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STUDIES ON THE CUMACEA (CRUSTACEA, MALACOSTRACA)
OF JAPAN. PART II.

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With 10 Text-Figures

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Family Nannastacidae SPENCE BATE, 1865.

Key to Japanese genera of Nannastacidae.

1. Molar process of the mandible styliform and pointed *Campylaspis*
— Molar process of the mandible stout and truncate 2
2. Eyes, when present, not paired *Cumella*
— Eyes present, paired 3
3. Exhalent respiratory orifices paired *Schizotrema*
— Exhalent respiratory orifices single *Nannastacus*

Genus *Nannastacus* SPENCE BATE, 1865.

The discrimination of species within the genus is very difficult owing to that the sexual dimorphism is very prominent in most species and the specific differences are often slight. ZIMMER (1921) attempted in the remarks of the genus to classify the species into two distinct groups based on the proportional length of the uropod. And further an advanced attempt was made by FAGE (1945). FAGE's table is here a little modified to include some Japanese species marked with an asterisk.

Group I—Uropod with peduncle at least twice as long as telsonic somite. Pseudo-rostrum long.

- N. longirostris* G. O. SARS. *N. lepturus* CALMAN
N. nasutus ZIMMER **N. japonicus* GAMÔ
N. nasutus var. *camelus* ZIMMER

Group II—Uropod with much shorter peduncle. Pseudorostrum short. Uropod with very short exopod and with endopod fringed with rather long hairs, intermingled several spines among them.

(A)—Third maxilliped and first and second peracopods without exopod in the female.

- N. reptans* CALMAN *N. tardus* CALMAN

(B)—Third maxilliped without exopod, and first and second peraeopods with exopod in the female.

- N. suhmii* G. O. SARS *N. zimmeri* CALMAN
**N. gibbosus* CALMAN *N. minor* CALMAN
N. agnatus CALMAN *N. sauteri* ZIMMER
**N. goniatus* GAMÔ **N. nyctagineus* GAMÔ
N. inflatus HALE *N. nichollsi* HALE
N. subinflatus HALE *N. johnstoni* HALE

(C)—Third maxilliped and first and second peraeopods with exopod in the female.

- N. georgi* STEBBING *N. mystacineus* ZIMMER
**N. spinosus* GAMÔ

Group III—Uropod with relatively long exopod and with endopod armed with serrations, which sometimes bears several spines or short hairs, in general intermingled two long hairs among them.

- N. unguiculatus* (SP. BATE) *N. ossiani* STEBBING
N. pardus CALMAN *N. hansenii* CALMAN
N. brevicaudata CALMAN *N. stebbingi* CALMAN
N. stebbingi var. *deformis* FAGE
N. erinaceus ZIMMER *N. stephensi* FAGE
N. sheardi HALE **N. rigida* GAMÔ
**N. umbellulifer* GAMÔ

Key to Japanese species of *Nannastacus*

1. Uropod with peduncle at least twice as long as telsonic somite, pseudorostrum very long *N. japonicus*
- Uropod with peduncle less than twice as long as telsonic somite, pseudorostrum not very long 2
2. Exopod of uropod very short 3
- Exopod of uropod relatively long 6
3. Dorsum of pleon somites, at least the first or more, with spiniform granules 4
- Dorsum of pleon somites without conspicuous spiniform granules *N. gibbosus*
4. Surface of carapace with glassy spiniform granules *N. pruinus* (♂)
- Surface of carapace without glassy spiniform granules 5
5. Basis of first peracopod less than 1/2 of the length of remaining distal segments together *N. goniatus* (♂)

- Basis of first peracopod as long as 2/3 of the length of remaining distal segments together *N. nyctagenus* (♀)
- 6. Dorsum of pleon with series of conspicuous spines 7
- Dorsum of pleon without spines, but with small granules *N. umbellulifer*
- 7. Carapace spinose, lower margin of pseudorostrum with 3 or 4 spines 8
- Carapace not spinose, lower margin of pseudorostrum without spines, side plates of 2-5 pedigerous somites with flattened hyaline spines *N. pectinatus* (♂)
- 8. Exopod of uropod much less than 1/2 as long as endopod, carapace covered with relatively shorter spines *N. spinulosus* (♂)
- Exopod of uropod a little more than 1/2 as long as endopod, carapace covered with relatively long spines *N. spinosus* (♂)

Nannastacus japonicus GAMÔ

(Fig. 12)

Nannastacus sp., GAMÔ 1960c, p. 118, pl. 59, fig. 6 (♂ coloured).

N. japonicus GAMÔ 1962b, p. 168, figs. 10-11; 1965c, p. 534, fig. 699.

Length, about 2 mm: The colour of body in life is yellowish and beset with a reddish pigment on both lateral sides of the base of the pseudorostrum and the posterior dorso-lateral margin of the carapace. The eyes are reddish pigmented. The pseudorostrum of the male is long, nearly one-fourth of the carapace length; the antero-lateral margin of the carapace is very short and meets the lower margin nearly at straight angle.

Adult female with marsupium (length, about 2.3 mm); about 20 embryos (each is measured about 0.21×0.13 mm in diameter) are carried in it. The female is very like the male in general at a glance, but the antero-lateral corner of the carapace is very conspicuously projected and subacute. The carapace is almost triangular in shape as seen from above; the surface is covered with fine scale-like granules (Fig. 12, C). There is a depressed area a little below the frontal lobe on each side of the carapace. The length of the carapace is a little less than two-sevenths of the total length of the animal and much more than twice the depth, which is much less than the width. The pseudorostrum is long, much longer than one-fifth of the carapace. The antero-lateral margin is well sinuated and the antero-lateral angle is much produced as a horn-like projection.

The length of all the free thoracic segments is about two-thirds of the carapace length. The first segment is exposed. The second segment is the widest of all the segments. The side plates are rather prominent.

The abdomen is slightly longer than the carapace. The first four segments are successively increased in length; the fifth is the longest and about one and a half times the length of the last segment.

The first segment of the peduncle of the antennule is much shorter than the distal two segments combined. The second segment is shorter than the third. The main flagellum is two-segmented and provided with a small protuberance like a

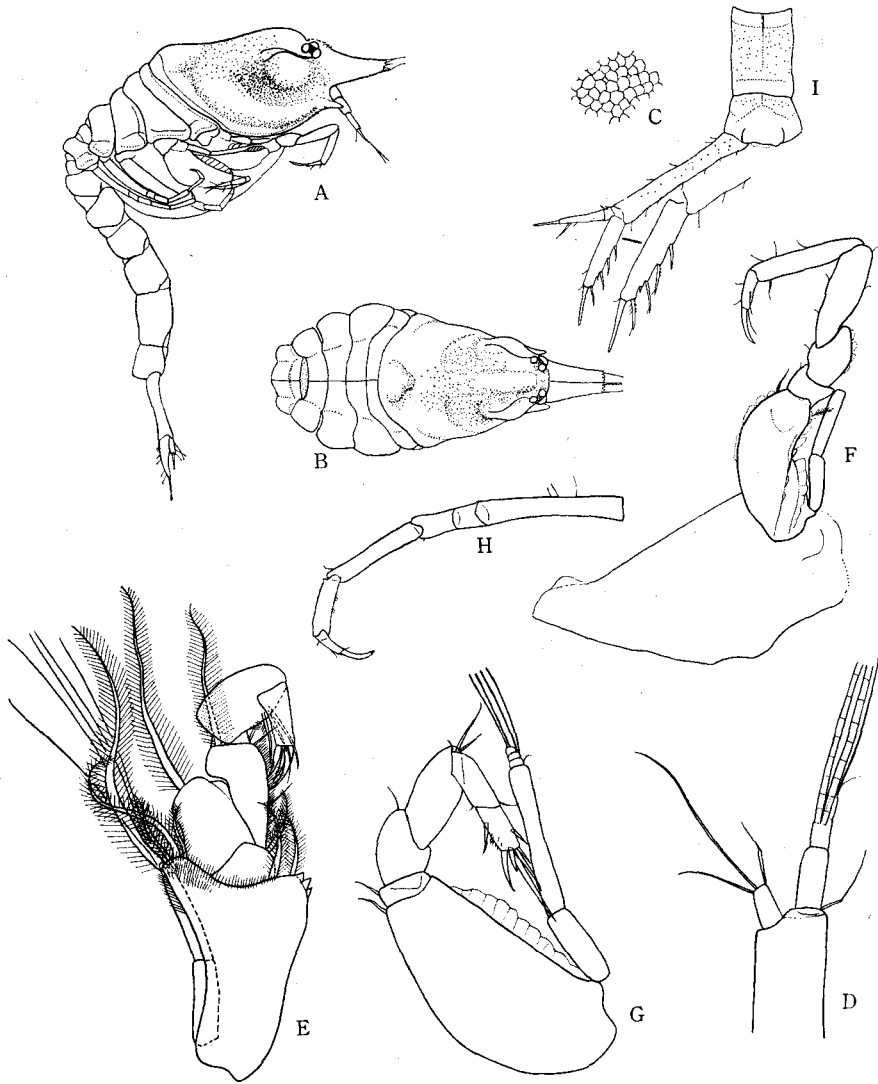


Fig. 12. *Nannastacus japonicus* GAMÔ. Ovigerous adult female (length, ca. 2.3 mm). A: lateral view. B: anterior portion of body, from above. C: texture of carapace surface. D: distal portion of antennule. E: third maxilliped. F-G: first and second pereopods. H: fifth pereopod. I: uropod with two last abdominal segments.

segment and two long aesthetascs at its distal end.

