

One New and Two Rare Species of the Genus *Pilumnus* Leach, 1816 (Crustacea: Decapoda: Brachyura: Pilumnidae) from Takase Submarine Bank off the Izu Islands, South of Tokyo, Japan

Masatsune Takeda

Department of Zoology, National Museum of Nature and Science,

4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan

e-mail: takeda@kahaku.go.jp

(Received 23 August 2024; accepted 25 September 2024)

<https://zoobank.org/References/5c3853f5-5b21-4b38-91c7-261ab4dd5b42>

Abstract One new and two rare crab species of the genus *Pilumnus* Leach, 1816 are reported from Takase submarine bank off the Izu Islands, south of Tokyo, Japan. The new species, *P. okutanii*, is characteristic in the glabrous carapace, with a vestigial third anterolateral tooth, and the heavily spinose chelipeds and ambulatory legs. The other two species, *P. curvipenis* Komai and Motoh, 2012 and *P. orbitospinis* Rathbun, 1911, are also newly recorded from Takase submarine bank. *Pilumnus curvipenis* is a small species having the heavily spinose chelipeds and ambulatory legs which are similar to those of the new species, but different from it in the carapace dorsal surface roughened with granules and the carapace anterolateral margin armed with three strong teeth. *Pilumnus orbitospinis* is readily distinguished from the other congeneric species by having a prominent spine at the inner angle of the infraorbital margin.

Key words: Pilumnid crabs, new species, *Pilumnus curvipenis*, *Pilumnus orbitospinis*, Western Pacific, Japanese waters.

Introduction

During curation of the specimens preserved in the Tsukuba Research Departments, National Museum of Nature and Science, Tokyo, some registered but unidentified crabs of the genus *Pilumnus* Leach, 1816 in the family Pilumnidae were found. They were collected by dredging in Takase submarine bank off Nii-jima Island, Izu Islands, south of Tokyo (Fig. 1), more than 30 years ago, but were kept in good condition. On close examination, one specimen was revealed to represent a new species, and is to be described in this paper under the name of *P. okutanii*. The other specimens were referred to two described species,

P. curvipenis Komai and Motoh, 2012 hitherto known only from the Izu and Ryukyu Islands in Japan, and *P. orbitospinis* Rathbun, 1911 known from some records in the central Indian Ocean and Japanese waters without intervening localities. Both of *P. okutanii* sp. nov. and *P. curvipenis* are small species and remarkable in having the characteristic chelipeds and ambulatory legs heavily armed with strong spines. Few records of *P. orbitospinis* in previous literature are probably due to its offshore rocky bottom inhabitant.

The genus *Pilumnus* consists of nearly 140 species from the Indo-West and Atlantic Oceans (Ng *et al.*, 2008; Komai and Motoh, 2012; Magalhães and Felder, 2019; Marin and d'Udekem d'Acoz, 2019; Takeda and Komatsu, 2020; Fahimi *et al.*, 2021; Ng and Rahayu, 2021; Magalhães *et*

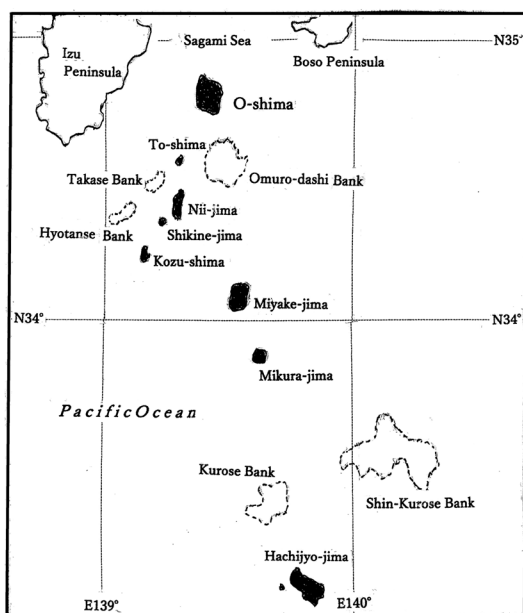


Fig. 1. Map of the Izu Islands, showing submarine banks (broken lines).

al., 2021). However, three species recorded in the present paper are readily distinguished from all the known species because of spinous armature on the carapace, chelipeds and ambulatory legs peculiar to each species.

The size of the carapace is indicated in millimeters, with breadth (cb) including the lateral teeth of both sides, and length (cl) from the frontal to posterior margins of the carapace in median line. The first male gonopod is abbreviated as G1. The collected date of the specimens is shown in the form of 11-IX-1989. The NSMT means the Tsukuba Research Departments, National Museum of Nature and Science, Tokyo.

