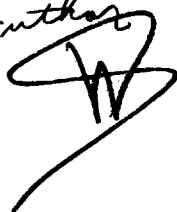


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STUDIES ON JAPANESE PALAEMONOID SHRIMPS

- I. PALAEMON
- II. PONTONIINAE

ITUO KUBO

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Studies on Japanese Palaemonoid Shrimps

I. *Palaemon*⁽¹⁾

Ituo KUBO

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Various authors have added to our knowledge of Palaemonoid fauna of Japan. And yet much has been left to be desired in this connexion. For several years past, the material in question has come rather sufficiently under my examination from Japan and adjacent regions so that I am now in a position to supplement, to a degree, the taxonomy of the group.

The present paper deals with not only 6 of the already known 9 species of the genus *Palaemon* but also one new and three species which are new to Japan. The material for this paper was mostly obtained from Riu-kiu Islands by the intermediation of Dr. Yaichirô OKADA and others, who had been able to make the collection with the aid of a research fund from Marquis Yamashina, and kindly placed at my disposal. It is my pleasant duty to return herewith my gratitude for this favour. I am also under obligation to Drs. Masamitsu ÔSHIMA and Denzaburo MIYADI, Messrs. Sada-yosi MIYAKE, Ichinosuke OKUKAWA, Tokutarô MOMIYAMA, Ukyo Oo and Genkiti ABE for cordial supply of the material from various parts of Japan.

The present work was carried out under the supervision of Dr. Arata TERAO, to whom I must express my hearty thanks.

Genus *Palaemon* FABRICIUS

Palaemon, MILNE-EDWARDS, 1837, p. 395; STIMPSON, 1860, p. 110;

ORTMANN, 1891, p. 693; SCHMITT, 1921, p. 35.

Macrobrachium, BATE, 1868, p. 363.

Bithynis, BATE, 1888, p. 788; RATHBUN, 1902, p. 123.

Brachycarpus, BATE, 1888, p. 788.

Body smooth, slightly laterally compressed. Rostrum laterally compressed, prominently toothed above and below. Carapace with antennal and branchiostegal spines. Mandible with three-segmented palp. First and

1) Contributions from the Zoological Laboratory, Imperial Fisheries Institute, Tokyo, No. 101.

second pairs of legs chelate, the latter larger and stouter than the former. Dactyli of last three pairs of legs simple. Branchiae arranged as follows:—

	<i>g</i>	<i>h</i>	<i>i</i>	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>
Pleurobranchiae	—	—	—	1	1	1	1	1
Arthrobranchiae	—	—	1+r	—	—	—	—	—
Podobranchiae	—	1	—	—	—	—	—	—
Mastigobranchiae	1	1	—	—	—	—	—	—

Key to the species of the genus *Palaemon*

- A. Rostrum with 10~15 spines on upper border
- B. Both upper and lower borders of rostrum convex in profile
- C. Rostrum neither shallow nor reflexed at apex
- D. Second cheliped 1.0~1.3 times as long as body in male
- E. Fingers of second cheliped hairy in male; proportion of length of telson to its breadth between postero-lateral angles: 9.5~10.5. ***P. nipponensis***.
- E'. Fingers of second cheliped not hairy; proportion of length of telson to its breadth between postero-lateral angles: 7.0~8.0. ***P. philippinensis***.
- D'. Second cheliped 1.7~1.9 times as long as body in male. ***P. longipes***.
- C'. Rostrum shallow and reflexed at apex
- F. Second cheliped depressed; oval in cross-section, covered with thickly set setae ***P. japonicus***.
- F'. Second cheliped not depressed; subcircular in cross-section, covered with sparsely set setae ***P. boninensis***.
- B'. Rostrum a little elevated, upper border horizontally straight and lower border convex in lateral view
- G. Second cheliped heavy, asymmetrical, finely covered with setae, palm depressed and oblong in cross-section ***P. grandimanus***.
- G'. Second cheliped slender, symmetrical, not covered with setae, palm not depressed and approximately circular in cross-section
- H. Rostrum reflexed at apex ***P. sundaicus***.
- H'. Rostrum not reflexed at apex ***P. riukiensis*** sp. nov.
- A'. Rostrum with 7~8 spines on upper border
- K. Rostrum reaches to or somewhat beyond the tip of antennular peduncle. Second cheliped not hairy, leaving a space between both fingers of the chela ***P. lar***.
- K'. Rostrum does not reach to the tip of antennular peduncle. Second cheliped hairy, leaving no space between both fingers of the chela ***P. latimanus***.

Palaemon nipponensis DE HAAN

(Pl. I, Fig. f and Text-figs. 1 and 2)

Palaemon nipponensis DE HAAN, 1850, p. 171; DE MAN, 1879, p. 175; LANCHESTER, 1901, p. 640; BALSS, 1914, p. 59; 1924, p. 50; DOFLEIN, 1902, p. 640; KEMP, 1918, p. 258; YÜ, 1931, p. 271.

Palaemon (Eupalaemon) nipponensis, ORTMANN, 1891, p. 713, taf. 47, fig. 4; DE MAN, 1892, p. 441; PARISI, 1919, p. 80, taf. fig. 2.

Bithynis nipponensis RATHBUN, 1902, p. 53.

Rostrum 0.6~0.8 times as long as carapace, slightly beyond distal end of antennular peduncle, dorsal carina extending backwards almost to the middle of carapace, armed with 12~14 spines, posterior 3 of them placed on carapace, interval between the hindmost spine and penultimate one somewhat larger than as found between other rostral spines; lower border with 2~3 spines (Fig. 2, *A*). Pleura of anterior three abdominal segments rounded on lower margin, first and third ones overlapped by second one, fourth and fifth ones blunt at posterior angle. Telson shorter than uropods, ratio of length against breadth between postero-lateral angles 10:1, furnished along each dorso-lateral margin with two bristles; one medially and the other distally; posterior border obtusely pointed at middle and armed with one pair of inner longer and one pair of outer shorter bristles; a tuft of hairs planted on dorsal median line near proximal border (Fig. 2, *D* and *C*). Mandible consists of molar and incisor processes, provided with three-segmented palp (Fig. 1, *A*). Maxillula with rather narrow inner laciniae (Fig. 1, *B*). Scaphognathite of maxilla rounded posteriorly (Fig. 1, *C*). All three maxillipeds with exopodite; endopodite of first maxilliped unsegmented (Fig. 1, *D*). Third maxilliped reaches to distal end of second

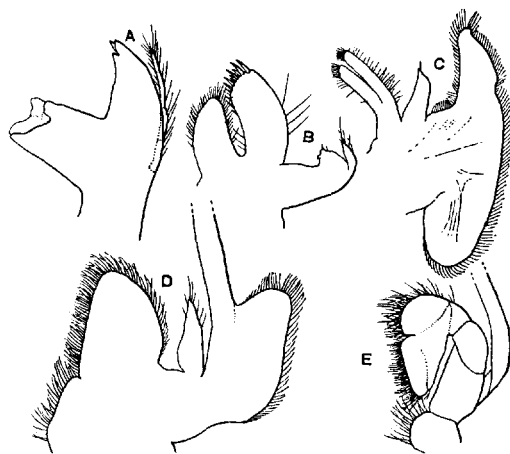


Fig. 1. Mouth-parts of *Palaemon nipponensis*. *A*, mandible, $\times 7$; *B*, maxillula, $\times 7$; *C*, maxilla, $\times 5$; *D*, first maxilliped, $\times 7$; *E*, second maxilliped, $\times 5$.

antennular peduncle. First leg about half times as long as body without rostrum. Second leg 1.0~1.3 times as long as body in male but 0.6~0.7 times in female; fingers of mature male hairy (Pl. 1, middle of *D*), with ratios of each segment to finger: propodus 1.4 in male, 1.3 in female; carpus 1.8 in δ , 1.9 in ♀ ; merus 1.1 in δ , 1.3 in ♀ . Third leg much longer than first

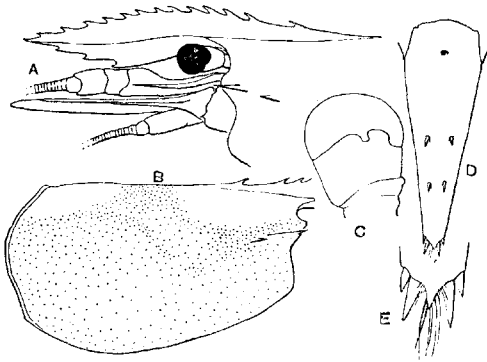


Fig. 2. *Palaemon nipponensis*, ♂, 80 mm long procured from Miya, Aiti Prefecture. *A*, frontal aspect, $\times 1.3$; *B*, showing distribution spinules on the carapace; *C*, upper aspect of eye, $\times 4$; *D*, telson, $\times 4$; *E*, tip of telson, $\times ca. 13$.

one. Fourth and fifth legs nearly similar in general aspects and proportions. Endopodite of second abdominal appendage with shorter stylamblys and longer appendix musculina in male, but stylamblys only in female.

