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Revision of the genus *Athanas* of Japan and the Ryukyu Islands, with description of a new species (Crustacea, Decapoda, Alpheidae)[1,2]

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There have been taken from Japan and the Ryukyu Islands six species of the genus *Athanas*, such as *Athanas parvus* De Man, *A. japonicus* Kubo, *A. ohsimai* Yokoya, *A. lamellifer* Kubo, *A. kominatoensis* Kubo, and *A. setoensis* Kubo. In addition, three other species are here newly recorded, *A. djiboutensis* Coutière and *A. marshallensis* Chace, as new to the fauna of this region and *A. acanthocarpus* as new to science.

In this paper it is the main purpose to make clear the range of variation in specific characters. Fortunately, in some species considerable number of specimens enough for this purpose come to our collection. As will be discussed below, almost all of the species here described show marked variation in the first pair of pereiopods with sex and size or maturity, and some species show considerable variation in the anterior part of carapace. In due consideration of the variation in the specific characters, it is suggested that *A. parvus* is a synonym of *A. sibogae* De Man, *A. lamellifer* a synonym of *A. japonicus*, and *A. kominatoensis* a synonym of *A. indicus* (Coutière).

All the specimens, including the holotype of *Athanas acanthocarpus* sp. nov., are preserved in the collection of the Zoological Laboratory, Faculty of Agriculture, Kyushu University (ZLKU).

We are greatly indebted to the gentlemen for offering us the material and to the staffs of the Amakusa Marine Biological Laboratory, Kyushu University for

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affording us the facilities to the study. We must be also thankful to Dr. Itsuo Kubo of Tokyo University of Fisheries and Dr. Huzio Utinomi of the Seto Marine Biological Laboratory, Kyoto University for their valuable advice, encouragement and the opportunity to study the type specimens. Our hearty thanks are also due to Drs. Albert H. and Dora M. Banner of University of Hawaii for their valuable suggestions on *Athanas acanthocarpus* sp. nov.

Key to eight species of *Athanas* in Japan and the Ryukyu Islands.

1. Body slender; dorsal distal margin of antepenultimate segment of third maxilliped truncate; carpus of second pereiopod with five joints········2
   Body robust; dorsal distal margin of antepenultimate segment of third maxilliped prominent; carpus of second pereiopod with four joints···6
2. Supracorneal tooth present······································*A. djiboutensis* Coutière
   Supracorneal tooth absent ···3
3. Dactyli of last three pereiopods simple··4
   Dactyli of last three pereiopods biunguiculate ················· *A. sibogae* De Man
4. First three pereiopods with epipods; in fifth abdominal segment posterior margin of pleuron pointed ··5
   First four pereiopods with epipods; in fifth abdominal segment posterior margin of pleuron rounded ·······································*A. ohsimai* Yokoya[1]
5. Infracorneal tooth acute; rostrum generally reaching to proximal half of third antennular segment; in almost all of mature males and females at least one of first pair of pereiopods well developed and its merus lamellar with serrations on ventral outer margin······················*A. japonicus* Kubo
   Infracorneal tooth at most slight; rostrum reaching to middle of second antennular segment; first pair of pereiopods of male almost symmetrical and well developed, each merus vaginal (deeply excavated on ventral surface); first pair of female symmetrical and slender, carpus as long as palm, merus faintly vaginal and slightly longer than palm ················ ···*A. marshallensis* Chace
   Infracorneal tooth at most slight; rostrum reaching to middle of third antennular segment; first pair of female symmetrical and slender, carpus equal in length to merus and twice as long as palm······················ ···*A. setoensis* Kubo

1) After Yokoya, 1936. No specimen available.

6. In each of first pereiopods inner ventral margin of carpus smooth without a process ; low rostral ridge, lateral margins of rostrum inconspicuously canaliculate at base ; first two pereiopods with epipods·· *A. indicus* (Coutière)

In each of first pereiopods inner ventral margin of carpus projecting as a blunt triangular process ; rostral ridge rather high, lateral margins of rostrum deeply canaliculate at base ; first three pereiopods with epipods ··*A. acanthocarpus* sp. nov.

Athanas djiboutensis Coutière 1897
(Fig. 1)

Athanas djiboutensis Coutière, 1897, p. 234 ; Coutière, 1899, p. 62, fig. 4, p. 177, fig. 207 ; Coutière, 1905b, p. 856, fig. 129 ; Tattersall, 1921, p. 398, pl. 28, fig. 25 ; Coutière, 1921, p. 413 ; De Man, 1922, p. 21 ; Edmondson, 1925, p. 9 ; Ramadan, 1936, p. 12 ; Barnard, 1950, p. 732, figs. 137e, f ; Chace, 1955, p. 16 ; Banner, 1956, p. 322 ; Banner, 1957, p. 193 ; Holthuis, 1958, p. 14 ; Banner and Banner, 1960, p. 140 ; Banner and Banner, 1964, p. 86.

Athanas sulcatipes Borradaile, 1898, p. 1011, pl. 65, fig. 9.

Description. The body is small (carapace length 2.6 mm, total length 7.2 mm) and polished (Fig. 1, A). The rostrum is lanceolate with a sharp dorsal carina, and extends to the proximal third of the third antennular segment (Fig. 1, B). The cornea is protected with three sharp teeth, i. e. the supra-, extra- and infra-corneal teeth. The pterygostomial margin is rounded.

The antennular peduncle is slender ; the stylocerite is sharply pointed, and exceeds the middle of the second antennular segment. The carpocerite of the antenna overreaches the tip of the second antennular segment ; the scaphocerite is slender and goes far beyond the tip of the antennular peduncle with its distal margin.

The first pereiopods are asymmetrical, folded beneath the body ; the large cheliped greatly exceeds the tip of the antennular peduncle by the tip of the merus ; the small cheliped overreaches the anterior margin of the carapace by the tip of the merus (Fig. 1, C). In the large cheliped the cutting edges of both fingers are crenate in full length (Fig. 1, D) ; the palm is cylindrical and twice as long as the movable finger ; the carpus is cornical and encloses the proximal portion of the palm ; the merus is as long as the palm, slightly swollen and vaginal (deeply excavated on the ventral surface) ; the ischium is slightly shorter than half of the merus, and armed with three spines on the dorsal margin and two spines on the ventral margin. The small cheliped is slender ; the cutting edges of both fingers are entire ; the palm is cylindrical and longer than both fingers ; the carpus is 1.5 times as long as the palm ; the merus is twice as long as the palm, flattend on the ventral surface ; the ischium is as long as the carpus with three spines on the dorsal margin.

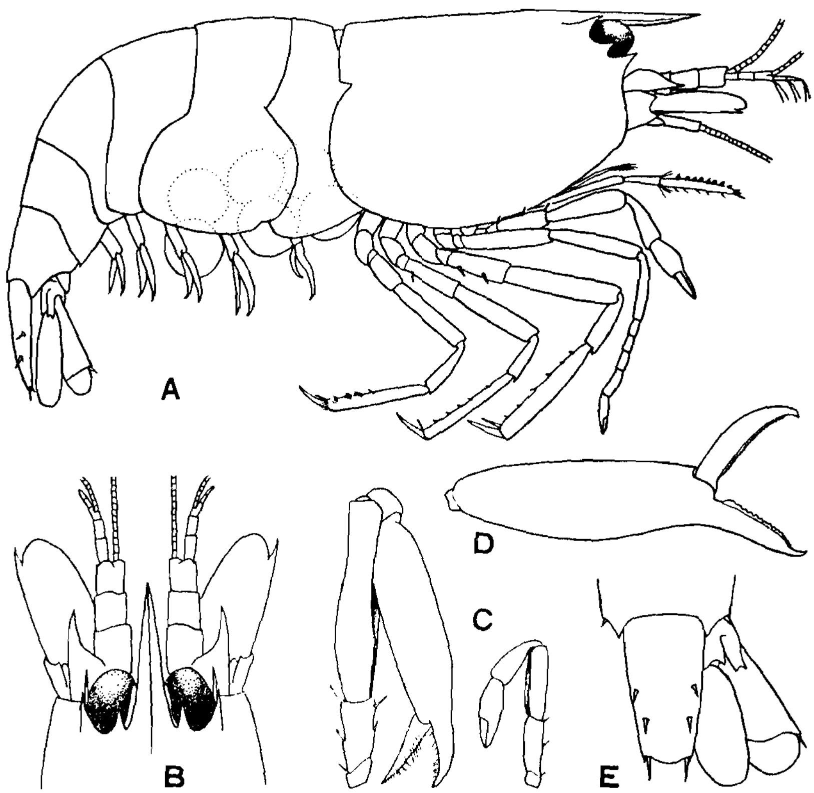


Fig. 1. *Athanas djiboutensis* Coutière, 1897.
A, Animal, ovigerous female in lateral view, x 17; B, anterior part of body in dorsal view; C, first pair of pereiopods of female in inner view; D, chela of large first pereiopod in ventral view ; E, telson and right uropod in dorsal view.

The third pereiopod has a simple dactylus ; the ventral margin of the propodus is furnished with several spines, the distal one extends to the middle of the dactylus.

Table 1. Branchial formula of *Athanas djiboutensis*.

	I	II	III	IV	V	VI	VII	VIII
Pleurobranchs	—	—	—	1	1	1	1	1
Arthrobranchs	—	—	—	—	—	—	—	—
Podobranchs	—	—	—	—	—	—	—	—
Epipods	1	1	1	1	1	1	—	—
Setobranchs	—	—	—	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

The posterior margins of the pleura of the first four abdominal segments are rounded, while that of the fifth is pointed and that of the sixth articulated. The telson is three times as long as broad at the posterior margin (Fig. 1, E).

Material examined. Ryukyu Islands : 1 ovig. ♀, ZLKU No. 3317, Kamiyama-jima, off Naha City, July 1, 1962, S. Miyake, T. A. Uchida and H. Minei leg.

Remarks. This specimen agrees very well with Coutière's descriptions and figures (1897, 1905).

