

Studies on the shrimps of the genus *Palaemon* (Crustacea: Decapoda: Palaemonidae) from Taiwan

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Shrimps of five species of the genus *Palaemon*, family Palaemonidae in Taiwan are described. They are *Palaemon (Palaemon) macrodactylus* Rathbun, 1902, *Palaemon (Palaemon) ortmanni* Rathbun, 1902, *Palaemon (Palaemon) pacificus* (Stimpson, 1860), *Palaemon (Palaemon) serrifer* (Stimpson, 1860) and *Palaemon (Exopalaemon) orientis* Holthuis, 1950. The first four species were collected from coastal area of mainly rocky shore and levee. The first and the last species was collected from fish and prawn ponds where it is considered as a serious pest in aquaculture for it's fast reproductive rate and high competition for food and space with the cultured species. In the present paper, the distinctive external characteristics as well as the coloration of each species are fully stated.

Palaemon (Palaemon) macrodactylus
Rathbun, 1902
(Textfig.1, pl.1 fig.A)

Palaemon macrodactylus, Rathbun, 1902: 52, fig. 24; Holthuis, 1980: 111.

Leander macrodactylus, Parisi, 1919: 76.

Leander serrifer longipes, Yu, 1930: 570, fig. 4. non *Leander macrodactylus*, Yoshida, 1941: 26, pl. 6 fig. 4.

Leander macrodactylus, Kubo, 1942: 36, figs. 7-9, tabs. 9-12, 19D, 20D, 21D, 22D, 23D, 23K, 24D, 25D, 25D', 26D, 26Q, 27D, 27N, 28L', 29D, 30.

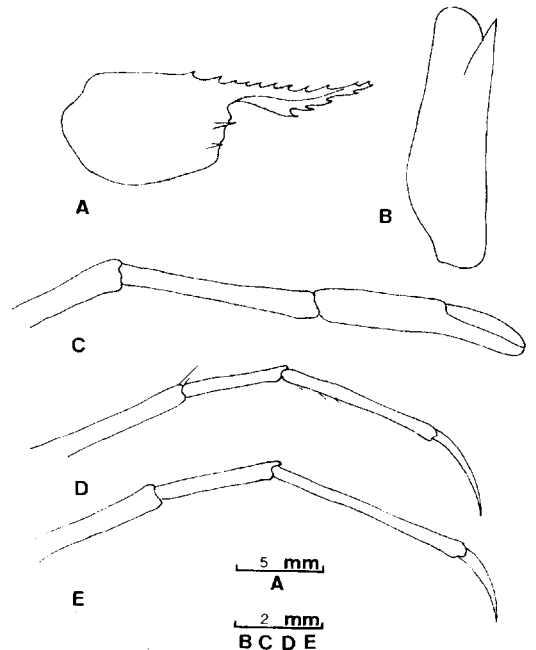
Palaemon (Palaemon) macrodactylus, Holthuis, 1950: 7; Kim, 1977: 195, pl. 17 fig. 27, a, b, textfig. 67.

Material Examined:

Pa-Tou-Tsu, Keelung City; 2♂♂, 2 ovig. ♀♀, 1 ♀; Jun. 3, 1984; Chan leg.

Tong-Kang, Ping-Tong Country; 27 ♂♂, 47 ovig. ♀♀, 7 ♀♀; Jun. 7, 1984; Chan leg.

The specimens examined mostly agree with the description of Kubo's (1942) *Leander macrodactylus*. The rostrum, with lateral carina, is straight in general but curves upwards



Textfig. 1. *Palaemon (Palaemon) macrodactylus* Rathbun.
A. Lateral view of carapace. B. Dorsal view of scaphocerite. C. Second pereopod. D. Third pereopod. E. Fifth pereopod.

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*** All measurements are body length excluded the rostrum.

at the apical portion and about as long as the carapace. The upper rostrum is armed with 8 to 13 teeth, mostly 9, and 1 to 3 teeth, mostly 2, are present on the post-rostral carina. There are 2 to 6 teeth, mostly 4, on the lower border. The scaphocerite is about three times as long as broad and the tooth is about to reach the lamella. The finger of the second pereopod is shorter than the palm. The above description is mainly based on a 30 mm male and a 31 mm ovigerous female, while 86 specimens ranging from 11.5 to 33 mm*** were also examined.