The foregoing description is based on 8 males, ranging from 60.0 mm to 86.0 mm in body length, and 15 females 59.0~73.7 mm in body length, collected from the following localities.

Localities: Miya, Aiti Prefecture; Hamanako, Sizuoka Prefecture; Turumi-gawa, Kanagawa Prefecture; Ogura-ike, Kyoto Prefecture; Yukuhasi, Hukuoka Prefecture.

Distribution: Yokohama (PARISI); Wakanoura, Kii, Chikugo River, Kurume (RATHBUN); Yodo River, Kasumigaura (KEMP); Shanghai, Pei-

Table 1.

♂, dimensions in mm.

No.	B.L.	Second pereiopod										Locality				
		A		A/D		B		B/D		C			C/D		D	
		R	L	R	L	R	L	R	L	R	L		R	L	R	L
1	86.0	24.0	26.0	1.0	1.1	40.0	41.0	1.7	1.7	35.0	35.0	1.5	1.5	23.0	24.0	Miya
2	85.0	25.0	—	1.0	—	40.0	—	1.7	—	34.0	—	1.4	—	24.0	—	"
3	80.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
4	79.0	25.0	25.5	1.4	1.1	37.8	41.0	2.1	1.8	27.6	32.8	1.5	1.5	18.0	22.3	"
5	77.0	17.6	24.0	1.4	1.0	26.5	33.5	2.0	1.6	20.0	30.0	1.5	1.3	13.0	24.0	Yukuhasi
6	76.0	25.5	22.5	1.3	1.1	36.0	36.4	1.8	1.8	28.0	29.4	1.4	1.5	19.7	20.0	Ogura-ike
7	71.0	—	19.7	—	1.1	—	30.7	—	1.7	—	23.0	—	1.3	—	17.7	"
8	60.0	—	9.5	—	1.1	—	14.0	—	1.6	—	10.0	—	1.0	—	9.0	Miya

♀, dimensions in mm.

No.	B.L.	Second pereopod								Locality						
		A		A/D		B		B/D			C		C/D		D	
		R	L	R	L	R	L	R	L		R	L	R	L	R	L
1	62.4	—	8.0	—	1.2	—	11.5	—	1.8	—	7.0	—	1.1	—	6.5	Miya
2	62.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
3	68.0	9.5	9.5	1.3	1.2	13.0	14.1	1.8	1.8	9.6	9.3	1.4	1.2	7.1	8.0	"
4	69.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
5	64.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
6	60.2	7.5	—	1.3	—	11.5	—	2.0	—	7.5	—	1.3	—	5.8	—	"
7	63.0	8.0	9.0	1.2	1.4	13.3	12.2	2.0	1.9	7.5	7.5	1.2	1.2	6.5	6.3	"
8	63.5	9.8	—	1.4	—	12.5	—	1.8	—	8.6	—	1.2	—	7.0	—	"
9	63.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	"
10	59.0	8.0	—	1.2	—	12.0	—	1.9	—	8.1	—	1.3	—	6.4	—	Lake Hamana
11	68.5	—	10.0	—	1.3	—	14.8	—	1.9	—	10.0	—	1.3	—	8.0	"
12	71.0	10.5	—	1.1	—	15.0	—	1.6	—	12.0	—	1.3	—	9.2	—	"
13	67.0	10.5	—	1.5	—	15.2	—	2.2	—	10.0	—	1.4	—	7.0	—	"
14	73.7	11.0	11.0	1.3	1.4	17.0	16.5	2.0	2.0	11.5	11.9	1.4	1.5	8.5	8.1	Turumi-gawa
15	62.5	—	9.5	—	1.3	—	14.0	—	1.9	—	9.5	—	1.3	—	7.4	"

A, merus; B, carpus; C, propodus; D, dactylus; B.L., body length;
R, right; L, left.

chu, Tsungming, Yangchow, Soochow, Chinkiang, Kiukiang, Hankow, Nanchang, Chengtu, Lac d'Ouest, Kashing, Amoy, Tsinan, Chefoo, Peitaiho, Chinwangtao, Shanhaikwan (Yü).

Note: Antennal, hepatic, intermediate region between gastric and cardiac regions, and branchial regions of carapace (Fig. 2, *B*) as well as pleura of anterior five abdominal segments are finely tuberculated in male which measures more than 70 mm in length, but it appears that such is not the case with young male and female.

The second pereopod is slightly asymmetrical in size; the length and ratios of merus, carpus and propodus against dactylus show considerable variations. Table 1 gives concisely such findings. So far as the writer's observation goes, proportions of each segment consisting of the third, fourth and fifth legs are nearly equal in both sexes: it ranges from 1.0 to 1.4 in merus; 1.6~2.1 in carpus; 1.0~1.5 in propodus in male, but in female 1.1~1.5 in merus and propodus; 1.6~2.0 in carpus. The hairs covering the

fingers of the leg becomes conspicuous when the animal attains about 60 mm in the body length.

Palaemon philippinensis COWLES

(Pl. 1 and Text-figs. 3 and 4)

Palaemon philippinensis COWLES, 1914, p. 340, pl. 2, figs. 2, 2 (a~m).

Rostrum lanceolated, very slightly descending, about half times as long as carapace, and a little beyond the tip of antennular peduncle, dorsal border extending backwards almost to the middle of carapace, forming moderate dorsal carina; it bears 9~13 spines, posterior 3 or 4 of which are placed on dorsal carina; ventral border toothless toward the tip but with 1~4 spines near its middle (Fig. 3, *A*). Abdominal pleura exactly similar in form to those of *P. nipponensis*. Telson resembles that of *P. nipponensis*, but ratio of length against breadth between postero-lateral angles 7.7~8.0:1 (Fig. 3, *E* and *F*). Eyes moderate, occupied by kidney-shaped cornea in

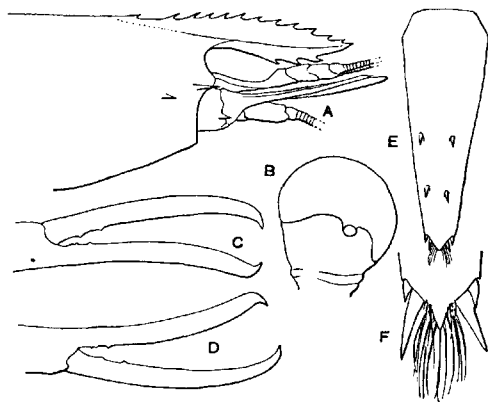


Fig. 3. *Palaemon philippinensis*, ♂, 72 mm long, secured from Riu Kiu. *A*, frontal aspect, $\times 1.4$; *B*, upper aspect of eye, \times ca. 7; *C*, outer view of second chela (left); *D*, same as *C* (right); *E*, telson, \times ca. 3; *F*, tip of telson, \times ca. 13.

distal half, corneal spot somewhat large (Fig. 3, *B*). Antennal scale well beyond tip of rostrum. Mouth-parts almost the same as those of the previous species in general aspects. First pereopods about half times as long as body. Second pereopods as long as or a little longer than body, proportions to movable finger: palm 1.3 in ♂, 1.5 in ♀; carpus 1.3 in ♂, 1.5 in ♀; merus 0.9 in ♂, 1.2 in ♀; fingers not hairy (Pl. 1, *D* and Fig. 3, *C* and *D*). Third, fourth and fifth pereopods as long as first one, but somewhat stouter. Endopodite of second abdominal appendage with stylamblys and appendix masculina on inner proximal border in male, but stylamblys only in female.