The present specimen has the branchial formula tabulated above, which agrees with "the more complete set" of the branchial formula in this species described by Banner and Banner (1960). They observed the variation in the branchial formula, as quoted below :

> In the present study, the branchial formula of *Athanas djiboutensis* was examined in 17 specimens from one locality on Canton Island, Phoenix group. ………… Only two of the specimens had mastigobranchs on the third thoracic appendages and the setobranchs on the fourth, the branchial formula for the genus ; on the other 15 specimens the last mastigobranch was on the second maxilliped and the last setobranch (…………) was on the third maxilliped. The two specimens with the more complete set did not differ in any other way from the specimens with the reduced branchial formula. Other specimens from Canton and from other localities were spot checked ; most were found with the reduced formula, but occasional individuals carried the more complete set. Thus the more common branchial formula in *Athanas djiboutensis* is the same as that for *Arete*.

Distribution. This species is widely distributed in the Indian Ocean and the Central Indo-Pacific region, but this is the first record from the Ryukyu Islands.

Athanas sibogae De Man, 1910
(Figs. 2, 3)

Athanas sibogae De Man, 1910, p. 314 ; De Man, 1911, p. 151 ; De Man, 1915, pl. 2, fig. 6.

Athanas parvus De Man, 1910, p. 315 ; De Man, 1911, p. 148 ; De Man, 1915, pl. 1, fig. 4 ; Tattersall, 1921, p. 372 ; De Man, 1922, p. 16 ; Kubo, 1940, p. 99, figs. 1, 2 ; Banner and Banner, 1960, p. 141, fig. 1.

Description. The body is small (c.l. 2.9 - 5.6 mm, t.l. 6.8 - 14.0 mm) and sparsely hairy (Fig. 2, A). The rostrum is lanceolate, carinate on the dorsal surface, projecting straight forward (Fig. 2, B) ; the rostral apex overreaches the distal margin of the second antennular segment, while in one ovigerous female from Genkai-nada (ZLKU No. 1432 ; c.l. 4.8 mm, t.l. 12.5 mm) the rostral apex reaches to the tip of the antennular pedunle. The extra- and infra-corneal teeth are acuminate ; the pterygostomial margin is rounded.

The antennular peduncle is slender, and consists of three subequal segments ; the stylocerite is sharp and extends beyond two-thirds of the second antennular segment. The carpocerite of the antenna reaches to the middle of the third antennular segment ; the scaphocerite is as long as or slightly shorter than the antennular peduncle, the tip of the lateral spine reaches to the distal round margin of the lamella.

The first pair of pereiopods in the male is almost symmetrical, stout, and folds the chelae in the expanded meri. The movable finger is crescent and much longer than the immovable finger, the tips of both fingers crossing together. The palm is smooth, swollen, slightly angled at the distal ventral margin, and engraved in the proximal portion of the inner surface ; the height (breadth) and the thickness are one-third of the length, respectively ; in one male (ZLKU No. 1430) an inconspicuous arcuate groove runs on the inner surface from the ventral distal margin of the palm to the proximal ventral margin of the carpus. The carpus is cup-shaped, the outer distal margin has a slight notch and the distal ventral margin is angled ; the merus is expanded and vaginal (deeply excavated on the ventral surface) ; the ischium is triangular in cross section, and has some movable spines on the dorsal and ventral inner margins. The length of each segment in proportion to palm is shown in Table 2.

Among these male specimens there are two patterns of denticulation on the cutting edges of both fingers noted as follows : (1) In one male (ZLKU No. 3446) the left cheliped (slightly larger) is provided with a huge, round tooth on the immovable finger and two obtuse triangular teeth on the movable finger ; the right cheliped is provided with the irregular serrations on the cutting edges of

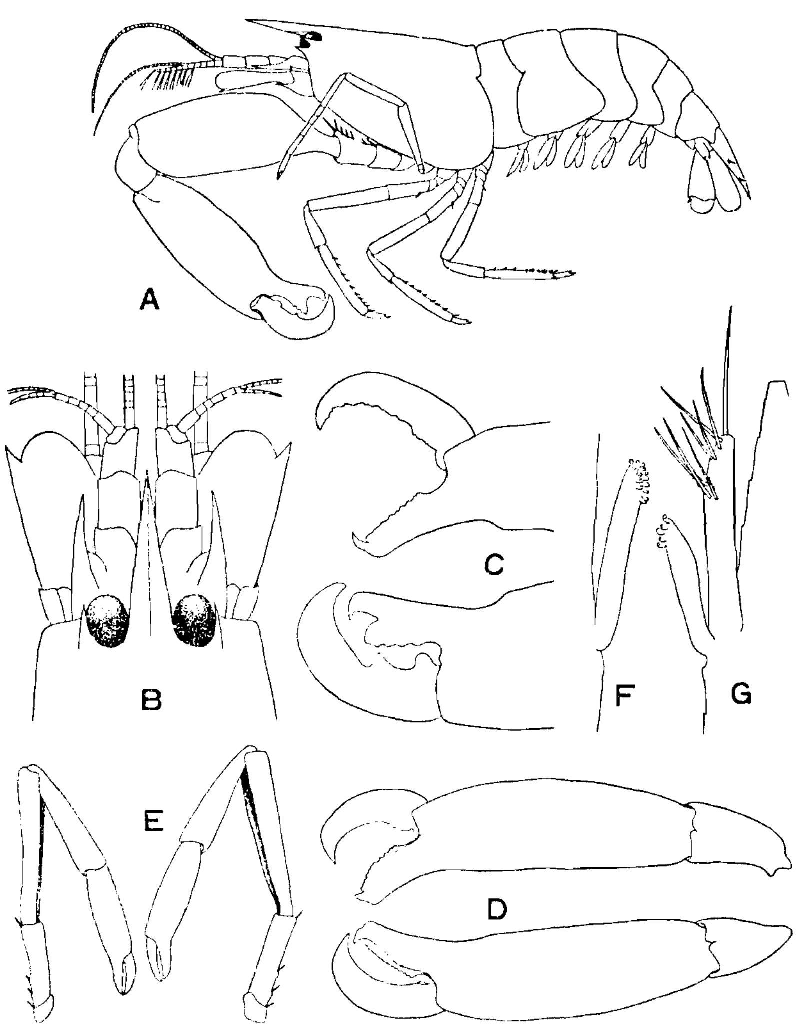


Fig. 2. *Athanas sibogae* De Man, 1910.

A, Animal, male in lateral view, x 6 ; B, anterior part of body in dorsal view ; C, distal part of chelae of first pereiopods of one male (ZLKU No. 3446 figured in A) in ventral view ; D, chelae and carpi of first pereiopods of the other male (ZLKU No. 3447) in ventral view ; E, first pair of pereiopods of female in inner view ; F, appendix interna of female ; G, appendix masculina and appendix interna of male. (C, D and E drawn to same scale.)

both fingers (Fig. 2, C). (2) In the other three males (ZLKU Nos. 3447, 3448 from Amakusa and ZLKU No. 1430 from Genkai-nada) both chelipeds have the same denticulation on both fingers as that on the right (slightly shorter) cheliped carried by the preceding male (Fig. 2, D). In these four specimens the appendix masculina on each of the second pleopods is well developed (Fig. 2, G).

In the female specimens the first pereiopods are symmetrical, slender, folded beneath the body (Fig. 2, E, F). The movable finger is slightly longer than the immovable one, the cutting edges of both fingers are smooth, fitting together ; the palm and the carpus are slender and cylindrical ; the merus is slender and vaginal (excavated on the ventral surface) ; the ischium is armed with some spines on the dorsal margin. The proportions of segments in the first pereiopods are shown in Table 2.

Table 2. Proportions in first pereiopods of *Athanas sibogae*.

		Large cheliped					Small Cheliped				
Sex	Carapace length (mm)	Movable finger	Palm (in proportion to palm)	Carpus	Merus	Ischium	Movable finger	Palm (in proportion to palm)	Carpus	Merus	Ischium
♂	5.0-5.5	0.5	1.0	0.4	1.2	0.3	0.5	1.0	0.4	1.3	0.4
♀	2.9-5.6	0.5	1.0	1.1	1.6	1.0	0.5	1.0	1.2	1.7	1.0

The first and second pereiopods have a rudimentary exopod ; the branchial formula of this species is : 5 pleurobranchs + 6 epipods + 4 setobranchs + 5 (3 + 2 rudim.) exopods.

The dactylus of the third pereiopod is slender and biunguiculate ; the ventral hook is one-third to half of the breadth of dorsal hook at its base ; both hooks are slender and almost straight.

The posterior margins of the first four abdominal segments are rounded, that of the fifth segment is pointed and that of the sixth one with a movable plate. The telson is truncate, three to four times as long as broad at the posterior margin.

Colour in life. With regard to the colouration of this species we observed twelve specimens from Amakusa (4 ♂♂, 6 ovig. ♀♀, ZLKU 3446 ; 1 ovig. ♀, 1 ♀, ZLKU No. 3456). The entire animal is generally pale blue in ground-colour, densely scattered with camine red chromatophores. A broad logitudinal stripe, free from pigment or of pale yellow, occurs along the median from the tip of the rostrum to the posterior margin of the sixth abdominal segment (Fig. 3) . The antennular peduncle except the portion of the stylocerite is free from pigment or pale yellow. The tail fan is uniformly pale blue to deep purplish blue. The eggs are yellowish red.

Habitat. The ten specimens (ZLKU No. 3446) were found living under the stones on the sandy bottom in the tide pools of Tsuji-shima, in Chijiwa Bay, Amakusa, together with some other decapod crustaceans, *Eualus gracilirostris*, *Galathea orientalis*, *Porcellana ornata* and some xanthid crabs. The other specimens were dredged from the sandy or coarse sandy bottom in 40 - 70 m deep, in Chijiwa Bay, Amakusa and from the coarse sandy bottom in 10 m deep, off Oshima, Fukuoka Prefecture.

Fig. 5. Colour pattern of *Athanas sibogae* De Man.
White region, trasparent with pale yellowish chromatophores; black region, pale blue with camine red chromatophores.

