

On the Post-Larval Stage of Three Species of the Shore Crab, Grapsidae

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イワガニ科カニ類 3 種の後期幼生について

1964年から1968年にかけて相模湾の真鶴付近の沿岸からカニ類 3 種のメガロパを得た。これら 3 種のメガロパはいずれもイワガニ科のイワガニ *Pachygrapsus crassipes* RANDALL, ヒメイワガニ *Pachygrapsus minutus* A.M. EDWARDS 及びミナミイワガニ *Grapsus strigosus* (HERBST) であることがわかった。

上記 3 種のメガロパについて、若干の知見を得たので報告するとともに、イワガニについてはすでに報告されているカリフォルニア産のメガロパの外部形態ともあわせて比較観察をおこなった。(村岡 健作)

Grapsoid crabs are usually found in the rocky beach and the shallow water along the shore line. In family Grapsidae, Sakai (1956) listed 54 species of the Japanese crabs. Among them, the three crabs of *Grapsus strigosus* (HERBST), *Pachygrapsus crassipes* RANDALL and *Pachygrapsus minutus* A.M. EDWARDS are found in Sagami Bay. The crab, *G. strigosus*, is found in the floating timber and the rope or bouy of the fixed shore net, but is not very common. The crabs of the other two species are commonly found at upper and middle tidal zone in the rocky beach, Sagami Bay, therefore are easily obtained.

In the Japanese Grapsinae the reports of post larvae were given by several authors. Rathbun (1923) treated of the larvae of *P. crassipes* from the planktonic materials off Cape San Lucas and Guadalupe Islands, but the description was not enough. Hiatt (1948) also treated of that of the same species from Carmel, California. However, he did not fully give the external characters to separate from the other species.

The present paper provides the description and comparison of the three magalopae of *P. crassipes*, *P. minutus*, and *G. strigosus*.

The author wishes to acknowledge Dr T. Sakai, President of Carcinological Society of Japan for his kind guidance.

Materials

The three kinds of megalopa were taken from the surface of the water off the coast of Manazuru, the western part of Sagami Bay. These larvae had been reared in the 200 ml. glass bowl, and were successful to getting the young crab.

The author recognized as megalopa of three kinds, *P. crassipes*, *P. minutus* and *G. strigosus*. Among them the megalopae of *P. crassipes* were found from the floating algae and the ropes of a fixed shore net, in April, 1964 and November, 1967. Those of *P. minutus* were also collected from same place, in September, 1967 and October, 1968, and those of the last in November, 1967.

1. *Pachygrapsus crassipes* RANDALL (Pl. 7, Fig. 1, A, B)

Megalopa-stage (Carapace length, 3.0mm., Carapace width, 2.3mm.)

The carapace is wholly yellowish, and the dorsal surface is a smooth. The front is divided into two lobes by small sinus.

In the antennule, the inflated peduncle is composed of three segments. The distal segment bears two flagella, one of which is segmented. The unsegmented flagellum bears 4 short setae, while the segmented flagellum bears numerous long setae from second to fourth segments. The fourth segment also bears two strong setae.

The antenna is composed of 11 segments. The eighth segment bears two long setae, which are well-developed.

The mandible bears a two segmented palp. the distal one of which bears 10 setae and 3 plumose ones along the lateral margin.

In the maxillule, the coxopodite and basipodite are provided with numerous strong setae on the lateral and distal margin. The endopodite is divided into two segments, the distal one of which bears two short setae.

In the maxilla, there are numerous setae on the lobes of the coxopodite and basipodite. The unsegmented endopodite bears about 4 short setae along the lateral margin. The scaphognathite is fringed with numerous plumose hairs.

In the first maxilliped, the coxopodite and basipodite bear well-developed lobes, of which are covered with setae along its margin. The endopodite bears about 3 setae. The exopodite is composed of three segments, of which first and terminal ones are provided with 4 plumose hairs.

In the second maxilliped, the endopodite and exopodite are well distinguished. The endopodite bears numerous setae at the sub-terminal segment. The exopodite is divided into three segments, the distal one of which bears 5 plumose hairs at the apex.

In the third maxilliped, the endopodite is furnished with numerous stout setae

on the lateral margin. The exopodite is divided into three pieces. There are about 5 plumose hairs at the apex of the distal piece.