The basis of the third maxilliped is nearly two-thirds of the distal segments together (Fig. 12, E).

The basis of the first pereopod is a little more than one-half as long as the distal segments together. The carpus is subequal to the length of the propodus. The

dactylus is one-third as long as the propodus and provided with a stout claw at its distal end. The basis of the second peraeopod is robust, and nearly as long as the distal segments together. The basis of the fifth peraeopod is more than a half length of the distal segments together. The first, second and fifth peraeopods are shown as in Fig. 12, F-H.

The peduncle of the uropod is nearly three times the length of the last abdominal segment. The endopod is about a half length of the peduncle and bears three spines on the inner border and a stout spine at its apex. The exopod is nearly two-thirds as long as the endopod and bears an end spine.

Material: 1 ♀ (ovigerous); night surface plankton, Zushi in Sagami Bay; 11 January, 1959.

Remarks: The male of this species is very closely allied to that of *N. longirostris* SARS (SARS, 1879; STEBBING, 1913; FAGE, 1951), *N. brachydactylus* CALMAN (CALMAN, 1905a) and *N. nasiutus* var. *camelus* ZIMMER (ZIMMER, 1914; HALE, 1945). The former may be distinguished from the latter three as follows: The pseudorostrum of *longirostris* is much longer than that of the species; in *brachydactylus* the peduncle of the uropod is about two and a half times as long as the last abdominal segment and a little more than one and a half times the length of the endopod; the carpus of fifth peraeopod of *nasiutus* var. *camelus* is more than three times as long as the merus, which is almost as long as the propodus.

Distribution: Sagami Bay, Kii Peninsula, Sado Island. Tsuyazaki (northern coast of Kyushu), Amakusa.

Nannastacus pruinosus GAMÓ

Nannastacus pruinosus GAMÓ 1962b, p. 171, figs. 12-13.

Distribution: Osyoro Bay (Hokkaido), Kii Peninsula (Shirahama); night surface plankton.

Nannastacus gibbosus CALMAN

Nannastacus gibbosus CALMAN 1911, p. 356, pl. 33, figs. 16-21.

N. gibbosus, FAGE 1945, p. 196, figs. 21, 22.

N. nudus GAMÓ 1962b, p. 173, figs. 14, 15.

N. gibbosus, GAMÓ 1963a, p. 45, figs. 11, 12.

Distribution: Kii Peninsula (Shirahama), Amami-Oshima I.; Viet Nam, Gulf of Siam.

Nannastacus goniatus GAMÓ

Nannastacus goniatus GAMÓ 1962b, p. 175, figs. 16, 17.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Nannastacus nyctageneus GAMÔ

Nannastacus nyctageneus GAMÔ 1962b, p. 178, figs. 18, 19.

Distribution: Kii Peninsula (Shirahama), night surface plankton.

Nannastacus pectinatus GAMÔ

Nannastacus pectinatus GAMÔ 1962b, p. 180, figs. 20, 21.

Distribution: Kii Peninsula (Shirahama), Sado I.; night surface plankton.

Nannastacus spinulosus GAMÔ

(Colour Pl., fig. 5)

Nannastacus spinulosus GAMÔ 1962b, p. 183, figs. 22, 23.

Distribution: Kii Peninsula (Shirahama), Sado I.; night surface plankton.

Nannastacus spinosus GAMÔ

Nannastacus spinosus GAMÔ 1962b, p. 186, figs. 24, 25.

Distribution: Sagami Bay, Kii Peninsula (Shirahama).

Nannastacus umbellulifer GAMÔ

Nannastacus umbellulifer GAMÔ 1963a, p. 48, figs. 13-15.

Distribution: Amami-Oshima I.; coral sandy beach, depth about 1 m at ebb tide.

Genus *Schizotrema* CALMAN, 1911.

Nineteen species have been described from the tropical and southern temperate regions of the Indo-Pacific. Only one species, *S. sakaii* is described from Japan.

Schizotrema sakaii GAMÔ

(Colour Pl., fig. 6)

Schizotrema sakaii GAMÔ 1964d, p. 249, figs. 6, 7; 1965, p. 535, fig. 700.

Female with marsupium, length about 1.1 mm. The colour in life is rather dark. The carapace is covered with minute spinules and ornamented symmetrically with rows of large spatulate hyaline spines. The free thoracic segments are somewhat expanded laterally and fringed with large lateral spines. Each of the abdominal

segments is furnished with a row of lateral spines on each side and two rows of dorsal spines; the last spine of each dorsal row is long, flattened and spatulate.

Distribution: Sado I.; night surface plankton.

Genus *Cumella* G. O. SARS, 1865.

Key to Japanese species of *Cumella*.

1. Telsonic segment longer than the preceding segment; exopod of uropod nearly a half length of its endopod *C. glabera* (♂) 2
- Telsonic segment not longer than preceding segment; exopod of uropod nearly as long as its endopod 2
2. Dorso-median carina of carapace with three or four teeth 3
- Dorso-median carina of carapace without teeth 5
3. Carapace with four teeth 4
- Carapace with three teeth, the anterior one on the frontal lobe, the median on the cardiac region, and the posterior near the rear margin; peduncle of uropod about 1-1/2 times the length of telsonic somite *C. arguta* (♂)
4. Carapace with two teeth on the frontal lobe, the median tooth on the cardiac region, the hindmost one near the posterior margin, besides an oblique ridge on each side; peduncle of uropod a little longer than telsonic somite *C. quadruplicata*
- Carapace with four teeth only on the anterior portion, without any ridge on each side; peduncle of uropod about 1-3/4 times the length of telsonic somite *C. scabera* (♂) 6
5. Surface of carapace with alveolate sculptures and pitted 6
- Surface of carapace covered with minute spiniform granules *C. rigida*
6. Exopod of uropod as long as endopod *C. alveata* (♂)
- Exopod of uropod much shorter than endopod *C. sadoensis* (♀)

Cumella glabera GAMÔ

Cumella glaberata GAMÔ 1962b, p. 189, figs. 26, 27.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Cumella scabera GAMÔ

Cumella scabera GAMÔ 1962b, p. 192, figs. 28, 29.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Cumella rigida GAMÔ

Cumella sp., GAMÔ 1962b, p. 179, figs. 32, 33.

C. rigida GAMÔ 1963a, p. 53, figs. 16-18.

Distribution: Kii Peninsula (Shirahama), Amami-Ôshima I.

Cumella arguta GAMÔ

Cumella arguta GAMÔ 1962b, p. 195, figs. 30, 31.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Cumella quadriplicata GAMÔ

Cumella quadriplicata GAMÔ 1965a, p. 15, figs. 8-10.

Distribution: Akkeshi Bay (Hokkaido); muddy bottom, 1-3 m deep.

Cumella alveata GAMÔ

Cumella alveata GAMÔ 1964a, p. 26, figs. 1-2.

Distribution: Sagami Bay (Hayama); sandy bottom, just below the low water level.

Cumella sadoensis sp. nov.

(Figs. 13, 14)

Cumella sp., (2), GAMÔ 1967, p. 27, 29 pl. 1, fig. 14.

Adult female holotype with developing marsupium (length, about 1.9 mm): The carapace is narrow triangular in shape as seen from above and much depressed laterally. The surface of the carapace is covered with small areolate patterns and pitted. A longitudinal carina with a suture-like line is well marked along the full length of the dorso-median line and much more raised in the middle portion. At the end of the postero-dorsal portion of the median carina, a pair of lateral carinae originate; each runs a little away from and almost parallel to the lower margin of the carapace, gradually diminishing towards the antero-lateral portion. The postero-lateral portion of the carapace is rather overlapped over the dorsum of the first two free thoracic segments. The length of the carapace is nearly three-sevenths of the total animal length and about twice the width, which is much less than the depth. The antennal notch is large and deeply sinuated. The antero-lateral corner is almost rectangular with a rounded apex. The lateral or lower margin of the carapace is finely serrate. The pseudorostral lobes meet in front of the ocular lobe for a distance about two-thirds of the length of the ocular lobe. The ocular lobe is rather large, rounded and provided with obscure ocelli.

