

New Records of Three Species of the Genus *Enosteoides* (Decapoda: Anomura: Porcellanidae) from Japan, with Description of a New Species

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Abstract A new porcellanid crab, *Enosteoides lobatus* sp. nov., is described from the Ryukyu Archipelago, southern Japan. The shapes of the rostrum and third thoracic sternite readily distinguish the new species from the other species of the genus *Enosteoides*. In addition, *Enosteoides melissa* and *E. palauensis* are recorded from Japanese waters for the first time based on the specimen from the Ryukyu Archipelago, with notes on the coloration in life.

Key words: Decapoda, Anomura, Porcellanidae, *Enosteoides*, new species, new records, Japan.

The porcellanid genus *Enosteoides* was established by Johnson (1970) as a subgenus of *Porcellana* Lamarck, 1801, and subsequently raised to generic rank by Haig (1978). Although Johnson (1970) included only the type species *Porcellana corallicola* Haswell, 1882 in his subgenus, Haig (1965) had considered that *P. corallicola* and *P. ornata* Stimpson, 1858 were synonymous. Haig (1978) assigned further *Porcellana melissa* Miyake, 1942 and *Porcellana palauensis* Nakasone and Miyake, 1968 to *Enosteoides*. Yang and Sun (1985) described *Enosteoides variabilis* from Weizhou Island in China, but Yang and Sun (1992) subsequently transferred that species to the genus *Pisidia* Leach, 1820. Yang and Sun (2005) further described a different new species, *E. hainanensis*, from Hainan Island in China, but Osawa (2007) considered that the taxon is synonymous with *E. palauensis*. Thus, *Enosteoides* is currently represented by three Indo-West Pacific species, *E. melissa*, *E. ornatus*, and *E. palauensis* (cf. Osawa, 2007). The genus is diagnosed primarily by characters such as the carapace with well-demarcated regions and some spines on the keeled branchial margins, and flattened chelipeds. Haig (1978) suggested that an eastern Atlantic species, *Porcellana caparti*

Chace, 1956, should be perhaps included in *Enosteoides*. However, this species seems to be very different from the other species of *Enosteoides* in the structure on the carapace, and future study may eventually reveal that the species is assigned to a separate genus.

An unusual species of *Enosteoides* was obtained from intertidal and shallow subtidal habitats in the Ryukyu Archipelago, southern Japan. This species is immediately distinguished from the other known species of the genus by the shape of the rostrum and third thoracic sternite, and is newly described herein as the fourth member of the genus. In addition to the description of the new species, new records of *E. melissa* and *E. palauensis* from Japanese waters are also included in this paper. Descriptions of the colorations in life are given for the three species.

The specimens from the Ryukyu Archipelago, including the type material of the new species, are deposited in the National Museum of Nature and Science, Tokyo (NSMT) and the Natural History Museum and Institute, Chiba (CBM). The type specimens of *Enosteoides melissa* and *E. palauensis* are deposited in the Kitakyushu Museum of Natural History and Human History (previously in the Zoological Laboratory, Faculty

of Agriculture, Kyushu University; ZLKU). Carapace length (cl), an indication of specimen size, was measured from the anterior median tip of the rostrum to the posteromedian margin of the carapace. Measurements of the cheliped and ambulatory legs follow Osawa (2007).

For comparative purposes, the following specimens were examined.

Enosteoides ornatus (Stimpson, 1858). CBM-ZC 9469, 2 ovigerous females (cl 3.2, 5.1 mm), Takeoka, Futtsu, Chiba Prefecture, gill net, 1 August 1994, coll. T. Komai.

Taxonomy

Family **Porcellanidae** Haworth, 1825

Genus *Enosteoides* Johnson, 1970

Enosteoides lobatus sp. nov.

[New Japanese name: Tsuno-kanidamashi]

(Figs. 1–3, 4A, B)

Material examined. Holotype: NSMT-Cr 18096, male (cl 3.4 mm), Sunabe, Chatan, Okinawa Island, Okinawa Islands, low intertidal, near outer edge of reef flat, space underneath dead coral block, 21 April 2007, coll. M. Osawa.