Family PILUMNIDAE Samouelle, 1819

Genus *Pilumnus* Leach, 1816

Pilumnus curvipenis Komai and Motoh, 2012 (Fig. 4A)

Pilumnus dofleini Balss, 1933: Ng, 2000, p. 301, figs. 1–2. —Takeda & Komatsu, 2005, p. 284.

Pilumnus curvipenis Komai & Motoh, 2012, p. 17, figs. 12–13, 18A–B. —Takeda & Komatsu, 2020, p. 111.

Material examined. Takase submarine bank

(Fig. 1; 34°28.64'N, 139°12.26'E, 105 m depth), northwest off Nii-jima I., Izu Is., 1 ♀ (NSMT-Cr 11034; cb 4.7 × cl 3.7 mm), 11-IX-1989, dredged by TV *Umitaka Maru* of Tokyo University of Fisheries (now, Tokyo University of Marine Science and Technology) and donated by T. Okutani; Takase submarine bank (34°26.11'N, 139°09.75'E, 112 m depth), 1 ovig. ♀ (NSMT-Cr 11052; cb 5.8 × cl 3.8 mm), 11-IX-1989, dredged by TV *Umitaka Maru*.

Comparative material examined. Shin-Kurose submarine bank (Fig. 1; 33°32'N, 140°10'E), southeast off Mikura-jima I., Izu Is., 160–230 m depth, 3 ♂♂, 1 ovig. ♀ (NSMT-Cr 6665), 26-XI-1974, T. Okutani leg.; Hyotanse submarine bank (Fig. 1; 34°21'N, 139°02.36'E, 105 m depth), northwest off Kozu-shima I., Izu Is., 1 ovig. ♀ (NSMT-Cr 6666), 26-VI-1973, T. Okutani leg.

Off Kasari Bay, Amami-Oshima I., Ryukyu Is., 120–122 m depth, 1 ♂ (NSMT-Cr 16204; cb, left branchial region heavily deformed × cl 2.6 mm), dredged by tugboat *Daiyu Maru No. 38*; Off Nakahise-saki, Amami-Oshima I., 117–123 m depth, 1 ovig. ♀ (NSMT-Cr 16201; cb 5.0 × cl 3.3 mm), by *Daiyu Maru No. 38*.

Remarks. The specimens from Shin-Kurose and Hyotanse (NSMT-Cr 6665, 6666) were recorded by Ng (2000) as *Pilumnus dofleini* Balss, 1933, but later described as a new species, *P. curvipenis*, by Komai and Motoh (2012). One male (NSMT-Cr 6665; cb 11.4 × cl 14.2 mm) was selected as the holotype, and two males (cb 8.0 × cl 9.5 mm; cb 8.8 × cl 10.2 mm) and one ovigerous female (cb 13.4 × cl 16.4 mm) in the same lot were designated as the paratypes with new registered number, NSMT-Cr 22177, together with one ovigerous female (NSMT-Cr 6666; cb 12.3 × cl 14.8 mm).

As for the specimens from Amami-Oshima Island, it is noted that Takeda and Komatsu (2005) recorded a male (MSMT-Cr 16204; cl 2.6 mm) as *Pilumnus dofleini*, and an ovigerous female (NSMT-Cr 16201; cb 5.0 × cl 3.3 mm) as *Nanopilumnus* sp.