The length of all the free thoracic segments is a little less than the carapace and their dorsum is furnished with a dorso-median suture-like line. The first two segments are very short and exposed; their dorsa are much depressed backwards. The side plates are prominent.

The abdomen is nearly a half length of the animal. The first four segments are approximately of the same size. The fifth is the longest, about twice the length of the fourth and nearly one and one-third times as long as the last abdominal segment.

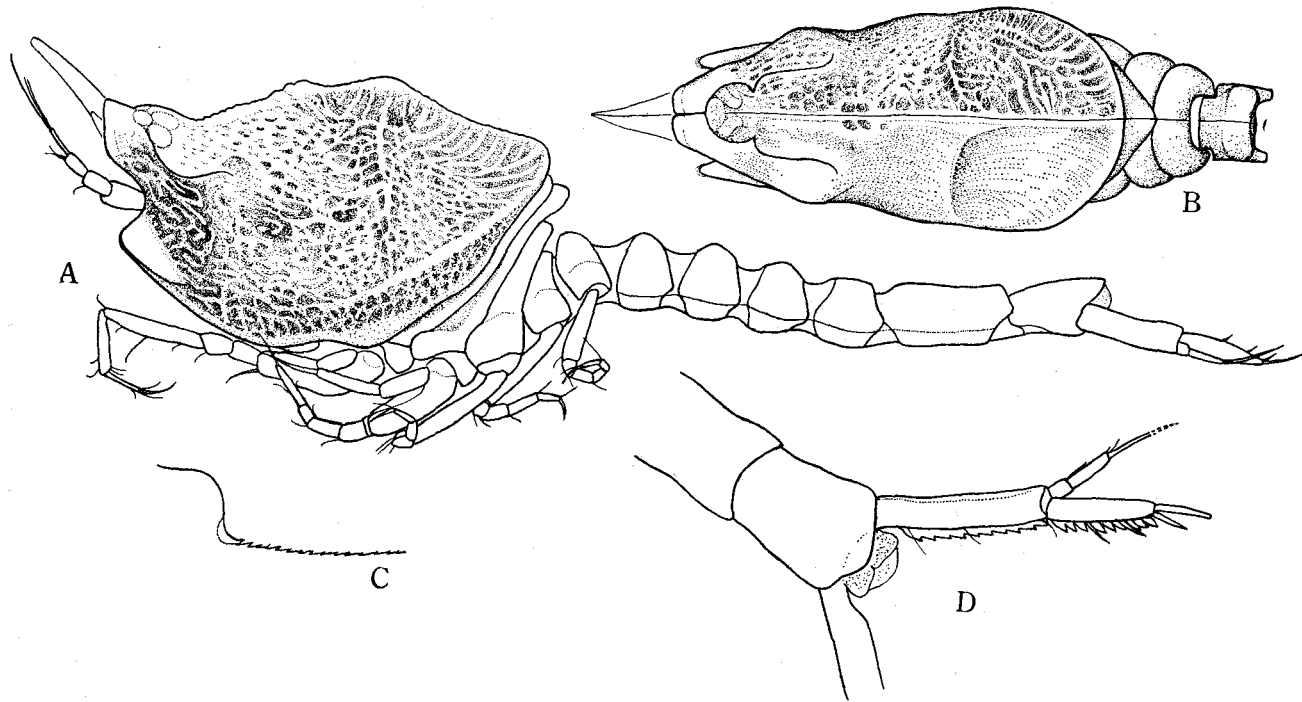


Fig. 13. *Cumella sadoensis* sp. nov., holotype adult female with developing marsupium (length, ca. 1.9 mm). A: lateral view. B: anterior portion of body, from above. C: antero-lateral margin of carapace. D: uropod with last two abdominal segments.

The first segment of the peduncle of the antennule is much shorter than the distal two segments combined. The second segment is a little longer than the third. The main flagellum is two-segmented and bears a long aesthetascs. The accessory flagellum is rather large and bears one segment.

The basis of the third maxilliped is nearly one and one-fifth times the length of the distal segments together and its outer distal angle is produced as a large prolongation with two long plumose hairs. The ischium is very short. The carpus is about three-fourths as long as the merus and a little shorter than the propodus. The dactylus is about a half length of the propodus.

The basis of the first peraeopod is a little longer than the distal segments together. The ischium is slightly longer than three-fourths of the merus. The carpus is very long, a little more than twice as long as the merus. The dactylus is two-thirds as long as the propodus which is nearly a half length of the carpus.

The basis of the second peraeopod is much shorter than the distal segments together. The ischium is very short. The dactylus is nearly one and two-thirds times the length of the propodus and bears five unequal apical setae.

The basis of the third peraeopod is much longer than the distal segments together. The basis of the fourth peraeopod is about two-thirds as long as the distal segments together. The basis of the fifth is about three-fifths the length of the distal segments combined.

The peduncle of the uropod is a little longer than the last abdominal segment; the inner border is serrate and bears three setae. The endopod is about two-thirds the length of the peduncle and bears three spines which are interspaced with three large teeth on the inner border, in addition a rather stout apical spine. The exopod is about two-thirds as long as the endopod and bears a long apical spine.

Material: 1 ♀ (with developing marsupium), collected by a subsurface haul at night, off Sado Marine Biological Sta., Niigata University, Sado I.; 26 Oct., 1962.

Remarks: The specific name, *sadoensis* is derived from the Sado Marine Biological Station of the Niigata University. The new species closely resembles *C. alveata* GAMÔ (1964a), from which it may be distinguished by having the different sculpture on the carapace.

Cumella sp. (A)

Cumella sp., ZIMMER 1943, p. 133.

An adult male specimen collected at Yeno-Ura in Suruga Bay was recorded by ZIMMER (1943), but without the exact specific identification, as the specimen was in an imperfect condition.

Cumella sp. (B)

Cumella sp., GAMÔ 1965b, p. 191.

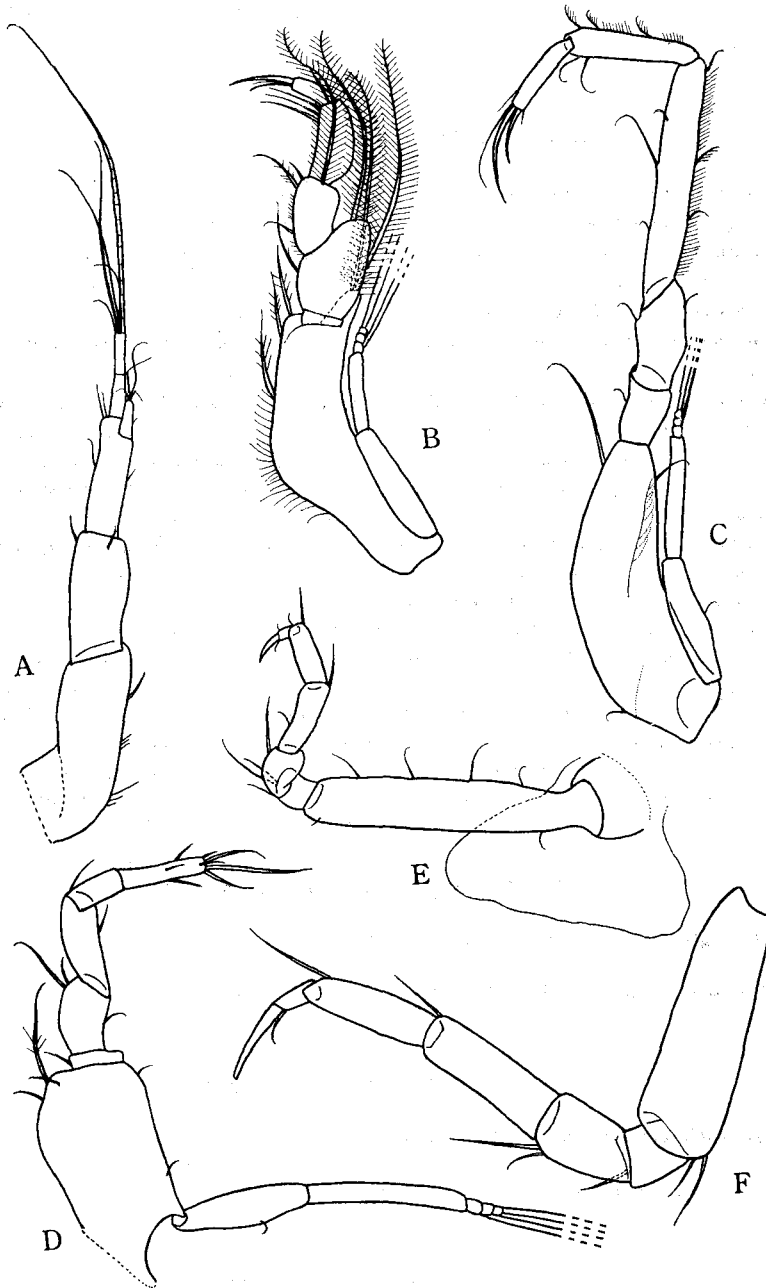


Fig. 14. *Cumella sadoensis* sp. nov., holotype adult female with developing marsupium. A: antennule. B: third maxilliped. C-E: first to third pereopods. F: fifth pereopod.