Described from 21 male specimens, 25.0~85.0 mm in body length, 21 females, 29.5~67.0 mm in body length, collected by Dr. Yaichirô OKADA and Mr. Isamu HORAZAWA.

Localities: Kuzi-gawa, Genka-gawa, Izumi (Okinawa-zima); Sirakawa (Miyako-zima).

Distribution: Philippines (COWLES, ESTAMPADORA).

Note: COWLES characterized this species by the presence of tubercles along both sides of the cutting edges of the chela of the second pereiopods, but such tubercles are not found in my specimens. The present species is closely related to *P. nipponensis* DE HAAN, but differs from it in the absence of the rather thick coating of hairs on the fingers of second chelipeds as already mentioned by COWLES.

It is worth mentioning that both sexes of the present species differ in size; females are generally smaller than males in body-build (Fig. 4). But they do not show significant differences in the proportions of the bodily parts. The growth of movable finger, palm, carpus, merus of the second cheliped in relation to that of body was studied in both sexes and represented in Fig. 4.

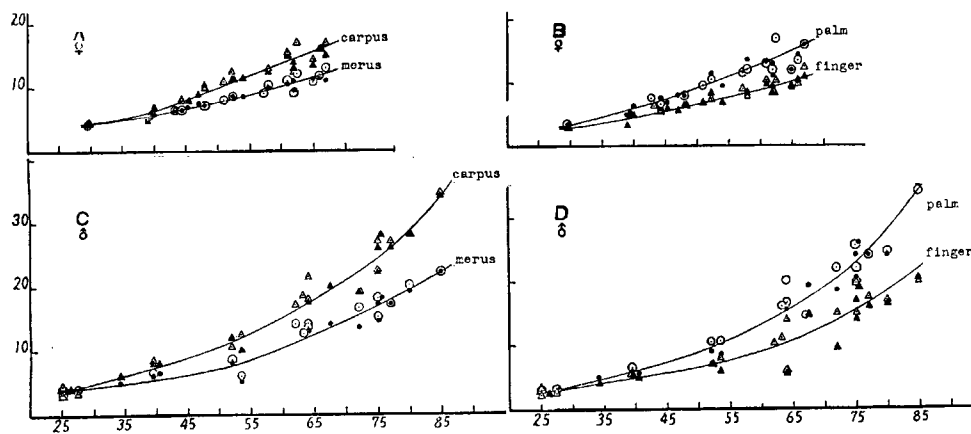


Fig. 4. Relative growth of second chelipeds in mm. Abscissa, body length; ordinate, length of each segment (black, right; white, left).

Palaemon longipes DE HAAN

(Pl. 1, D and Text-fig. 5)

Palaemon longipes DE HAAN, 1850, p. 171; DE MAN, 1897, p. 177; ORTMANN, 1891, p. 715; BALSS, 1924, p. 50.

Palaemon (Eupalaemon) longipes PARISI, 1919, p. 79, Tav. 6, fig. 4.

Macrobrachium longipes, MAKI and TUTIYA, 1923, p. 61, pl. 7, fig. 3.

Rostrum almost similar to that of *P. nipponensis* and of *P. philippinensis* in form, slightly beyond antennular peduncle, but does not reach to distal margin of antennal scale, both upper and lower borders convex in outline, dorsal carina extending backwards to about middle of carapace, armed with 12 spines, posterior 3 of which are placed on carapace, lower border with 3 spines but no subterminal one (Fig. 5, *A*). Pleura entirely resemble those of *P. nipponensis* and of *P. philippinensis*. Telson shorter than uropods, provided with a median tuft of hairs near proximal border, armed with two pairs of spinules on dorso-lateral margins, posterior border pointed at middle bearing one outer pair of shorter and one inner pair of longer spinules, ratio of length against breadth between postero-lateral angles 8:1 (Figs. 5, *C* and *E*). Eyes rather short, covered with somewhat kidney-shaped cornea in distal half, ocular spot large (Fig. 5, *B*). Mouth-parts

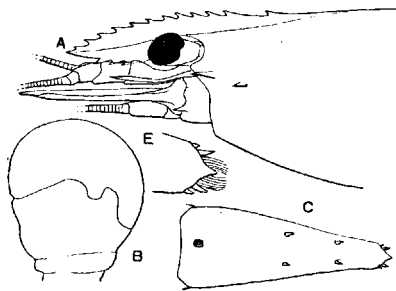


Fig. 5. *Palaemon longipes*, ♂, 73 mm long, collected from Kamakura, Kanagawa Prefecture. *A*, frontal aspect, \times ca. 1.3; *B*, upper aspect of eye, \times 5; *C*, telson, \times ca. 2.3 *E*, tip of telson, \times 5.

exactly the same as the corresponding ones of *P. nipponensis* and *P. philippinensis* in form. First pereopods slender and a little shorter than half of body. Second leg very stout and long, 1.7~1.9 times as long as body; palm 1.5~2.1 times as long as movable finger; carpus a little longer than palm; merus 0.5~0.7 times as long as carpus; fingers with two teeth on prehensile edge, leaving a nearly crescent space between them when closed (Pl. 1, Fig. *D*). Third, fourth and fifth ambulatory legs almost equal in length and somewhat stouter than the first one. Endopodite of second pleopod with a shorter stylamblys and longer appendix masculina thickly set with hairs on inner border.

Material examined: A male 73.0 mm in body length collected from Kamakura by Dr. Nagamichi KURODA and a male 75.5 mm long, secured by Dr. Yaichirō OKADA from Sirakawa, Miyako-zima (Riu-Kiu).

Distribution: Japan (DE HAAN, DE MAN); Taihoku, Formosa (MAKI and TUTIYA); Nagasaki; Loochoo (PARISI).

Note: The specimens at my disposal agree well with the description of DE HAAN of the present species, but differs from DE MAN's (1879) description in having three closely set conical tubercular teeth and one larger conical tooth on proximal prehensile edge of fixed finger whereas only one tooth is present in DE MAN's material.

The present species is distinguished from the previous two species, *P. nipponensis* and *P. philippinensis*, by the following characters: cheliped remarkably long and a space left between fingers of its chela when closed. It is separated from the former by having globular eye and lacking thickly set hairs on fingers of second cheliped.

The present species is not so common in Japan proper as *P. nipponensis*.

Palaemon japonicus DE HAAN

(Pl. 2, fig. D and Text-figs. 6 and 7)

Palaemon japonicus DE HAAN, 1850, p. 172; DE MAN, 1879, p. 175; ORTMANN, 1891, p. 726; BALSS, 1924, p. 50.

Palaemon (Parapalaemon) japonicus, DE MAN, 1892, p. 462, pl. 27, fig. 40; PARISI, 1919, p. 83, pl. 6, figs. 3 and 11.

Macrobrachium japonicus, MAKI and TUTIYA, 1923, p. 63, pl. 5, fig. 2.