Paratypes: NSMT-Cr 18097, 3 females (cl 3.7–4.3 mm), same data as holotype; CBM-ZC 4459, 1 female (cl 5.0 mm), Kuchino-shima Island, Tokara Islands, port, 3–5 m, under rock, SCUBA diving, 31 May 1997, coll. H. Saito.

Description. Carapace (Fig. 1A, B) 1.0–1.1 times longer than broad; dorsal surface convex, with scattered, short and long plumose setae (lateral setules of each setae minute) and numerous granules; regions well demarcated, gastric and anterior branchial regions strongly elevated; proto-gastric crests blunt but well marked; cervical grooves relatively deep. Rostrum (Fig. 1D, E) broad, trilobate, generally horizontal; median lobe exceeding and approximately twice as broad as lateral lobe, with distinct groove on anterior dorsal midline; anterior margin concave in dorsal view; anterior median apex strongly bent ventrally, terminating subacutely; lateral lobes subtri-

angular, slightly directed laterally. Orbits shallow, supra-orbital margins weakly concave; outer orbital angles each produced as small subacute tubercle or not produced. Hepatic margins weakly convex, with small tubercles but without spines. Branchial margins strongly convex, constricted on posterior 0.3, elevated to form thin crest, with row of small, blunt or subacute tubercles; median margins with 2–4 spines; posterior margins with some oblique, blunt ridges.

Pterygostomial flap (Fig. 1B, C) with longitudinal tuberculate ridges on ventral half, anteriorly terminating in acute projection; anterior dorsal margin with row of small tubercles, strong spine present posteriorly.

Third thoracic sternite (Fig. 1F) with ventral surface somewhat convex medially; anterior median margin concave, with row of setae; lateral lobes narrow, each with rounded apex. Fourth thoracic sternite with row of setae along strongly concave, V-shaped anterior margin.

Ocular peduncles (Fig. 1A, I, J) comparatively small; dorsal extension onto cornea rounded.

Basal article of antennular peduncles (Fig. 1H) longer than broad; anterior surface separated from ventral surface by transverse tuberculate ridge, with numerous small tubercles; anterior margin with 2 blunt lobes mesially; ventral surface with transverse ridges on posterior lateral part.

Antennal peduncles (Fig. 1A, I, J) short, slender. First article largest, strongly produced forward in lateral view, broadly in contact with lower orbital margin, with longitudinal, tuberculate ridge along ventral margin; lateral surface slightly concave, with small tubercles; anterior margin bluntly produced. Second article with small subacute tubercle at each anterior and posterior, distal end. Third article transversely subrectangular; anterior surface with small, blunt and subacute tubercles. Fourth article short, rounded.

Third maxilliped (Fig. 3A) with coxa bearing small, distal subtriangular projection on flexor margin, distomedian projection not basally articulated. Basis not fused with ischium, roundly tri-