Chelipeds are nearly equal; there are two blunt processes at the prehensile edge of movable and immovable fingers, respectively.

The three anterior pairs of ambulatory legs are rather slender; the second and third pairs are nearly equal, and the dactylus are curved inwards, furnished with 4 stout teeth and two tiny spinules. The last pair is shorter than the others. The dactylus is not furnished with a stout spine, but with 3 spinules and a spine along the inner margin, and also with 3 long sensory hairs at the distal end.

The abdomen is composed of the six segments and telson. The second to fifth segments are respectively provided with a pair of biramous pleopods. The exopodite of these pleopods is respectively furnished with 27-38 plumose hairs along the lateral margin, and the endopodite with 3-5 small hooks along the inner

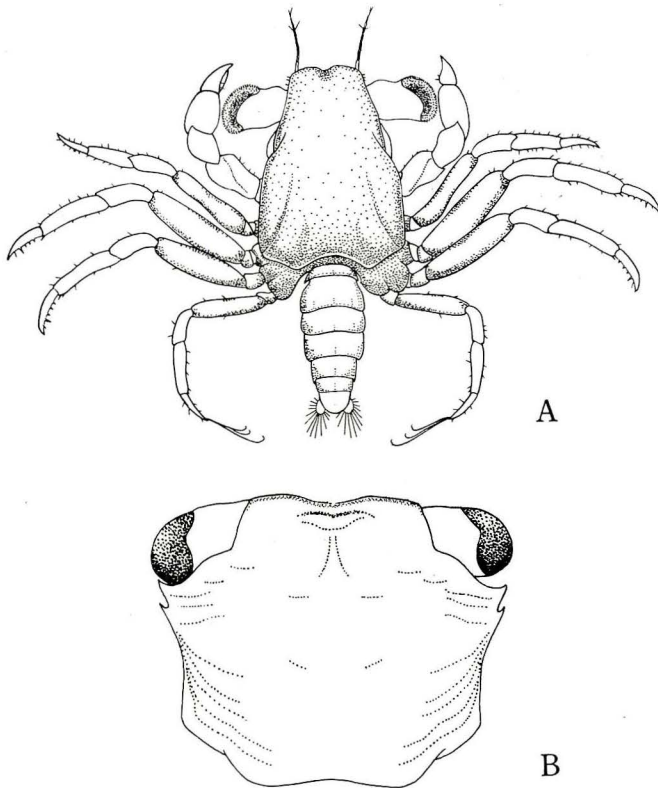


Fig. 1. *Pachygrapsus crassipes* RANDALL
 A; Megalopa, dorsal view.
 B; First crab-stage, dorsal view.

margin. The sixth segment is provided with a pair of small uropods, which are divided into two segments. The proximal one is furnished with 3 plumose hairs on the outer margin, and the distal one with 21 plumose hairs on the lateral margin. The telson is a semicircle, and the surface is furnished with two long and short setae on the middle portion, and also with 8 short setae along the lateral margin.

First crab-stage (Carapace length, 3.0mm., Carapace width, 3.6mm.)

The dorsal surface of carapace is similar to that of the adult specimen. The anterolateral border of the carapace is armed with a spined tooth behind the acute external orbital spine.

The chelipeds are equal; the palm is strongly bulged as compared with the other segments,

2. *Pachygrapsus minutus* A. M. EDWARDS (Pl. 8, Fig. 2, A, B)

Megalopa-stage (Carapace length, 2.0 mm., Carapace width, 1.5 mm.)

The carapace is rather narrow and very convex to the middle portion. The front is deflexed and cut into two rounded lobes by a small sinus.

The antennule is composed of the peduncles and flagella, the peduncle is segmented. The unsegmented flagellum bears 3 terminal setae. The segmented flagellum is divided into four pieces, and bears numerous long sensory hairs the second to terminal ones, respectively. The terminal segment also bears a long seta.

The antenna is composed of 11 segments and has the conspicuous setae on all segments other than segments base, four, five and nine; the setae of the eighth and terminal segments are remarkably longer than those of the others.

The mandible bears a segmented palp with nine stiff spines on the terminal segment.

In the maxillule, the coxopodite and basipodite are provided with numerous strong setae. The endopodite is divided into two pieces.