Rostrum rather shallow, somewhat descending, about 0.4 times as long as carapace, reaches to distal end of antennular peduncle, both upper and lower borders convex, dorsal carina ending near the middle of carapace, with 9~12 spines, posterior four or three of them situated on carapace, ventral border with 2~4 spines (Fig. 6, A). Telson shorter than uropods, proportion of length against breadth between postero-lateral angle 8:1, ratio of proximal breadth to distal one 3:1, with a median tuft of hairs near proximal border, armed with two pairs of spinules along dorso-lateral margin, acutely tipped at middle of distal border bearing one outer smaller and inner larger spinule and subterminal tuft of hairs on each side of the tip (Fig. 6, K). Eyes moderate, distally covered with cornea not reaching half in extent, ocular spot moderate (Fig. 6, B). Mouth-parts quite resemble those of *P. nipponensis* in form. First cheliped symmetrical and slender, about half times as long as body. Second one asymmetrical, wholly covered with thickly set setae, larger hand approximately 1.4 times as long as body but smaller one about 1.1 times in male, proportions against finger: merus 0.9~1.3 in larger hand of males above 50 mm in body length, 1.0~1.5 in

smaller one of the same, 1.1~1.2 in larger hand, 1.1~1.4 in smaller one of females above 50 mm in body length; carpus 1.0~1.4 in larger hand, 1.1~1.8 in smaller one of male, 1.3~1.4 in larger one, 1.3~1.5 in smaller one of females above 50 mm in body length; carpus 1.0~1.4 in larger hand, 1.1~1.8 in both larger and smaller ones of female, fingers somewhat curved inwards, leaving a small space between them when closed; movable one with a strong tooth near middle of prehensile edge and several smaller teeth (3 or 4) on proximal edge, immovable one of larger hand also armed along cutting edge with a series of teeth distally gradually increasing in size; both fingers armed with several somewhat smaller teeth on proximal cutting edges in smaller hand of male (Fig. 6, *C* and *D*); but with smaller teeth in female than in male. Endopodite of first pleopod lobe-like in outline in both sexes (Fig. 6, *F*). Endopodite of second pleopod carries a shorter stylamblys and the other longer appendix masculina fringed with densely set hairs on inner border in male (Fig. 6, *G*), but in female with a stylamblys only (Fig. 6, *H*).

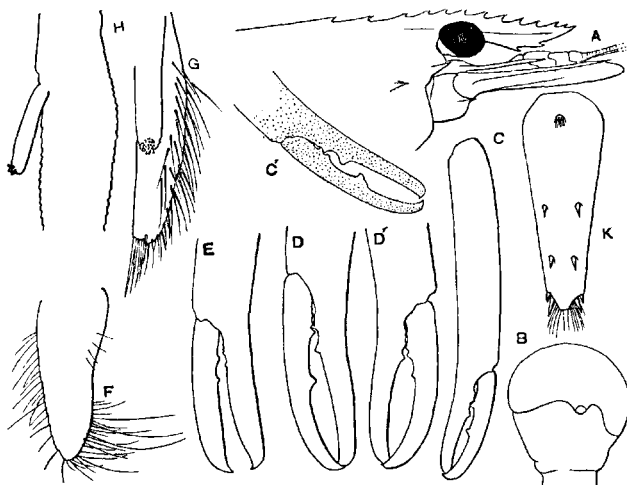


Fig. 6. *Palaemon japonicus*, ♂, 62 mm in body length obtained from Riu Kiu. *A*, frontal aspect, \times ca. 1.4; *B*, upper aspect of left eye, $\times 5$; *C*, smaller chela of second pereiopod, \times ca. 1.3; *C'*, larger chela of the same pereiopod as *C*, \times ca. 1.3; *D*, a type of second chela of the same species (larger chela), \times ca. 1.6; *D'*, same as *D* (smaller chela), \times ca. 2.7; *E*, left chela of second cheliped in female, $\times 4$; *F*, Endopodite of first pleopod in female, \times ca. 16; *G*, stylamblys and appendix masculina removed from second pleopod, \times ca. 13; *H*, endopodite of second pleopod with stylamblys in female, \times ca. 13.

Described from 25 males measuring 21.5~78.0 mm long without rostrum and 18 females ranging 35.0~63.0 mm long obtained by Dr. Yaichirô OKADA and others, and two males collected by the present author in August of 1936 in Itiki, Kagosima.

Note: Seeing that the largest female is nearly as half in size as the largest male in my collection, it may be taken that a lower rate of growth exists in the female than in the male. But if, on the contrary, the rate of growth is the same in both sexes and larger females are not represented somehow in the material at my disposal, it follows that the relative growth of second cheliped as well as its several joints (Fig. 7) does not significantly differ in both.

That larger males have the second cheliped distinctly spooned but smaller males have the corresponding appendage almost as straight as that of females is worth mentioning but it is of no value to decide between the above-mentioned two alternatives.

Localities: Henoki, Nakizin, Kinmura, Genka-gawa, Kuzi-gawa, Idumi, Yohuke-gawa, Hentona, Sasiki-mura (Okinawa); Simozi, Hora-gawa (Miyakozima); Riu Kiu Island: Itiki, Kagosima Prefecture.

Distribution: Japan (DE HAAN); Kagi, Formosa (PARISI); Tansui, Formosa (MAKI and TUTIYA).

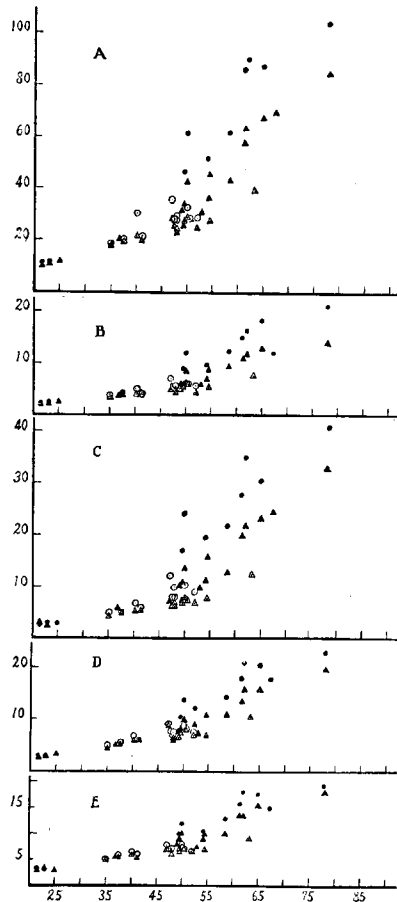


Fig. 7. Length of second pereopod (A) measuring from proximal border or merus to tip of chela, finger (B), palm (C), carpus (D) and merus (E) in relation to body length without rostrum in mm; circle, larger leg; triangle, smaller leg (solid ones representing males).

***Palaemon boninensis* STIMPSON**

(Figs. 8 and 9)

Palaemon boninensis STIMPSON, 1860, p. 41; ORTMANN, 1891, p. 706.

Female: Body smooth. Carapace with rounded pterygostomial angle. Rostrum almost horizontal, nearly lanceolate in profile, reaches to or slightly beyond the tip of antennular peduncle, a little longer than half of carapace, upper border passes into dorsal carina which extends to the middle of carapace and has a consecutive series of 12 spines on it: 4 carinal and 8 rostral ones, the first rostral one situated near apex; lower border provided with 3 subterminal spines (Fig. 8). Pleura entirely agree with those of

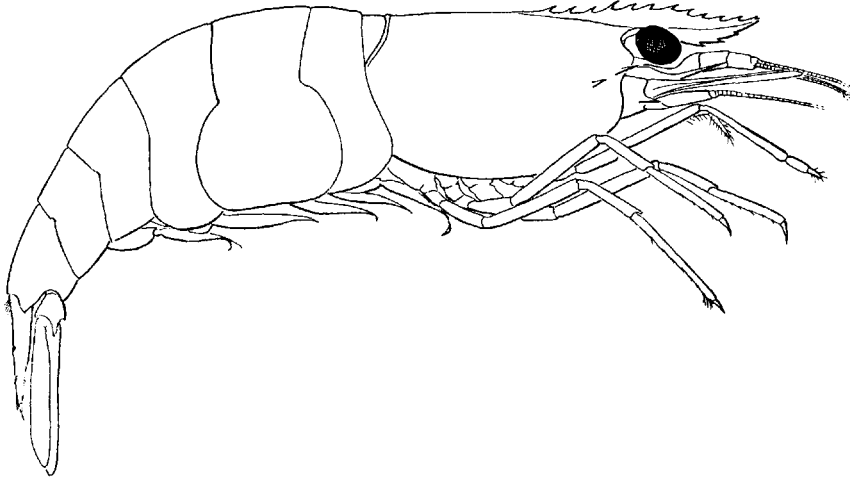
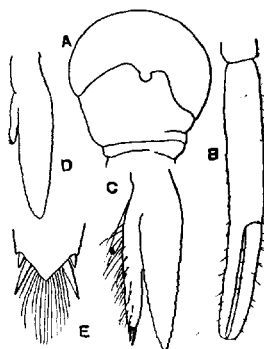


Fig. 8. *Palaemon boninensis*, ♀, ovigerous, 48 mm long, collected from Titi-zima, Bonin Island, $\times 2$.