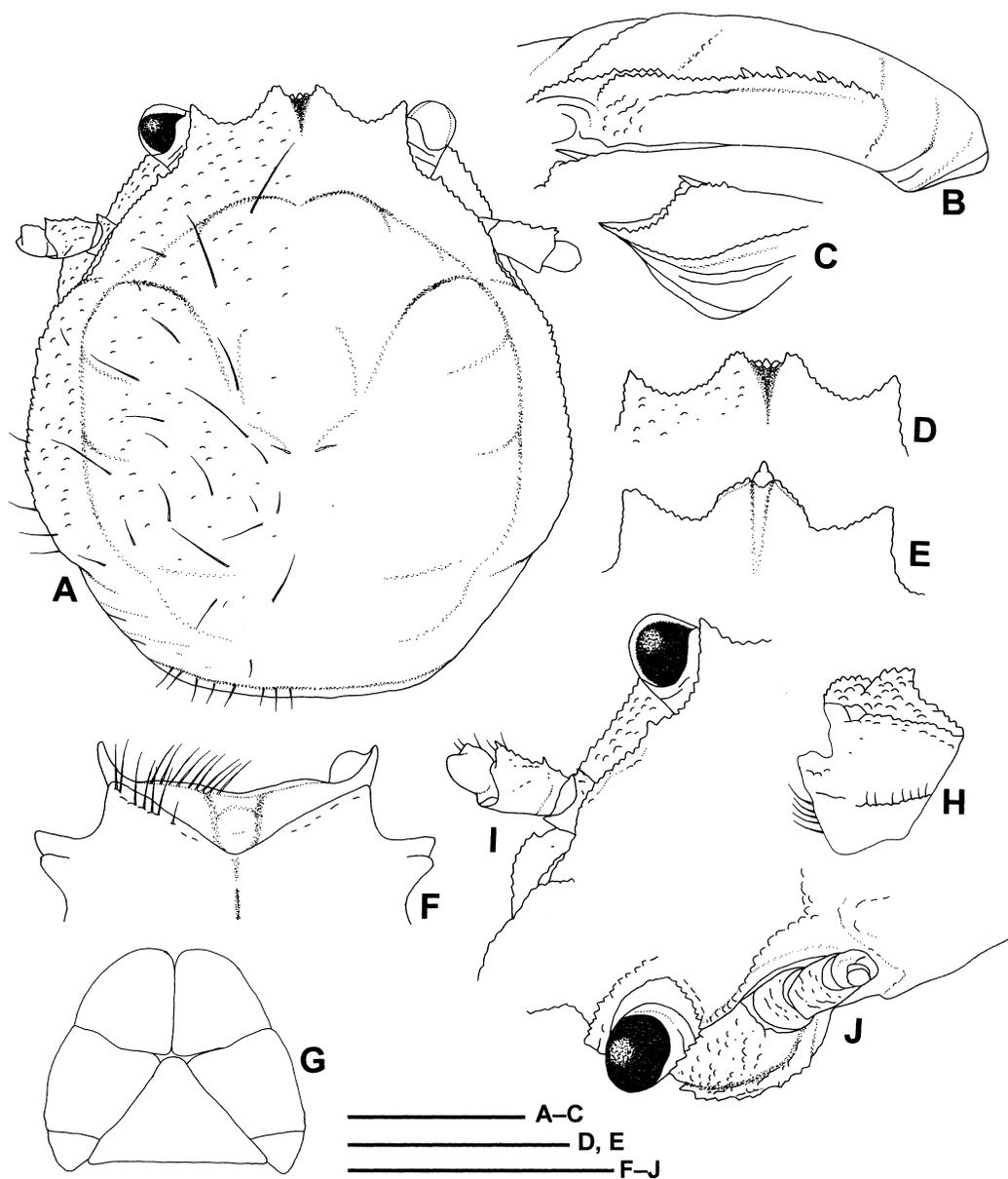


Fig. 1. *Enosteoides lobatus* sp. nov. Holotype, male (cl 3.4 mm), NSMT-Cr 18096. A, carapace, and ocular and antennal peduncles, dorsal view (granules and setae omitted from right side); B, left gastric and branchial region of carapace and anterodorsal margin of pterygostomial flap, lateral; C, left pterygostomial flap, anterior part, ventrolateral view; D, rostrum, dorsal view; E, same, anterior dorsal view; F, third and fourth thoracic sternites, ventral view (setae omitted from left side); G, telson, extensor view; H, basal segment of left antennular peduncle, ventral view; I, left anterior part of carapace, and ocular and antennal peduncles, dorsal view; J, same, lateral view. Scales: 1.0 mm.

angular. Ischium broad, ventral surface with short transverse ridges and longitudinal ridge along extensor margin; distal extensor projection rounded. Merus with laminate, broad, roundly subrectangular lobe on flexor margin; ventral surface with transverse rugae. Carpus with small subtriangular projection on median part of flexor margin. Propodus relatively long. Dactylus short, roundly subtriangular. Merus to dactylus with long setae on flexor margin. Exopod with proximal article small, rounded; distal article laminated, moderately broad, nearly reaching to distal margin of merus; proximal part of distal article inflated; flagellum well developed.