During this study, the type specimens (NSMT-

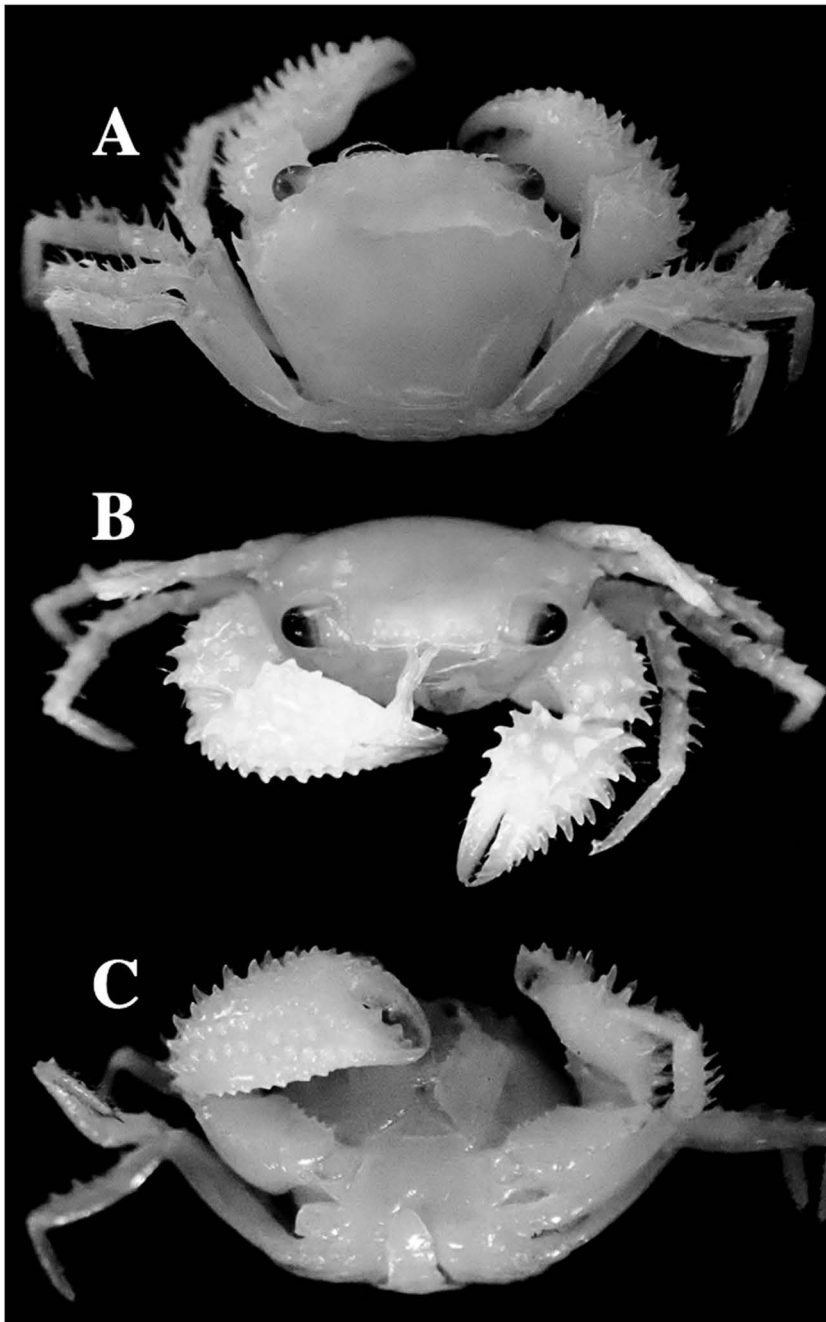


Fig. 2. *Pilumnus okutanii* sp. nov., holotype, ♂ (NSMT-Cr 11043; cb 4.8 × cl 3.8 mm). Habitus; dorsal (A), frontal (B) and ventral (C) views.

Cr 6665, 6666, 22177) and additional two females (one ovigerous) (NSMT-Cr 11034, 11052) from submarine banks off the Izu Islands, and one male (NSMT-Cr 16204) and one oviger-

ous female (NSMT-Cr 16201) from off Amami-Oshima Island, Ryukyu Islands, were re-examined. The armature of the carapace anterolateral margins illustrated by Ng (2000, fig. 1a) and