P. nipponensis in shape. Telson shorter than uropods, armed along each dorso-lateral margin with two spinules, one middle and one distal; distal margin rectangularly pointed, with two pairs of outer shorter and inner longer (about twice as long as outer one) bristles, provided with long plumose hairs on ventral subterminal region (Fig. 9, *E*). Mouth-parts wholly resemble those of *P. nipponensis*, third maxilliped not reaching to terminal margin of antennular peduncle when stretched out. First cheliped slender, about 1.5 times as long as carapace. Third leg much stouter but slightly longer than first one: about 1.7 times as long as carapace, ratios to propodus: dactylus 0.3; carpus 0.7; merus 1.4. Fourth and fifth legs nearly similar to third one in shape and proportions, but fifth leg fringed with a tuft of hairs near distal border of propodus. Endopodite of second pleopod with a stylamblys on inner border (Fig. 9, *D*).

Young male: Much resembles female but differs from it particularly in the following points:—Second cheliped a little longer than carapace, proportions against movable finger: palm 1.4, carpus 1.6, merus 1.6, ischium 1.0; chela sparsely covered with setae, both fingers toothless on cutting edges and hardly leaving space between them when closed (Fig. 9, B). Endopodite of second pleopod provided with a short stylamblys and a long appendix masculina furnished with sparsely set hairs on inner border (Fig. 9, C).

Fig. 9. *Palaemon boninensis*, ovigerous female, 48 mm long, secured from Bonin Island. A, upper aspect of eye $\times 7$; B, right chela of second pereiopod, $\times 7$; C, endopodite of second pleopod bearing stylamblys and appendix masculina, 27 mm in body length, \times ca. 13; D, endopodite of second pleopod, $\times 5$; E, tip of telson, $\times 7$.



The above description is based on an ovigerous female, second leg of which is wanting, 48.0 mm long, and a young male measuring 27.0 mm in body length. Four immature specimens (3♂, 1♀) ranging 18.5~26.0 mm were also examined. These specimens were secured from Byōbu-dani, Ōmura, Titi-zima (Bonin Island) by Mr. Kazue ARAMOMI in the middle of May of 1938.

Distribution: Bonin Island (STIMPSON).

Note: The rostral spines show such variation in its number as 10~12/1~3 in the material placed under my examination.

The rostrum and the appendix masculina of the present species are closely related to those of *P. japonicus* in shape respectively, but the relative length of the latter against the endopodite much larger than that of *P. japonicus*, whereas the appendix masculina extends slightly beyond the middle of the endopodite in *P. japonicus*.

My specimens almost agree with the description of STIMPSON excepting the following characters: (1) the carpus of the second cheliped is longer than the half of the chela, (2) the palm about one and a half times as long as the finger (one-third times in STIMPSON's description) and (3) the chela of second cheliped bears no tooth on the prehensile edges.

Palaemon grandimanus RANDALL

(Pl. 1, C and Text-fig. 10)

Palaemon grandimanus RANDALL, (Jour. Acad. Nat. Sci. Phila., 8, 1839, p. 142); DANA, 1852, p. 588; 1855, pl. 38, fig. 12 a~b; ORTMANN, 1891, p. 736; LENZ, 1901, p. 436, pl. 32, figs. 4 and 5; ESTAMPADOR, 1937, p. 489.

Bithynis grandimanus BATE, 1888, p. 793, pl. 120, figs. 2 and 3; RATHBUN, 1906, p. 923, pl. 22, fig. 5.

Carapace posteriorly rounded, antero-dorsally carinated and produced to a rostrum which is about 0.7 times as long as carapace; dorsal carina horizontal, provided with 5 spines; upper border of rostrum mostly horizontal but slightly reflexed at tip, and armed with 7 spines, lower border with 3 spines (Fig. 10, *A*). Abdominal pleura entirely resemble those of *P. nipponensis*. Telson nearly oblong, subrectangular, but gradually reducing its width posteriorly, shorter than uropods, and armed with two pairs of spinules at dorso-lateral angle as well on the distal margin as in *P. nipponensis* (Fig. 10, *H*). Eyes pyriform; kidney-shaped cornea obliquely covering half of the stalk; ocular spot rather large (Fig. 10, *B*). Antennular peduncle does not reach to apex of rostrum. Scaphocerite terminates at the same level as tip of rostrum. First leg slender, symmetrically chelate, about half times as long as body, reaching beyond antennal scale by the entire chela when stretched out. Second leg asymmetrically chelate, left chela larger than right. Larger chela covered with fine tubercles, about 1.5 times as long as body; ischium 0.24, merus 0.61, carpus 0.7, palm 1.1 in proportion against finger; movable finger with one prominent tooth at proximal one-third and smaller tubercular teeth along distal two-thirds of cutting edge; fixed finger with one strong tooth a little proximal to the corresponding one of the movable finger (Fig. 10, *C*). Smaller chela about 0.9 times as long as body, ratios of each segment to finger: ischium 0.4, merus 0.7, carpus 0.7, palm 0.5; fingers with inturned tips and straight cutting edges (Fig. 10, *E*). Third, fourth and fifth legs much alike in general aspects but the last a little longer than preceding ones, although neither of them reaches beyond antennal scale when stretched out. First pleopod with leaf-shaped endopodite (Fig. 10, *F*). Endopodite of second pleopod provided with a shorter, bar-shaped stylamblys and longer appendix musculina, growing somewhat long setae on almost entire surface in male (Fig. 10, *G*).

Ten males measuring from 22.0 to 51.0 mm in body length and seven females (3 ovigerous and 4 younger) ranging 24.0~38.5 mm in length,

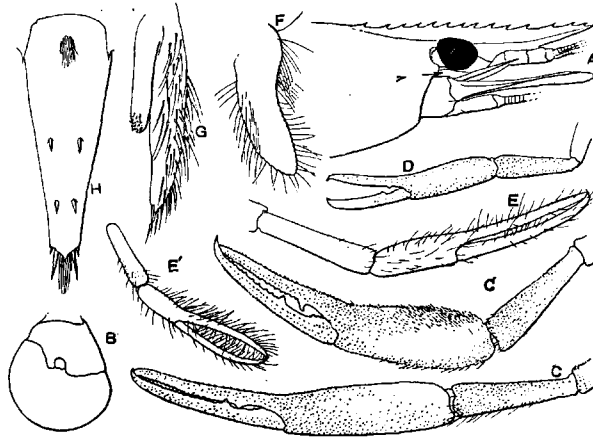


Fig. 10. *Palaemon grandimanus*, ♂, 39.5 mm in body length obtained from Miyako-zima, Riu Kiu. A, frontal aspect, \times ca. 1.6; B, upper aspect of eye, \times 5; C, larger hand of second pereiopod, \times ca. 1.3; C', same as C of an aberrant form, \times ca. 1.3; D, same as C of a young male, \times ca. 1.6; E, smaller hand of second pereiopod, \times ca. 1.6; E', same as E of the aberrant one, \times ca. 1.3; F, endopodite of second pleopod, \times ca. 13; G, stylamblys and appendix masculina of second pleopod, \times ca. 16; H, telson, \times ca. 13.

procured in March, 1936 from Miyako-zima, Riu-Kiu by Dr. Yaichirô OKADA and others.