Material examined. Southern Japan: 1 ovig. ♀, ZLKU No. 3291, low tide mark, Ushi-buka, Amakusa, Apr. 27, 1932, H. Ikeda and Eguchi leg; 4 ♂♂, 6 ovig. ♀♀, ZLKU No. 3446, low tide mark, rocky shore, Tsuji-shima, Chijiwa Bay, Amakusa, June 20, 1966, A. Taki and Y. Miya leg; 1 ovig. ♀, 1 ♀, ZLKU No. 3456, dredged, 40 m in depth, off Uze, Chijiwa Bay, Amakusa, June 21, 1966, T. Kikuchi and Y. Miya leg; 3 ♀♀, ZLKU No. 2672, dredged, 45 m in depth, off Uze, Chijiwa Bay, Amakusa, Apr. 14, 1963, T. Kikuchi leg; 1 ovig. ♀, ZLKU No. 9337, dredged, 70 m in depth, near Kaba-shima, Chijiwa, Bay Amakusa, 1961, T. Kikuchi leg; 1 ovig. ♀, ZLKU No. 9338, dredged, 60 m in depth, off Uze, Chijiwa Bay, Amakusa, 1961, T. Kikuchi leg; 1 ♂, 2 ovig. ♀♀, ZLKU No. 1430, 10 m in depth, off Oshima, Fukuoka Pref., Genkai-nada, July 3, 1957, Y. Motomatsu leg; 1 ovig. ♀, ZLKU No. 2131, 10 m in depth, off Oshima, Fukuoka Pref., Genkai-nada, Oct. 11, 1958, Y. Motomatsu leg.

Remarks. De Man (1911) stated that *A. sibogae* in the *Dimorphus* group of the genus was closely related to *A. parvus* in the *Nitescens* group, but he enumerated the characters distinguishable each other, as compared below:

	A. sibogae	*A. parvus*
1.	Type specimen (♂) carried chelipeds with carpi and chelae directed backward, fitting in elongate, excavated meri—— character of *Dimorphus* group.	Type specimen (ovig. ♀) carried chelipeds with carpi and chelae directed straight forward, meri short—— character of *Nitescens* group.
2.	Extracorneal tooth appeared a little shorter than cornea, infracorneal one extending as far forward as the other.	Extracorneal one extending by half its length beyond cornea, infracorneal one a little shorter than the other.
3.	Length to breadth proportion of merus and propodus of third pereiopod : merus 5.7 - 6, propodus 8.3 - 9.7.	Merus 7, propodus 10.2.
4.	In dactylus of third pereiopod dorsal hook twice as broad as ventral one.	Dorsal hook three times as broad as ventral one.

From the study of all the specimens as to each of the above characters it may be concluded that these characters are not able to be used as the reliable ones for specific separation :

1. The shrimps in life usually folded their chelipeds beneath the body. Preserved in 5 % formalin, some of them kept their chelipeds folding as in life, while the others extended their chelipeds directed forward as figured in *A. parvus* by De Man (1915). From these observations this species must be placed in the *Dimorphus* group.

2. The development of the orbital teeth is so variable as follows :

Extracorneal tooth slightly shorter than infracorneal one .... 4 ♂♂, 7 ovig. ♀♀, 4 ♀♀
Extracorneal tooth as far forward as infracorneal one .... 3 ovig. ♀♀
Extracorneal tooth exceeding beyond infracorneal one...... 1 ♂, 2 ovig. ♀♀, 1 ♀

3. In the third pereiopod the length to breadth proportion of the merus varies from 4.7 to 6.2, that of the propodus from 7.5 to 11.0.

4. In the dactylus of the third pereiopod the dorsal hook is twice to three times as broad at its base as the ventral one.

Furthermore, there are some interesting points noted in the form of the first pereiopods, which suggest clearer to us the relationships between *A. sibogae* and *A. parvus* :

(1) The first pereiopods in the female (Fig. 2, E) are symmetrical, slender, wholly dissimilar in structure to the enlarged first pereiopods in the male,

but completely agree with those of *A. parvus* originally described.

(2) Among the full grown male specimens there are two patterns of the denticulation on the fingers (see p. 134). The first form (Fig. 2, C) is closely related to the first pereiopods in the type specimen (male) of *A. sibogae.* The second form (Fig. 2, D) agrees very well with those in "a probably female" from Siboga St. 162 of *A. sibogae* described by De Man (1911). This "probably female," he stated in his text, "is considered to be the female of this species, with some doubt, because it carries no eggs." But we found no reference in his text to the presence or absence of the appendix masculina, which is regarded as one of the good criteria of sex in the shrimps belonging to Caridea.

After considering the phenomenon in all its aspect, we come to a conclusion that in *A. sibogae* the first pereiopods show : (1) the sexual differences given in *A. sibogae* (representing the first pereiopods of the male) and *A. parvus* (representing those of the female), respectively, originally described ; (2) the dimorphic forms, as would be expected by Kemp (1915), each given in the type specimen and "a probably female" from Siboga St. 162 of *A. sibogae*, developed simultaneously in the full grown males. From this point of view we will support Banner and Banner's suggestion (1960) which proposed the possibility of the combination of the two species.

Distribution. This species is widely distributed in the Indian Ocean and the Central Indo-Pacific region, being previously recorded from the Red Sea, Flores Sea, Timor Sea to Tonga and Samoa, and from southern Japan (Tanabe Bay, Wakayama Pref.).

Athanas japonicus Kubo, 1936

(Figs. 4 - 6)

Athanas japonicus Kubo, 1936, p. 43, pl. 8, figs. A-M.

Athanas lamellifer Kubo, 1940, p. 102, figs. 3 - 5.

Description. The body is small (c. l. 2.0 - 8.3 mm, t. l. 5.1 - 20.6 mm) and sparsely hairy (Fig. 4, A). Generally, the rostrum is sharp, triangular in dorsal view and runs horizontally in lateral view. In most the rostral apex reaches to the proximal half of the third antennular segment ; in one ovigerous female it merely extends beyond the tip of the first antennular segment, meanwhile in two specimens (1 ♂, 1 ovig. ♀) it reaches to the tip of the antennular peduncle (Fig. 4, B-D). The rostral carina is inconspicuous, and extends backward to the carapace. The extra- and infra-corneal teeth are triangular and acutely pointed.

In the majority of the specimens the infracorneal tooth is well developed, but in varying degree, and longer than the extracorneal one, while in the rest the infracorneal tooth is as long as, or shorter than the extracorneal one (Fig. 4, E-H).

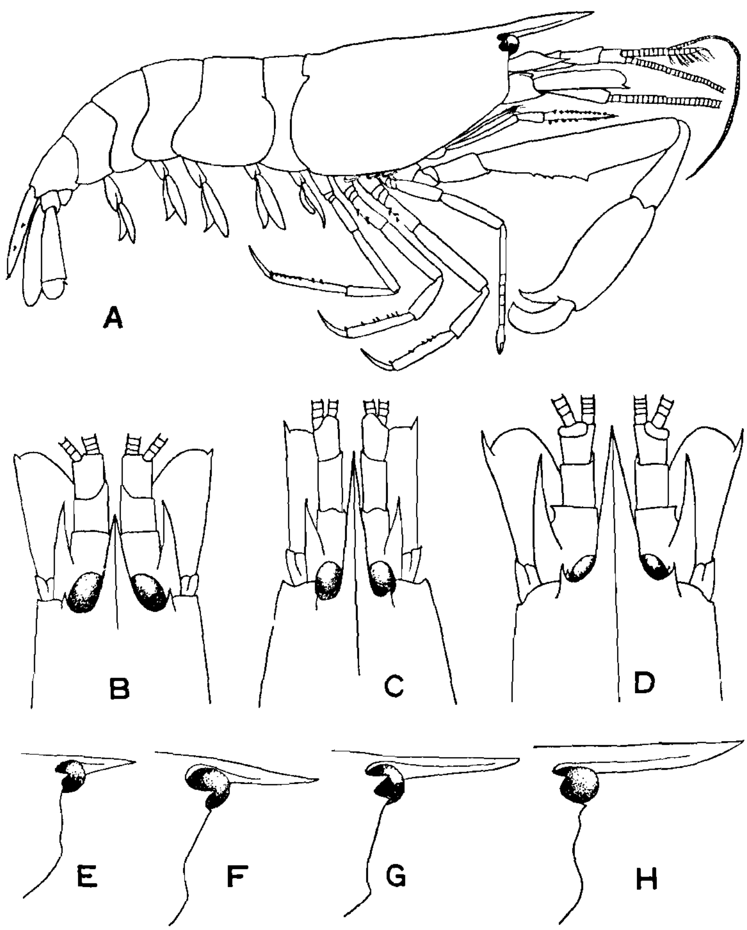


Fig. 4. *Athanas japonicus* Kubo, 1936.
A, Animal, male in lateral view, x 7; B, C and D, showing variations in anterior part of body in dorsal view; E, F, G and H, showing variations in shape of rostrum and extra- and infra-corneal teeth in lateral view. (B-H drawn to same scale.)