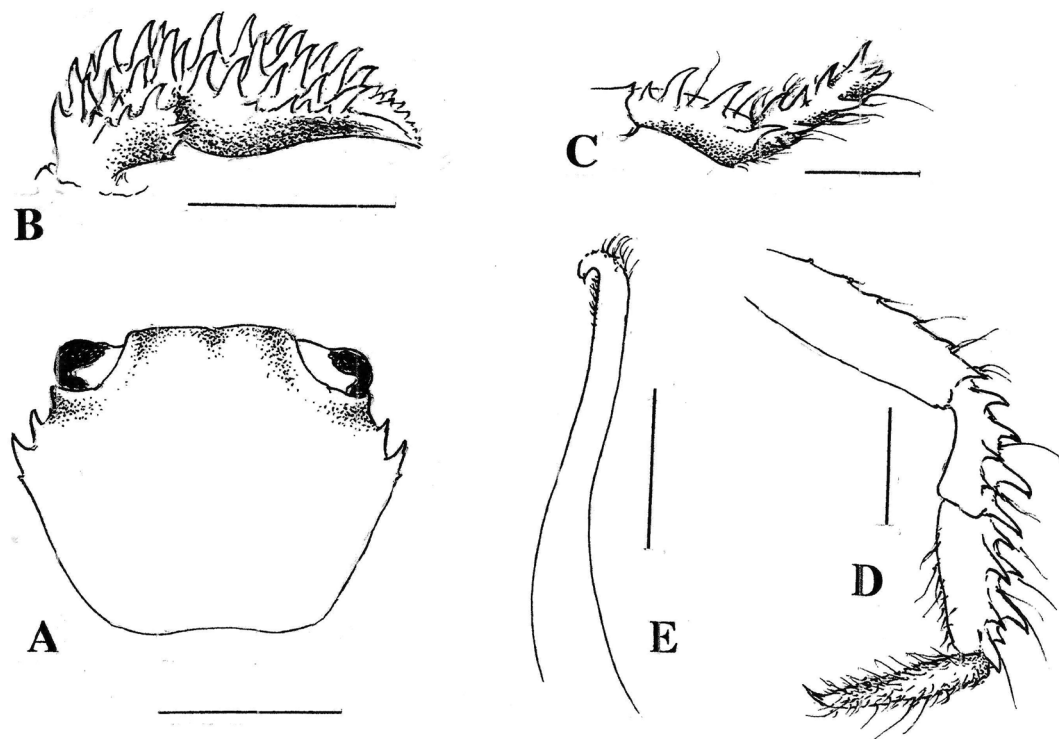


Fig. 3. *Pilumnus okutanii* sp. nov., holotype, ♂ (NSMT-Cr 11043; cb 4.8 × cl 3.8 mm).

Carapace, dorsal view (A); left chela, dorsal view (B); carpus and propodus of right second ambulatory leg, anterior view (C); right third ambulatory leg, dorsal view (D); left G1, sternal view (E). Scales A–B = 2 mm; C–E = 1 mm.

Komai and Motoh (2012, fig. 18A) seem to be somewhat different from each other. In the present specimens (Fig. 4A), the anterolateral teeth are not spinulate, but distinctly toothed, being close to those of the carapace right side in Komai and Motoh's figure (fig. 18A). The most obvious character of *P. curvipenis* is the G1 shape as figured by Ng (2000, fig. 2b–e, as *P. dofleini*) and Komai and Motoh (2012, figs. 13F–I). The distal part of the G1 is short and strongly bent, somewhat similar to that of *P. bohol* Komai and Motoh, 2012 in which, however, the distal part is shorter and only weakly curved, not vent at all.

The specimens from off Amami-Oshima Island previously reported as *P. dofleini* (NSMT-Cr 16204) and *Nanopilumnus* sp. (NSMT-Cr 16201) by Takeda and Komatsu (2005) agree well with the type specimens of *P. curvipenis* from the Izu Islands off the Pacific coast of cen-

tral Japan, and also with notes on three females from the west of Amami-Oshima Island, 120 m depth, and a male from off Naha, Okinawa-jima Island, Ryukyu Islands, 60–70 m depth, made by Takeda and Komatsu (2020).

Distribution. Known from some submarine banks off the Izu Islands, south of Tokyo, and from off Amami-Oshima Island and Okinawa-jima Island in the Ryukyu Islands; 60–230 m depth.

Pilumnus okutanii sp. nov.

(Figs. 2–3)

urn:lsid:zoobank.org:act:DB16283D-D532-489A-A6AA-7DB68048B877

Material examined. Takase submarine bank (Fig. 1; 34°26.78'N, 139°11.27'E, 99 m depth), northwest off Nii-jima I., Izu Is., holotype ♂ (NSMT-Cr 11043; cb 4.8 × cl 3.8 mm), 11-IX-

1989, dredged by TV *Umitaka-Maru* of Tokyo University of Fisheries (now, Tokyo University of Marine Science and Technology) and donated by T. Okutani.

Diagnosis. Small species. Carapace dorsal surface convex, ill-defined, smooth, shining without granules or hairs; anterolateral margin armed with two tuberculate teeth behind obtuse external orbital angle, and with one vestigial tooth on posterior slope of outer margin of second tooth. Both chelipeds heavy, unequal in size, but similar in shape, armed with numerous spiniform tubercles on carpi and palms. Ambulatory legs armed with long spines along anterior margins of meri, carpi and propodi.

Description of holotype (male). Carapace (Figs. 2A, 3A) relatively narrow among congeners, with 1.3 times as wide as long, hexagonal rather than ovate, equally convex dorsally for most part, curved downwards around frontal and lateral margins; dorsal surface (Figs. 2A–B, 3A) quite ill-defined, only with median longitudinal shallow furrow separating frontal and gastric regions of both sides, wholly smooth, shining, without granules or spinules. Frontal margin (Figs. 2A–B, 3A) not produced forwards, divided into two truncated lobes by a median small, wide notch; lateral end of each lobe weakly angulated, with a small notch close to lateral end; outer margin of frontal lobe longitudinal behind angulated lateral end, shallowly separated posteriorly from obscure supraorbital angle. Supraorbital margin thin, narrowly raised to form deep orbit, with minute notch at median part; external orbital angle not formed; infraorbital margin thin, raised similarly in supraorbital margin; inner infraorbital angle strongly developed as triangular tooth along inner one third of infraorbital margin, sharply pointed at tip.