The foregoing description is based on a male, 39.5 mm long without rostrum.

Localities: Sira-kawa, Hora-gawa, Simozi (Miyako-zima).

Distribution: Hawaiian Islands (DANA, RATHBUN); Honolulu (BATE); Kalihi, Oahu (LENZ); Philippines (ESTAMPADOR).

Note: The number of upper rostral spines ranges from 11 to 15 in my specimens as shown in Table 2, whereas it is either 15 or 16 in the Hawaiian ones as reported by BATE and RATHBUN.

Table 2.

Number of upper rostral spine	11	12	13	14	15
Frequency	1	8	6	1	1

Another difference may be noted in the degree of convexity of the rostrum in Japanese and Hawaiian specimens. It is very remarkable in the Hawaiian. But it is highly probable that it is due to age since the specimens at my disposal are less than half the Hawaiian in size.

The present species is closely related to *P. philippinensis*, *P. japonicus*, *P. longipes* and *P. riukiensis*, but differs from *P. nipponensis*, *P. lar* and *P. sundaicus* in the form of the eyes.

It is worth mentioning that this species characterizes the female in having: (1) the second cheliped much smaller, and (2) endopodite of second pleopod provided with stylamblys only.

***Palaemon sundaicus* HELLER**

(Text-fig. 11)

Palaemon sundaicus HELLER, 1862, p. 415, taf. 2, figs. 38 and 39; 1865, p. 115; ORTMANN, 1891, p. 719; COWLES, 1914, p. 355, pl. 2, fig. 3; COUTIÈRE, 1901, p. 335, pl. 14, figs. 44~46; KEMP, 1918, p. 261; YÜ, 1931, p. 276; ESTMPADOR, 1937, p. 489.

Palaemon (Eupalaemon) sundaicus, DE MAN, 1892, p. 437, taf. 26, fig. 35; 1897, p. 779 and 10, pl. 37, fig. 71; ROUX, 1932, p. 564.

Macrobrachium sundaicus MAKI and TUTIYA, 1923, p. 57, pl. 2, fig. 2.

Rostrum almost horizontal but slightly reflexed at apex, nearly as long as carapace, much surpassing scaphocerite, upper border armed with 13 equidistant teeth, posterior 3 of them situated on carapace; lower border somewhat convex and provided with 3 teeth (Fig. 11, A). Eyes moderate, with somewhat kidney-shaped cornea which is about half the stalk longitudinally; ocular spot rather small (Fig. 11, B). First leg a little beyond

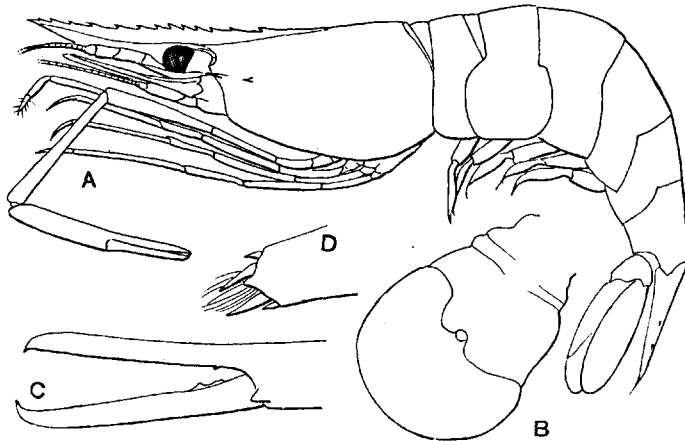


Fig. 11. *Palaemon sundaicus*, ♂, 42 mm long without rostrum, procured from Tainan, Formosa. A, lateral view, \times ca. 2; B, upper aspect of eye, \times ca. 10; C, right chela of second pereopod, \times 6; D, tip of telson, \times ca. 10.

the tip of rostrum. Second leg symmetrical, about 0.9 times as long as body, proportions against finger: carpus 0.8, merus 0.6, ischium 0.4; movable finger with two tubercular teeth at proximal one-fifth of cutting edge; fixed one bears a tubercular tooth opposite the proximal tooth of the former (Fig. 11, C). Third and fourth ambulatory legs a little longer than half of body. Fifth one somewhat longer than preceding two legs and more or less longer than half of body.

The above description is based on a male specimen measuring 42.0 mm long, collected from Tainan, Formosa. Besides, 9 males, 14.0~42.0 mm in body length and 14 females, ranging 14.0~28.2 mm long, secured by Dr. Densaburô MIYAZI and Mr. Ukyô Oo, were also examined.

Localities: Kotôhi, South Formosa (Dr. D. MIYADI); Tainan, Formosa (Mr. Ukyô Oo).

Distribution: Java (HELLER); Flores, Celebes (DE MAN); Philippine (COWLES, ESTAMPADOR); Tale Sap near Singgora (KEMP); Amoy (YÜ); Sunda (ROUX).

Note: The number of rostral spines varies from 12 to 16 on the upper border and from 2 to 4 on the lower. The upper aspect of the eye of the present species much resembles that of *P. nipponensis*, but the corneal region is somewhat thicker than that of the latter species.

***Palaemon riukiensis* sp. nov.**

(Pl. 1, B and Text-figs. 12~13)

Rostrum lanceolate in profile, about 0.8 times as long as carapace, well beyond antennular peduncle, upper border sub-horizontal or very slightly

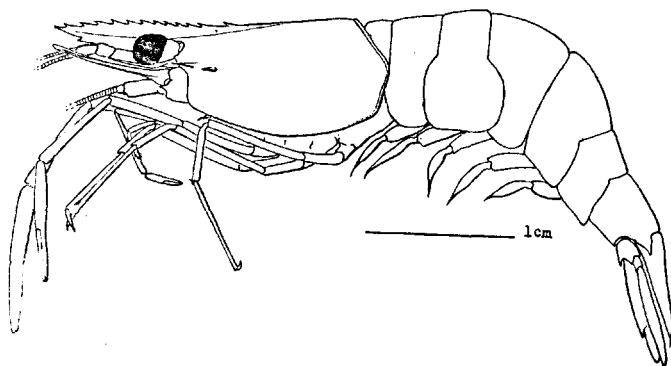


Fig. 12. *Palaemon riukiensis*, ♂, collected from Okinawa-zima, Riu Kiu.

convex; dorsal carina arising near the middle of carapace, with 12~16 teeth, posterior 3 or 4 of them situated on carapace; lower border provided with 2~4 spines (Fig. 12). Pleura mostly resemble those of *P. nipponensis*. Telson shorter than uropods, nearly oblong in outline, narrowing posteriorly until it is two-fifths the width of the proximal border and then suddenly

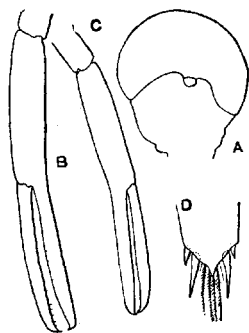


Fig. 13. *Palaemon riu-kiuensis*, ♂, 42 mm long. A, upper aspect of eye, $\times 7$; B, larger chela of second pereopod, $\times 4$; C, smaller chela of the same, $\times 4$; D, tip of telson, $\times 10$.

acuminated at tip, armed along each dorso-lateral margin with one spinule at middle and one spinule at distal one-fourth; distal margin provided with two pairs of inner longer and outer shorter bristles (about half as long as inner one) (Fig. 13, D). Eyes rather large, inverted pear-shaped; cornea reniform, about half the stalk; ocular spot rather large (Fig. 13, A). Mouth-parts closely allied to those of all the above mentioned species. First cheliped slender, a little longer than half of body. Second one symmetrical, about 0.8 times as long as body; movable finger and palm equal in length; chela more or less longer than carpus; both merus and ischium subequal in length but shorter than carpus; fingers with inturned tips and straight toothless cutting edges (Fig. 13, B and C). Third leg slender, somewhat longer than first cheliped. Remaining two pairs of legs

similar to third one in general aspects.

Type locality: Okinawa-zima (Riu-Kiu).