Color in Life:

The color patterns of this species are variable. However, some invariable marking can be noticed, generally, the coloration of this species is different from other local species in having simpler and fewer markings. There is a prominent deep brown cross-band at the posterior margin of the third abdominal somite, while the cross-bands at other somites are unclear. The palm of the second pereopod is bluish. Moreover, two pairs of yellowish luniforms are present at the posterior margin of the uropod and the brown marking at the inner margin of scaphocerite and the antennula is rather deep. The entire shrimp is transparent with some irregular brown strips. The abdominal somites have many tiny brown spots. No interconnecting line is found between the inconspicuous cross-bands of the abdomen. The carapace has a few longitudinal stripes. On the ventro-lateral sides of the first three abdominal somites, there are two prominent thick brown stripes; one situated transversely on the first somite while the other one run longitudinally from the first to the third. A thick brown bar also present along the lateral sides in each of the anterior three pleopods. However, these two special markings are absent in the male. Orange spots are distinctly present on the thoracic appendages. Yellow dots are scatter over the shrimp and fade away quickly after the shrimp is dead. Furthermore, some male specimens show a distinctive white color pattern; the dark brown cross-band at the third abdominal somite and the yellowish luniforms on uropod are only rudimentary observed. The

orange and yellow spots are unclear, only some blue-brown lines are striped on the carapace. This variation in color may be due to different habitats of the shrimp.

Distribution:

This species was previously recorded in Mainland China, Japan, Korea and now is found in Taiwan.

Remarks:

The species was previously described as *Leander macrodactylus*. The following notes may be added as a supplementary description of this species. The apical portion of the rostrum always noticeably bears one to two accessory subterminal teeth. The outer margin of the the scaphocerite is slightly concave. The pereopods, except the second pair, reach or slightly exceed the apex of scaphocerite. The dactylus is long, more than half the length of the propodus in the third pereopod and more than one-third the length of the propodus in the fifth pereopod. The size of this species is rather small. They inhabit rocky shore and levee with some moving currents. However, a large number of specimens was also found in fish and prawn ponds where they are considered as a serious pest in aquaculture. Eggs are greenish and about 0.5 x 0.55 mm in diameter. Eye spots are observed in yellowish eggs.

***Palaemon (Palaemon) ortmanni*
Rathbun, 1902
(Textfig.2, pl.1 fig.B)**

- Palaemon ortmanni*, Rathbun, 1902: 53. footnote; Holthuis, 1980: 112.
Palaemon longipes, de Man, 1907: 409, pl. 32, fig. 26-30.
Leander longipes, Kemp, 1925: 291, 293.
Leander longipes, Kubo, 1937: 346, figs. 2M, 2N, 3T, 3U; Kubo, 1942: 52, figs. 13, 19G, R, 20G, 21G, 22G, 23G, R, 24G, R, 25G, G', 26G, T, 27G, Q, 28F, O, 29G, 32.
Palaemon (Palaemon) ortmanni, Holthuis, 1950: 80, fig. 17; Kim, 1977: 207, pl.

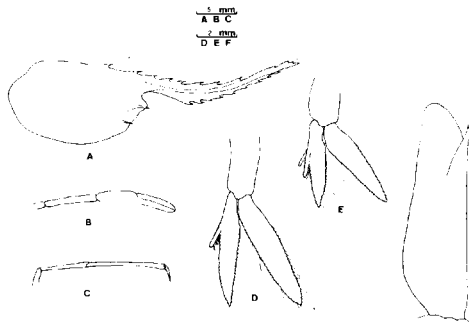
49, fig. 31, textfigs. 74, 75; Miyake, 1982: 29, pl. 10—fig. 4.

Material Examined:

Pa-Chei-Mun, Keelung City; 4 ♂♂, 10 ovig. ♀♀, 1 ♀; May 12, 1984; Chan leg.

Pa-Tou-Tsu, Keelung City; 5 ♂♂, 5 ovig. ♀♀; May 24, 1984; Chan leg.

Many authors, such as de Man (1907), Kubo (1942), and Holthuis (1950) have extensively described this species. The supplementary description on the characters is as follow. The rostrum is long, about one and a half times as long as the carapace, and remarkably curves upwards in the portion beyond the scaphocerite. The total number of rostral teeth on upper border varies from 5 to 9, mostly 6 and have 0-3 apical teeth, mostly 2. The post-rostral carina bears 2 teeth. The low border bears 5 to 10 teeth, mostly 8. The scaphocerite is slightly shorter than the carapace and the length is three times longer than the width, the outer margin is straight with the lamella exceeding the tooth. The finger of the second pereopod is slightly longer than the palm. The dactylus are short. The above description is mainly based on one 41 mm male and one 55 mm female. The other 21 specimens are with 16-60 mm body length and also fully examined.