Anterolateral margin of carapace (Figs. 2A, 3A) armed with two spine-tipped teeth and one minute, but distinct tooth at posterior slope of outer margin of second tooth; first tooth narrow, weakly curved, directed obliquely forward, second tooth similar to first tooth in shape, but much stouter. Outer margin of second tooth directly

retreating toward lateral end of carapace posterior margin, without distinct boundary of carapace anterolateral and posterolateral margins; distance from tip of second tooth to lateral end of carapace posterior margin more than two times of distance from tip of second tooth to external end of supraorbital margin. Subhepatic region unarmed, smooth, weakly expanded, separated from infraorbital margin.

Third maxilliped smooth on external surface, comparatively narrow; ischium 1.5 times width of exopod; merus 1.5 times as long as ischium, weakly becoming wider distally, with obtuse antero-external angle.

Both chelipeds (Fig. 2) comparatively large, slightly different in size, similar in armature, right cheliped being larger. Merus short, smooth, with strongly edged upper margin. Outer surfaces of carpus and chela, even proximal halves of both fingers, thickly covered with strong, curved spiniform tubercles (Fig. 3B); tubercles more or less arranged in some lines, tubercles of larger chela stronger, but shorter than those of smaller chela; those on outer lower surfaces of larger chela becoming conical in shape. Fingers of larger chela armed with two triangular teeth at median part and subsided by a small tooth each at basal and distal parts on each cutting edge; fingers of smaller cheliped irregularly toothed on cutting edges.

Ambulatory legs (Figs. 2, 3C–D) slender, with sparse silky hairs on meri, carpi and propodi, but dactyli with dense fringe of silky hairs of various lengths; each merus with some equidistant spinules on anterior margin, distal part of anterior margin obtusely tuberculated; each carpus and propodus armed with some long, strong spines along anterior margin; each carpus of first two pairs with two rows of four strong spines along anterior margin, carpus of third pair with a row of strong spines and a row of small tubercles, carpus of fourth pair unarmed on anterior margin.

Pleon six-segmented, third to fifth pleonites becoming narrow, but lateral margins of sixth pleonite to proximal halves of telson subparallel to each other; telson 1.5 times as long as sixth

pleonite, obtusely rounded along distal margin. G1 (Fig. 3E) not strongly curved, with small, strongly recurved sharp tip; marginal hairs at subterminal part not so long.

Remarks. The present new species is impressive in having the smooth and shining carapace and the ambulatory legs armed with long spines on the meri, carpi and propodi. The carapace dorsal surface completely lacking granules, spinules and hairs suggests that the new species may be referred to the genus *Glabropilumnus* Balss, 1932 and some related genera (cf. Galil and Takeda, 1988). In all the species of these genera, however, the carapace anterolateral teeth are less developed, not spiniform nor tubercular, and the ambulatory legs are entirely unarmed unlike the most of the *Pilumnus* species.

The vestigial third tooth of the carapace anterolateral margin of the new species is also seen in the genus *Viaderiana* Ward, 1942, but the small third tooth is distinctly isolated from the second tooth not on the margin of the second tooth. In all the known *Viaderiana* species, the carapace are covered with longish single hairs or bundles of plumose hairs, and the long ambulatory legs are armed with some spines only on the merus anterior margin.

The present new species is somewhat aberrant in the genus *Pilumnus* in the carapace dorsal surface being entirely naked and the third anterolateral tooth being vestigial on the slope of the second tooth, but it seems reasonable for the present that the taxonomic position is in the genus *Pilumnus* rather than the other pilumnid genera until the detailed revision of *Pilumnus* and some related genera is made on the basis of adequate comparison of the known species.

The distinct rows of long spines along the anterior margins of the ambulatory meri, carpi and propodi link *Pilumnus okutanii* sp. nov. to *P. acanthosoma* Ng, 2000 from Taiwan (Kaohsiung County), *P. armatus* Komai and Motoh, 2012 from the Philippines (Bohol Sea), *P. bohol* Komai and Motoh, 2012 from the Philippines (Panglao), *P. curvipenis* Komai and Motoh, 2012 from Japan (Izu Islands), and *P. dofleini* Balss,

1933 from Japan (Sagami Sea and Ishikawa Prefecture in the Sea of Japan). All of these species are closely related to each other, but distinguished by the elaborate descriptions and figures by Komai and Motoh (2012). In *P. dofleini* and the related congeneric species mentioned above, the carapace dorsal surface is shallowly but rather distinctly divided into regions and covered with scattered obtuse or conical granules (vs. smooth and shining in the new species), and the anterolateral margin is armed with three, more or less lobate teeth or spines with some accessory spinules (vs. two spiniform teeth and a vestigial spinule in the new species).