Chelipeds (first pereopods) (Fig. 2A–E) subequal in size, flattened; dorsal surface of each article with scattered, granules, small flattened tubercles, and very short striae; ventral surface also with numerous, short striae; surfaces and margins bearing sparse plumose setae (lateral setules of each seta minute). Merus with transverse series of small tubercles and blunt transverse crest submedially on dorsal surface; dorsal flexor margin with large, roundly subrectangular lobe marginally bearing small, blunt and subacute tubercles; ventrodistal margin with small tubercles, flexor angle with or without small spine. Carpus 1.5–1.7 times as long as broad; dorsal flexor margin with 1–3 subtriangular teeth on proximal half, each tooth marginally bearing small tubercles and spines and terminating acutely; dorsal surface with longitudinal elevated crest of short squamiform ridges on midline; extensor margin with elevated blunt crest bearing row of small spines or subacute protuberances, terminating in small spine; ventral flexor margin crenulated or with subacute tubercles on proximal half. Chela relatively broad, 1.9–2.3 times as long as carpus, 2.5–2.6 times as long as high; extensor margin slightly convex or nearly straight, thin, with row of small, blunt and subacute tubercles and plumose setae. Palm weakly convex on dorsal surface; longitudinal, blunt crest present on dorsal midline; flexor margin elevated dorsally to form blunt, protuberant crest, protuberances occasionally subacute; ventral surface with low,

longitudinal crest of short ridges on midline; extensor half of ventral surface flat or weakly concave, covered with small, flattened tubercles. Fixed finger with weakly curved, distal claw; dorsal surface with longitudinal blunt crest; cutting edge nearly straight, with row of obsolete, small teeth. Dactylus 0.4–0.5 length of chela, opening at slight oblique angle, with curved distal claw; dorsal surface with longitudinal, blunt crest along midline; extensor (posterior) margin elevated to form thin, weakly tuberculate crest; cutting edge nearly straight, with row of obsolete, small teeth; ventral cutting region concave, with sparse short plumose setae but without tuft of dense setae.

Ambulatory legs (second to fourth pereopods) (Fig. 3B–E) relatively slender, with scattered, sparse, simple setae marginally and on ridges, setae on meri and carpi plumose and those on propodi and dactyli simple and most numerous. Meri somewhat compressed laterally, elongated subrectangular, decreasing in size posteriorly; extensor margin crenulated or with row of subacute and blunt protuberances, weakly convex; lateral surface with short transverse ridges, decreasing in number on fourth pereopod; distal flexor margins of lateral and mesial surfaces each with row of small protuberances but without distinct spines or lobes. Carpi elongate; lateral surface with crests of small tubercles along extensor margin and midline; dorsal surface tuberculate, small subdistal spine present or absent on second pereopod but always absent on third and fourth pereopods; distal, extensor and flexor margins rounded. Propodi 1.4 (fourth pereopod)–1.7 (second pereopod) times as long as dactyli, 3.7 (fourth pereopod)–5.1 (second pereopod) times as long as high; lateral surface with short ridges; extensor margin weakly crenulated; distal flexor margin with 3 corneous spines, distal paired spines subequal in size. Dactyli each terminating in weakly curved claw; flexor margin with 3–5 (usually 4) corneous spines.