Juvenile specimens were taken from Akkeshi Bay. They are somewhat related to *C. rigida* GAMÔ, but exact specific identification is impossible, as the specimens are all juvenile.

Genus *Campylaspis* G. O. SARS. 1865.

Key to Japanese species of *Campylaspis*.

1. Carapace smooth, without tubercles, carinae, spinules or furrow 2
— Carapace not smooth, with tubercles, carinae, spinules or furrow 4
2. Merus of 3rd maxilliped not robust *C. angularis*
— Merus of 3rd maxilliped robust 3
3. Dactylus of 2nd peraeopod elongate, as long as carpus and propodus combined
..... *C. amblyoda*
— Dactylus of 2nd peraeopod shorter than carpus and propodus combined *C. kiiensis* (♂)
4. Carapace with a pair of oblique furrows 5
— Carapace with furrows or carinae and tubercles or spinules combined 7
5. Dactylus of 2nd peraeopod with rounded distal end with only very short spines or setae *C. fusiformis*
— Dactylus of 2nd peraeopod with normal distal end with rather long distal spines or setae 6
6. Carapace with three pairs of short sub-median dorsal lines *C. striata*
— Carapace without short sub-median dorsal lines *C. pumila*
7. Carapace spinulose, with a pair of furrows *C. reticulata*
— Carapace not spinulose 8
8. Carapace granulose, with a pair of very shallow furrows *C. granulata*
— Carapace carinate or tuberculose, or both combined 9
9. Carapace with 2 pairs of lateral carinae *C. sinuosa*
— Carapace with tubercles *C. sagamiensis* sp. nov.

Campylaspis angularis GAMÔ

Campylaspis angularis GAMÔ 1960d, pp. 377, 384, figs. 9, 10.

Distribution: Sagami Bay (off Manazuru, sandy bottom).

Campylaspis amblyoda GAMÔ

Campylaspis amblyoda GAMÔ 1960d, p. 377, 385, figs. 11, 12.

Distribution: Sagami Bay (off Manazuru).

Campylaspis kiiensis GAMÔ

Campylaspis kiiensis GAMÔ 1960b, p. 154, figs. 1, 2.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Campylaspis fusiformis GAMÔ

Campylaspis fusiformis GAMÔ 1960d, pp. 370, 380, figs. 3, 4.

Distribution: Sagami Bay, Tosa Bay (Usa); night surface plankton.

Campylaspis striata GAMÔ

Campylaspis striata GAMÔ 1960d, pp. 372, 381, figs. 5, 6.

Distribution: Sagami Bay (Zushi); night surface plankton.

Campylaspis pumila GAMÔ

Campylaspis pumila GAMÔ 1960b, p. 158, figs. 5, 6.

Distribution: Kii Peninsula (Shirahama); night surface plankton.

Campylaspis reticulata GAMÔ

(Colour Pl., fig. 7)

Campylaspis reticulata GAMÔ 1960d, pp. 369, 379, figs. 1, 2.

Distribution: Sagami Bay (off Yoshihama); sandy bottom.

Campylaspis sinuosa GAMÔ

Campylaspis sinuosa GAMÔ 1960d, pp. 374, 383, figs. 7, 8.

Distribution: Sagami Bay (off Yoshihama); sandy bottom, 70 m deep.

Campylaspis granulata GAMÔ

Campylaspis granulata GAMÔ 1960b, p. 155, figs. 3, 4(♀); 1964a, p. 24, figs. 7, 6(♂)

Distribution: Sagami Bay (near Misaki), Kii Peninsula (Shirahama); night surface plankton.

Campylaspis sagamiensis sp. nov.

(Figs. 15, 16)

Immature male holotype (length, about 8.8 mm): The body integument is well calcified and hardened. The specimen preserved in alcohol has many small reddish spots which are clearly visible at the base of large tuberculate protuberances found on the carapace, free thoracic and abdominal segments, also on the segments of uropods and partly on the basis of pereopods.

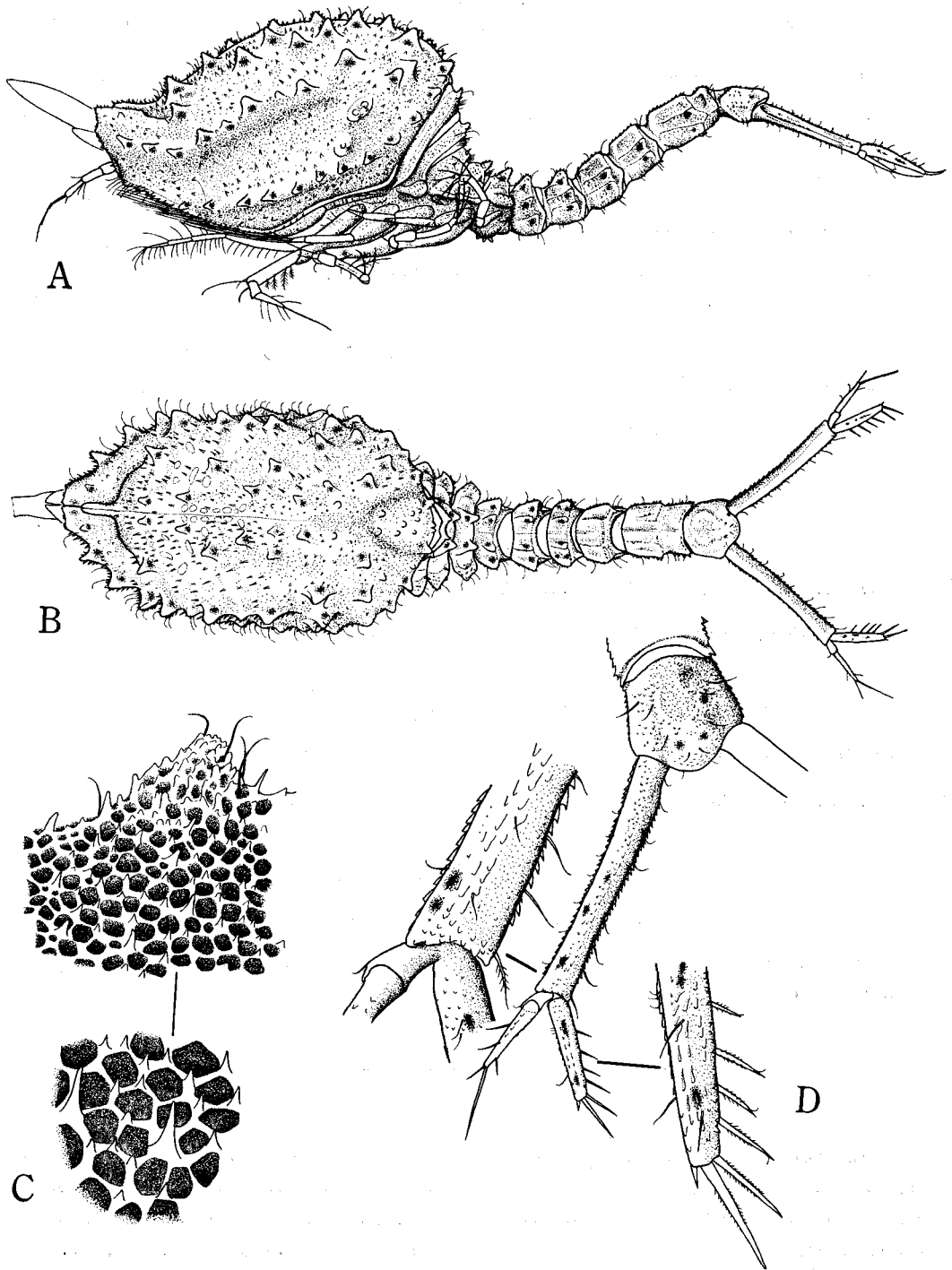


Fig. 15. *Campylaspis sagamiensis* sp. nov., holotype subadult male (length, ca. 8.8 mm). A: lateral view. B: dorsal view. C: sculptures of carapace surface. D: uropod with last abdominal segment.

