippisii HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris phippisii GREVE, 1963, p. 30 (key), 33, fig. 2 C, D.
Spirontocaris phippisii SQUIRES, 1965, p. 42.

Remarks This species described by SQUIRES (1965) and figured by GREVE (1963), and shows the circumpolar distribution (HOLTHUIS, 1947). DOFLEIN (1902) once reported it from Nemuro, Hokkaido, but I could not find any specimen of this species during the present study.

Spirontocaris prionota (STIMPSON, 1864)
 (Fig. 7 a–g)

- Hippolyte prionota* STIMPSON, 1864, p. 153.
Hippolyte prionota SHARP, 1893, p. 117.
Spirontocaris prionota WALKER, 1898, p. 277.
Hippolyte prionota KINGSLEY, 1899, p. 717 (key), fig. 41.
Spirontocaris prionota HOLMES, 1900, p. 206.
Spirontocaris prionota RATHBUN, 1904, p. 9 (list), 56 (key), 61.
Spirontocaris prionota BRASHNIKOV, 1907, p. 147.
Spirontocaris prionota BALSS, 1914, p. 42.
Spirontocaris prionota SCHMITT, 1921, p. 52, fig. 28.
Spirontocaris prionota YOKOYA, 1930, p. 528.
Spirontocaris macrodonta HART, 1930, p. 101.
Spirontocaris prionota DERJUGIN and KOBJAKOVA, 1935, p. 142 (list).
Spirontocaris prionota KOBJAKOVA, 1936, p. 221 (key), figs. 33, 34.
Spirontocaris prionota KOBJAKOVA, 1937, p. 129.
Spirontocaris prionota URITA, 1942, p. 13.
Spirontocaris prionota HOLTHUIS, 1947, p. 8 (list), 23 (foot note), 37 (key).
Spirontocaris macrodonta HOLTHUIS, 1947, p. 23, (list and foot note).
Spirontocaris prionota VINOGRADOV, 1950, p. 199 (key), fig. 34.
Spirontocaris prionota KOBJAKOVA, 1958, p. 227.

North Pacific Ocean

Paramushir Island, Kurile Islands, August 21, 1936, collector unknown – 8 ♂♂, 6 ♀♀ (TUF).

Description Body moderate in size (Fig. 7a). Rostrum lamelliform, more than half as long as carapace in females and slightly shorter in males; dorsal margin minutely serrated with 10–13 spinuliform teeth in males and 31–37 similar teeth in females (Fig. 7b); lower margin with 5–7 small simple teeth near apex. Carapace carinate along almost

whole dorsal margin; dorsal carina with three teeth, which are secondarily serrated with minute teeth; two or three supraorbital spines present; antennal and pterygostomial spine also present; suborbital angle pointed.

Abdomen dorsally smooth; pleura of first two somites with smooth margins in both sexes; pleuron of third somite bluntly pointed in males, while not pointed in females; pleura of fourth to sixth somites acutely pointed posteriorly in both sexes. Telson with four pairs of dorsal spines; posterior margin pointed at middle and flanked by three pairs of spines.

Eye small; cornea shorter than eyestalk, with a distinct ocellus; stalk with a stout, bluntly pointed spine on inner surface (Fig. 7c). Antennular peduncle not reaching rostral apex; stylocerite pointed, reaching a little beyond second segment; stout marginal spine