Type specimen: male, 42.0 mm in body length.

Paratopotype: five males, 32.0~50.0 mm.

All specimens collected by Dr. Yaichirô OKADA and Mr. Isamu HORAZAWA.

The present species is closely related to *P. sundaicus* HELLER, *P. equidens* DANA and *P. dispar* MARTENS. But it is separable from *P. sundaicus* in having: (1) rostrum neither surpassing the tip of the scaphocerite nor reflexed at the apex; (2) eyes rather broad in upper aspect and a little larger ocular spot; and (3) second chela without tooth on the prehensile edges. It differs from *P. equidens* in the shorter rostrum which does not surpass the tip of the scaphocerite and in the wider interval between the last and the penultimate teeth on the median carina of the carapace. The rostral characters separate this species also from *P. dispar*.

***Palaemon lar* FABRICIUS**

(Pl. 2, A~C and Text-fig. 14)

Palaemon lar, ORTMANN, 1891, 5, p. 724; MIYAKE, 1938, p. 110; ESTAMPADOR, 1937, p. 488.*Palaemon (Eupalaemon) lar*, DE MAN, 1892, p. 445; ROUX, 1929, p. 236; 1932, p. 565; 1934, p. 531; 1934a, p. 217.*Palaemon ornatus*, MILNE-EDWARDS, 1837, p. 396; DE MAN, 1879, p. 168.*Palaemon vagus*, HELLER, 1865, p. 417, taf. II, figs. 42 and 43.*Palaemon spectabilis*, HELLER, 1865, p. 113, taf. 10, fig. 8.*Palaemon ruber*, (HESS, 1865, p. 39, taf. 7, fig. 20.); DE MAN, 1887, p. 710; ORTMANN, 1891, p. 705, taf. 47, fig. 3.*Bithynis lar* BATE, 1888, p. 789, pl. 129, fig. 1.*Macrobrachium lar*, MAKI and TUTIYA, 1923, p. 56, pl. 5, fig. 1.

Rostrum rather shallow, about half as long as carapace, slightly descending, a little reflexed at tip, reaches to or somewhat beyond antennular peduncle, but not to apex of scaphocerite; dorsal carina arising a little before the middle of carapace, with 7~9 spines, lower border convex, with 2~4 spines. Telson shorter than uropods, about 6 times as long as wide across postero-lateral angles, proportions of proximal breadth to distal one 2.3:1, dorso-lateral and terminal margins armed with two pairs of bristles respectively in such manner as in *P. nipponensis*, furnished with a median tuft of hairs near proximal border (Fig. 14, B). Eye somewhat small, half covered with cornea, ocular spot small (Fig. 14, A).

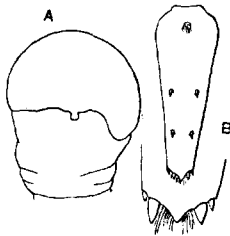


Fig. 14. *Palaemon lar*, ♂, 128 mm in body length, obtained from Okinawa-zima, Riu Kiu. A, upper aspect of eye, $\times 4$; B, telson (\times ca. 1.3) and its tip ($\times 4$).

First leg very slender, about half times as long as body. Second leg conspicuously stout and large, symmetrical, finely tuberculated on whole surface, about 1.0~1.5 times as long as body, proportions to fingers: palm 1.3 in male, 1.2 in female; carpus 0.8, ♂, 1.0, ♀; merus 0.9, ♂, 0.9~1.2, ♀; ischium 0.4, ♂, 0.8~1.2, ♀; fingers strongly curved inwards, movable one provided with a prominent sharp tooth near the middle of cutting edge, immovable finger with one prominent tooth and one or several smaller teeth situated more proximally on the opposite edge. Third, fourth and fifth legs subequal in size and general aspects, about half times as long as body, much shorter than first leg. Endopodite of second pleopod bears shorter stylamblys in male and female and longer appendix mesculina coated thickly with hairs on inner border in male as in *P. nippon-*

ensis, *P. longipes*, *P. sundaicus* and *P. philippiensis*.

The above mentioned description is based on 7 male specimens, ranging from 59.0 to 110.0 mm in body length and 12 female specimens, 40.5~97.0 mm in body length, collected from the following localities.

Localities: Kimmura, Okinawa-zima; Sirakawa, Miyako-zima, collected by Dr. Yaichirô OKADA, Mr. Isamu HORAZAWA and Mr. Heizi IKEDA: Hirakawa, Isigaki-zima; Iriomote-zima, collected by Mr. Sadayosi MIYAKE: Palau Isl., collected by Mr. Itinosuke OKUKAWA.

Distribution: Amboine (MILNE-EDWARDS); Celebes, Saleyer, Flores, Adonara, Rotti Isl., Timor (DE MAN); Tahiti, Fuji Isl., Pasananea, Mindanao, near Samboangan, Philippine, Banda Isl. (BATE); Philippine (COWLES); Formosa (MAKI and TUTIYA); Sunda, Madagascar; Nouvelle-Bretagne, N.-Irlande; N.-Hamovre (Archipel Bismark), Manus (Archip. de L'Amirauté) (ROUX).

Note: The specimens at my disposal are quite in accord with the descriptions of BATE, DE MAN and others of the present species.

The ocular spot of the present species is the smallest of all found in the species dealt with in this paper.

Palaemon latimanus v. MARTENS

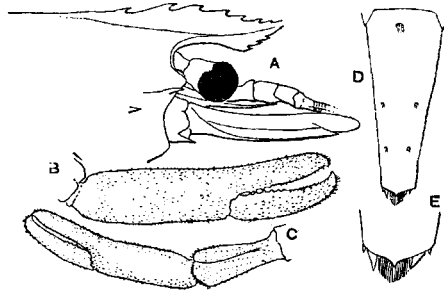
(Pl. 1, A and Text-fig. 15)

Palaemon (Macrobrachium) latimanus, DE MAN, p. 477, taf. 28, fig. 45.

Not: *Palaemon latimanus*, OETMANN, 1891, p. 737, taf. 47, figs. 11 and 11 Z.; ESTAMPADOR, 1937, p. 489.

Rostrum short, about one-fourth as long as carapace, not reaching to tip of antenular peduncle, both dorsal and ventral borders convex in profile, slightly reflexed at tip, 3 spines on the ventral, 5 on the dorsal border, and 2 on the dorsal carina which runs for one-third of carapace (Fig. 15, A). Telson shorter than uropods, dorsally armed with two pairs of spinules in distal half, obtusely pointed at apex bearing two pairs of spinules, provided with a median tuft of hairs near proximal border as in *P. lar* (Fig. 15, D and C), proportions against length: 0.4 along anterior border and 0.2 along posterior border. Mouth-parts quite similar to those of *P. nipponensis*. First pair chelate, slender, a little shorter than half of body. Second pair robust, asymmetrically chelate and right larger than the other, wholly covered with fine spinules and hairs; larger cheliped about 0.7 times of body, proportions against finger: palm 1.2, carpus 0.8, merus 1.1, ischium 1.0; fingers armed proximally with several teeth along cutting edges, leaving

Fig. 15. *Palaemon latimanus*, ♂, 89.4 mm long, procured from Okinawa-zima, Riu Kiu. *A*, frontal aspect, \times ca. 1.3; *B*, larger hand of second pereopod, \times ca. 1.3; *C*, smaller hand of the same pereopod, \times ca. 1.6; *D*, telson, \times 2; *E*, tip of telson, \times 4.



no space between them when closed, palm sub-cylindrical (Fig. 15, *B* and *C*); smaller hand closely resembles larger one in general aspects, but no tooth in fixed finger (Fig. 15, *C*). Third, fourth and fifth legs stout, somewhat shorter than body. Endopodite of second abdominal appendage carries a shorter stylamblys and a longer appendix musculina coated with thickly set hairs on inner border.

Described from a male specimen measuring 89.4 mm long, obtained from Genka, Hanegi-mura, Okinawa-zima by Dr. Yaichirô OKADA and others in April, 1935.