In addition to the species of the *P. dofleini* group mentioned above, *P. acutifrons* Rathbun, 1906 is also close to the new species in the general appearance of the carapace, chelipeds and ambulatory legs. This species is known only by the holotype male from the French Frigate Shoals in the northwestern Hawaiian Islands, 30.5–31.5 m depth, and is also small in size (cb $3.8 \times$ cl 3 mm); the chelipeds and the ambulatory meri and carpi are armed with strong spines somewhat similar to those of the new species, although the anterior margins of the ambulatory propodi is unarmed unlike the strongly armed propodi of the new species. According to the original description of *P. acutifrons* by Rathbun (1906), the carapace dorsal surface is smooth and weakly areolated, with scattered tufts of hairs; each carapace anterolateral margin is armed with three spines, the first two of which are large and have broad bases and slender tips; the last is explained as to be small and bifid at the tip; the frontal lobes are deflexed, with the very oblique and subtruncated margins. The new species differs from *P. acutifrons*, as mentioned above, in the smooth, ill-defined dorsal surface of the carapace, the frontal lobes not extended forward, the vestigial third anterolateral tooth of the carapace, and the strongly armed propodi of the ambulatory legs.

Etymology. This species is named after Dr. Takashi Okutani, Professor Emeritus of the Tokyo University of Fisheries (now, Tokyo Uni-

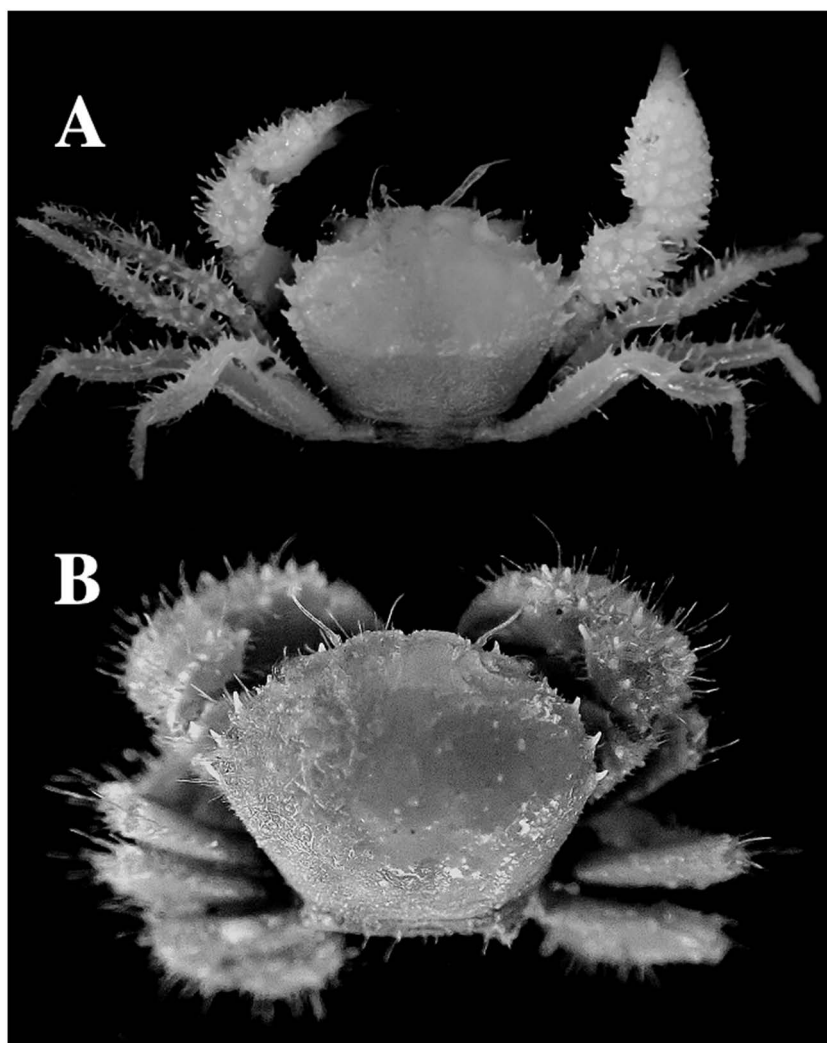


Fig. 4. A: *Pilumnus curvipenis* Komai and Motoh, ovig. ♀ (NSMT-Cr 11052; cb 5.8 × cl 3.8 mm). B: *Pilumnus orbitospinis* Rathbun, ovig. ♀ (NSMT-Cr 6659; cb 8.9 × cl 7.2 mm).

versity of Marine Science and Technology), who enriched the National Museum of Nature and Science, Tokyo, with various marine invertebrate specimens from offshore banks.