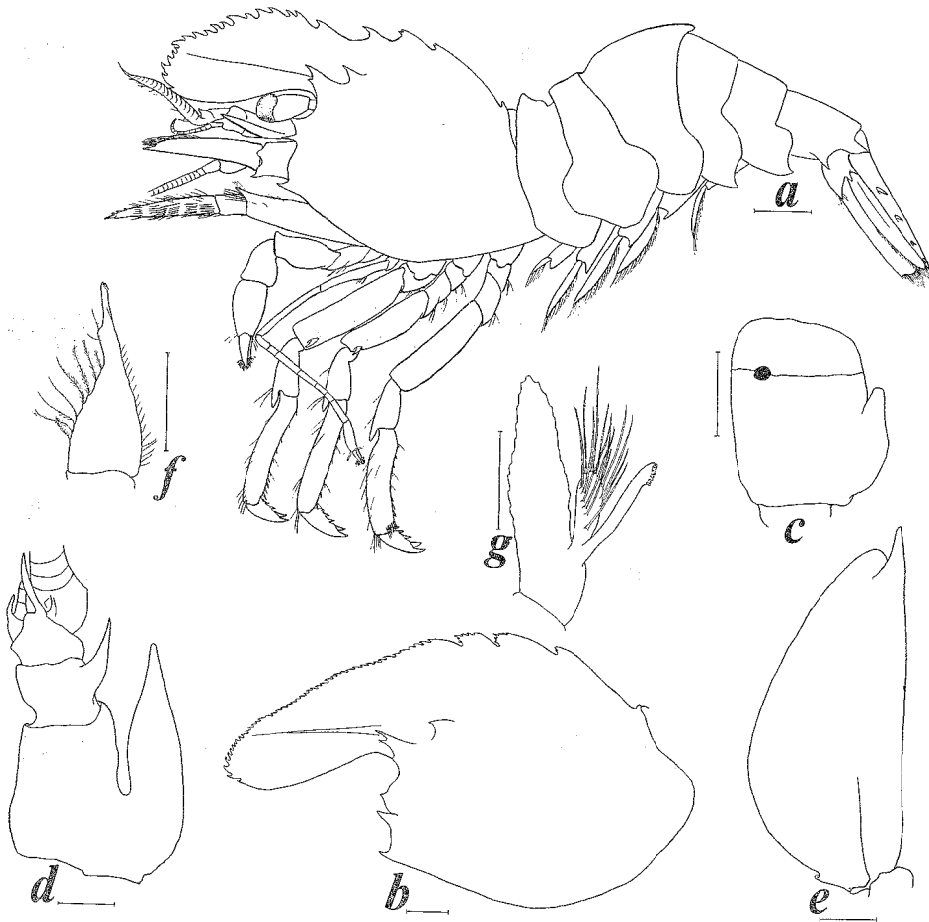


Fig. 7. *Spirontocaris prionota* (STIMPSON), *a, f, g*, males, *b-e*, females from Kurile Islands; *a*, animal in lateral view, *b*, carapace and rostrum, *c*, eye, *d*, antennular peduncle, *e*, antennal scale, *f*, male first pleopod, *g*, male second pleopod. Scales for *a, b* represent 1 mm and scales for *c-g* represent 0.5 mm.

present on each second and third segment (Fig. 7d). Antennal scale triangular in dorsal view, about 2.2 times as long as broad, reaching rostral apex; outer terminal spine large, reaching beyond lamella by its entire length (Fig. 7e). Basicerite with two outer processes, upper bluntly and lower sharply pointed; carpocerite reaching middle of scale.

Third maxilliped reaching with one-third length of ultimate segment beyond antennal scale. First pereopod short and stout, reaching end of antennular peduncle. Second pereopod slender reaching with chela beyond antennal scale; carpus subdivided into seven joints. Merus of third and fourth pereopods with one or two subterminal spines, but sometimes unarmed in fourth pereopod. Fifth pereopod with merus unarmed. Dactyli of last three pereopods with four or five spinules on posterior margin.

Uropod slightly shorter than telson. Endopod of first pleopod tapering with some retinaculæ in males (Fig. 7f) and broad in females. Endopod of second pleopod in males with broad appendix masculina and slender appendix interna (Fig. 7g).

Remarks The present species readily distinguished from the other members of this genus by having three or four supraorbital spines and the peculiar form and spination of the rostrum and carapace.

Size The largest female examined (non-ovigerous) is 7.5 mm in carapace length, 4.5 mm in rostrum length. The largest male examined is 3.6 mm in carapace length, 3.2 mm in rostrum length. The largest specimen in literature is a female, measuring 40 mm in total length, 10.5 mm in carapace length and 6.0 mm in rostrum length (URITA, 1942).