In the maxilla, there are numerous setae on the lobes of coxopodite and basipodite. The endopodite is unsegmented, and bears one short hair in the outer margin. The scaphognathite is fringed with numerous plumose hairs.

The first maxilliped is composed of four pieces, coxopodite, basipodite, endopodite and exopodite. The coxopodite and basipodite bear numerous setae on the lobes. The endopodite is provided with one segment and with two short terminal hairs. The exopodite is divided into three pieces; the distal one bears 5 plumose hairs on the apex.

Setation of the second maxilliped is as shown in Pl. 8, G.

The third maxilliped is composed of a segmented endopodite and exopodite.

The endopodite is divided into five pieces. There are numerous setae along the lateral margin of those pieces. The exopodite is divided into three pieces, the distal one of which bears 4 terminal plumose hairs.

The thoracic sternum is divided into four distinct segments, the distal one of which is armed with a pair of flated boards at the posterior portion. The board is horizontally projecting backwards.

The chelipeds are nearly equal. The colour of the carpus and palm is bright red in the living specimen. In the chela, the fingers bear two blunt teeth on the cutting edges.

In the ambulatory legs each length of the second and third is nearly equal. In the first three pairs of ambulatory legs, the dactylus bears five teeth along the inwards, while a tooth is small spiniform. In the last pair, however, the tooth of the dactylus is not developed. But the inner margin is furnished with four spinules, and also with three long feelers near the distal end.

The abdomen is divided into seven distinct segments. The second to fifth segments are respectively provided with a pair of biramous pleopods. The exopodite bears 23-28 plumose hairs. The endopodites of all pleopods have 4 or 5 small

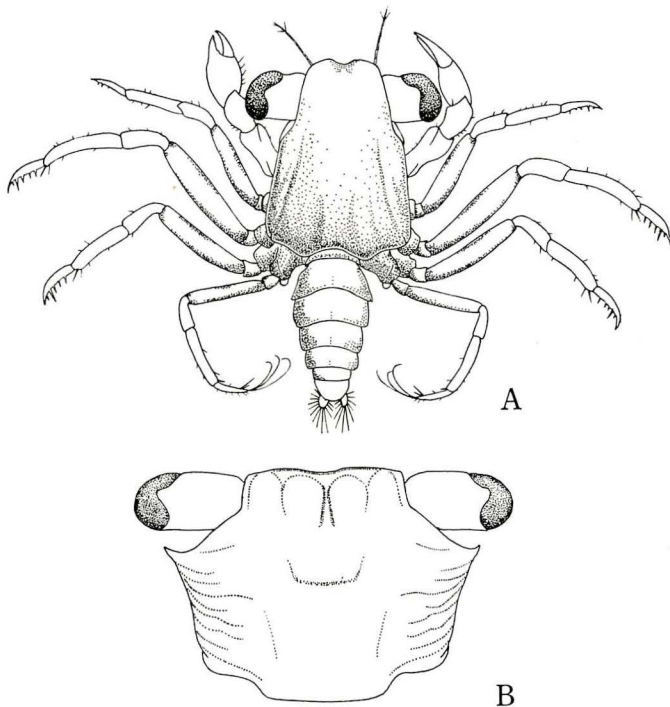


Fig. 2. *Pachygrapsus minutus* A. MILNE-EDWARDS
 A; Megalopa, dorsal view.
 B; First crab-stage, dorsal view.

denticulate hooks. The sixth segment is provided with a pair of small uropods, which are divided into two segments. The proximal one is furnished with 4 or 5 plumose hairs on the outer margin, and the distal one with 16-17 plumose hairs on the lateral margin. The telson is round; the dorsal surface and lateral margin bear several setae, and the setation is as shown in Plate 8, L.

First crab-stage (Carapace length, 1.4 mm., Carapace width, 2.9 mm.)

The carapace of dorsal surface is similar to that of adult specimen. The anterolateral border of the carapace is not armed with a denticulated tooth behind the acute external orbital spine. The eye stalks are long and slender. The cornea is more prominent than the external orbital spine.

3. *Grapsus strigosus* (HERBST) (Pl. 9, Fig. 3, A, B, C)

Megalopa-stage (Carapace length, 3.3 mm, Carapace width, 2.4 mm.)

The carapace has no dorsal spine or protuberance. The front is slightly projecting forward and cut into two rounded lobes by a median small sinus. The posterolateral border is found two pair of shallow depressions.