Distribution: Philippines; Loquilocum and Samar Island (v. MARTENS); Rotti; Timor, Flores (DE MAN).

Note: The specimen at my disposal shows some discrepancies from DE MAN's *P. latimanus* in having (1) both cutting edges of larger hand of second cheliped toothless at least in the distal half, and (2) fixed finger of smaller hand of the same cheliped toothless at all.

Interrelationship

Geographical distribution of the species dealt with in this paper warrants one to recognize two groups, viz., temperate and tropical. The temperate group is represented by *Palaemon nipponensis* which inhabits temperate region only. The tropical group consists of those which are mainly found in the tropics and sometimes in subtropical regions. To give the members, *Palaemon lar*, *P. sundaicus*, *P. philippinensis*, *P. riukiuiensis*, *P. grandimanus*, *P. latimanus* and *P. boninensis* are exclusively found in the tropics, but *P. longipes* and *P. japonicus* spread over tropical and subtropical waters.

To elucidate more minutely interrelationship of these species respectively, enumeration of every character was first tried in each, and frequency

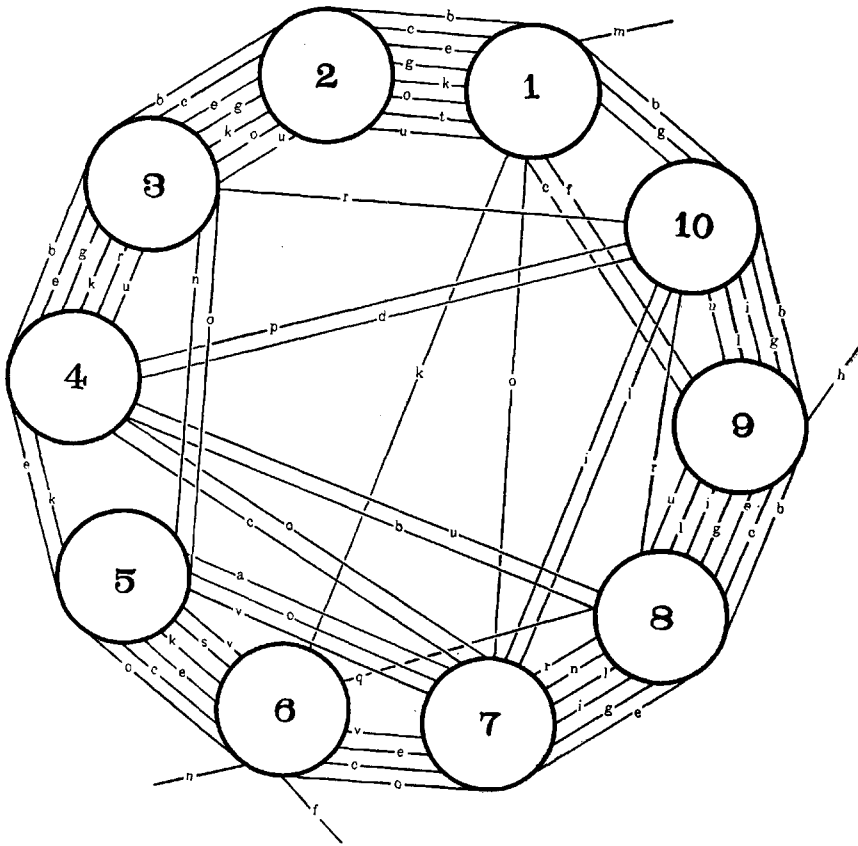


Fig. 16. *a*, upper border of rostrum almost horizontal; *b*, upper border of rostrum a little convexed; *c*, number of upper rostral spine >10 ; *d*, number of upper rostral spine <10 ; *e*, the tip of rostrum ends at the same level or a little surpassed the level of the first antennal peduncle; *f*, second cheliped smooth; *g*, second cheliped covered with thickly set setae; *h*, second cheliped covered with sparsely set setae; *i*, second cheliped asymmetrical; *k*, palm of second cheliped with subcircular cross-section; *l*, the same segment as in *k* with oval cross-section; *m*, fingers of second cheliped hairy; *n*, no tooth on the prehensile edges of second cheliped; *o*, merus shorter than carpus in the second cheliped; *p*, merus longer than carpus in the second cheliped; *q*, merus as long as carpus in the second cheliped; *r*, carpus shorter than palm in the second cheliped; *s*, carpus longer than palm in the second cheliped; *t*, carpus as long as palm in the second cheliped; *u*, finger shorter than palm in the second cheliped; *v*, finger as long as palm in the second cheliped; 1, *P. nipponensis*; 2, *P. philippinensis*; 3, *P. longipes*; 4, *P. lar*; 5, *P. sundaicus*; 6, *P. riukiensis*; 7, *P. grandimanus*; 8, *P. japonicus*; 9, *P. boninensis*; 10, *P. latimanus*.

of each was noted down as shown in Table 3. It may be argued that there must exist relative importance of the characters in question so that mere counting would be of no value. Inasmuch as it does not appear to warrant one to adopt any scheme for the time being, I must confine myself to take things as they really count. Frequency of coincidence is thus given in the table and graphically represented in Fig. 16, by way of drawing a line as a coincidence takes place at each time.

Taking apparent value of the frequency for granted, three groups may be established in the degree of interrelationship. The common and remark-

Table 3.

Frequency of coincidence of characters in the species of *Palaemon*.

(A)(B)	8																		
(A)(C)	7	(B)(C)	7																
(A)(D)	5	(B)(D)	5	(C)(D)	6														
(A)(E)	4	(B)(E)	4	(C)(E)	4	(D)(E)	2												
(A)(F)	2	(B)(F)	2	(C)(F)	2	(D)(F)	1	(E)(F)	5										
(A)(G)	4	(B)(G)	4	(C)(G)	5	(D)(G)	3	(E)(G)	5	(F)(G)	4								
(A)(H)	5	(B)(H)	5	(C)(H)	6	(D)(H)	5	(E)(H)	2	(F)(H)	3	(G)(H)	6						
(A)(I)	4	(B)(I)	5	(C)(I)	5	(D)(I)	4	(E)(I)	2	(F)(I)	2	(G)(I)	5	(H)(I)	7				
(A)(J)	3	(B)(J)	3	(C)(J)	4	(D)(J)	6	(E)(J)	0	(F)(J)	0	(G)(J)	4	(H)(J)	5	(I)(J)	5		

A, *P. nipponensis*; B, *P. philippinensis*; C, *P. longipes*; D, *P. lar*; E, *P. sundaicus*;
 F, *P. riukiensis*; G, *P. grandimanus*; H, *P. japonicus*; I, *P. boninensis*;
 J, *P. latimanus*.

able character in the first group is possession of the slender second cheliped, whereas the stout second cheliped in the second group, and small body-build in the third. The first consists of *P. nipponensis*, *P. philippinensis*, *P. longipes* and *P. lar*; the second *P. japonicus*, *P. grandimanus*, *P. boninensis* and *P. latimanus*; and the third *P. sundaicus* and *P. riukiensis*.

It is hoped that any evidence from developmental or physiological side whatever will test the validity of the classification here given.

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Explanation of Plate I

- Fig. A. *Palaemon latimanus* v. MARTENS, ♂, × ca. 0.75.
- Fig. B. *Palaemon riukiensis* sp. nov. ♂, × ca. 1.
- Fig. C. *Palaemon grandimanus* DANA, ♂, × ca. 1.
- Fig. D. Second pereopod of grown up male, × ca. 0.6.
Upper, *P. philippinensis* COWLES; middle, *P. longipes* DE HAAN;
lower, *P. nipponensis* DE HAAN.

Explanation of Plate II

- Fig. A and B. *Palaemon lar* FABRICIUS, ♂, × ca. 0.7 and its second chelipeds, × ca. 0.6.
- Fig. C. *Palaemon lar* FABRICIUS, ♀, × 1.
- Fig. D. *Palaemon japonicus* DE HAAN, ♂, × ca. 0.53.