Distribution The species shows an amphipacific distribution. Bering Sea to California, 2–89 fms (RATHBUN, 1904); Alaska, 45 fms (SHARP, 1893); Puget Sound, 2–12 fms (STIMPSON, 1864; WALKER, 1898); False Narros and Departure Bay, 10 fms (HART, 1930); California (HOLMES, 1900; SCHMITT, 1921); Kurile Is., 19–104 m (KOBJAKOVA, 1958); Tatar [Tatarskij] Strait, 120 m (BRASHNIKOV, 1907); Sakhalin (URITA, 1942); Soya [La Perouse] Strait (KOBJAKOVA, 1937); Gulf of Peter the Great, 35–126 m (KOBJAKOVA, 1937); Aomori (BALSS, 1914), Mutsu Bay, Aomori Prefecture, 19 fms (YOKOYA, 1930).

Spirontocaris spinus (SOWERBY, 1805)
(Figs. 8 a–n, and 9 a–h)

- Cancer Spinus* SOWERBY, 1805, p. 47, pl. 23.
Hippolyte Sowerbei LEACH, 1817, pl. 39 figs. 1–10.
Hippolyte spina STIMPSON, 1860, p. 34 (103).
Hippolyte spinus MIERS, 1877, p. 59.
Hippolyte spinus DOFLEIN, 1900, p. 332.
Spirontocaris spinus RATHBUN, 1904, p. 9 (list), 57 (key), 63.
Spirontocaris spinus BRASHNIKOV, 1907, p. 138, fig. 14c.
Spirontocaris spinus KEMP, 1910, p. 103, pl. 14 fig. 1.
Spirontocaris brevidigitata KOBJAKOVA, 1935, p. 88, fig. 3.
Spirontocaris spina subsp. *laevidens* DERJUGIN and KOBJAKOVA, 1935, p. 142 (list).
Spirontocaris brevidigitata DERJUGIN and KOBJAKOVA, 1935, p. 142 (list).
Spirontocaris brevidigitata KOBJAKOVA, 1936, p. 221 (key).

- Spirontocaris spina intermedia* KOBJAKOVA, 1936, p. 221 (key).
Spirontocaris spina laevidens KOBJAKOVA, 1936, p. 221 (key).
Spirontocaris spina intermedia KOBJAKOVA, 1937, p. 126, fig. 7.
Spirontocaris spina laevidens KOBJAKOVA, 1937, p. 127.
Spirontocaris brevidigitata KOBJAKOVA, 1937, p. 128.
Spirontocaris spina URITA, 1942, p. 14.
Spirontocaris brevidigitata HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris spinus HOLTHUIS, 1947, p. 8 (list), 37 (key).
Spirontocaris spina var. *intermedia* HOLTHUIS, 1947, p. 9 (list).
Spirontocaris brevidigitata VINOGRADOV, 1950, p. 200 (key), fig. 38.
Spirontocaris spina intermedia VINOGRADOV, 1950, p. 200 (key), fig. 36.
Spirontocaris spina laevidens VINOGRADOV, 1950, p. 201 (key).
Spirontocaris spinus SQUIRES, 1957, p. 471.
Spirontocaris spina intermedia KOBJAKOVA, 1958, p. 221 (list), 227.
Spirontocaris spinus PIKE and WILLIAMSON, 1961, p. 187, figs. 1, a, b, d-r.
Spirontocaris spinus GREVE, 1963, p. 30, figs. 1, A, C.
Spirontocaris spinus SQUIRES, 1965, p. 39.
Spirontocaris brevidigitata IGARASHI, 1969, p. 5, pl. 4 fig. 12.
Spirontocaris spinus HAYASHI, 1976, p. 18.

Sea of Okhotsk

- Shimshir Island, Kurile Islands, depth 50–60 m, 1937 – 1 ♀ (TUF).
 Off Abashiri, Abashiri, Hokkaido, depth 170–240 m, July 29, 1957, M. YAMAMOTO leg. – 1 ♂, 3 ovig. ♀♀ (ZLKU No. 2407).
 Off Kitami, Hokkaido, September 7, 1966, T. IGARASHI leg. – 1 ovig. ♀ (ZLKU No. 13973).