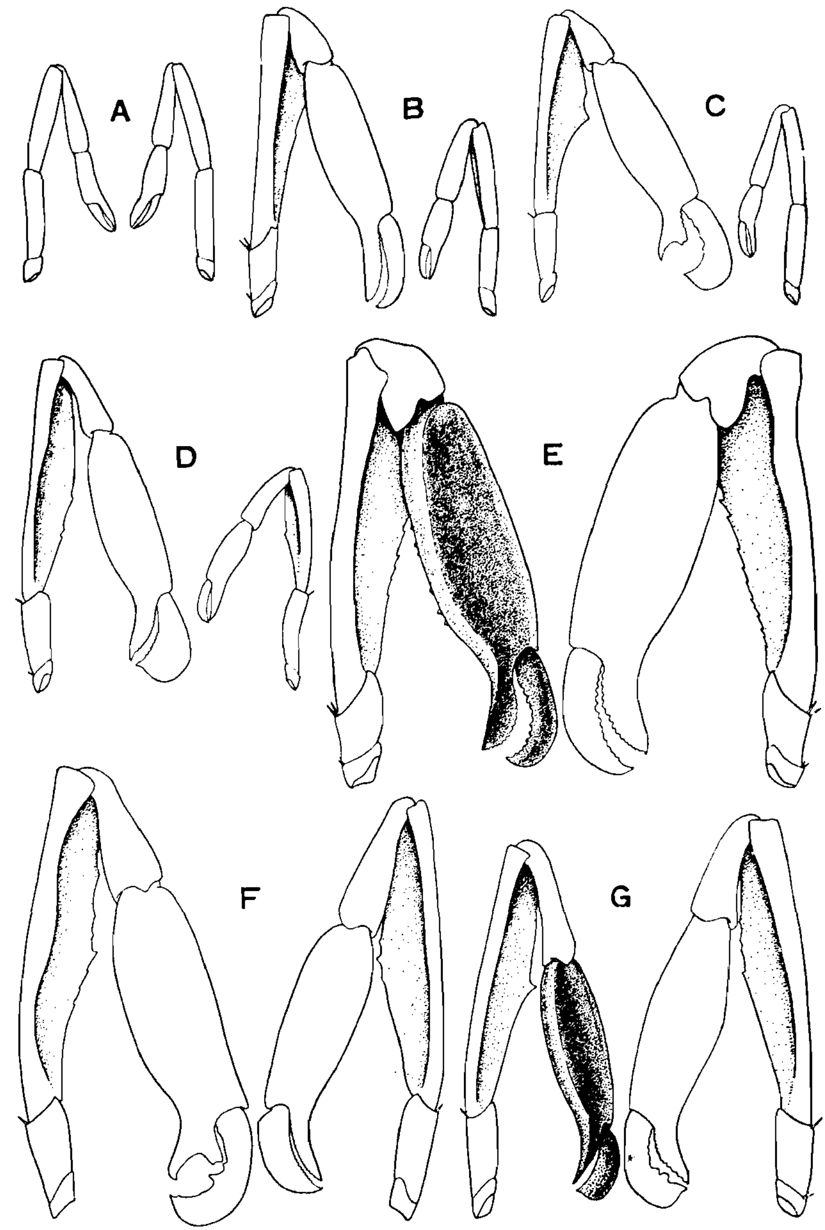


Fig 5. Various patterns found in first pair of pereiopods of *Athanas japonicus* Kubo.

A, Pattern I ; B, P. II, A-1 ; C, P. II, B ; D, P. II, A-2 ; E, P. III ; F, P. IV,A ; G, P. IV,B. (All drawn to same scale.)

The antennular peduncle consists of three segments, which are subequal or gradually diminished in length distally. The second segment varies from 0.7 to 2.5 times as long as broad. The stylocerite is slender and pointed ; in two-thirds of the present material the stylocerite reaches to the proximal third of the second antennular segment, while in the rest the stylocerite is much developed and reaches to the proximal half of the third segment.

In general the carpocerite of the antenna extends near to the middle of the third antennular segment. The scaphocerite is broad, and as long as the antennular peduncle, the lateral spine of it usually exceeds the anterior margin of the lamella.

The first pair of pereiopods in both sexes is habitually flexed at the carpo-meral joint, and there are several patterns of form of first pereiopods, as far as they are present, noted as follows. The average value for the length of each segment in proportion to palm is represented in Table 3, however, there is considerable variation with the individual even in the same pattern.

Pattern I (Fig. 5, A). First pair of pereiopods symmetrical, slender and small ; without tooth on cutting edges of both fingers, merus cylindrical. This pattern possessed by twelve specimens (1 ♂, 7 ovig. ♀♀, 4 ♀♀).

Pattern II. Asymmetrical. One of this pair slender ; cutting edges of both fingers entire, merus slightly lamellar. The other one enlarged ; merus lamellar.

A - 1 (Fig. 5, B). Large cheliped with fine teeth on both fingers. This pattern possessed by eight specimens (6 ovig. ♀♀, 2 ♀♀).

Table 3. Variation in proportions in each pattern

Pattern	Sex and number of specimens	Large cheliped				
		Movable finger	Palm	Carpus	Merus	Ischium
		(in proportion to palm)				
I	1 ♂, 7 ovig. ♀♀, 4 ♀♀	0.9	1.0	1.6	2.1	2.0
II A-1	6 ovig. ♀♀, 2 ♀♀	0.6	1.0	0.5	1.4	0.6
II B	5 ovig. ♀♀	0.6	1.0	0.5	1.3	0.5
II A-2	6 ♂♂	0.6	1.0	0.5	1.4	0.9
III	7 ♂♂	0.5	1.0	0.6	1.5	0.5
IV A	5 ♂♂	0.5	1.0	0.5	1.4	0.4
IV B	7 ♂♂	0.5	1.0	0.5	1.4	0.4

A - 2 (Fig. 5, D). Large cheliped having same characters as pattern II A - 1, while small cheliped differing from that pattern in proportion to length of palm as shown in Table 3. This pattern possessed by six specimens (6 ♂♂).

B (Fig. 5, C). Large cheliped with fine teeth on cutting edge of movable finger and a prominent, round tooth on immovable one. This pattern possessed by five specimens (5 ovig. ♀♀).

Pattern III (Fig. 5, E). Symmetrical, both enlarged ; with more coarse teeth on both fingers, merus lamellar. This pattern possessed by seven specimens (7 ♂♂).

Pattern IV. Asymmetrical. One of this pair enlarged, larger than the other one, having same characters as pattern III.

A (Fig. 5, F). Large cheliped with several large teeth, varying in size, on movable finger and a huge, round tooth on immovable one. This pattern possessed by five specimens (5 ♂♂).

B (Fig. 5, G). Large cheliped with several large teeth, varying in size, on movable finger and coarse teeth on immovable one. This pattern possessed by seven specimens (7♂♂).

The third pereiopod extends beyond the tip of the rostrum by the length of dactylus and the distal half of propodus ; the dactylus is simple, slender and 0.4 to 0.6 times of the length of propodus. The fourth and fifth pereiopods are similar to the third one, the dactylus of the fifth one is slightly longer than that of the third one in proportion to the length of propodus.

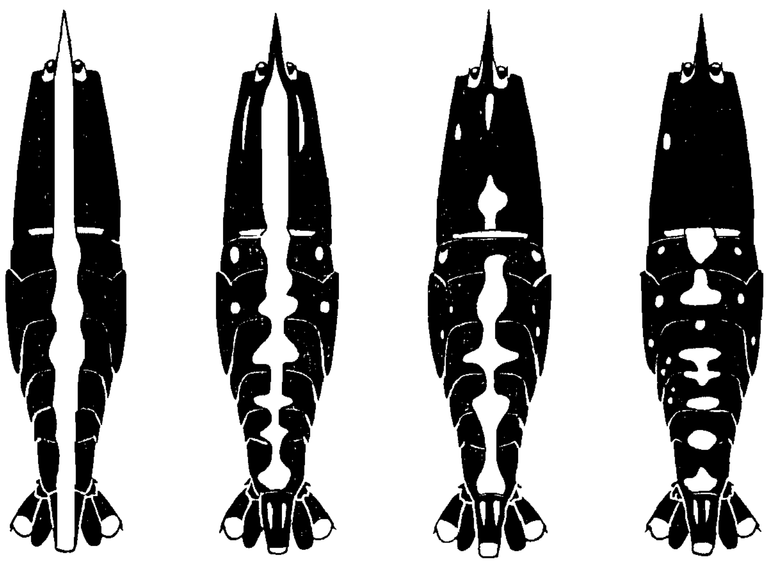
of first pereiopods in *Athanas japonicus*.

		Small cheliped						
Carpus l/b	Merus l/b	Movable finger	Palm	Carpus (in proportion to palm)	Merus	Ischium	Carpus l/b	Merus l/b
4.1	5.2	0.8	1.0	1.5	2.0	1.8		
		0.8	1.0	1.8	2.3	1.9	3.6	5.5
		0.8	1.0	2.0	2.3	2.4		
2.7	4.7	0.7	1.0	1.2	1.9	1.5		
		0.5	1.0	0.6	1.5	0.5		
		0.5	1.0	0.7	1.6	0.7	2.5	4.9
		0.5	1.0	0.6	1.5	0.4		

The branchial formula of this species is: 5 pleurobranchs + 6 epipods + 4 setobranchs + 3 exopods.

The posterior margins of the first four abdominal segments are rounded, that of the fifth one is pointed, that of the sixth one has a movable plate. The telson is truncated with a round distal margin; the length of telson is, on an average, 3.4 times of the breadth at the posterior margin (range 2.8 - 4.0 times), while in one male it is very slender, 6 times as long as broad at the posterior margin.

Colour in life. In thirty eight specimens collected in a narrow habitat at Amakusa (21 ♂♂, 14 ovig. ♀♀, 3 ♀♀), they are bluish purple in ground colour, with scattered red chromatophores. The eggs are green. There are following four colour patterns:



A B C D

Fig. 6. Various colour patterns of *Athanas japonicus* Kubo. A, Colour pattern A; B, Cp. B; C, Cp. C; D, Cp. D. White region, transparent with pale yellowish chromatophores; black region, bluish purple with red chromatophores.

Colour pattern A (Fig. 6, A). The broad longitudinal stripe of pale yellow or pigmented free runs along median dorsal line from the tip of the rostrum to the tip of the telson, a patch of colour-less presents on the exopod of the uropod. This pattern is shown in nine specimens (5 ♂♂, 1 ovig. ♀, 3 ♀♀).

Colour pattern B (Fig. 6, B). The longitudinal stripe runs straight on the carapace, while on the abdomen this stripe enters into the colour scheme on both sides. A distal broad patch and two longitudinal narrow patches present on the telson, a patch on the exopod of uropod. This pattern is shown in thirteen specimens (13 ♂♂).

Colour pattern C (Fig. 6, C). The longitudinal stripe is irregular, brokenly running along the median dorsal line from the tip of the rostrum to the tip of the sixth abdominal segment, the same patches as shown in colour pattern B present on the telson, a patch on the exopod of the uropod. This pattern is shown in eleven specimens (2 ♂♂, 9 ovig. ♀♀).

Colour pattern D (Fig. 6, D). The longitudinal stripe is absent on the carapace and come to an end at intervals on each abdominal segment, the same patches on the telson, a patch on the exopod of the uropod. This patten is shown in five specimens (1 ♂, 4 ovig. ♀♀).