Distribution. Known only by the holotype male from Takase submarine bank, 99 m depth, off the Izu Islands, south of Tokyo, Japan. One of the related species mentioned in the text, *P. curvipenis* Komai and Motoh, 2002 was also obtained from Takase not far from the type locality of *P. okutanii*.

***Pilumnus orbitospinis* Rathbun, 1911**
(Fig. 4B)

Pilumnus orbitospinis Rathbun, 1911, p. 229, pl. 16 figs. 14–15. —Parisi, 1916, p. 185. —Sakai, 1939, p. 536, pl. 100 fig. 6; 1965, p. 158 (English part), p. 68 (Japanese part), pl. 78 fig. 3; 1976, pp. 484 (in key), 487, fig. 261a (English vol.), p. 300 (Japanese vol.). —Takeda & Miyake, 1968, pp. 6 (in key), 19, figs. 4d–f, pl. 3 fig. B. —Takeda *et al.*, 2005, p. 112. —Takeda & Ueshima, 2006, p. 92.

Material examined. Takase submarine bank,

northwest off Nii-jima I., Izu Is., 140–180 m depth, 1 ovig. ♀ (cb 8.9 × cl 7.2 mm), NSMT-Cr 6659; 9-VII-1968, dredged by the TV *Umitaka Maru* of Tokyo University of Fisheries (now, Tokyo University of Marine Science and Technology) and donated by T. Okutani.

Remarks. The ovigerous female examined agrees with the original description and the records from Japanese waters cited above, in having the convex and ill-defined carapace covered with the rather sparse longish hairs and four sharp anterolateral spines including one at the external orbital angle, and each ambulatory merus armed with one or two spinules on the anterior margin and a terminal spine. The most obvious characteristic of *P. orbitospinis* is the presence of a remarkable spine at the inner angle of the infraorbital margin (Fig. 4B). In the present female, the carapace anterolateral spines are much shorter than those of the male figured by Takeda and Miyake (1968, pl. 3 fig. B), indicating one of the sexual intraspecific differences.

Distribution. This species was originally described on the basis of two females (one ovigerous) from the Chagos Archipelago in the central Indian Ocean, 108–216 m depth, and is otherwise known from Sagami Bay and Tosa Bay, the Pacific coast of Japanese mainland, 85–200 m depth, Izu-Oshima Island, Izu Islands, 160–180 m depth, and southwest of Kume-jima Island and about 100 km west of Okinawa-jima Island in the central Ryukyu Islands, 372–375 m depth. Now, from Takase submarine bank, northwest off Nii-jima Island, Izu Islands, 140–180 m depth.

Acknowledgments

The author wishes to thank Dr. Takashi Okutani, Professor Emeritus of the Tokyo University of Fisheries (now, the Tokyo University of Marine Science and Technology), who enriched the NSMT marine invertebrate collections with the specimens from submarine banks collected by the TV *Umitaka Maru*. The author's cordial thanks are also due to Dr. Masayuki

Osawa of the Estuary Research Center, Shimane University, for his critical reading and comments on the manuscript. The author also sends his thanks to Drs. Célio Magalhães and Fernando L. Mantelatto of the University of São Paulo for their help in getting literature.