Sea of Japan

- Off Mashike, Rumoi, Hokkaido, August 29, 1966, T. IGARASHI leg. – 1 ovig. ♀ (ZLKU No. 13975); February 5, 1967, T. IGARASHI leg. – 1 ♀ (ZLKU No. 13977).
 Off Raiden, Shiribeshi, Hokkaido, October 16, 1973, depth 316 m, Kinseimaru leg. – 4 ♀♀ (NSMT-Cr. 5043).
 Off Uozu, Toyama Bay, Toyama Prefecture, September 1950 – 2 ovig. ♀♀ (TUF).
 Off Ishikawa Prefecture, January 24, 1973, H. MOTOH leg. – 3 ovig. ♀♀ (NSMT-Cr. 5040).

Description Body large and robust (Fig. 8a). Carapace carinate along almost whole dorsal margin, with four or five large teeth; anterior first or first two teeth are armed with a few secondary teeth. Rostrum deep; upper margin with many small irregular teeth; apex sharply pointed; lower margin with three to six small teeth. Midaxis straight at base, turned slightly upward near apex. Two supraorbital spines well developed; antennal and pterygostomial spines also present; suborbital angle sharply pointed as large as antennal spine (Fig. 8b, l).

Abdomen dorsally smooth, third somite produced backward as a blunt process; pleura of fourth to sixth somites pointed posteriorly. Telson 1.5–1.6 times as long as sixth somite, with usually four pairs of dorsal spines; posterior margin not acutely pointed, with three pairs of spines.

Eye relatively small, with distinct ocellus. Eyestalk with lobular projection on inner basal surface (Fig. 8c). Antennular peduncle falling short of rostral apex; stylocerite pointed, reaching to or slightly beyond second segment of antennular peduncle; second and third segments very short, each with a small marginal spine (Fig. 8d). Antennal

