

# Description of the male of *Upogebia miyakei* from Ryukyu Islands, Japan (Decapoda: Thalassinidea: Upogebiidae)

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*The small upogebiid shrimp, Upogebia miyakei, was originally described from a female collected from Ishigaki-jima Island, Ryukyu Islands, southern Japan. However, no male specimen has been reported since the discovery of the holotype. During surveys at Iriomote-jima Island and its type locality, both females and males of U. miyakei were collected from the intertidal zone. Based on this material a full description of the male is given, and comparison with the female reveals the sexual dimorphic characteristics. The palm of the first pereiopod of male specimens is about 1.5 times wider than that of females. In male specimens, one or two spines are present on the dorsal margin of the palm of the first pereiopod, while three to six sharp spines are found on female specimens. This species is compared here with Upogebia lincolni from Java, Indonesia.*

**Keywords:** Decapoda, Ryukyu Islands, sexual dimorphism, Thalassinidea, *Upogebia miyakei*

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## INTRODUCTION

Upogebiid shrimps are one of the infaunal animals on muddy or sandy flats. More than 130 species are reported world wide, and 16 species inhabit intertidal muddy flats, dead-coral and sandstones in Japan (Sakai, 1970, 1982, 2006; Komai *et al.*, 1999; Itani, 2004; Sakai *et al.*, 2004; Sakai & Hirano, 2006). Three Japanese species, *Upogebia issaeffi* (Balss, 1913), *Upogebia major* (De Haan, 1841), and *Upogebia yokoyai* Makarov, 1938, are distributed over almost all the muddy flats of Japan (Sakai, 1982, 2006; Itani, 2004). Other species live in the southernmost area of Japan (Sakai, 1982, 2006; Itani, 2004). Especially, *Upogebia snelli* Ngoc-Ho, 1989, *Upogebia saigusai* Sakai & Hirano, 2006, *Upogebia iriomotensis* Sakai & Hirano, 2006, and *Upogebia spinidactylus* Sakai & Hirano, 2006 inhabit only Iriomote-jima Island, Yaeyama Islands, southern Japan (Ngoc-Ho, 1989; Sakai *et al.*, 2004; Sakai & Hirano, 2006). Five of 16 species of mud shrimp, *Acutigebia trypeta* (Sakai, 1970), *Neogebicula monochela* (Sakai, 1967), *Tuerkayogebia kiiensis* (Sakai, 1971), *Upogebia imperfecta*, Sakai, 1982, and *Mantisgebia kyushuensis* (Yokoya, 1933), are only known from each type locality (Yokoya, 1933; Sakai, 1967, 1970, 1971, 1982, 2006; Ngoc-Ho, 1990; Komai *et al.*, 1999).

During an investigation in the Yaeyama Islands during 2003–2006, 18 specimens of a very small upogebiid shrimp were collected from the seashore with cobblestones on Ishigaki-jima and Iriomote-jima Islands, Ryukyus, southern Japan. Detailed examination proved that the specimens represented *Upogebia miyakei* Sakai, 1967, originally

described from Ishigaki-jima Island, Japan. The specimens also included eight males which had not previously been discovered. Comparison of the males with the females showed sexual dimorphism in the first pereiopod. Only female specimens, including ovigerous females, were found from the type locality and Haroekoe Island of Ambon, Indonesia (Sakai, 1967; Ngoc-Ho, 1990). Furthermore, *U. miyakei* was originally described based on a damaged ovigerous female specimen. Therefore, we provide a fuller description of *U. miyakei* with illustrations including male specimens.

## MATERIALS AND METHODS

The specimens of *Upogebia miyakei* were collected from Ishigaki-jima Island and Iriomote-jima Island during 2003–2006. All the specimens were fixed with 70% ethanol. After the fixation, the carapace length (CL) and total length (TL) were measured. Carapace length means the length from the tip of the rostrum to the posterior edge of the carapace, and total length was measured from the tip of the rostrum to the posterior border of the telson. Because it is difficult for mud shrimp to be extended fully, we put a piece of sewing yarn along the body of specimens, and marked from the tip of the rostrum to the posterior border of the telson when we measured the total length of the mud shrimp. After that, the length between two marked points was measured using a digital micrometer calliper as a total length. Drawings and measurements were carried out using a drawing tube attached to a stereomicroscope (Olympus SZX12).