The carapace is much raised towards the postero-dorsal portion as seen from the side and ellipsoidal in shape with straight lateral borders as seen from above and the median postero-dorsal portion is a little swollen. The surface is covered with spinules and sparse fine hairs; horn-like large tuberculate protuberances are distributed rather regularly and a suture-like dorso-median line is visible on the anterior portion. Under a high magnification large tuberculate protuberances and the surface texture are well confirmed as shown in Fig. 15, C. There are about eleven pellucid spots on the posterior portion of the frontal lobe. There is a rather wide shallow depressed area on each lateral side of the carapace. The length of the carapace is nearly half the length of the total length of the animal and more than one and one-half times the width, which is slightly more than the depth. The antennal notch is obsolete, only slightly sinuated. The ocular lobe is very narrow and digitiform without distinct ocelli. The pseudorostral lobes meet in front of the ocular lobe for a distance nearly two-thirds the length of the ocular lobe and its apex is widely truncated.

The total length of the free thoracic segments is nearly one-third the length of the carapace. A pair of tuberculate protuberances are on the dorsum of each segment. The first segment is exposed dorsally and laterally. One or two spinules are on the dorso-lateral surface of the third and fourth segments. The side plates are well marked and furnished with fine spiniform granules and sparse hairs. The third to fifth segments are successively narrowed towards the rear.

The abdomen is two-fifths as long as the animal. Each of the first five segments has a pair of tuberculate or carinate protuberances on the dorsum and two longitudinal ridges on the lateral side. The first two segments are very like the fifth free thoracic segment and approximately of the same size. The fifth segment is the largest and a transverse notch is clearly marked at about the posterior one-third. The sixth segment is nearly about three-fourths as long as the fifth, its posterior margin is rounded.

The first segment of the peduncle of the antennule is nearly three-fourths the length of the distal two segments combined. The third segment is a little shorter than three-fourths as long as the second segment. The main flagellum is long, three-segmented and more than one and a half times the length of the third peduncular segment and bears two aesthetascs. The accessory flagellum is minute and two-segmented.

The antenna is not yet fully developed and the flagellum barely reaches to the level of the base of the second pereopod in the natural position.

The mandibles are widened and truncated at base and furnished with styliform molar process; there are five plumose spines and three setules on the right mandible, and four plumose spines, three setules, and a lacinia mobilis on the left mandible.

The maxillula is as shown in Fig. 16, D.

The terminal segment of the first maxilliped is very small and furnished with



Fig. 16. *Campylaspis sagamiensis* sp. nov., holotype subadult male. A: antennule. B: antennal flagellum. C: mandibles. D: maxillula. E-G: first to third maxillipeds. H-L: first to fifth pereopods.

two setules at the apex and with hairs on both lateral borders. The penultimate segment is very broad, largely lamellated, and fringed with fine hairs on the lateral borders, in addition one plumose seta near the outer margin. The branchial apparatus bears about forty-one leaflets and one accessory lobule.

The second maxilliped is as shown in Fig. 16, F. The distal segment bears two long and one minute teeth and the penultimate segment has a long tooth on the outer and one rather broad tooth on the inner border. The antipenultimate segment has a small tooth on the distal portion of the inner border.

The basis of the third maxilliped is about as long as the remaining distal segments together and bears fine hairs on both lateral borders and several small teeth on the distal part of the inner border. The ischium is rather short and two teeth on the inner border. The merus is slender and a little shorter than the distal three segments combined. The carpus is one-third as long as the merus. The propodus is nearly one and a half times the length of the merus and one-half as long as the dactylus.

The first peraeopod is one and one-seventh times the length of the third maxilliped. The basis is less than the length of the distal segments together. The ischium is short and distinct. The merus is rather slender, one and one-fifth times as long as the carpus which is nearly one and one-third times as long as the propodus. The dactylus is nearly three-fourths the length of the propodus.

The second peraeopod is a little less than the length of the first one. The basis is robust in the middle portion, a little serrate on the distal portion of the lateral borders and about two-thirds as long as the distal segments together. The ischium is short and distinct. The merus is about a half length of the carpus. The dactylus is about subequal to the length of the carpus and bears plumose setae on the lateral borders and also at the apex.

The third peraeopod is about four-fifths the length of the second and its basis is nearly two-thirds as long as the distal segments together. The fourth peraeopod is one and one-seventh times as long as the third and its basis is subequal to the length of the distal segments together. The fifth peraeopod is nearly two-thirds as long as the fourth and the length of the basis is nearly two-thirds the combined length of the distal segments. The first four pairs of peraeopods bear well developed exopods.

The dorsal surface of the segments of the uropod is furnished with several rows of irregular granulate tubercles. The peduncular segment is more than two times as long as the last abdominal segment, serrate on the lateral borders with eight or ten fine setules. The endopod is two-fifths the length of the peduncle, serrate on the inner border and furnished with four plumose spines. Its distal end bears three unequal spines, the middle one is large and outer ones are minute. The exopod is slightly shorter than the endopod, and furnished with two spines on the outer border, one small spine on the distal portion of the inner border, and two unequal spines at the apex; the inner apical spine is very prominent, longer than the exopod itself.

Material: 1 ♂ immature (holotype); KT 64-17, Plankton Rec. -2; Sagami

Bay (35°6'30" N, 139°17' E); maximum depth about 1000 m, collected by an oblique tow of ORI-net (Ocean Research Institute net, a macroplankton net), 2000 m wire out; October 25, 1964 (Time: 16.34–17.45), coll. Dr. M. OMORI.

Remarks: This new species resembles in general form of the body the following twelve species in some respects: —*C. nodulosa* G. O. SARS (1886), *C. horrida* G. O. SARS, *C. verrucosa* G. O. SARS (1900), *C. antarctica* CALMAN (= *C. v.* var. *antarctica* CALMAN, 1907), *C. frigida* ZIMMER (1908), *C. maculata* ZIMMER (1909), *C. horrida* STEPHENSEN (1915), *C. intermedia* HANSEN, *C. globosa* HANSEN (1920), *C. squamifera* FAGE (1929), *C. clavata* LOMAKINA, and *C. papilata* LOMAKINA (1952a). It is, however, differentiated from respective species mentioned above in the tuberculation on the carapace, the shape of the carapace, the proportional length of uropod segments and by having the third maxilliped with much elongated merus.

CALMAN (1912, pp. 627, 628) described under the name of *C. horrida* G. O. SARS (?) an immature male (7.7 mm long) from Sagami Bay (1107 m deep). He stated as follows: "It differs somewhat from SARS' figures of the adult female. The tubercles on the carapace are slightly smaller and more acutely conical, and they show less tendency to run together into continuous ridges. The distal segments of the third maxillipeds and first and second legs are noticeably more slender than in SARS' figures. It is possible that the examination of further materials may show this Japanese form to be distinct form that found in the Atlantic." It seems probable that CALMAN's specimen may be referred to or very closely related to the present new species.

Family Lampropidae G. O. SARS, 1878.

Nine genera, *Lmaprops*, *Hemilamprops*, *Platysympus*, *Platytyphlops*, *Stenotyphlops*, *Paralamprops*, *Chalarostylis*, *Pseudodiastylis*, and *Bathylamprops* have been referred to the family. GIVEN (1965) recommended the STEBBING's system (STEBBING, 1913) in his paper and established a new family, Mesolampropidae, and proposed a characteristic new genus, *Mesolamprops* GIVEN, from the California coast.

Key to Japanese genera of Lampropidae.

1. Carapace with distinct antennal notch. Male quite devoid of pleopods *Lamprops*
- Carapace without antennal notch in the female. Male with three pairs of well developed pleopods *Hemilamprops*

Genus *Lamprops* G. O. SARS, 1863.

Key to Japanese species of *Lamprops*

1. Telson with three or four pairs of lateral spines. Carapace with oblique lateral ridges *L. quadriplicata longispina*
- Telson without lateral spines 2
2. Peduncle of uropod is 1–1/2 times the length of telson. Carapace without oblique lateral ridges *L. flava*

- Peduncle of uropod much less than 1-1/2 times the length of telson. Carapace with
or without two oblique lateral ridges *L. sarsi*

Lamprops quadriplicata longispina LOMAKINA

Lamprops quadriplicata longispina LOMAKINA 1958b, p. 85, fig. 32.

L. quadriplicata longispina, GAMÔ 1965b, p. 190, figs. 2-4.

The specimens from Akkeshi Bay (GAMÔ, 1965b) are very like *L. multifasciata* ZIMMER (1937) and *L. fasciata* G. O. SARS (1900), but they are distinguished from *L. multifasciata* by having the uropod with the exopod almost reaching the level of the rear end of the endopod and by that the outer pair of long apical spines of the telson are a little beyond one-third of the length of the telson, and from *L. fasciata* (♀) by the different armature of the telson. The specimens are very closely related to *L. quadriplicata* SMITH, which has been split into following three subspecies by LOMAKINA (1958b): *L. q. typica* SMITH, *L. q. krashennikovii* DERZHAVIN and *L. q. longispina* LOMAKINA. Though the adult specimens are most allied to *L. q. longispina* in having the telson with the outer pair of long apical spines and three pairs of lateral spines, the carapace bears two short oblique lateral ridges on the intermediate spaces between the last three long ridges, while in juvenile stages such ridges are not developed. GIVEN (1965) has briefly described the variation in number of lateral spines of the telson and in both the first and last oblique ridges on the carapace among the arctic forms of *L. quadriplicata* SMITH.