The proximal portion of antennule is composed of three segments, of which the third one bears two flagella. The endopodite is unsegmented. The exopodite is divided into four segments. The second to fourth segments are furnished with long sensory hairs. The distal segment also bears a long setae.

The antenna is composed of 11 segments; the eighth segment bears two long setae, which are well developed and the terminal one also bears 3 setae at the distal end.

The mandible bears a two segmented palp with 17-18 stiff spines on the terminal segment.

In the maxillule, the coxopodite and basipodite are provided with numerous strong setae on the lateral and distal margin. The endopodite is divided into two segments.

The maxilla is provided with the coxopodite and basipodite which are divided into two lobes. Each lobe bears numerous setae on the lateral margin. The unsegmented endopodite bears 2 short hairs along the lateral portion. The scaphognathite is fringed with numerous plumose hairs.

In the first maxilliped, the coxopodite and basipodite are densely covered with setae near the distal portion. The unsegmented endopodite bears 4 setae on the distal portion. The exopodite is divided into three pieces, of which the terminal one bears 4 plumose hairs on the distal end.

In the second maxilliped, the endopodite is provided with numerous setae on its outer and inner borders of the sub-terminal and terminal segments. The exopodite is divided into three pieces, the distal one of which bears 5 plumose

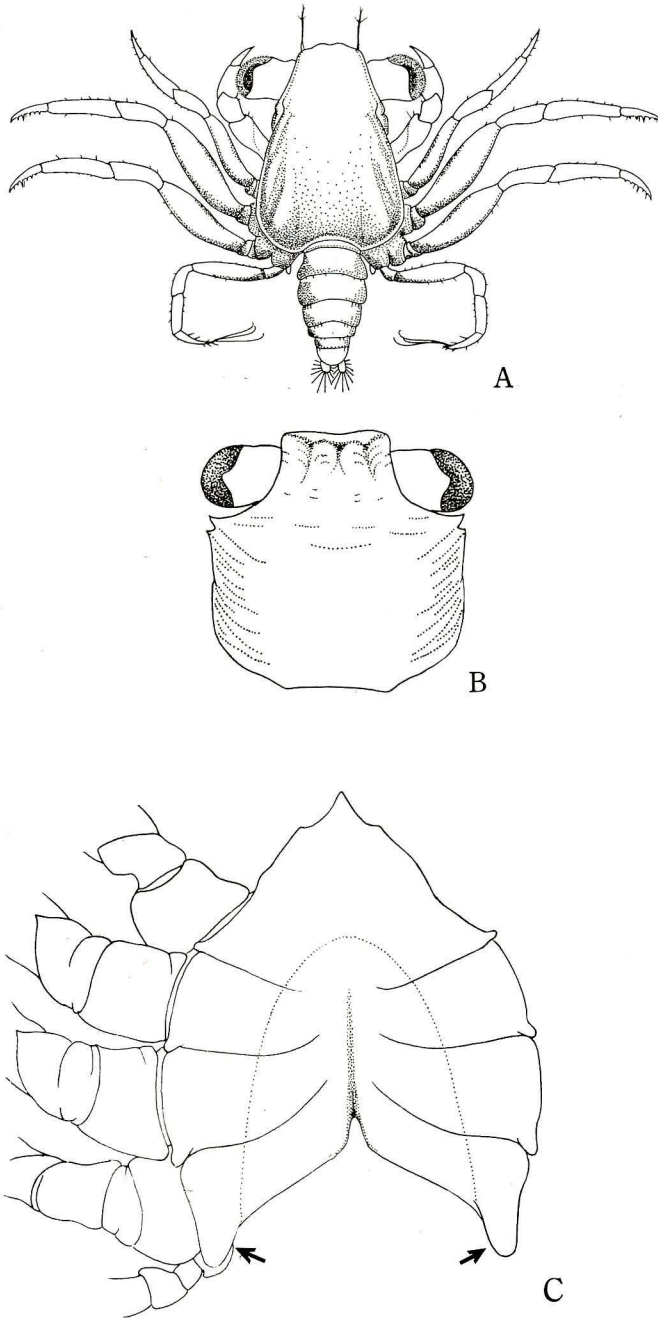


Fig. 3. *Grapsus strigosus* (HERBST)
 A; Megalopa, dorsal view.
 B; First crab-stage, dorsal view.
 C; Showing the process of the distal segment
 of the thoracic sternum.

hairs on the distal end.