The materials are deposited in the National Science Museum, Tokyo (NSMT, with a code of Cr) and Science Division of Okayama University (SDO).

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## SYSTEMATICS

Order DECAPODA Latreille, 1802  
 Suborder PLEOCYEMATA Burkenroad, 1963  
 Infraorder THALASSINIDEA Latreille, 1831  
 Family UPOGEBIIDAE Borradaile, 1903

Genus *Upogebia* Leach, 1814

*Upogebia miyakei* Sakai, 1967

(Figures 1–3)

*Upogebia (Upogebia) miyakei*: Sakai, 1967

*Upogebia miyakei*: Ngoc-Ho, 1979; 1990; Itani, 2004; Sakai, 2006.

## MATERIAL EXAMINED

Two males (7.2 mm CL; 24.6 mm TL) [NSMT-Cr 16823], (5.9 mm CL; 20.1 mm TL) [SDO 0148], two ovigerous females (6.0 mm CL; 21.0 mm TL) [NSMT-Cr 16824], (5.5 mm CL; 19.3 mm TL) [SDO 0149], Ohsaki, Ishigaki-jima Island (24.2°N 124.5°E), intertidal zone, 18 April 2004, collected by Dr Yoshitake Takada. One male (3.8 mm CL; 13.0 mm TL) [SDO 0152], Shirahama, Iriomote-jima Island (24.2°N 123.4°E), 11 March 2005, collected by Dr Hideki Ikeda. One ovigerous female (5.0 mm CL; 16.3 mm TL) [SDO 0153], one female (5.9 mm CL; 20.0 mm TL) [SDO 0154], Mitara, Iriomote-jima Island, 14 June 2003, collected by one of us (M.S.). Three males (4.7–6.6 mm CL; 16.7–21.5 mm TL) [SDO 0128–0130], three females (6.5–6.9 mm CL; 21.1–23.3 mm TL) [SDO 0131–0133], three ovigerous females

(6.2–6.9 mm CL; 21.5–24.3 mm TL) [SDO 0134–0136], 30 May 2006, two males (6.4–6.9 mm CL; 21.6–23.1 mm TL) [SDO 0137, 0138], 31 May 2006, Funauki, Iriomote-jima Island, intertidal zone, collected by Miss Shino Taguchi, Miss Natalia Blatt, and M. Saigusa.

## DESCRIPTION OF MALES

Small sized species (Figure 1A&C).

**Rostrum** (Figures 1A,C & 2A,B) triangular, not acute anteriorly, longer than broad at base; each lateral margin with four spines; tip of rostrum seems to be trilobate with small tuft of short setae; ventral surface unarmed. Median groove narrow, extending from tip of rostrum to anterior 0.25 length of gastric region. Lateral frontal process developed as strong spine, and posterior to it row of 6–10 (usually 8) tubercles present on longitudinal ridge; tip of spine not reaching to middle of rostrum; short setae aligned marginally along row of longitudinal tubercles; lateral longitudinal groove straight, and deeper and wider from posterior to anterior. Dorsal surface of gastric region posterior to rostrum with scattered tubercles or granules, including one small median tubercle at posterior end of median groove; short setae sparsely among tubercles or granules. No hepatic spine. Anterolateral margin of carapace armed with a strong spine located posterior to eyestalk. Cervical groove deep, lateral edge with 1–2 small denticles. *Linea thalassinica* extending to posterior margin of carapace.