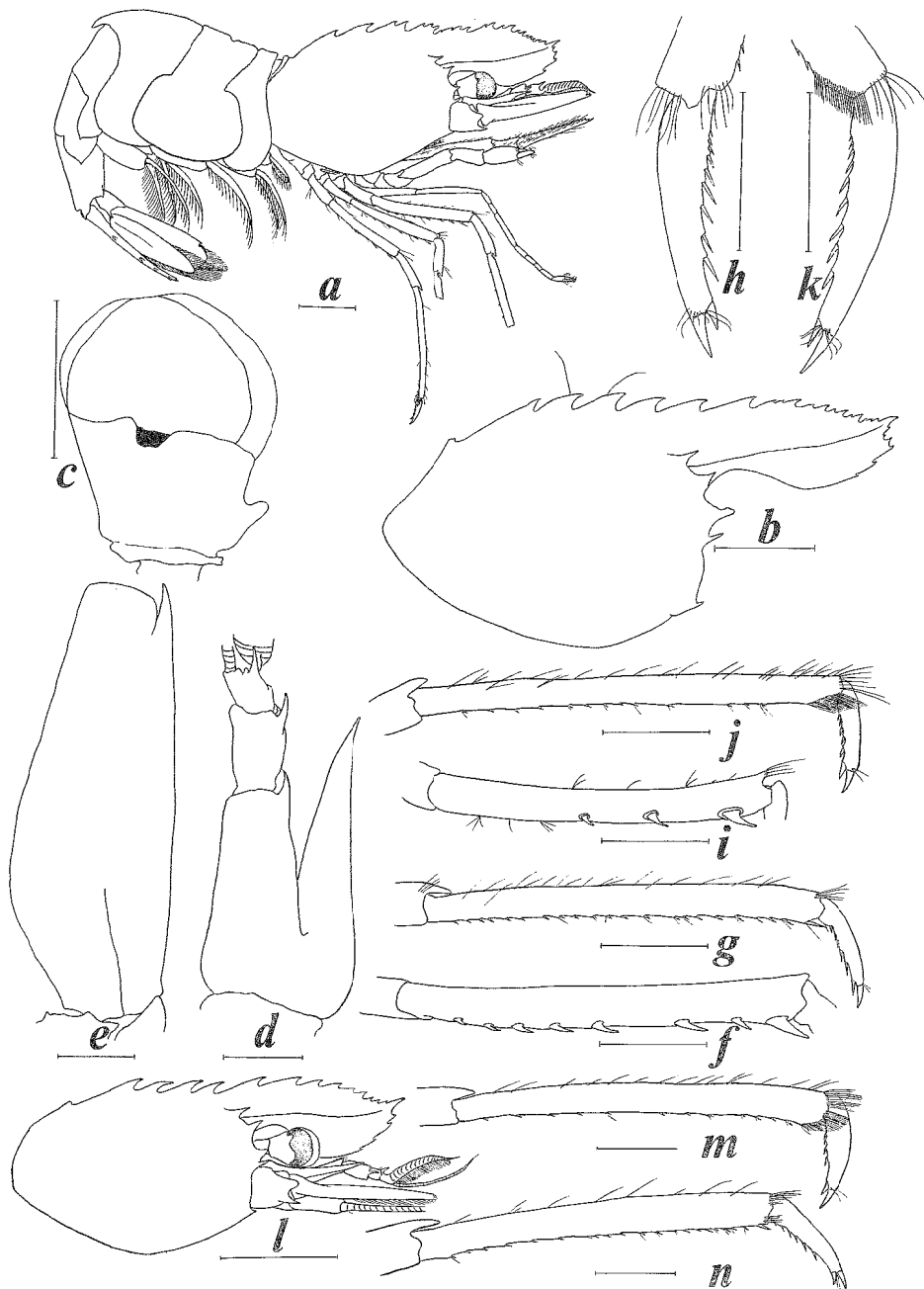


Fig. 8. *Spirontocaris spinus* (SOWERBY), *a-k*, females from Sea of Japan, *l*, male, *m, n*, female from Sea of Okhotsk; *a*, animal in lateral view, *b, l*, carapace and rostrum, *c*, eye, *d*, antennular peduncle, *e*, antennal scale, *f*, merus of third pereiopod, *g, m*, dactylus and propodus of third pereiopod, *h*, dactylus of third pereiopod, *i*, merus of fifth pereiopod, *j, n*, dactylus and propodus of fifth pereiopod, *k*, dactylus of fifth pereiopod. Scales for *a, b*, represent 5 mm and scales for *c-n* represent 2 mm.

scale 2.5 times as long as broad and extending beyond rostral apex; outer distal spine extending beyond lamella (Fig. 8e). Basicerite with two outer spines; carapocerite reaching a little beyond proximal third of scale.

Third maxilliped reaching just to tip of antennal scale. First pereopod short, reaching end of antennular peduncle. Second pereopod slender reaching with chela or distal one or two joints of carpus beyond antennal scale; carpus subdivided into seven joints. Merus of third pereopod with five to eight spines on outer surface (Fig. 8f). Usually four or five spines present on outer surface of merus of fourth pereopod. Propodi of third and fourth pereopods 2.8–4.0 times as long as dactylus (Fig. 8g, h, m). Usually three outer spines present on merus of fifth pereopod (Fig. 8i); propodus of fifth pereopod 2.7–3.6 times as long as dactylus (Fig. 8j, k, n). Uropod slightly longer than telson; protopod with two pointed processes.

Remarks The present 17 specimens belonging to the *spinus* group were collected from the Japanese side of the Sea of Japan and the Sea of Okhotsk. Of these a single male specimen does not apparently show any sexual dimorphism in the shape of the rostrum, carapace and third abdominal somite, though the spination of the rostrum and carapace is rather simplified. Even in the females examined, however, the spinulation of rostrum and carapace are very variable. These specimens may be referred to *S. spinus* (SOWERBY) for following reasons.