In the third maxilliped, the endopodite is furnished with numerous stout setae on the lateral margin. The exopodite bears 5 plumose hairs near the distal end.

The thoracic sternum is divided into four pieces, of which the distal one is armed with the spatulate process near the proximal portion of the fourth ambulatory leg, and the process is horizontally projecting backwards.

Chelipeds are nearly equal; the immovable finger is provided with two blunt teeth along the prehensile edge, and the movable finger with a blunt tooth.

Ambulatory legs are very slender. Each of dactylus is compressed; in the dactyli the anterior three pairs are armed with five distinct spiniform teeth on the inner border, whereas, the last pair is not armed with these teeth, but with three brush-like spinules along the inner border, and also with 3 long feelers at the distal end.

The abdomen is composed of six segments and a telson. The second to fifth segments are provided with a pair of biramous pleopods. The exopodites of pleopods of abdominal segments 2 to 5 each bear 25-32 plumose hairs. The endopodites of all pleopods have 4 small hooks along the inner margin. The sixth segment is provided with a pair of small uropods, which are divided into two segments. The proximal one is furnished with 2 or 3 long plumose hairs on the outer margin, and distal one with 16 same hairs on the lateral margin. The telson is a plate, and a round form in the posterior border; the dorsal surface and the lateral margin bear several setae, and the setation is as shown in Plate 9, L.

First crab-stage (Carapace length, 3.1 mm., Carapace width, 3.3 mm.)

The dorsal surface is similar to that of the adult specimen. The anterolateral border, however, is not swelled and extended, and bears a small denticulated tooth behind the external orbital spine. The eyestalk is thick and short.

Discussion

A comparison of the external features of larvae of *Pachygrapsus* and *Grapsus* belonging to the sub-family Grapsinae is reported by several authors. Rathbun (1923) obtained the megalopa of *Pachygrapsus crassipes* from planktonic materials, and figured the dorsal and lateral aspect each, but did not treat the particular features. Hiatt (1948), who dealt with in the megalopa of *P. crassipes*, did not describe the particular points of the antennule, antenna, mandible, pleopods and uropods. But he clearly given to the setation of the dorsal surface of telson. Hyman (1924) describing the zoea and megalopa of *P. marmoratus*, treated two stages in the larval development of the megalopa. In

P. crassipes the megalopa changed readily into a young crab, therefore the megalopa should be compared with that of the second stage of *P. marmoratus*.

Among the megalopa of three species the external morphological features are so similar. That is, a: The antenna is furnished with a plumose hair at the second segment, and also with several long setae on the distal end of the eighth segment. b: The fourth ambulatory leg bears three feelers at the distal portion. c: The uropods bear three plumose hairs on the outer margin of proximal segment.

These larvae, however, are easily distinguished by the following respects. In the mandible of *P. crassipes*, the palp bears ten stiff spines and three plumose hairs on the lateral margin of terminal segment, while in the same of *P. minutus*, the palp bears 9 stiff spines on the terminal segment, and in *G. strigosus* there are 17 to 18 stiff spines along the lateral margin of same segment.

In *P. crassipes* each of the pleopods and uropods bears 27 to 38 and 21 plumose hairs along the lateral margin of the exopodites. In *P. minutus* each of them is furnished with 23 to 28 and either 16 or 17 plumose hairs, and in *G. strigosus* with 25 to 32 and 16 plumose hairs (Table I).

Table I.

Number of the plumose hairs and small hooks in the pleopods and uropods of abdominal segments