Distribution: Akkeshi Bay (Hokkaido), night surface haul; Zaliv Petra Velikogo (Peter the Great Bay), depth 21 m.

Lamprops sarsi DERZHAVIN

(Colour Pl. fig. 8)

Lamprops sarsi DERZHAVIN 1926, p. 177, pl. 5.

L. sarsi?, ZIMMER 1943, p. 161.

L. sarsi, LOMAKINA 1958a, p. 138; 1958b, p. 88, fig. 36.

L. sarsi, GAMÔ 1965b, p. 196, figs. 5, 6.

L. sarsi, GIVEN 1965, p. 222.

The adult ovigerous female (3.7 mm) from Akkeshi Bay (GAMÔ, 1965b) conforms well to DERZHAVIN's original description and figures of the adult female with marsupium from Kamtschatka, from which the former differs in the following points: 1) the body is much smaller than DERZHAVIN's specimen (4.3 mm), 2) the dactylus of the second pereopod with long spines, of which the longest one exceeds the length of the dactylus, 3) the combined length of all the free thoracic segments is a little more than the carapace length (scarcely shorter than the carapace in DERZHAVIN's specimen), and 4) the telson is slightly less than twice as long as the last abdominal segment (nearly 2.5 times the last abdominal segment in DERZHAVIN's specimen).

The adult male (2.7 mm) is much smaller than DERZHAVIN's specimen and the young male (4.5 mm) described from Alaska as *L. sp.* (*Sarsi* DERZHAVIN) by ZIMMER (1943). The former differs from the latter two in the following characters: 1) the abdomen, inclusive of telson, is much longer than the cephalothoracic portion (as long as the cephalothoracic portion in DERZHAVIN's female and ZIMMER's male), 2) the peduncle of the uropod a little exceeds the level of the tip of the telson and with eleven spines on the inner border (five spines in ZIMMER's young male), and 3) the telson is a little more than twice as long as the last abdominal segment (one and a half times in ZIMMER's young male and twice in DERZHAVIN's specimen).

Such differences are attributable to the geographic variation. In some of the specimens from Akkeshi Bay two oblique lateral ridges on each side of the carapace are less distinct.

Distribution: Akkeshi Bay (Hokkaido), depth 0.3–14 m, fine sandy or muddy bottom and night subsurface haul (GAMÔ 1965b); Kodiak I. (Alaska), Olytorsky Bay (the Bering Sea), Avachinskaya Guba (northern part of the Sea of Okhotsk), Mys Syurkum (the Tartary Strait), depth 14–19 m (LOMAKINA, 1958b); Point Barrow (Alaska), depth 2–7 m (GIVEN, 1965).

Lamprops flava HARADA

Lamprops flava HARADA 1959, p. 234, fig. 3.

Distribution: Sagami Bay (Shimoda).

Genus *Hemilamprops* G. O. SARS, 1883.

Hemilamprops is distinctly separated from *Lamprops* by male characters only. The former differs from the latter in that the male is provided with pleopods, but the female of *Hemilamprops* may be distinguishable by having the carapace without a distinct antennal notch.

Key to Japanese species of *Hemilamprops*.

1. Telson with three end spines at the apex 2
- Telson with five end spines at the apex 4
2. Carapace without serrated crest *H. izuana*
- Carapace with a pair of submedian serrated crests 3
3. Posterior portion of carapace without serrated crest *H. tanseiana* sp. nov.
- Posterior portion of carapace with serrated crests *H. miyakei* sp. nov.
4. Carapace with two pairs of oblique lateral ridges *H. japonica*
- Carapace with a pair of oblique lateral ridges 5
5. Basal segment of uropod exopod nearly or a little longer than 1/2 of the length of basal segment of endopod *H. californica*
- Basal segment of uropod exopod much less than 1/2 of the length of endopod .. *H. pacifica*

Hemilamprops japonica (HARADA)

Lampropoides japonicus HARADA 1959, p. 237, figs. 4, 5.

Hemilamprops japonica, GAMÔ 1960c, p. 118, pl. 59, fig. 8 (♀ coloured); 1962b, p. 200.

Distribution: Sagami Bay.

Hemilamprops izuana HARADA

Hemilamprops izuana HARADA 1959, p. 231, figs. 1, 2.

Distribution: Sagami Bay (off Shimoda, 50 m deep).

Hemilamprops californica ZIMMER

Hemilamprops (?) *californica* ZIMMER 1936, p. 429, fig. 36.

Lampropoides californicus, HARADA 1959, p. 240, fig. 6.

Hemilamprops californica, GAMÔ 1962c, p. 199, fig. 34.

Distribution: Sagami Bay, Kii Peninsula (Shirahama); California.

Hemilamprops pacifica (HARADA)

Lampropoides pacificus HARADA 1959, p. 243, fig. 7.

Hemilamprops pacifica, GAMÔ 1962c, p. 200.

Distribution: Sagami Bay.

Hemilamprops tanseiana sp. nov.

(Figs. 17, 18)

Description of holotype: The holotype is an adult female (length, about 9.2 mm, exclusive of the telson) with a well developed marsupium, containing twenty-five embryos. The diameter of each embryo is measured about 0.36 mm. The integument is pellucid, thin and finely scabrous. The surface of the carapace is covered with minute spinules and sparse hairs on a finely areolar background (Fig. 17, D). A dorso-median carina with a row of about twenty-five forwarded small teeth extends from the ocular lobe to about the middle of the carapace. On the posterior portion of the carapace, there is a longitudinally depressed groove between the inflated branchial regions. The antero-lateral border is only slightly sinuated and bears rather long teeth. The lower margin is finely serrated. The ocular lobe is narrow, linguiform, without lenses or ocelli and furnished with a small median and a pair of teeth on the anterior portion, and a row of four small median teeth on the dorsal portion (Fig. 17, B and C). The pseudorostral lobes meet in front of the ocular lobe for a