Textfig. 2. *Palaemon (Palaemon) ortmanni* Rathbun. A. Lateral view of carapace. B. Second pereopod. C. Fifth pereopod. D. Endopodite of second abdominal appendage of female. E. Endopodite of second abdominal appendage of male. F. Dorsal view of scaphocerite.

Color in Life:

The entire body of this shrimp is transparent with many unpatterned narrow brown stripes. The apical portion and lower margin of the rostrum are deep brown. The carapace has many complex brown stripes. The abdomen has many brown cross-bands in such a pattern that seven invariably cross-bands with two situated at the anterior and posterior margins of the first somite and then each at the posterior margin of the second to sixth, and these cross-bands are interconnecting by many longitudinal narrow lines somewhat like a network. Apparent orange bands are present on the thoracic appendages. Many yellow spots scatter over the body, especially on the pleonic appendages and the ventro-lateral sides of the first three abdominal somites. These spots fade out quickly after the shrimp is dead. The marking appears simpler and paler in male and in young specimens. Generally, the color of the marking is not as deep as that of *Palaemon (Palaemon) pacificus*.

Distribution:

This species has been recorded in Mainland Chian and Japan and is newly recorded in Taiwan.

Remarks:

This species was described mostly under the name of *Leander longipes*. The finger of the second pereopod is slightly longer than the palm. The description of this characteristic is somewhat controversy among many authors. Holthuis (1950) stated that the palm is longer, while de Man (1907) and Kubo (1942) stated the finger is longer. In all the specimens collected in this study, the palm is just a little shorter than the finger. Thus, the fact that the finger is almost as long as the palm can be acceptable. This species is usually found around rocks, harbour, and levee of sandy or muddy sea bed. Almost all females found were ovigerous. This species is rather large, the largest specimen is 60 mm. They hid during daytime and crawled out on rocks at night, and were collected with the aid of light and

small collecting nets. It appeared that it was easier found during Spring than Fall. The female found after early Spring is mostly ovigerous. The eggs are about 0.5×0.6 mm in

Palaemon (Palaemon) pacificus
(Stimpson, 1860)
(Textfig. 3, pl. 1 fig. C)

Leander pacificus, de Man, 1888: 559; Doflein, 1902: 639; de Man, 1902: 806; Balss, 1914: 57; Kemp, 1925: 307; Yu, 1930: 555; Kubo, 1937: 346, figs. 1C, 2D, 2D', 2E, 2F, 3D, 3E, 3F, 3G, 3H, 3K, 3L, 3M; Kubo, 1942: 42, figs. 10-12, 19B, M, 20B, 21B, 22B, 23B, I, 24B, M, 25B, B', 26B, O, 27B, L, 29B, 31.

Palaemon pacificus, Rathbun, 1902: 53; Rathbun, 1906: 924, pl. 22, fig. 3; Holthuis, 1980: 113.

Palaemon quoianus, Stebbing, 1910: 384.

Leander squilla, Stebbing, 1910: 386.

Leander peringueyi, Stebbing, 1915: 75, pl. 17.

Leander gilchristi, Stebbing, 1915: 76, pl. 18.

Palaemon (Palaemon) pacificus, Gee, 1925: 158.

Palaemon (Palaemon) pacificus, Holthuis, 1950: 87, fig. 19; Kim, 1977: 193, pl. 48, fig. 26, textfig. 66; Miyaki, 1982: 29, pl. 10—fig. 3.

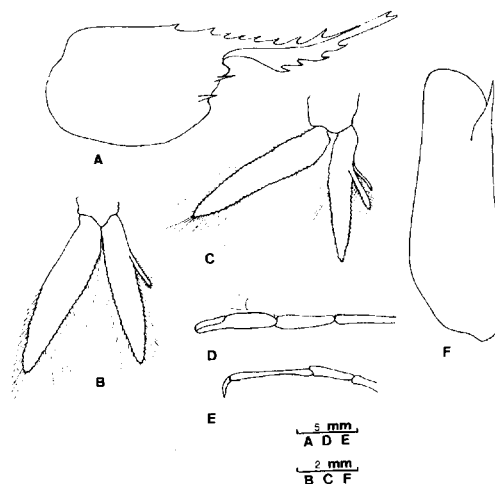
Material Examined:

Pa-Chei-Mun, Keelung City; 2 ♂♂, 4 ovig. ♀♀; May 15, 1984; Chan leg.