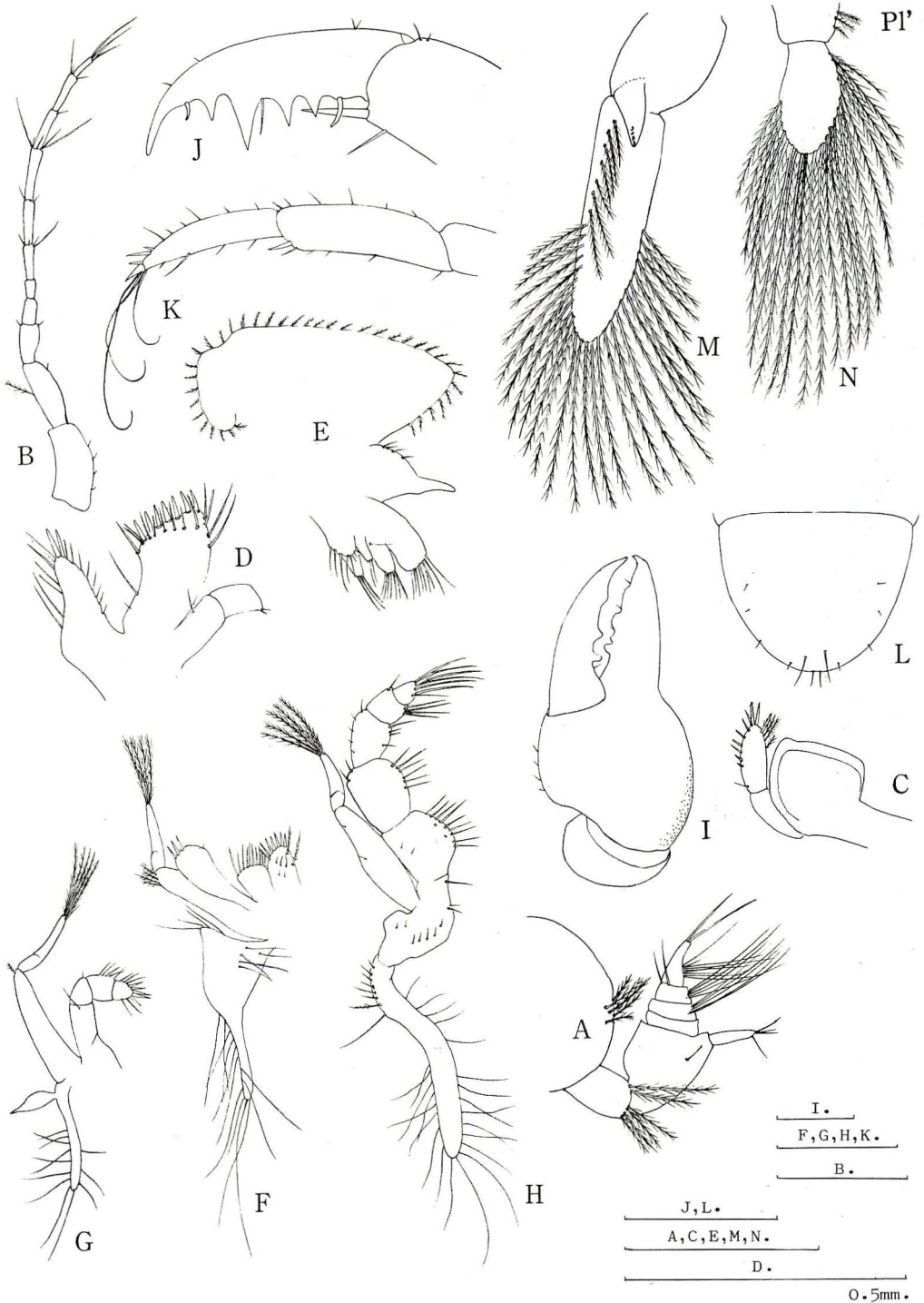
	pleopods		uropods	
	end.	exp.	prox. seg.	dist. seg.
<i>P. crassipes</i>	3 ~ 5	27~38	3	21
<i>P. minutus</i>	4 ~ 5	23~28	4 ~ 5	16~17
<i>G. strigosus</i>	4	25~32	2 ~ 3	16

In the case of telson, there is clearly a difference among the setations on the dorsal surface and lateral margin of these larvae, therefore those are also distinguished by the dorsal and marginal hairs.