**Eyestalks** (Figure 2B) reach to about two-thirds as long as rostrum. Antennule peduncle (Figure 2C) with no spine;

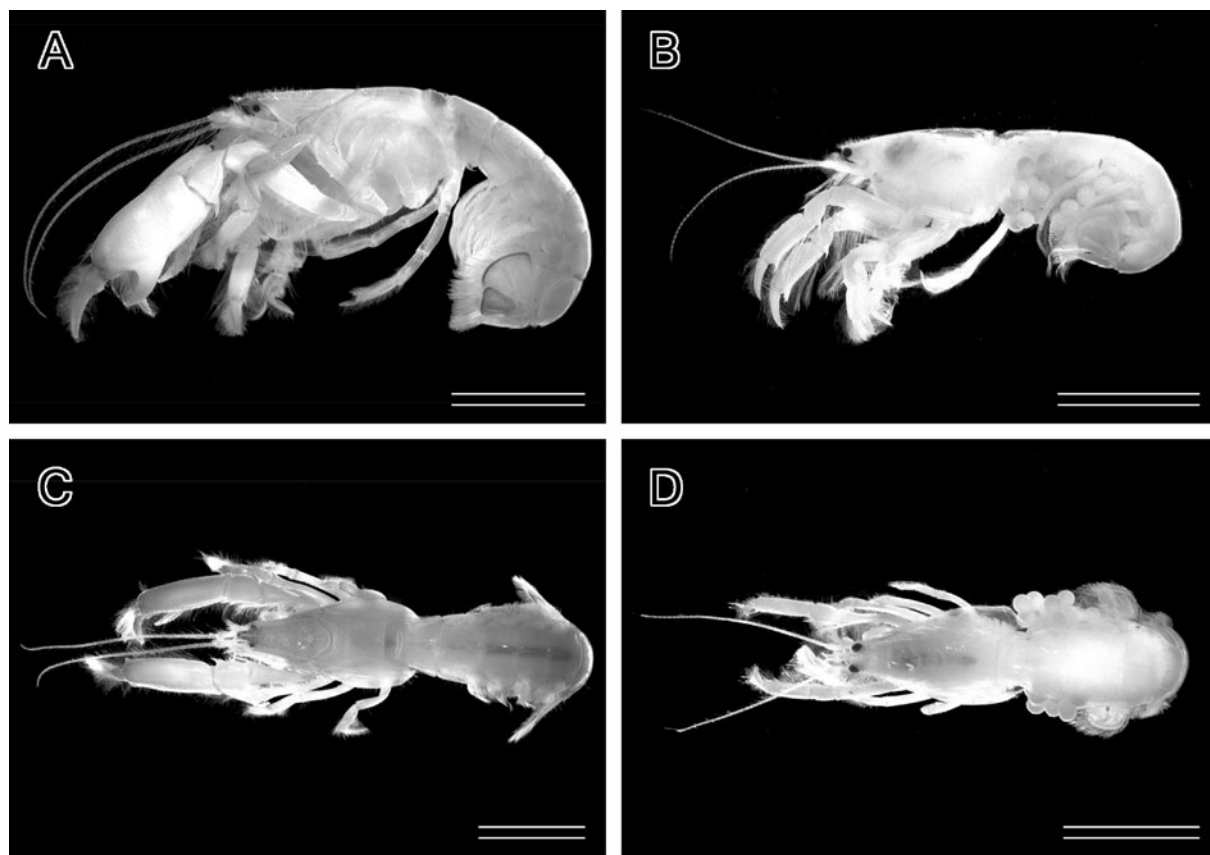
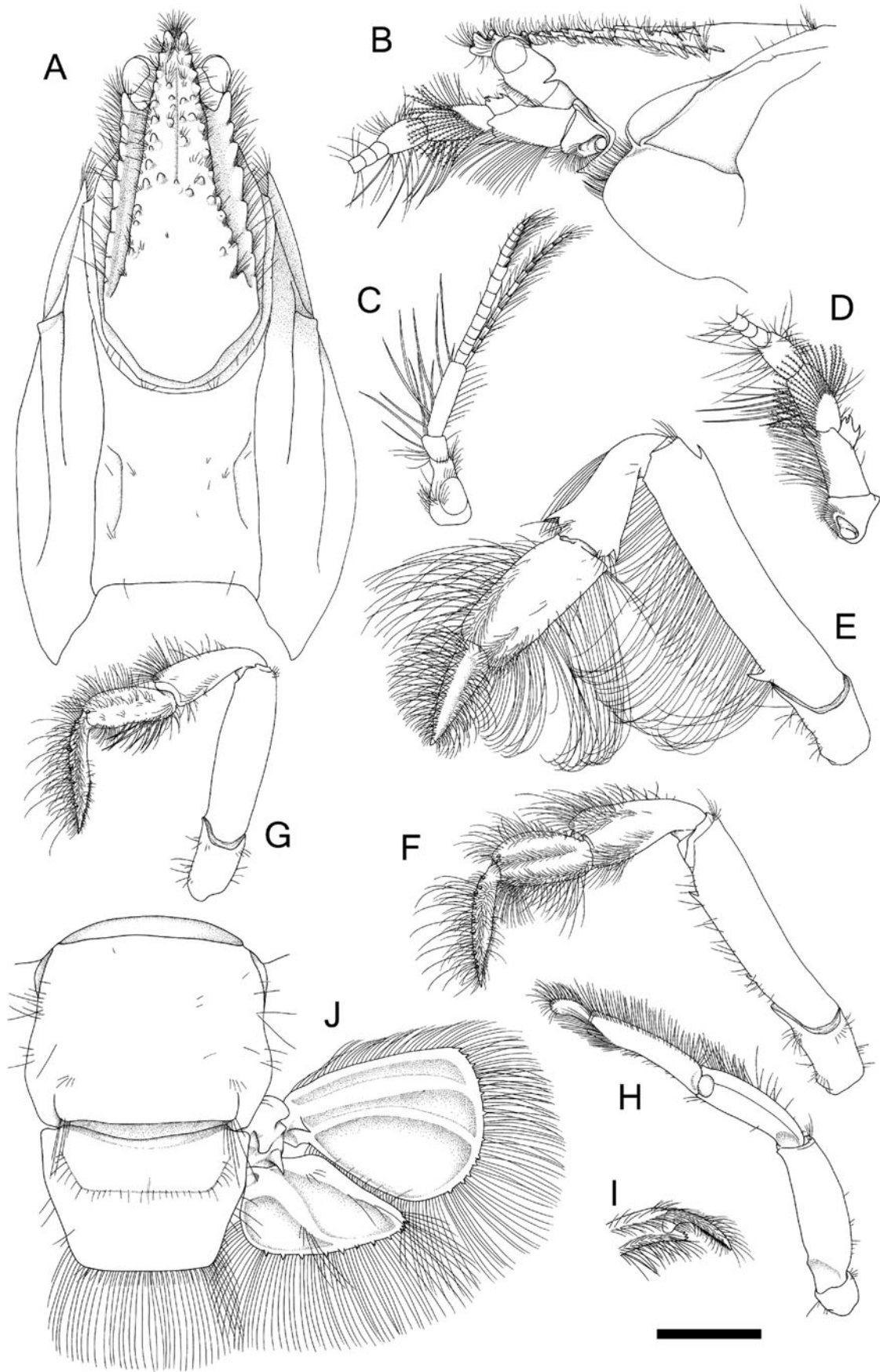