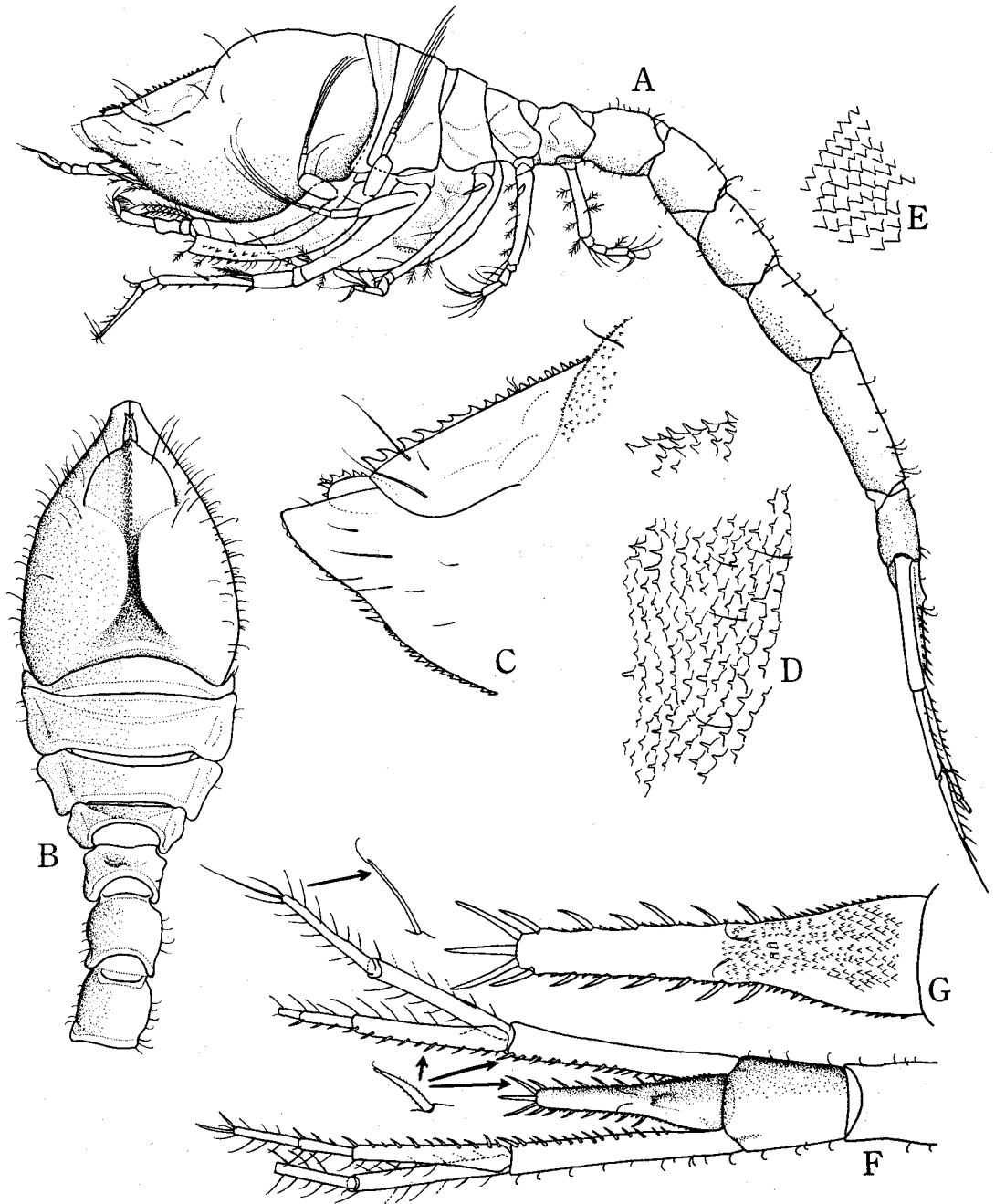


Fig. 17. *Hemilamprops taseiana* sp. nov., holotype ovigerous female (length, ca. 9.2 mm). A: lateral view. B: anterior portion of body, from above. C: anterior portion of carapace, from side. D: sculpture of carapace surface. E: sculpture of pleon segment. F: uropods with telson and last two abdominal segments.

distance about as long as the ocular lobe. The length of the carapace is a little less than two-sevenths of the total length of the animal (exclusive of the telson) and nearly one and one-third times the width, which is much more than the depth.

The combined length of all the free thoracic segments is about four-fifths of the carapace. The sides are rather prominent.

The abdomen is slender, longer than the cephalothorax. The first five segments are successively elongated. The fifth segment is about one and a half times the length of the fourth one and about twice as long as the sixth.

The first segment of the peduncle of the antennule is slender, about one and one-third times the combined length of the distal two segments. The distal portion of the first peduncular segment bears a tooth on one side, while on the other side it bears four teeth. The second segment is half as long as the first one, and slightly more than twice the third. The main flagellum is three-segmented and a little more than twice the length of the distal two segments together; the distal segment bears a small protuberance like a segment and two aesthetascs. The accessory flagellum is three-segmented and a little shorter than the main one.

The antenna is four-segmented; each of the first three segments has a plumose setae; the distal two segments are elongate.

The mandible is boat-shaped and furnished with 12 or 13 plumose setules.

The maxillula and maxilla are as shown in Fig. 18, E and F.

The first maxilliped bears seven lobules on the branchial apparatus.

The second maxilliped bears eight filaments on the coxal segment. The ischium is present, but less distinct (Fig. 18, H).

The basis of the third maxilliped is one and one-fifth times as long as the distal segments together and fringed with fine hairs on both lateral borders, in addition plumose hairs on the inner border; the distal portion is a little dilated, much wider than the ischium, nearly as wide as the proximal portion, and bears plumose hairs at its obtuse distal outer corner.

The first and second peracopods bear well developed exopods, whereas the third and fourth pairs with rudimentary two-segmented exopods. The basis of the first peracopod is slender, curved outwards and bears about ten small teeth and plumose hairs on the distal portion of the inner border. The length of the basis is shorter than the successive four segments together. The short ischium bears two small teeth. The merus is a little shorter than the carpus and the both segments are serrate on the inner border. The dactylus of the first peracopod in the holotype and paratypes is damaged and not observed.

The second peracopod is shorter than the combined length of the basis, ischium, merus, carpus and propodus of the first peracopod. The basis of the second peracopod is a little curved, and bears two plumose setae on the distal portion of the lateral borders; its length is slightly shorter than two-thirds the length of the distal segments together. The short ischium has two spines and the merus has three spines and



Fig. 18. *Hemilamprops tanseiana* sp. nov., holotype ovigerous female. A: antennule. B: antenna. C: labium. D: left mandible. E: maxilla. F: maxillula. G-I: first to third maxillipeds. J-N: first to fifth pereopods.

three setae, of which the two are plumose. The propodus is elongate, furnished with nine spines on the inner border and slightly longer than the short propodus and the slender dactylus combined.

The third peraeopod is about one-half the length of the second one. The basis is about twice as long as the distal segments together. The fourth peraeopod is about six-sevenths the length of the third, and its basis is about one and a half times the length of the distal segments together. The fifth peraeopod is much shorter than the fourth and its basis is nearly as long as the distal segments together.

The peduncle of the uropod is a little longer than the telson and shorter than the rami; the inner border bears 14 or 15 lateral spines. The exopod is slightly shorter than the endopod and two-segmented; the first segment is much longer than the second one; the both segments are provided with six or seven setae on the lateral borders and the distal segment has two long apical spines. The endopod is three-segmented; the first segment is longer than the distal two segments together and with 11 spines on the inner border and with six setae on the outer; the second segment is shorter than the third one, and bears three spines on the inner border and three setae on the outer; the third segment has three setae on both lateral borders, and two spines and two setae at its apex.

The telson is one and a half times the length of the last abdominal segment and five-sixths as long as the uropod; at about anterior one-third there is a dorsal elevation with two spiniform granules and two hairs; the pre-anal portion is rather robust and serrate on the lateral borders; the post-anal portion is slightly narrowed backwards, serrated and furnished with seven pairs of articulated spines and three end spines which are about one-sixth of the length of the telson itself.

Four adult female paratypes (7.9–9.4 mm in length) with marsupium are all very like the holotype, but their bodies and some appendages are partly damaged. The telson has 6 or 7 pairs of lateral spines.

Material: 1 ♀ ovigerous (holotype) and 4 ♀ with marsupium (paratypes); KT 64-17, Plankton Rec. -2; Sagami Bay (35°6'30" N, 139°17' E); maximum depth about 1000 m, collected by an oblique tow of ORI-net (Ocean Research Institute net, a macroplankton-net), 2000 m wire out; October 25, 1964 (Time: 16.34–17.45), coll. Dr. M. OMORI.

Remarks: The new species is very closely related to *H. normani* BONNIER (BONNIER, 1896; FAGE, 1951), *H. cristata* G. O. SARS (SARS, 1900; LOMAKINA, 1958b) and *H. pellucida* ZIMMER (ZIMMER, 1908; JONES, 1963). They are all different from the new species in the following characters: *H. normani* has the telson with five end spines and the antennular main flagellum with five segments; the telson of *H. cristata* is short, scarcely longer than the last abdominal segment, furnished with two or three pairs of lateral spines and without a dorsal elevation; in *H. pellucida* the main flagellum is five-segmented and the telson without a dorsal elevation.

Hemilamprops miyakei sp. nov.

(Figs. 19-21)

Holotype: An adult female (length, about 10 mm) with well developed marsupium, in which thirty-five embryos (each is measured about 0.31 mm in diameter) are carried. The integument is rather thin, pellucid and finely spinulose or scabrous. Under a high magnification the surface of the carapace appears to be covered with a minute honeycomb-like texture, at the center of each hexagonal facet with a minute brittle spinule (Fig. 19, C and D). On each side of the carapace there is a serrated oblique carina (Fig. 19, E and F) which originates at the side of the pseudorostrum, almost encircles the frontal lobe and then approaches each other at about the middle of the carapace. A conspicuous serrated dorso-median carina is found in the anterior half of the carapace and on the posterior portion there is a median groove which is flanked by a submedian serrated carina on each side. The ocular lobe is almost ovoid in shape without lenses or ocelli and bears a row of small teeth on the dorsal surface. The pseudorostral lobes meet in front of the ocular lobe for a distance nearly twice as long as the ocular lobe, and shallowly grooved along the dorso-median line; the groove is flanked by a pair of rows of small teeth on both sides. The length of the carapace is about one and six-sevenths times the width, which is nearly one and one-third times the depth.

The combined length of all the free thoracic segments is about five-sixths the carapace length. The sides are rather prominent.

The abdomen is rather slender, longer than the cephalothorax; the first five segments are successively elongated and the third to sixth segments are dorsally serrate. The fifth segment is the longest, one and one-third times the length of the fourth segment and nearly twice as long as the sixth.