Pa-Tou-Tsu, Keelung City; 5 ♂♂, 13 ovig. ♀♀; 8 May 24, 1984; Chan leg.

Byi-Tou, Taipei County; 1 ♂, 1 ♀; Jun. 3, 1984; Chan leg.

The rostrum, with lateral carina, is slightly longer than the carapace. The number of rostral teeth in upper border varies from 5 to 8, mostly 6, and with 2 to 4 post-rostral teeth, lower border remarkably convex, provided with 4 to 5 strong teeth, mostly 5. The scaphocertie, with a straight outer margin, has a length about three times as long as the width, and the distal margin of lamella is slightly longer than the tooth. The finger of the second pereopod is noticeably shorter than the palm. The above description is mainly based on a 41 mm male



Textfig. 3. *Palaemon (Palaemon) pacificus* (Stimpson)
A. Lateral view of carapace. B. Endopodite of second abdominal appendage of female. C. Endopodite of second abdominal appendage of male. D. Second pereopod. E. Fifth pereopod. F. Dorsal view of scaphocertite.

and a 52 mm ovigerous female. 34 specimens ranging from 12-54 mm in body length were also fully examined.

Color in Life:

The coloration of this animal is rather distinctive. There are two large prominent orange spots on the exopods. The entire body is transparent and covered with many irregular red-brown stripes. The stripes in the carapace are longitudinal and complex. The abdomen has seven invariably deep red-brown cross-bands; two at the anterior and posterior margins of the first somite and then each at the posterior margin of the second to sixth. There are no noticeable interconnecting lines between the red-brown cross-bands of the abdomen. However, this interconnecting network sometimes appears on the abdomen of large ovigerous female, such as that of *Palaemon (Palaemon) ortmanni*. Further, many conspicuous orange bands as well as spots are present on both the thoracic appendages and the distal margin of the lateral abdominal somites. The stripes on both the lateral surfaces of the first four abdominal somites and pleonic appendages are deep colored. Many yellow spots appears

on this shrimp, especially on the lateral surfaces of pleonic appendages in ovigerous female, but not so obvious in male. These spots quickly fade away after the shrimp is dead, and it is also true for the other markings. The marking appears to be simpler and paler in male but especially prominent in large ovigerous female.

Distribution:

This species is widely known in the Indo-Pacific regions; ranging from E. and S. Africa, through the Red Sea, Gulf of Suez, S. India, Hong Kong, Japan to Hawaii. The Taiwan locality is reported here.

Remarks:

The species was described in detail under the name of *Leander pacificus* by many authors. The following notes are added to the description of this species. The rostrum slightly exceeds the apex of the scaphocerite and curves upwards in the distal half. The number of apical teeth of the rostrum ranges from 1 to 2 in most of specimens. The apex of the distolateral tooth in the scaphocerite slightly curves upwards as relative to the lamella. The pereopods, except the second pair, fail to reach the apex of scaphocerite. The dactylus are short. Moreover, the pereopods in male are shorter than those in female. This species is quite large in size. Their habit and habitats are similar to those of *Palaemon (Palaemon) ortmanni* and therefore these two species often appear together in collection. Eggs are about 0.5 x 0.6 mm in diameter, which are not as numerous as *Palaemon (Palaemon) ortmanni*, about 750 in a 51 mm ovigerous female. The color of the eggs is oliver-green. Eye spots are visible when the eggs become yellowish.

Palaemon (Palaemon) serrifer
(Stimpson, 1860)
(Textfig. 4, pl. 1 fig. D)

Leander serrifer, Doflein, 1902: 640; Balss, 1914: 57, Kemp, 1925: 305; Urita, 1926: 428; Yokoya, 1930: 543; Yu, 1930: 567, figs. 4A-C; Kubo, 1937: 346, figs. 1D, 2G, 2H, 3N, 3P, 3Q; Kubo, 1942:

33, figs. 8, 9, 19C, N, 20C, 21C, 22C, 23C, J, 24C, N, 25C, C', 26C, 27C, M, 28B, K, 29C, 30.

non *Leander serrifer*, Stebbing, 1914: 31; Yoshida, 1941: 26, pl. 6, fig. 3.