In this colouration the two partners differ slightly ; most of the males belong to the colour patterns A and B, while most of the females belong to C and D.

Habitat and habit. These shrimps were living in groups under the scattered boulders and other shelters resting in slight pools at the low tidemark on the muddy shore near the Amakusa Marine Biological Labratory, Kyushu Univerity. When disturbed, they were walking about slowly on the bottom, and hid to near shelters, but they did not make burrows. Walking about in a pool, they usually kept their chelae of the first pereiopods folding beneath the body. When their fellows came near, they stretched their chelae forward for driving back their fellows.

Material examined. Ryukyu Islands: 1 ♂, ZLKU No. 3290, Komi, Iriomote-jima, Dec. 13, 1965, T. A. Uchida leg.

Southern Japan: 1 ♂, 1 ovig. ♀, ZLKU No. 2670, under stones on tidal zone of muddy shore near AMBL, Tomioka, Amakusa, June 22, 1962, T. Kikuchi leg; 1 ♂, ZLKU No. 3292, *Zostera marina* belt, under low tidemark, Tomioka, Amakusa, Sept. 15, 1959, with a Danish seine, T. Kikuchi leg; 1 ♂, 2 ovig. ♀♀, 1 ♀, ZLKU No. 3458, *Zostera marina* belt, under low tidemark, Tomioka, Amakusa, May 5, 1966, T. Kikuchi leg; 1 ♂, 2 ovig. ♀♀, 1 ♀, ZLKU No. 3462, under stones on tidal zone of muddy shore, Tomioka, Amakusa, May 31, 1966, T. Kikuchi leg; 21 ♂♂, 14 ovig. ♀♀, 3 ♀♀, ZLKU No. 3466, under stones on tidal zone of muddy shore near AMBL, June 18-19, 1966, Y. Miya leg; 1 ♂, 1 ovig. ♀, ZLKU No. 3504, under stones on tidal zone, Aio, Yamaguchi Pref., Seto Inland Sea, June 17, 1966,

K. I. Hayashi and T. Tateishi leg; 1 ovig. ♀, ZLKU No. 3506, *Zostera* belt, Ogori Bay, Seto Inland Sea, Aug. 19, 1966, with a Danish seine, T. Tateishi leg; 1 ♂, ZLKU No. 3324, Manazuru, Kanagawa Pref., Sagami Bay, Apr. 1960, K. Sakai leg.

Northern Japan: 2 ♂♂, ZLKU No. 1319, off Iwafune, Niigata Pref., Sea of Japan, 50 m in depth, July 30, 1958, collector unknown.

Remarks. In the series of material, in which the specimens have the complete first pereiopods not regenerated, we find the marked differences in the degree of development of the first pereiopods with sex and maturity, as it is essentially noted by Kemp (1915) in his *A. polymorphus*. The diversity of form

Table 4. Occurrence of each pattern of the first pair of pereiopods related to carapace length of individuals.

Patterns	Carapace length (mm) 2.0–2.2	2.3–2.5	2.6–2.8	2.9–3.1	3.2–3.4	3.5–3.7	3.8–4.0	4.1–4.3	4.4–4.6	4.7–4.9	5.0–5.2	5.3–5.5	5.6–5.8	5.9–6.1	6.2–6.4	Total numbers and sex of specimens
I	1 + ①			②			**2** + ①		**1**		**2**	**1**		**1**		1 ♂[1], 7 ovig. ♀♀, 4 ♀♀
II A-1										**2** + ①	**1** + ①		**3**			6 ovig. ♀♀, 2 ♀♀
II B										**1**	**2**			**2**		5 ovig. ♀♀
II A-2			1				1	1			2	1				6 ♂♂
III												3	2	1	1	7 ♂♂
IV A										2	1	1	1			5 ♂♂
IV B								1		1		3		2		7 ♂♂

Bold-faced figure is number of ovigerous female.
Marked figure is number of non-ovigerous female.
1) An immature male, with undeveloped appendix masculina on endopod of second pleopod, has the genital pores still closed and not exserted.

may be summarized as is shown above. And the occurence of several patterns of the first pair is appearently correlated with sex, maturity and growth of the individual as shown in Table 4.

Besides this marked variation in the first pereiopods, the present material shows the considerable variations in the following characters:

Characters	Present material	*A. japonicus*[1]	*A. lamellifer*[2]
Rostrum	Reaching from proximal third of 2nd antennular segment to tip of antennular peduncle.	Extending to or a little beyond tip of 2nd segment.	Reaching to or slightly beyond antennular peduncle.
Development of extra- and infra-corneal teeth	A gradual series of development of both teeth present; extracorneal one varying from very slight to pronounced and exceeding the other in length.	Extracorneal one well developed; infracorneal one spinous, exceeding the other in length.	Extracorneal one well developed, exceeding the other in length.
Stylocerite	Reaching from proximal third of 2nd antennular segment to proximal half of 3rd segment.	Somewhat beyond tip of 1st segment.	Reaching to about middle of 3rd segment.

1) After Kubo, 1936. Original type specimens (2 ♂♂, 1 ovig. ♀) are deposited in the collection of the Tokyo University of Fisheries.
2) After Kubo, 1940.

Finally, the present material is identified with *A. japonicus* Kubo and now it is advisable to consider *A. lamellifer* Kubo a synonym of *A. japonicus* Kubo, because the enumerated differenciations of the two species seem to be involved in the range of variation of those characters tabulated above.

Distribution. Known from Mitajiri, Yamaguchi Pref. (type locality), in Seto Inland Sea and Kominato, Chiba Pref., Pacific coast.

Athanas marshallensis Chace, 1955

(Fig. 7)

Athanas marshallensis Chace, 1955, p. 17, fig. 8; Banner, 1957, p. 193, fig. 2; Banner and Banner, 1960, p. 142, fig. 2.

Description. The body is small (1 ♂, c.l. 3.6 mm, t.l. 10.4 mm; 1 ovig. ♀, c.l. 3.7 mm, t.l. 10.1 mm) and polished (Fig. 7, A). The rostrum is triangular with a low dorsal carina along its full length; in the male specimen the rostrum exceeds the end of the first antennular segment, and in the ovigerous female it hardly reaches to the end of the second one (Fig. 7, B). The extracornial tooth is acute, and extends beyond middle of the cornea; the infracorneal tooth is short and blunt the pterygostomial margin is rounded.

The antennular peduncle is robust; the stylocerite is sharply pointed and reaches to the proximal third of the third antennnular segment. The carpocerite of the antenna is shorter than the antennular peduncle; the scaphocerite extends to the end of the antennular peduncle and its lateral spine barely reaches as far as the distal margin of the lamella.

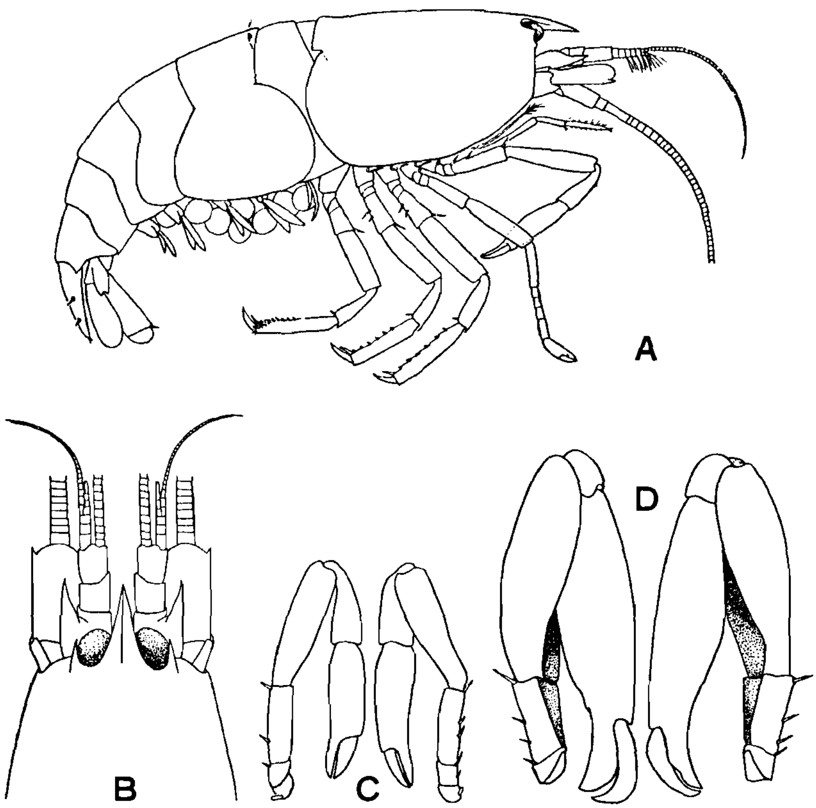


Fig. 7. *Athanas marshallensis* Chace, 1955.
A, Animal, ovigerous female in lateral view, x 9; B, anterior part of body in dorsal view; C, first pair of pereiopods of female in outer view; D, first pair of pereiopods of male in inner view. (C and D drawn to same scale.)

In both sexes the first pereiopods are almost symmetrical, folded beneath the body. In the male specimen the movable and immovable fingers of both chelipeds are lamellar, serrated on the cutting edges and densely hairy in the inner margin of the cutting edges (Fig. 7, D); the movable finger is curved and slightly longer than the immovable one. The palm is smooth, cylindrical, longer than twice as long as the movable finger and three times as long as broad; the carpus is cup-shaped, one-fourth of the palm; the merus is three times as long as broad, vaginal (the ventral surface is deeply excavate to accommodate the palm); the ischium is half of the merus, armed with four spines on the dorsal margin.

In the ovigerous female the first pereiopods are also symmetrical and slenderer than the first pereiopods of male (Fig. 7, C). The movable and immovable fingers are toothless, two-fifths of the palm, which is 2.5 times as long as broad; the carpus is slender and somewhat shorter than the palm; the merus is 3.7 times as long as broad and semi-circular in cross section with a shallow excavation on the ventral surface; the ischium is 0.8 times as long as the merus, the dorsal margin of this segment is armed with several spines.