Fig. 1. *Upogebia miyakei* Sakai, 1967. (A) Male, lateral view; (B) ovigerous female, lateral view; (C) male, dorsal view; and (D) ovigerous female, dorsal view. Male (20.1 mm TL) [SDO 0148]; ovigerous female (19.3 mm TL) [SDO 0149]. Scale bar: 5 mm.



**Fig. 2.** *Upogebia miyakei* Sakai, 1967. (A) Carapace, dorsal view; (B) carapace, lateral view; (C) right antennule, lateral; (D) left antenna, lateral; (E) pereopod 2; (F) pereopod 3; (G) pereopod 4; (H) pereopod 5, lateral view; (I) pereopod 5 dactylus, mesial view; and (J) telson and uropod. Male (20.1 mm TL) [SDO 0148]. Scale bar: 1 mm.



second article short, and some long setae on dorsal surface; third article about three times as long as second article, dorsal surface with marginal long setae and ventral margin with row of shorter setae; outer flagellum about two times longer than third article of peduncle; inner flagellum longer and more slender than outer flagellum. Antenna peduncle (Figure 2D) with four articles; second article bears distal spine on ventral margin, scaphocerite provided with three small spines. Epistome armed with one acute anterior spine.

*First pereopod* (Figure 3A & B) subchelate. Ischium with a small sharp spine on ventral margin. Merus bears 2–6 small sharp spines in proximal half of ventral margin; one sharp subterminal spine on dorsal margin. Carpus with sharp strong spine on dorsal corner; sharp small spine on distomesial margin (Figure 3B); another sharp strong spine on ventral corner; ridge present along lower margin of outer surface. Palm oblong; lower margin of outer surface forming distinct ridge, which extends backward along posterior margin to half of upper margin; long setae arranged below lower ridge; tuft of setae on subdistal portion of outer surface; inner surface with a row of short setae on dorsal margin, and another row of long setae below it; one or two spines near upper distal margin of inner surface, one of eight male specimens without spine; one rounded large tubercle on distal margin; distinct ridge extending from posterior of fixed finger to middle of posterior margin, and a row of long setae below it; row of 5–10 small denticles on proximal one-third of ventral margin; small granules scattered on lower half of inner surface. Dactylus strong, about two times longer than fixed finger, obscured by row of long setae on outer surface, and terminating in corneous tip; inner surface with large tubercle proximally, and row of long setae along dorsal margin; another row of setae arranged along cutting edge; cutting edge bears two blunt teeth on proximal part and 4–7 small obscured denticles on distal margin. Fixed finger stout and subterminal, curved inward, and unarmed on cutting edge.

*Second pereopod* (Figure 2E) ischium unarmed. Merus with one or two sharp spines in proximal part of ventral surface, and subterminal spine on dorsal margin. Carpus with sharp spine on both dorsal and ventral corner. Propodus rectangular, two times longer than wide; dorsal surface with long setae; lateral surface with assemblage of setae on distal half. Dactylus 0.7 times longer than propodus, terminating in slightly upturned corneous tip; dorsal margin with dense, longer setae; another row of dense setae above lower edge; outer surface with shallow groove located between two rows of setae.

*Third pereopod* (Figure 2F) ischium unarmed. Merus with 2–4 spines on ventral margin. Carpus also unarmed; flattened prominent area of dorsodistal region obscured by thick setae; upper and below surface of distolateral region with dense setae. Propodus with one or two very small distal spines on outer surface; dorsal margin with long setae; a longitudinal row of setae on lateral surface; ventral margin with long setae, tuft of slightly longer setae on anterior half. Dactylus 1.3 times longer than propodus, terminating in acute corneous tip; dorsal edge with 7–11 small tubercles, obscured by dense setae; ventral margin with comb-like setae.

*Fourth pereopod* (Figure 2G) ischium and merus unarmed. Carpus also unarmed, with tuft of short setae on anterior corner of dorsal margin. Propodus with one or two small

spines on distomesial surface; dorsal margin with row of long setae; lateral surface with longitudinal row of short setae; tuft of short setae on anterior half, and longer and thicker setae on the posterior half of ventral margin. Dactylus 1.4 times longer than propodus, terminating in acute, slightly upturned, corneous tip; dorsal border concealed by thick setae; lateral surface with longitudinal band of short setae; very short comb-like setae on anterior half of ventral margin; dorsal margin with 7–11 small spines.

*Fifth pereopod* (Figure 2H & I) subchelate. Ischium and merus unarmed. Carpus twisted and with no spine. Propodus with tuft of short setae in one-third distal part of inner surface; row of short setae on both dorsal and ventral margin. Dactylus four times longer than fixed finger; very short comb-like setae bears on anterior half of cutting edge; inner surface obscured by dense setae. Fixed finger spoon-like form with three small spines on distal edge.