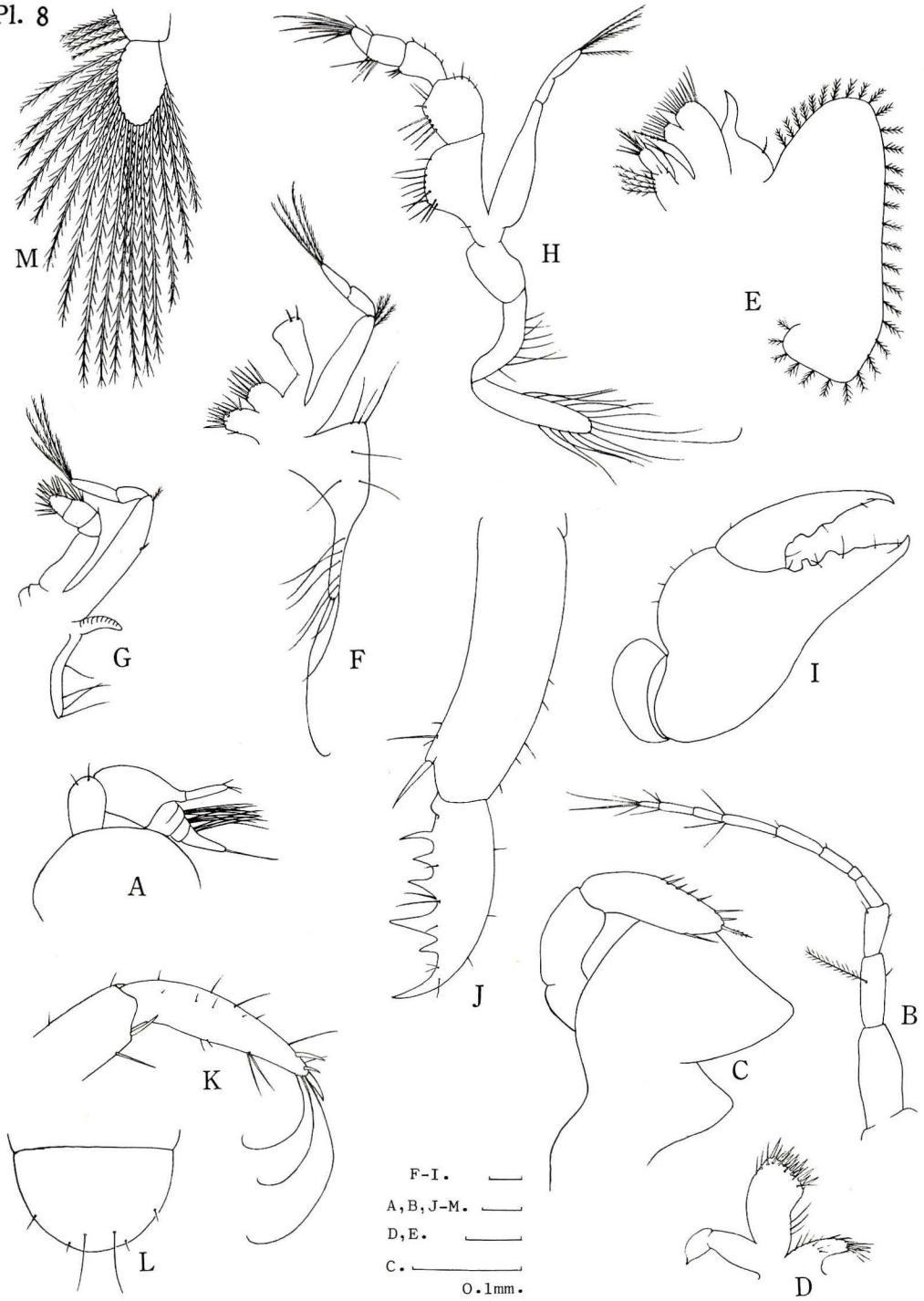
The setation of Hiatt's description agrees closely with that of megalopa of *P. crassipes* obtained from Sagami Bay.