In these specimens the first and second pereiopods have a rudimentary exopod; the branchial formla is: 5 pleurobranchs + 6 epipods + 4 setobranchs + 5 (3 + 2 rudim.) exopods.

The dactylus of the third pereiopod is simple; the propodus bears six or seven small spines at the ventral margin, the terminal spine is two-thirds of the dactylus.

The abdominal segments are polished, the posterior margins of the first four segments are rounded, that of the fifth is pointed and that of the sixth is articulated with a movable plate. The telson is truncate, three times as long as broad at the posterior margin.

Colour. The present specimens preserved in 5 % formalin for about a week were uniformly pale brown, densely scattered with red chromatophores and had irregular transverse stripes of pale blue on the anterior and posterior margins of the abdominal segments.

Material examined. Ryukyu Islands : 1 ovig. ♀, ZLKU No. 3245, coral reef, Suno, Kasari, Amami-oshima, July 31, 1965, K. Baba leg.

Southern Japan : 1 ♂, ZLKU No. 3301, Ohama, west coast of Ashizuri-misaki, Kochi Pref., May 29, 1966, K. Sakai leg.

Remarks. The present specimens are referable to this species defined by Chace (1955) with slight differences in proportion to length of the palm of the first pereiopods.

Distribution. This species has been recorded only from various localities of the northern Marshall Islands.

Athanas setoensis Kubo, 1951
(Fig. 8)

Athanas setoensis Kubo, 1951, p. 265, figs. 5, 6.

Description. The body is small (1 ♂, c.l. 5.1 mm, t.l. 13.5 mm; 1 ovig. ♀, c.l. 5.0 mm, t.l. 13.3 mm) and sparsely pubescent (Fig. 8, A). The rostrum is lanceolate, and provided with a sharp dorsal carina along its full length; the rostral apex hardly reaches to the proximal third of the third antennular segment (Fig. 8, B). The extracorneal tooth is pointed, and reaches beyond the blunt infracorneal tooth. The pterygostomial margin is rounded.

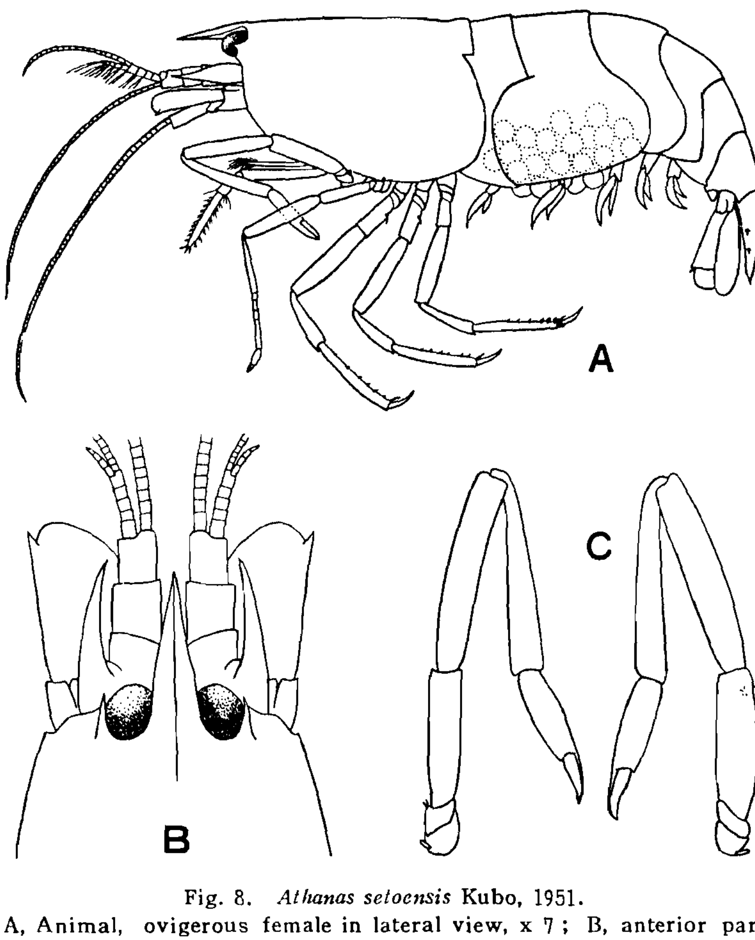


Fig. 8. *Athanas setoensis* Kubo, 1951.
A, Animal, ovigerous female in lateral view, x 7; B, anterior part of body in dorsal view; C, first pair of pereiopods of female in inner view.

The antennular peduncle is robust, the first, second and third segments are subequal in length ; the stylocerite in the female specimen is acute and reaches to the middle of the third antennular segment, while in the male specimen the stylocerite barely overreaches the distal margin of the second segment. The carpocerite of the antenna extends beyond the middle of the third antennular segment. The scaphocerite is broad, exceeding well the tip of the antennular peduncle, the lateral spine is as long as the distal margin of the lamella.

The male specimen has the first pair of pereiopods missing.

The female specimen has the first pair which are symmetrical and slender (Fig. 8, C). The cutting edges of the movable and immovable fingers are entire, closely fitting together. The movable finger is longer than half of the palm, which is cylindrical ; the carpus is somewhat broad distally and twice as long as the palm ; the merus is as long as the carpus, the distal part of the ventral surface is slightly excavated ; the ischium is slightly shorter than the merus, bearing a short spine on the subproximal part of the dorsal margin.

The first and second pairs of the pereiopods are provided with a rudimentary exopod; the branchial formula is: 5 pleurobranchs + 6 epipods + 4 setobranchs + 5 (3 + 2 rudim.) exopods.

The third pereiopod has the simple dactylus; the propodus is three times as long as the dactylus and bears several spines, the distal one of which is conspicuous and exceeds the middle of the dactylus.

The posterior margins of the first four abdominal segments are rounded, but that of the fifth segment is pointed and that of the sixth one has a movable plate. The telson is tapering, and 3.2 times as long as broad at the posterior margin.

Material examined. Ryukyu Islands: 1 ♂, 1 ovig. ♀, ZLKU No. 3315, Chinen, Okinawa-jima, June 18, 1962, S. Miyake, T. A. Uchida and H. Minei leg.

Remarks. The specimens here examined agree well with the original type specimen (a female) in the collection of the Seto Marine Biological Laboratory, Kyoto University (SMBL Type No. 113). Unfortunately the male examined has the first pair of pereiopods missing.

Distribution. This species has previously been recorded only from the type locality (Shirahama, Wakayama Pref., southwest of Kii Peninsula).

Athanas indicus (Coutière, 1905)

(Figs. 9 ; 10, A-C, E-G, I ; 11, A, B, D ; 12, A-D, F-H)

Arete indicus Coutière, 1905b, p. 863, figs. 134, 135 ; Balss, 1915, p. 21 ; Coutière, 1921, p. 413 ; Barnard, 1956, p. 7 ; Banner, 1959, p. 130.

Athanas indicus : Banner and Banner, 1960, p. 149 ; Banner and Banner, 1964, p. 85.

Arete iphianassa De Man, 1910, p. 312 ; De Man, 1911, p. 164 ; De Man, 1915, pls. 3, 4, fig. 11 ; De Man, 1922, p. 22, pl. 3, fig. 11 ; Banner, 1956, p. 325 ; Holthuis, 1958, p. 17.

Arete intermedius Yu, 1931, p. 513, fig. 1.

Athanas kominatoensis Kubo, 1942, p. 82, figs. 1, 2.

Description. The body is smooth and small (5 ♂♂, 2 ovig. ♀♀, 2 ♀♀ : c.l. 4.1-6.7 mm, t.l. 10.8-16.5 mm). The dorsal margin of the carapace is almost straight or hump-backed, and the rostrum is curved downward (Fig. 9). The rostrum is lanceolate or triangular, depressed with very faint canals on the lateral margins ; in general the rostral apex reaches to the proximal half of the third

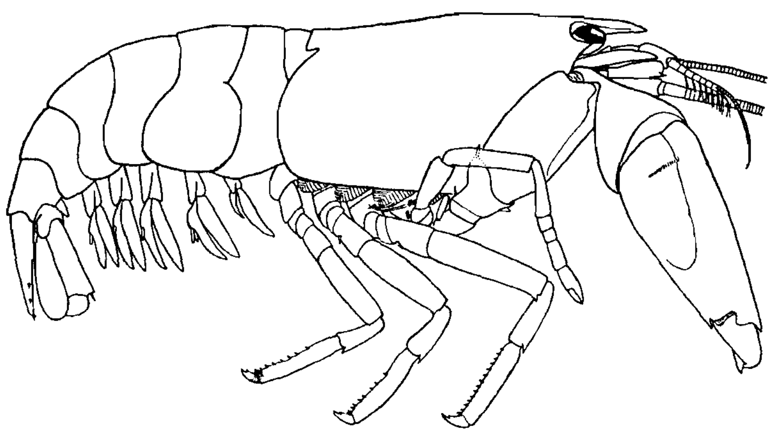


Fig. 9. *Athanas indicus* (Coutière, 1905), male, x 8.

antennular segment (Fig. 10, A, F), however, in one ovigerous female (ZLKU No. 3321 : Fig. 10, B, E) the rostral apex extends over the tip of the antennular peduncle, and in two specimens (1 ♂, 1 ovig. ♀, ZLKU No. 3318 : Fig. 10, C, G) it reaches barely to the distal half of the second segment ; the rostral carina is absent or feeble. The infracorneal tooth is sharp. The pterygostomial margin is rounded, while in two specimens (1 ♂, 1 ovig. ♀, ZLKU No. 3318) it is prominent.