Leander Fagei, Yu, 1930: 561, fig. 2.

Palaemon (Leander) serrifer, Gee, 1925: 158; Kellogg, 1928: 352.

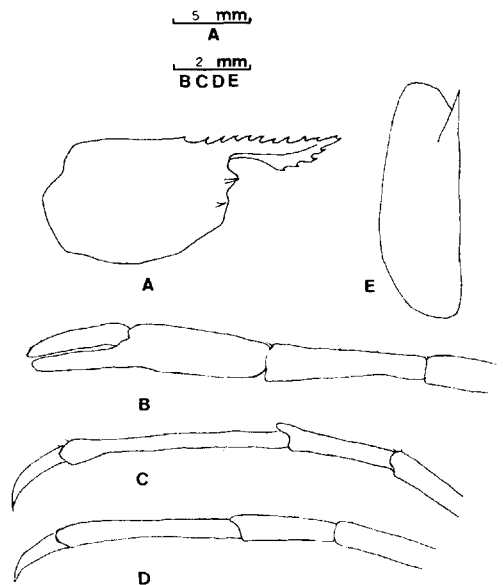
Palaemon (Palaemon) serrifer, Holthuis, 1950: 83, fig. 18; Kim 1977: 189, pl. 47, fig. 25, textfigs. 64, 65; Miyake, 1982: 26, pl. 10—fig. 2.

Palaemon serrifer, Holthuis, 1980: 115.

Material Examined:

Pa-Tou-Tsu, Keelung City; 4 ♂♂, 5 ovig. ♀♀; May 24, 1984; Chan leg.

The rostrum, shorter than the carapace, is almost horizontally straight. The upper rostrum bears 7 to 9 teeth, mostly 8, while one of them is subapical. Usually 3 teeth are present on the post-rostral carina. The teeth between the second post-rostral tooth to the penultimate rostral tooth are equally spaced. The lower border is convex and bears 3 to 4



Textfig. 4. *Palaemon (Palaemon) serrifer* Stimpson. A. Lateral view of carapace. B. Second pereopod. C. Fifth pereopod. D. Third pereopod. E. Dorsal view of scaphocerite.

strong teeth. The finger of the second pereopod is somewhat shorter than the palm. The pereopods, except the second pair, just reach the apex of the scaphocerite. The above description is mainly based on a 41 mm ovigerous female and a 30 mm male. Other specimens ranging from 28 mm to 43 mm were also examined in detail.

Color in Life:

The entire body is transparent and covered with many unpatterned black-brown stripes. Moreover, there are many black-brown spots on the abdomen. The fingers of the second pereopods are blue. There are also two prominent black-brown stripes on the ventro-lateral sides of the first three abdominal somites in a similar pattern as that of *Palaemon (Palaemon) macrodactylus* but not so deep in color, however, this marking is absent in male. Orange bands are obvious on the thoracic appendages. In male, there are apparent orange spots on the posterior margin of the lateral sides of the fifth somite and the outer margin of the exopod, but these markings are not as remarkable as those of *Palaemon (Palaemon) pacificus*. The stripes on the carapace is longitudinal and complex. No interconnecting network is found on the abdomen. Yellow spots are scattered in a similar pattern as other local species and fade away quickly after death.

Distribution:

This species has been reported from Bombay, Burma, Mergui Archipelago, Mainland China, Japan, Hong Kong, Java and now is reported in Taiwan.

Remarks:

The present species closely resemble to *Palaemon (Palaemon) macrodactylus*. Besides their different coloration, the following characteristics can be used to distinguish it from *Palaemon (Palaemon) macrodactylus*. The rostrum just reaches the apex of the scaphocerite, only slightly curves upwards at the apex, and is deeply compressed laterally. The scaphocerite is rather broad, its length is two and a half times as long as the width, whereas the

outer margin is almost straight and with the disto-lateral tooth nearly reaches the anterior of the lamella. The dactylus are short, in the third pereopod it is less than half as long as the propodus and in the fifth pereopod it is less than one-third as long as the propodus. The species is small in size but the body is robust. It is found at the base of levee and rocky shore of sandy sea bed that provided with some water movements. The muddy green eggs are 0.5 x 0.6 mm in diameter and numerous. Eye spots are visible in some eggs.