KOBJAKOVA (1935) created *S. brevidigitata* from the continental side of the Sea of Japan. As mentioned by him, *S. brevidigitata* resembles *S. lilljeborgii* (DANIELSSEN) but is readily distinguished from that species by the short dactyli of the last three pereopods. In contrast it is very difficult to find any differences between the descriptions both of *S. brevidigitata* and *S. spinus*. Fortunately through the courtesy of Dr. SQUIRES, five specimens of *S. spinus* collected from the Atlantic coast of Canada could be examined (Fig. 9a–h). The following minor differences are present between the Asian specimens and the Atlantic *S. spinus*. 1) The present Asian specimens are larger than the Atlantic *S. spinus*; in the former the carapace length is 10–18 mm in ovigerous females, while in the latter it is 10–12 mm including rostrum (GREVE, 1963), 2) the posterior margin of the third abdominal somite is never produced as the carinated prolonged projection in the Asian specimens, 3) the merus of the fifth pereopod is armed with 1–3, usually 2, spines in *S. spinus* and it is armed with 2–5, usually 3, spines in the Asian material and 4) the propodus of the fifth pereopod varies 2.4–3.4 times as long as the dactylus in the five specimens of *S. spinus* examined, while it is 2.7–3.6 times in the Asian specimens. These differences, however, are small and mostly overlapped each other and therefore seem not to be of any specific value.

KOBJAKOVA (1936 and 1937), moreover, created two new subspecies of *S. spinus* from the North Pacific Ocean; one, *S. s. laevidens*, from the continental side of the Sea of Japan, the other, *S. s. intermedia*, from the Sea of Okhotsk. According to KOBJAKOVA (1937), these two subspecies are separated from the typical *S. spinus* by the following five features; 1) low carapace carina, 2) less produced posterodorsal margin of third abdominal somite, 3) slightly longer rostrum, 4) oval pleuron of second abdominal somite and 5) slightly longer sixth abdominal somite. These differences are also very small and these distinctive characters, except for the feature of the third abdominal somite, are very variable. In all the Asian specimens belonging to the *spinus* group,

the posterodorsal margin of the third abdominal somite is more or less produced but not carinate nor prolonged as in some specimens of the Atlantic *S. spinus*, as mentioned above.