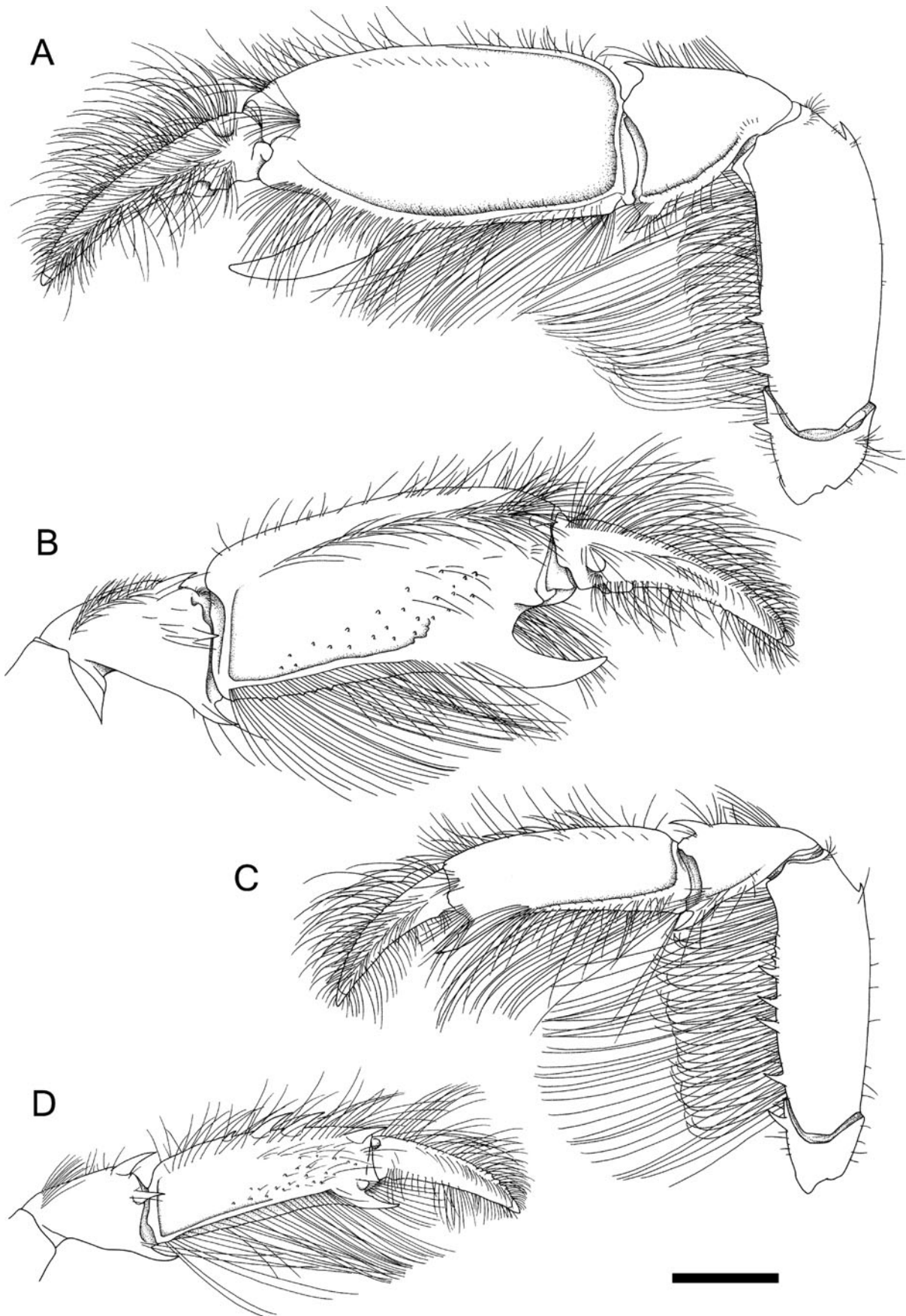
*Sixth segment of abdomen* (Figure 2J) as long as wide; posterior margin smoothly carinate. Telson 1.5 times broader than length; lateral margin tapering in posterior half; posterior margin almost straight; transverse carina inconspicuous sparsely marked with short setae. Uropod with one strong spine on posterior part of protopod. Endopod broad and slightly shorter than telson; distal corner with four small denticles, and other 4–8 spines on posterior margin. Exopod over-reaches to posterior edge of endopod, with a sharp proximal spine and many small denticles on posterior margin.

## DISCUSSION

### Morphological remarks

The morphology of present female specimens is consistent with the original description and figures of *Upogebia miyakei* given by Sakai (1967), and subsequent paper of Ngoc-Ho (1979, 1990). The male and female specimens of this small upogebiid shrimp were collected from the same scoop of substrate, and the morphological characteristics of rostrum, carapace, pereopods and telson were similar. Based on these characteristics, we identified these male specimens as *U. miyakei*.