Palaemon (Exopalaemon) orientis

Holthuis, 1950

(Textfig. 5, pl. 1 fig. E)

Leander longirostris japonicus, Doflein, 1902: 63a.

Leander japonicus, Balss, 1914: 58; Parisi, 1919: 77, pl. 6 fig. 10; Kemp, 1925: 289; Yu, 1930: 553; Kubo, 1937: 346, figs. 2K, 2L, 3R, 3S; Yoshida, 1941: 28, pl. 7 fig. 1; Kubo, 1942: 57, figs. 14A, B, 15, 16C, 17, 19J, U, 20L, 22K, 23P, U, 24J, U, 25L, L', 26L, V, 27J, U, 28H, S, 29J, 33.

Palaemon japonicus, Rathbun, 1902: 50; Maki & Tsuchiya, 1923: 53, pl. 2, fig. 4.

Palaemon (Leander) japonicus, Gee, 1925: 158; Kellogg, 1929: 352.

Palaemon (Exopalaemon) orientis, Holthuis, 1950: 49; Kim, 1977: 216, pl. 49, fig. 34, textfigs. 80, 81; Miyake, 1982: 29.

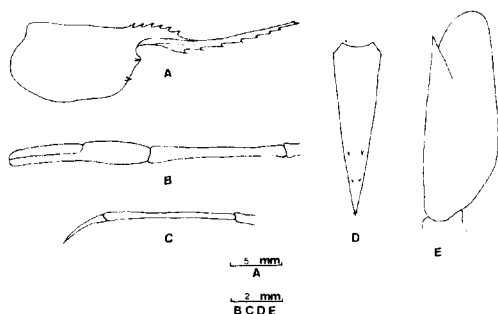
Exopalaemon orientis, Holthuis, 1980: 83.

Material Examined:

Tong-Kang, Ping-Tong Country; 4 ♂♂, 22 ovig. ♀♀, 8 ♀♀; Jun. 7, 1984; Chan leg.

The rostrum is long and slender. It exceeds the scaphocerite and is about one and a half times as long as the carapace. It curves obliquely upwards and is provided with one tiny accessory subterminal tooth. The basal portion of the upper rostrum above the orbital region is remarkably convex and developed into a crest that bearing 6 to 7 teeth, with one of them is placed behind the post-orbital margin. The

lower border bears 5 to 8 teeth, mostly 6. The antenna peduncle reaches at about the three-fourth of the scaphocerite. The scaphocerite is broad, about two and a half times as long as the width. The outer margin of scaphocerite is slightly convex and the tooth does not reach the lamella. The finger of the second pereiopod is somewhat longer than the palm, and is about half as long as the carpus. The pereiopods, except the second pair, fail to reach the apex of scaphocerite. Dactylus are long, which is about half as long as the propodus in the third pereiopod. The above description was mainly based on a 41 mm male, a 46 mm ovigerous female and a 40 mm female. 34 specimens ranging from 31 to 51 mm were also examined.



Textfig. 5. *Palaemon (Exopalaemon) orientis* Holthuis.

A. Lateral view of carapace. B. Second pereiopod. C. Third pereiopod. D. Dorsal view of telson. E. Dorsal view of scaphocerite.

Color in Life:

The species shows a rather simple coloration. The body is not as transparent as other local *Palaemon (Palaemon)* species. There are many tiny brown spots scattered over the entire body. The outer antennular flagellum is blue and the anterior portion of the rostrum is blue-brown. Moreover, two to three prominent large blue spots are always visible on the ventro-lateral sides between the first three abdominal somites. The brown stripes on both the carapace and abdomen are not apparent, however, the marking at the branchio-cardiac groove are somewhat deeper. There are no orange bands on the thoracic appendages and no yellow spots distributed on the body.

Young and male specimens are rather red-brown in color.

Remarks:

This species is described as *Leander japonicus* by many authors but Holthuis (1950) proposes the name *Palaemon (Exopalaemon) orientis* for this species in order to prevent the unnecessary confusion with *Macrobrachium japonicum*. Despite many ambiguities in the characteristics of this species, Kubo's (1942) description is adopted here mainly for comparison. The present species can be easily distinguished from the species of *Palaemon (Palaemon)* by the presence of the basal crest in the rostrum. This species is quite large in size. They inhabit both sea-water and brackish-water. The specimens were collected in fish and prawn ponds. This animal, together with *Palaemon Palaemon macrodactylus* are always considered as serious pests in aquaculture. Eggs are olive-green to mud-yellow in color and numerous. It is about 0.6 x 0.7 mm in diameter. Eye spots are visible in some eggs.