Literature

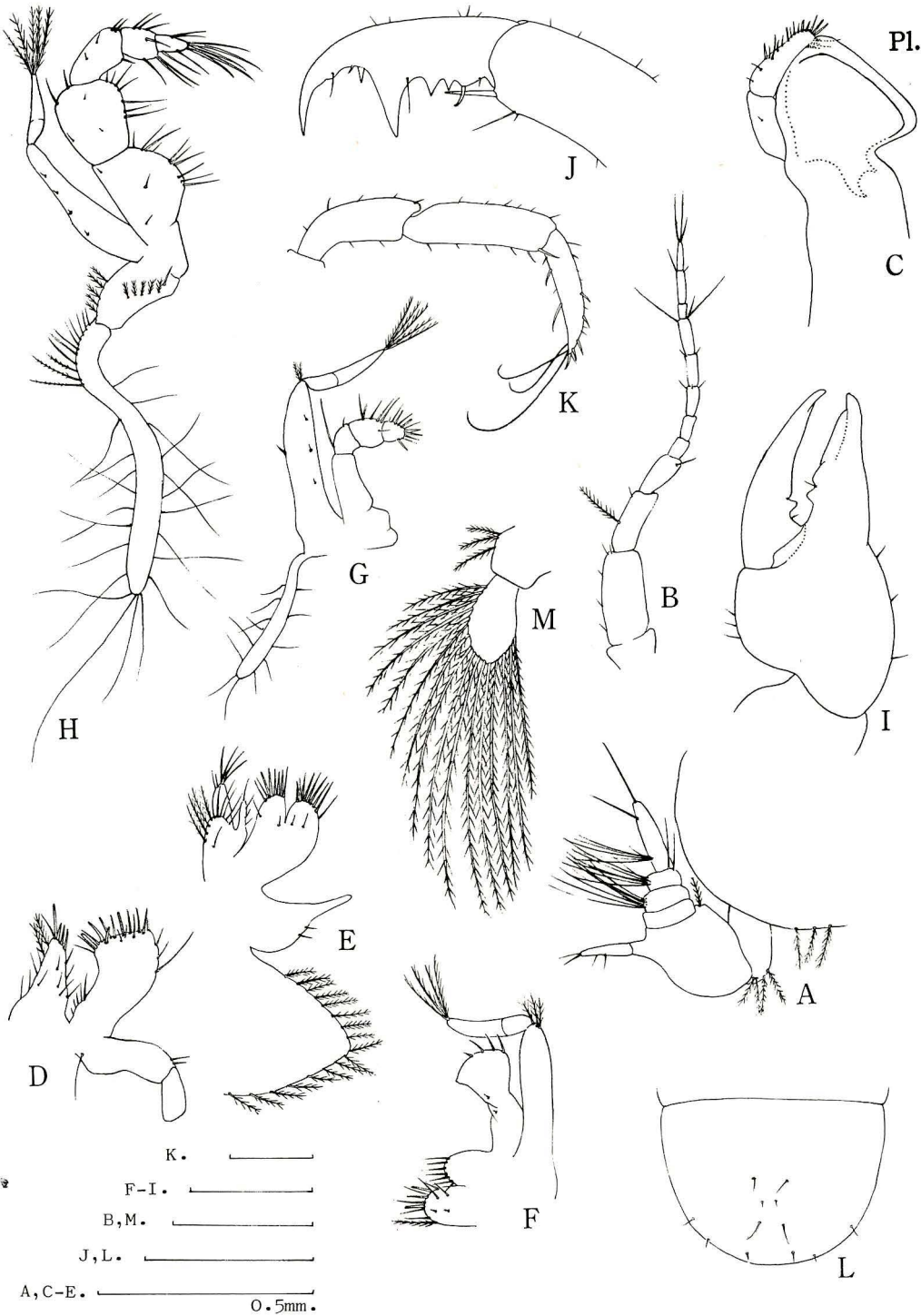
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Appendages, megalopa of *Pachygrapsus crassipes* RANDALL
 A: antennule. B: antenna. C: mandible. D: maxillule. E: maxilla.
 F: first maxilliped. G: second maxilliped. H: third maxilliped,
 I: cheliped. J: first ambulatory leg. K: fourth ambulatory leg.
 L: telson. M: second pleopod. N: uropod.
 The bar scales represent 0.5 mm.



Appendages, megalopa of *Pachygrapsus minutus* A. MILNE-EDWARDS
 A: antennule. B: antenna. C: mandible. D: maxillule. E: maxilla.
 F: first maxilliped. G: second maxilliped. H: third maxilliped.
 I: cheliped. J: first ambulatory leg. K: fourth ambulatory leg.
 L: telson. M: uropod.
 The bar scales represent 0.1 mm.



Appendages, megalopa of *Grapsus strigosus* (HERBST)

- A: antennule. B: antenna. C: mandible. D: maxillule. E: maxilla.
 F: first maxilliped. G: second maxilliped. H: third maxilliped.
 I: cheliped. J: first ambulatory leg. K: fourth ambulatory leg.
 L: telson. M: uropod.

The bar scales represent 0.5 mm.