The antennular peduncle is robust ; the third antennular segment is as long as or slightly longer than the proximal two segments together, while in one ovigerous female (ZLKU No. 3321) the third one is merely half of these segments together. The stylocerite is curved inward, with its blunt tip reaching to the

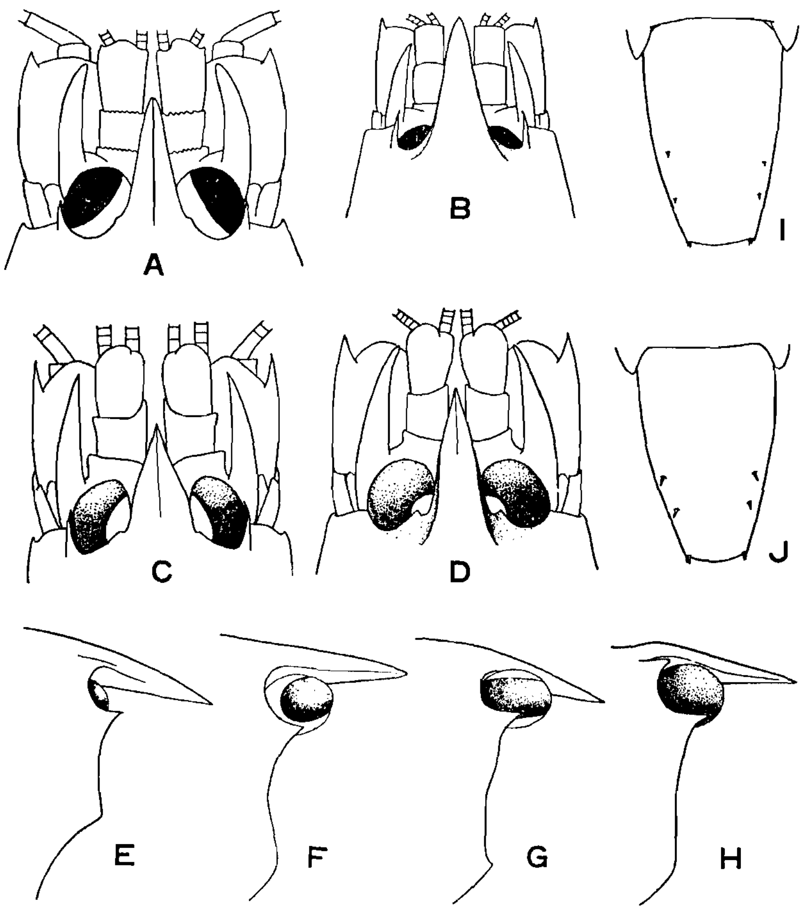


Fig. 10. *Athanas indicus* (Coutière) and *Athanas acanthocarpus* sp. nov.
A. indicus: A, B and C, anterior part of body in dorsal view, respectively, ZLKU Nos. 3322, 3321 and 3318 ; E, F and G, anterior part of carapace in lateral view, respectively, same specimens figured in B, A and C; I, telson in dorsal view (ZLKU No. 3322). *A. acanthocarpus* sp. nov., holotype, male: D, anterior part of body in dorsal view; H, anterior part of carapace in lateral view; J, telson in dorsal view.

distal half of the third segment. The number of the broaden part of the outer antennular flagellum varies from five to nine joints.

The carpocerite of the antenna is 1.5 times as long as broad, and hardly reaches to the tip of the antennular peduncle. The scaphocerite is broad, and extends over the tip of the stylocerite, the lateral spine is strong, and apparently overreaches the distal margin of the lamella.

The third maxilliped is strong ; the dorsal distal margin of the antepenultimate segment is spiniform.

The first pereiopods are almost symmetrical and heavy ; there is no marked variation in form and proportion with individual except in the armature of both fingers (Fig. 11, A, B). The carpus is cup-shaped, engraved on the ventral

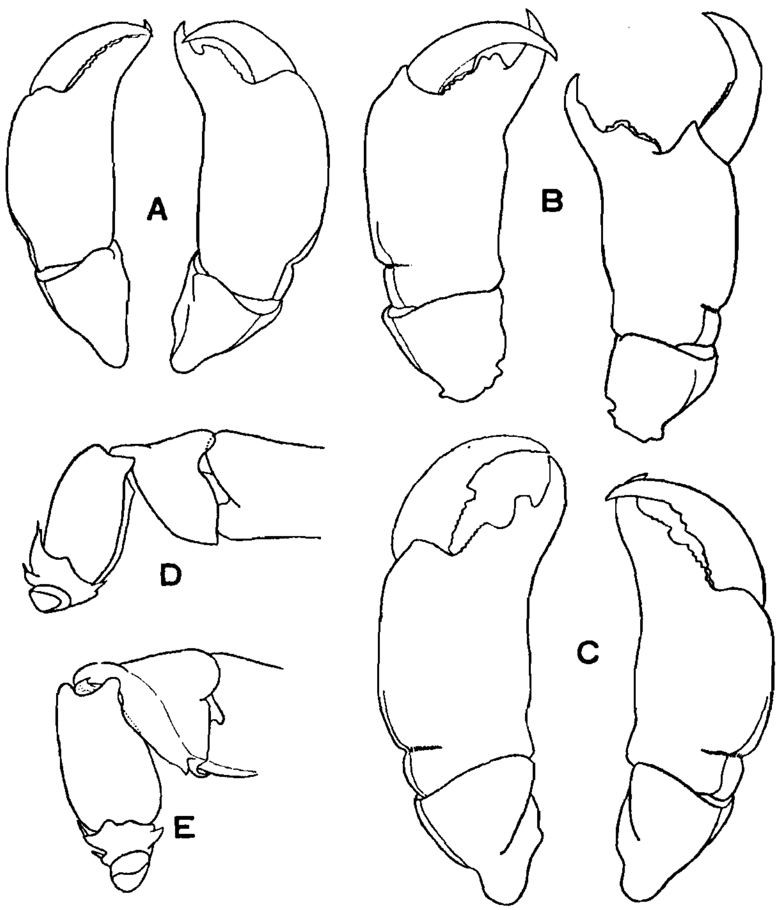


Fig. 11. First pair of pereiopods in *Athanas indicus* (Coutière) and *Athanas acanthocarpus* sp. nov.

A. indicus: A, chelae and carpi of first pereiopods in one male (ZLKU No. 3322); B, same portion of first pereiopods in the other male (ZLKU No. 3318); D, proximal portion of palm, carpus, merus and ischium of left first pereiopod (figured in B) in inner view.

A. acanthocarpus sp. nov., holotype, male: C, chelae and carpi of first pereiopods; E, proximal portion of palm, carpus, merus and ischium in inner view.

surface (Fig. 11 ,D) ; the inner distal margin has a distinct notch, the ventral inner margin is smooth without a process as found in *A. acanthocarpus* sp. nov.

The last three pereiopods resemble each other. In the third one the dactylus is biunguiculate ; the merus is 3.6 to 4.3 times as long as broad, the ventral distal margin of this segment is angled or slightly prominent.

The branchial formula of this species is : 5 pleurobranchs + 5 epipods + 3 setobranchs + 5 (3 + 2 rudim.) exopods.

In all of the male specimens each second pleopod is furnished with a developed appendix masculina and a developed appendix interna on the middle of the endopod (Fig. 12, A, B, F) ; in one ovigerous female (ZLKU No. 3321 : Fig. 12, H) each second pleopod is furnished with the well developed appendix interna only, while in other females (1 ovig. ♀, ZLKU No. 3318 ; 1 ♀, ZLKU No. 2467 ; 1 ♀, ZLKU No. 3220 : Fig. 12, C, D, G) each second pleopod is furnished with both the well developed appendix interna and the appendix masculina, the latter of which is diminutive and fringed with small number of spines.

The telson is truncated, and 3.3 to 4.7 times as long as broad at the posterior margin (Fig. 10, I).

Colour in life. Two specimens (ZLKU No. 3322) associated with a sea urchin *Anthocidaris crassispina* (A. Agassiz) are uniformly dark purple bearing resemblance to their host, with a band of white near the tip of the movable finger of the first pereiopod. The colouration of the present material is similar to Kubo's description (1942), but the present specimens lack a broad stripe of pale yellow along the dorsal median line of the abdominal segments and telson and a white patch on the tip of the endopod of the uropod.

Material examined. Palau Islands : 1 ♀, ZLKU No. 2467, associated with *Diadema* sp., Ngadarák Reef (7° 17′ 30″ N., 134° 28′ 30″ E.), June 29, 1938, S. Wada leg.

Ryukyu Islands : 1 ovig. ♀, ZLKU No. 3321, Miyara, Ishigaki-jima, Mar. 25, 1959, H. Minei leg ; 1 ♂, 1 ovig. ♀, ZLKU No. 3318, Itoman, southern Okinawa-jima, June 30, 1962, S. Miyake, T. A. Uchida and H. Minei leg.

Southern Japan : 1 ♂, 1 ♀, ZLKU No. 3220, associated with *Anthocidaris crassispina* (A. Agassiz), Tomoe-zaki, Tomioka, Amakusa, Apr. 1940, K. Baba leg ; 1 ♂, ZLKU No. 2355, Katsu-zaki, Okino-shima, Fukuoka Pref., Genkai-nada, Mar. 25, 1963, K. Sakai leg ; 2 ♂♂, ZLKU No. 3322, associated with *Anthocidaris crassispina* (A. Agassiz), in tidal zone of rocky shore near the Seto Marine Biological Laboratory, Shirahama, Wakayama Pref., Apr. 7, 1966, T. Kikuchi leg.

Remarks. The specimens examined from various localities agree with

Coutière's description and figures (1905) with the exception of the following differences: the ventral margin of the propodus of the third pereiopod is armed with about a dozen or more spines; the ventral margin of the merus of the same pereiopod bears distally a slight tooth while in the type it bears a strong tooth; in all the specimens except for an ovigerous female (ZLKU No. 3321) the rostrum is slightly shorter than that of the type specimen.