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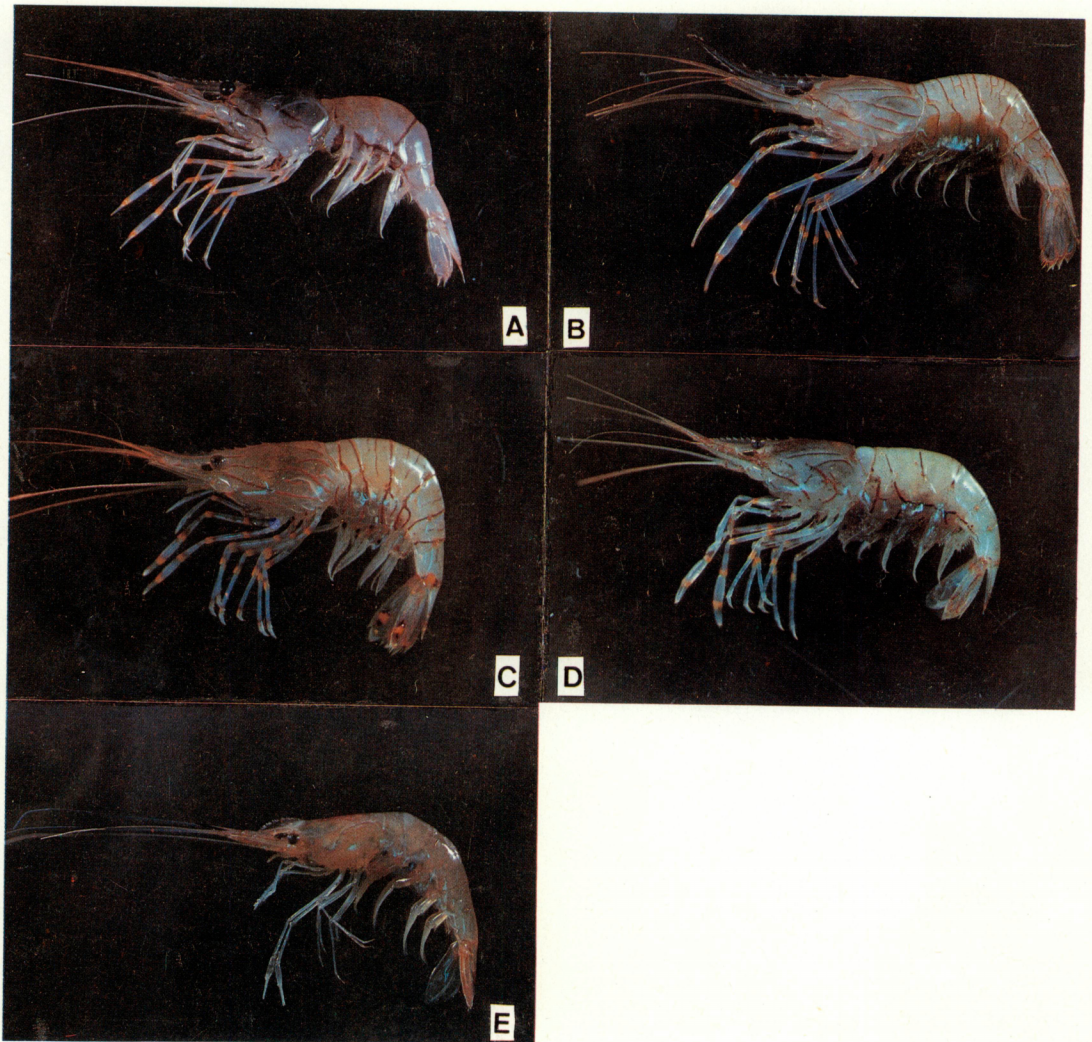


Plate.1. Explanation.

A. *Palaemon (Palaemon) macrodactylus* Rathbun. B. *Palaemon (Palaemon) ortmanni* Rathbun. C. *Palaemon (Palaemon) pacificus* (Stimpson). D. *Palaemon (Palaemon) serrifer* (Stimpson). E. *Palaemon (Exopalaemon) orientis* Holthuis.