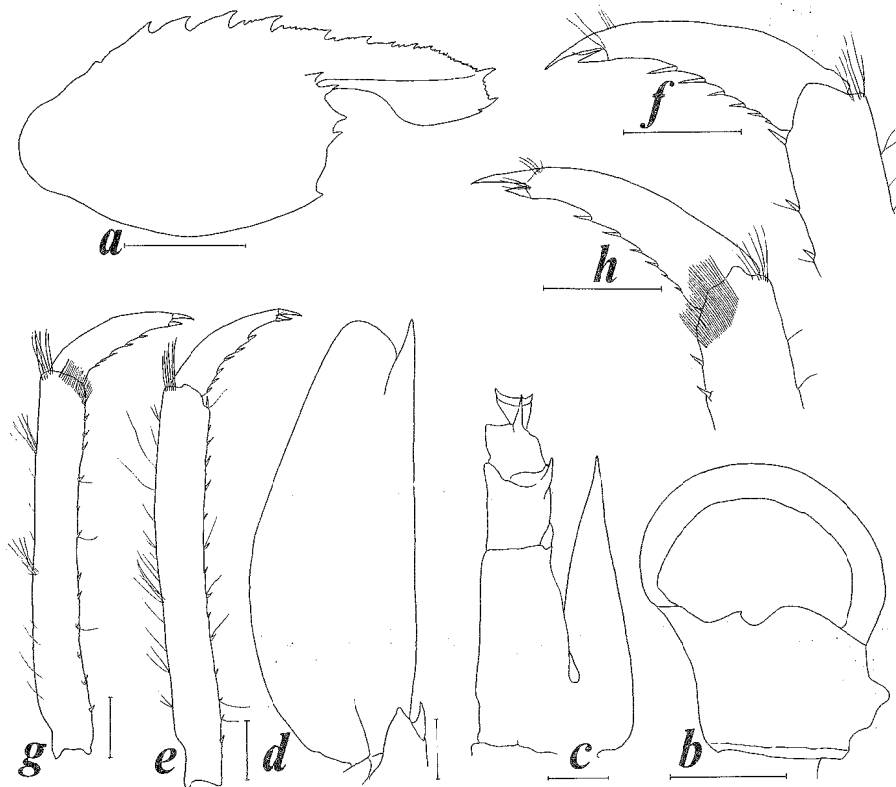


Fig. 9. *Spiroptocaris spinus* (SOWERBY), specimens from Atlantic coast of Canada; *a*, carapace and rostrum, *b*, eye, *c*, antennular peduncle, *d*, antennal scale, *e*, dactylus and propodus of third pereiopod, *f*, dactylus of third pereiopod, *g*, dactylus and propodus of fifth pereiopod, *h*, dactylus of fifth pereiopod. Scale for *a* represents 5 mm and scales for *b-h* represent 1 mm.

It is necessary to discuss the differences between these two subspecies and another species *S. brevidigitata* KOBJAKOVA. According to the keys given by KOBJAKOVA (1936) and VINOGRADOV (1950), the two subspecies differ principally from *S. brevidigitata* in the shape of the rostrum; in the subspecies a large tooth is present on the lower margin of the rostrum, which extends anteriorly to or nearly to the tip of the rostral midaxis. This character, however, seems not to be of specific value, because these two rostral types and an intermediate type are found in specimens of the same haul from the Sea of Japan, though the type of rostrum found in the subspecies is rare.

The distinctions between these two subspecies are the number of teeth on the carapace, the length of the outer spine of the antennal scale, and the posterodorsal end of the

third abdominal somite (VINOGRADOV, 1950). These characters are also very variable, for instance, the carapace is armed with four large teeth in 10 specimens examined five large teeth in 4 specimens and six moderate teeth, seven moderate teeth and twelve small teeth in one specimen, respectively. In most cases there are small teeth on the anterior part of the carapace, in addition to the foremost large tooth. These results may indicate that these two subspecies are identical with each other and also with *S. spinus*.

S. spinus is separated from the Asian species, *S. murdochi*, by the short dactyli of the last three pereopods. More detailed distinctive characters are shown in the account for the latter species.

Size The ovigerous females are 10–18 mm in carapace length and 9.5–14.5 mm in rostrum length. The single male is 9.8 mm in carapace length and 7.4 mm in rostrum length.

Distribution Circumpolar, southward to the northern North Sea, East coast of America, Massachusetts Bay (HOLTHUIS, 1947).

Pacific Ocean: Bering Sea, 10–20 fms (STIMPSON, 1860), Bering Sea, Aleutian Is., 5–91 fms (RATHBUN, 1904), Bering Sea, Sea of Okhotsk, 50–165 m (KOBJAKOVA, 1937), Kamchatka, Shantar Bay (BRASHNIKOV, 1907), Gulf of Peter the Great to Nelma Bay, 75–1380 m (KOBJAKOVA, 1935 and 1937), Otomari [Korsakov], Sakhalin, 16 fms (URITA, 1942), Kunasir [Kunasir], Etorofu [Iturup], Is., 75–390 m (KOBJAKOVA, 1958), off Mashike, Hokkaido (IGARASHI, 1969), off Niigata Pref., Sea of Japan, 100 fms (HAYASHI, 1976).

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Summary

- 1) A taxonomic study is made of the hippolytid genus *Spirontocaris* based upon the material from Japan and its adjacent waters.
- 2) The specific status of all the known species is elucidated and the key is provided for

the identification of them.

3) The following seven known species are recorded from Japan and its adjacent waters; *S. arcuata*, *S. arcuatoides*, *S. murdochi*, *S. ochotensis*, *S. pectinifera*, *S. prionota* and *S. spinus*. *S. phippisii*, which was once reported from Japan, can not be found during the study.

4) Synonyms, description with figures, size and distribution are given for these Japanese species.

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