The first segment of the peduncle of the antennule is a little serrate, a little longer than the distal two segments combined; the second segment is also a little serrate and less than twice as long as the third segment. The main flagellus is three-segmented and a little shorter than the distal two peduncular segments combined; the first segment is a little longer than each of the two distal subequal segments; the third segment has a small protuberance like a segment and two aesthetascs. The accessory flagellum is a little shorter than the main flagellum and three-segmented.

The antenna has four segments and bears a plumose seta on the first and two on the second segment.

The mandible is boat-shaped and provided with 14 or 15 plumose setules.

The maxillula and maxilla are as shown in Fig. 17, C and D.

The first maxilliped has eight lobules on the branchial apparatus.

The second maxilliped bears a short and indistinctive ischium, and eighteen setae on the coxal segment.

The basis of the third maxilliped is nearly one and one-third times the length of

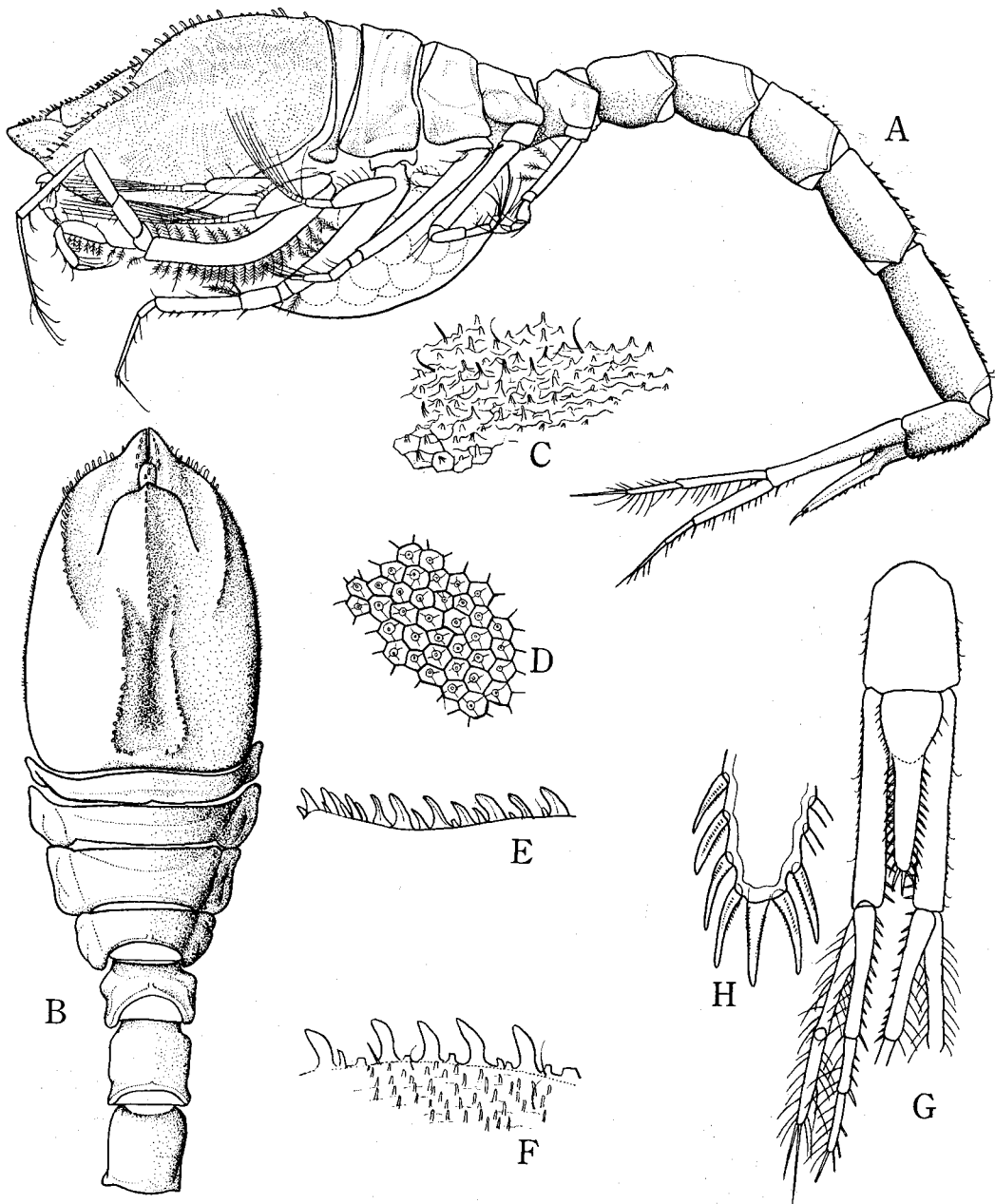


Fig. 19. *Hemilamprops miyakei* sp. nov., holotype ovigerous female (length, ca. 10.0 mm). A: lateral view. B: anterior portion of body, from above. C-D: sculpture of carapace surface (D: from above). E-F: spines on anterior and posterior portion of dorsal crest of carapace. G: uropods with telson and last abdominal segment. H: distal portion of telson.



Fig. 20. *Hemilamprops miyakei* sp. nov., holotype ovigerous female. A: antennule and antenna. B: mandibles. C: maxilla. D: maxillula. E-G: first to third maxillipeds. H: first peracopod. I-J: fourth and fifth peracopods.

the distal segment together, hairy on both lateral borders, plumose hairs on the inner border and long hairs at the distal outer corner; the distal portion is dilated, nearly as wide as the proximal portion and much broader than the ischium.

The first two pairs of peraeopods bear well developed exopods, while the third and fourth pairs with rudimentary two-segmented exopods. The basis of the first peraeopod is slender, curved outwards, a little longer than the successive four segments together and furnished with serrations and plumose hairs on both lateral borders. The short ischium bears two short plumose hairs. The merus and carpus are nearly subequal in length and furnished each with serrations on the inner border. The dactylus is a slightly shorter than the propodus which is about one and a half times the length of the carpus.

The second peraeopod is nearly three-fourths the length of the first. The basis is almost cylindrical, nearly two-thirds as long as the distal segments together and bears several plumose hairs on both lateral borders. The short ischium bears a spine and a seta on its distal portion. The merus has two spines, three plumose setae and a



Fig. 21. *Hemilamprops miyakei* sp. nov., holotype ovigerous female. A-B: second and third peraeopods.

seta on its distal portion. The propodus is rather elongate, provided with seven spines on the inner border and slightly longer than the short propodus and slender dactylus together.

The third peraeopod is a little more than two-thirds as long as the second, and nearly five-sixths the length of the fourth. The basis of the third peraeopod is nearly twice as long as the distal segments together, while that of the fourth one is about one and a half the length of the distal segments together. The fifth peraeopod is about six-sevenths the length of the fourth and the basis is a little longer than the distal segments together.

The peduncle of the uropod is nearly one and three-fourths times the length of the last abdominal segment and bears thirteen spines on the inner border; the outer border is finely serrate. The exopod is two-segmented and slightly shorter than the endopod; the basal segment is much longer than the distal and bears about ten or six setae on the lateral border, the distal segment has eight pairs of lateral setae and two end spines. The endopod is three-segmented; the first segment is about equal in length to the basal segment of the exopod and a little longer than the subequal distal two segments combined, and furnished with seven setae on the outer border and 11–12 spines on the inner; the second segment has four setae on the outer border and four spines on the inner; the third segment bears five setae on the outer border, two spines on the inner border and two apical spines.

The telson is about five-sixths as long as the peduncle of the uropod and shorter than the rami; the pre-anal portion is robust, setose on the lateral borders and much depressed; the post-anal portion is narrowed towards the rear, slightly raised, a little serrate dorsally, and provided with about 11 or 12 pairs of articulated spines and three apical spines.

Material: 1 ♀ ovigerous holotype; KT 64–17, Plankton Rec. -2; Sagami Bay (35°6'30" N, 139°17' E); maximum depth about 1000 m, collected by an oblique haul of ORI-net (Ocean Research Institute net, a macroplankton net), 2000 m wire out; October 25, 1964 (Time: 16.34–17.45), coll. Dr. M. OMORI.

Remarks: The new species somewhat resembles *H. normani* BONNIER, *H. cristata* G. O. SARS, *H. pellucida* ZIMMER and *H. tanseiana*, from those the former is easily distinguished by having the different arrangement of the serrated crests on the carapace.

H. miyakei sp. nov. is also closely allied to *Paralamprops* in the appearance of its carapace ornamentation, but this new species is easily distinguishable from any of the hitherto known species of *Paralamprops* by that the distal portion of the third maxilliped is dilated, much broader than the ischium, and that the basal segment of the uropod exopod is not extremely short.

The two new species described in this part, *H. tanseiana* and *H. miyakei* are represented by female sex only, but they are distinguishable from *Lamprops* species by having the carapace without a distinct antennal notch. (to be continued)