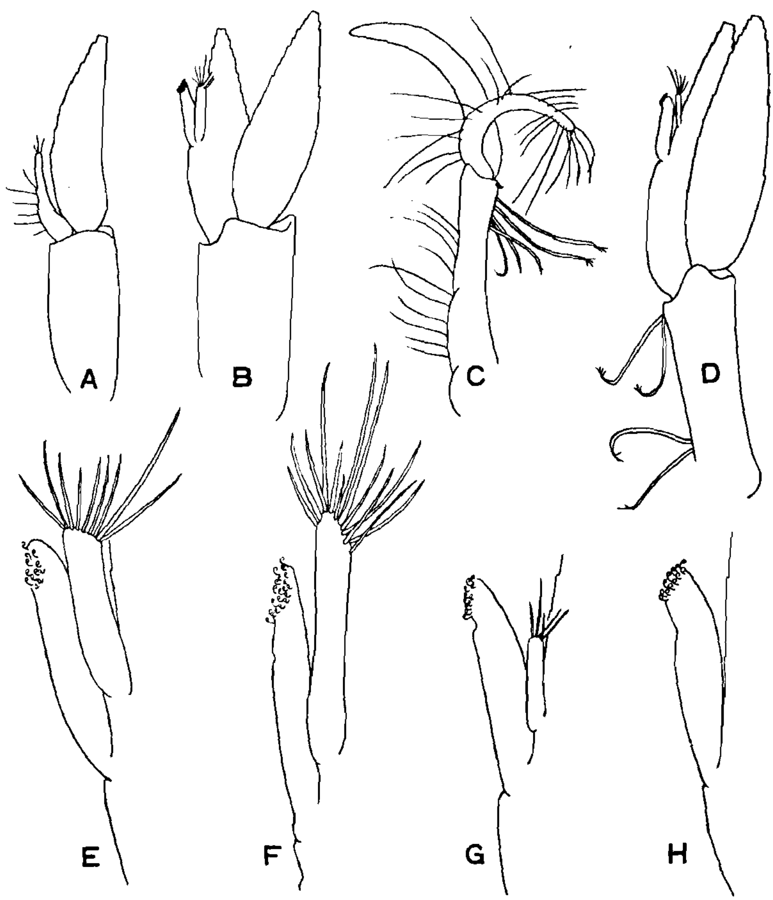


Fig. 12. *Athanas indicus* (Coutière) and *Athanas acanthocarpus* sp. nov. *A. indicus:* A and B, 1st and 2nd pleopods of a male (ZLKU No. 3322); C and D, 1st and 2nd pleopods of a female (ZLKU No. 2467); F, appendix masculina and appendix interna of a male (ZLKU No. 3318); G, diminutive appendix masculina and appendix interna of an ovigerous female (ZLKU No. 3319); H, appendix interna in an ovigerous female (ZLKU No. 3321). *A. acanthocarpus* sp. nov: E, appendix masculina and appendix interna of holotype, male.

Among three female specimens (1 ovig. ♀, 2 ♀♀, ZLKU Nos. 2467, 3220, 3319) we observed both the appendix interna and the appendix masculina on the second pleopod, though generally the female of Caridea has the appendix interna only on the second pleopod. In the present state we regard it as aberrant as in the case observed in *Aretopsis amabilis* De Man (Miyake and Miya, 1967).

According to the previous records, this species is usually, if not always, associated with sea urchins of the genus *Echinometra* (Coutière, 1904 and 1905a, b; Barnard, 1956; Banner and Banner, 1960). In our record one female from the Palaus (ZLKU No. 2467) was associated with a sea urchin of *Diadema* and four specimens from Amakusa and Shirahama (ZLKU Nos. 3220, 3322) were found living among the spines of the sea urchin, *Anthocidaris crassispina* (A. Agassiz).

Banner and Banner (1960) suggested the probability of the combination of *A. indicus* and *A. kominatoensis* from Japan. The careful study of the present material proved impossible for us to find out the differences which were able to be used for specific distinctions. It appears wiser to place *A. kominatoensis* in synonymy of this species.

Distribution. This species is widely distributed throughout the Indian Ocean and the Central Indo-Pacific region.

Athanas acanthocarpus sp. nov.

(Figs. 10, D, H, J; 11, C, E; 12, E; 13)

Description. The body measuring 5.6 mm in carapace length and 14.2 mm in total length is smooth (Fig. 13). The dorsal surface of the carapace is almost straight, the rostrum is strongly bent down. The rostrum is marked off from the lateral deep canals at the base, lanceolate, twice as long as broad at the base, with a short rostral carina; the rostral apex reaches to the tip of the second antennular segment (Fig. 10, D). The supracorneal tooth is merely a rudimentary process, the infracorneal tooth is acute (Fig. 10, H). The pterygostomial margin is rounded.

The antennular peduncle is robust, the third antennular segment is as long as the proximal two segments together. The stylocerite is curved inward with a blunt tip, which reaches to the distal third of the third segment. The broaden part of outer antennular flagellum consists of nine joints.

The carpocerite of the antenna is twice as long as broad, reaching to the distal third of the third antennular segment. The scaphocerite is broad, the distal margin of the lamella is round and fails to reach to the tip of the antennular peduncle, the lateral spine is strong, and extends beyond the distal margin of the lamella.

The third maxilliped is robust, and exceeds the antennular peduncle by the proximal third of the ultimate segment; the antepenultimate one projects the dorsal distal margin as a sharp, strong tooth. The exopod extends over the tip of the antepenultimate one.

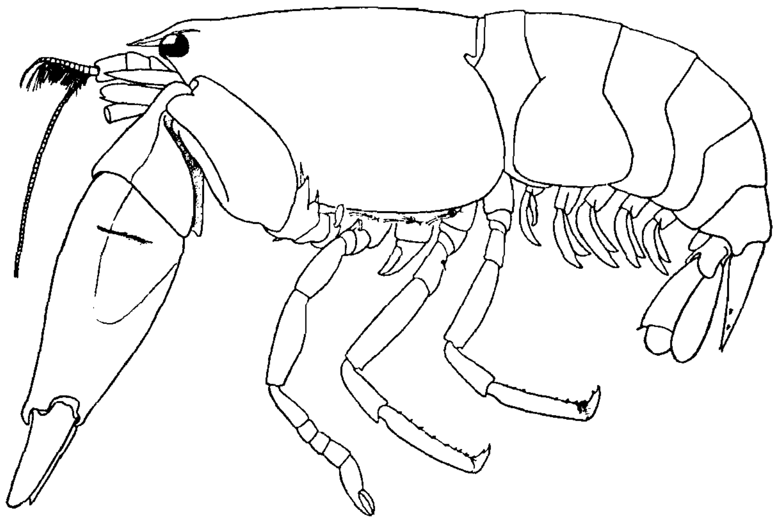


Fig. 13. *Athanas acanthocarpus* sp. nov., holotype, male, x 8.

The first pereiopods are heavy and almost symmetrical except for the armature of the cutting edges of both fingers (Fig. 11, C); the chalae turn outward at a right angle. In each of the first pair the movable finger is slightly shorter than the palm, strongly curved, crossing together with the immovable finger; in the large cheliped the cutting edge of the movable finger is almost smooth except for a blunt large tooth on the middle of it, while that of the immovable one is furnished with a large tooth on the middle and a large triangular tooth on the proximal third of the cutting edge; in the small cheliped the cutting edges of both fingers are irregularly serrated. The palm is rectangular in lateral view, slightly compressed and gradually reduced in thickness distally; the short depression lies across the dorsal surface near the carpus; the curved fine groove like the "linea impressa" presents on the dorsal outer surface and proximally connecting with the similar groove on the outer surface of the carpus. The carpus is cup-shaped, half of the palm (Fig. 11, E); the distal margin slightly projects over the base of the palm, having a conspicuous notch on the middle; the ventral surface is largely engraved to cover the flat ventral surface of the merus, distally projecting as a blunt triangular process. The merus is two-thirds of the palm, triangular in cross section. The ischium is conical, greatly produced externally as teeth, two of them on the dorsal margin and one on the ventral margin, these dorsal teeth bearing strong movable spines.

The second pereiopod has the carpus subdivided into four joints, the proximal (first) one of which is slightly shorter than the following three joints together. The last three pereiopods resemble each other. In the third pereiopod (right; this specimen has left third pereiopod missing) the dactylus is biunguiculate, the dorsal margin is slightly curved, the ventral hook is very slender, running parallel with the strong dorsal hook. The propodus is furnished with fourteen movable spines on the ventral margin. The merus is 4.5 times as long as broad, bearing a strong tooth on the ventral distal margin. In the following two pereiopods the ventral distal teeth of the meri are gradually inconspicuous.

The first and second pereiopods have a rudimentary exopod; the branchial formula of this species is : 5 pleurobranchs + 6 epipods + 4 setobranchs + 5 (3 + 2 rudim.) exopods; the number of epipods and setobranchs differs from the number in *A. indicus*.

The posterior margins of pleura of the abdominal segments are rounded, except for that of the sixth one with a movable plate. The second pleopod is furnished with an appendix masculina and an appendix interna on the middle of inner margin of the endopod (Fig. 12, E). The telson is trapeziform, and 3.5 times as long as broad at the posterior margin (Fig. 10, J).

Holotype. Male, ZLKU No. 3320, Kamiyama-jima, near Naha City, Okinawa-jima, Ryukyu Islands, July 1, 1962, S. Miyake, T. A. Uchida and H. Minei leg.

Remarks. This species is closely allied to *A. dorsalis* (Stimpson, 1860) and *A. indicus* (Coutière, 1905b), but is at once separated from them by: (1) the presence of a triangular process, from which the specific name *acanthocarpus* is derived, on the ventral inner surface of the carpus of each first pereiopod; (2) the lateral margins of rostrum deeply canaliculate at base; (3) having an epipod on the third pereiopod.

When we asked Drs. A. H. and D. M. Banner's opinion regarding this species, Dr. D. M. Banner, who was working temporarily at the Muséum National d' Histoire Naturelle in Paris, was kind enough to compare the present figures (Figs. 9, 10, 11 and 13) with some specimens of *A. dorsalis* and *A. indicus* in the collection of the Muséum National d' Histoire Naturelle in Paris. According to the private communication from her, she found there were none of the specimens with a process on the ventral inner surface of the carpus of the first pereiopods and with the rostrum deeply canaliculate at base. As to the importance of the number of epipods, however, she is of a different opinion,"……we [Drs. A. H. and D. M. Banner] find the branchial formula so variable that it probably cannot be used as a reliable character," which is grounded on the fact that the variation in the branchial formula (in the number of epipods) is occurred in *Athanas djiboutensis* (Banner and Banner, 1960) and in *Alpheus clippertoni* (now *A. rostratipes*, in her letter; Banner and Banner, 1964).

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