References

- Balss, H. 1933. Beiträge zur Kenntnis der Gattung *Pilumnus* (Crustacea Decapoda) und verwandter Gattungen. *Capita Zoologica* 4(3): 1–47, pls. 1–7.
- Fahimi, N., H. Zolghameiun, A. Keykhosravi and R. Naderloo 2021. Molecular phylogeny and taxonomy of the genus *Pilumnus* Leach, 1815 (Eucarustacea: Brachyura: Pilumnidae) in the Persian Gulf and Gulf of Oman. *Zoologischer Anzeiger* 291: 7–22.
- Galil, B. and M. Takeda 1988. A revision of the genus *Glabropilumnus* (Crustacea, Decapoda, Brachyura). *Bulletin of the National Science Museum, Tokyo (A)* 14: 67–90.
- Komai, T. and H. Motoh 2012. The identity of *Pilumnus dofleini* Balss, 1933 (Crustacea: Decapoda: Brachyura: Pilumnidae), with descriptions of three new species from the western Pacific. *Zootaxa* 3305: 1–27.
- Magalhães, T. and D. L. Felder 2019. A new species of the hairy crab genus *Pilumnus* (Decapoda: Brachyura: Pilumnidae) from Belize. *Zootaxa* 4711: 175–184.
- Magalhães, T., J. A. F. Pantaleão and F. L. Mantelatto 2021. Resurrection of *Pilumnus vinaceus* A. Milne-Edwards, 1880 (Brachyura: Pilumnidae) using integrative evidence from molecular and morphology. *Zootaxa* 5047: 547–556.
- Marin, I. N. and C. d'Udekem d'Acoz 2019. Resurrection and neotype designation of *Pilumnus spinulosus* Kessler, 1861 (Crustacea: Decapoda). *Arthropoda Selecta* 28: 545–548.
- Ng, P. K. L. 2000. The Indo-Pacific Pilumnidae XIII. On a new species, *Pilumnus acathosoma* (Crustacea: Decapoda: Brachyura), from Taiwan and the South China Sea, with notes on *P. dofleini* Balss, 1933. *Zoological Studies* 39: 301–306.
- Ng, P. K. L. and D. L. Rahayu 2021. On the Pilumnidae (Crustacea: Brachyura: Pilumnoidea) collected during the SJADES 2018 biodiversity cruise in Indonesia, with description of a new species of *Pilumnus*. *Raffles Bulletin of Zoology, Supplement* 36: 265–276.
- Parisi, B. 1916. I Decapodi Giapponesi del Museo di Milano. IV. Cyclometopa. *Atti della Società Italiana di Scienze Naturelli e del Museo Civico di Storia Naturale, Milano* 55: 153–190, pls. 7–11 (in Italian).
- Rathbun, M. J. 1906. The Brachyura and Macrura of the Hawaiian Islands. *Bulletin of the United States Fish*

- Commission 23: 827–930, pls. 1–24.
- Rathbun, M. J. 1911. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner. XI. Marine Brachyura. Transactions of the Linnean Society of London (2) 14: 191–261, pls. 15–20.
- Sakai, T., 1939. Studies on the Crabs of Japan. IV. Brachygnatha, Brachyrhyncha. Pp. 365–741, pls. 42–111. Yokendo Ltd., Tokyo.
- Sakai, T. 1965. The Crabs of Sagami Bay, collected by His Majesty the Emperor of Japan. xxix + 206 pp. (English part), 92 pp. (Japanese part), 32 pp. (Bibliography and Index), 1 map, 100 pls. Maruzen Co., Ltd., Tokyo.
- Sakai, T. 1976. Crabs of Japan and the Adjacent Seas. xxix + 773 pp. (English vol.); 461 pp. (Japanese vol.); 16 pp. + 251 pls. (Plates). Kodansha Ltd., Tokyo.
- Takeda, M. and H. Komatsu 2005. Collections of crabs dredged off Amami-Oshima Island, the northern Ryukyu Islands. In Hasegawa, K., G. Shinohara and M. Takeda (eds): Deep-Sea Fauna and Pollutants in Nansei Islands. National Science Museum Monographs, Tokyo 29: 271–288.
- Takeda, M. and H. Komatsu 2020. Some records of off-shore crabs (Crustacea, Decapoda, Brachyura) from the Ryukyu Islands. II. Families Portunidae, Xanthidae, Pilumnidae and Planopilumnidae. Bulletin of the National Museum and Nature and Science, Tokyo (A) 46: 97–121.
- Takeda, M. and S. Miyake 1968. Pilumnid crabs of the family Xanthidae from the West Pacific. I. Twenty-three species of the genus *Pilumnus*, with description of four new species. OHMU: Occasional Papers of Zoological Laboratory, Faculty of Agriculture, Kyushu University 1: 1–60, pls. 1–4.
- Takeda, M. and R. Ueshima 2006. Crabs preserved in the Department of Zoology, the University Museum, the University of Tokyo. In Ueshima R. (ed.): Catalogue of invertebrate collection deposited in the Department of Zoology, the University of Tokyo. The University Museum, The University of Tokyo, Material Reports 62: 61–105 (in Japanese with English summary).
- Takeda, M., H. Watabe and S. Ohta 2005. Deep-sea crabs collected by the R.V. *Hakuho Maru* during KH-05-01 cruise off the Ryukyu Islands. Bulletin of the National Science Museum, Tokyo (A) 31: 105–114.