The body size of the male specimens was slightly smaller than that of the female specimens. This species shows significant sexual dimorphism on the first pereopod (Figures 1A–D & 3A–D): comparison of specimens of similar total length show that the palm length and width of male specimens are about 1.2 and 1.5 times bigger than that of the females, respectively; the ventral spines of the merus are 2–6 in the males, while these spines are 4–9 in the females; the male specimens had one or two spines on the dorsal margin of the palm, while 3–6 spines are arranged on the same margin in females; two blunt teeth are arranged on the proximal part of the cutting edge of the dactylus in the males, although one small proximal tooth is present in females; some small sharp spines arranged on the dorsal margin of the dactylus, present in females, are absent in males. Sexual dimorphism is also shown in the relative length of the rostrum and eyestalk: in male specimens, eyestalks (Figure 2B) reach almost to about two-thirds of rostral length, while those of the female specimens reach to the tip of rostrum (Figure 1D).



**Fig. 3.** *Upogebia miyakei* Sakai, 1967. (A) Male pereopod 1, lateral view; (B) same, inner view; (C) female pereopod 1, lateral view; and (D) same, inner view. Male (20.1 mm TL) [SDO 0148]; ovigerous female (19.3 mm TL) [SDO 0149]. Scale bar: 1 mm.

## Variation in female specimens

In this study, ten female specimens of *Upogebia miyakei* were investigated. It revealed that the maximum total length of females was longer than that in the previous study. The total length of holotype females was 18.5 mm, and that of females from Indonesia was 18–19 mm (Sakai, 1967; Ngoc-Ho, 1990). However, the female specimens used in this study were 21.3 mm in average, and the maximum size was 24.3 mm. Furthermore, the smallest female specimen [SDO 0153] (16.3 mm TL) was ovigerous, and all ovigerous females were collected from April to June. It seems that this species reaches maturity when they grow to more than 16 mm in total length, and the breeding season is during April, May, and June.

The morphological variations of the first pereopod of females are as follows (those of the holotype in parentheses); the ischium bears only one (two) spine on the ventral margin; the merus bears 4–9 (6) spines on the ventral surface (Figure 3C); three to six (three) spines are arranged on the dorsal margin of the palm. The scaphocerite of the second article of the antenna peduncle is provided with three (two) small spines.

## Comparison of the male specimens between *Upogebia miyakei* and *U. lincolni*

*Upogebia miyakei* resembles *Upogebia lincolni* Ngoc-Ho, 1977 from Java, Indonesia (Ngoc-Ho, 1979). Differences between the two species also were discussed by Ngoc-Ho (1979), who mentioned only the females. Here we compare the male specimens of *U. miyakei* with that of *U. lincolni* (Ngoc-Ho, 1977; Figures 1–3).

The males of *U. miyakei* are similar to those of *U. lincolni* in terms of: (1) rostrum almost triangular, not acute anteriorly, and each lateral margin with four small spines; (2) one spine on the second peduncular article of antenna, and scaphocerite terminating in three spines; (3) lateral edge of cervical groove with two small denticles; (4) longitudinal crest on the outer surface of carpus of first pereopod; (5) no spine on dorsal margin of palm of first pereopod; (6) fixed finger of pereopod 1 with two blunt teeth on proximal margin of cutting edge; (7) dactylus of both third and fourth pereopod bear granules on dorsal margin; and (8) strong spines on both protopod and exopod of telson proximally.

However, the males of these two species are different for the following reasons (those of *U. lincolni* in parentheses): (1) merus of first pereopod with 2–6 spines (4 or 6 spines and denticles) on ventral margin; (2) distinct ridge of palm of first pereopod extending along the margin to the middle of dorsal margin (extending backward to the middle of posterior margin); (3) dactylus of first pereopod with (without) one large granule on inner surface proximally; and (4) posterior margin of telson almost straight (concave medially), transverse carina inconspicuous (conspicuous), and median groove absent (present).

## HABITAT

In this study, four specimens of *Upogebia miyakei* were captured from Ishigaki-jima Island, and others from the neighbouring Iriomote-jima Island, southern Japan. These mud shrimps were found on a beach of small cobbles, at a depth of less than 1 m. They make the small U-shaped

burrows in fine sediment between these cobbles or gravels (Y. Hirano, unpublished data).

## TYPE LOCALITY

Ishigaki-jima Island, Ryukyu Islands.

## DISTRIBUTION

Intertidal zone, Ohsaki, Ishigaki-jima Island, intertidal zone, Shirahama and Funauki, Iriomote-jima Island, Japan; Haroekoe Island of Ambon, Indonesia.

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