Fifth pereopod short, slender, chelate; propodus with tuft of short simple setae on distal flexor margin; fixed finger and distal part of palm with

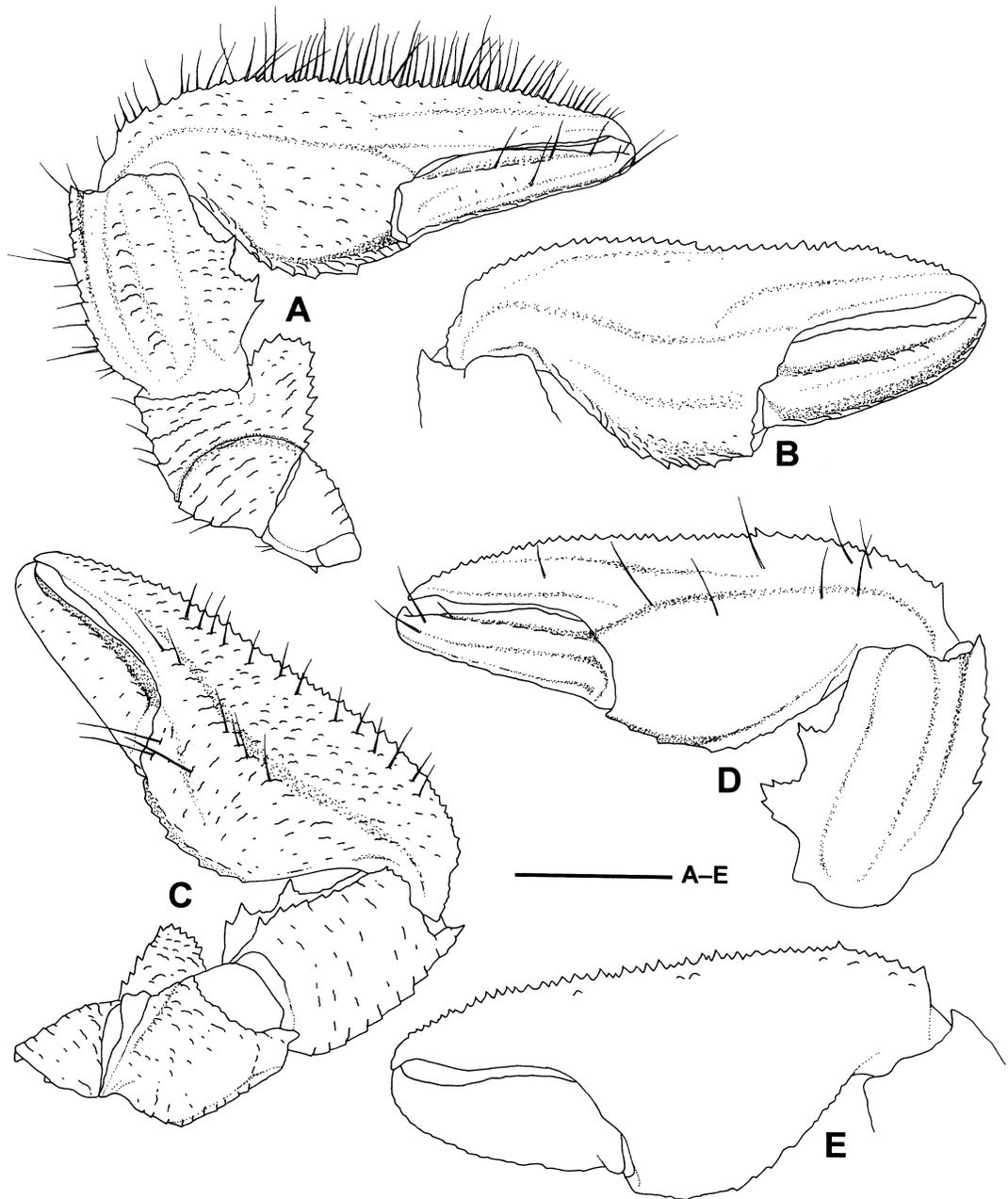


Fig. 2. *Enosteoides lobatus* sp. nov. Holotype, male (cl 3.4 mm), NSMT-Cr 18096. A, left cheliped, dorsal view; B, same, chela, dorsal extensor view; C, same, chela, ventral view; D, right cheliped, carpus and chela, dorsal view; E, same, chela, dorsal extensor view. Scale: 1.0 mm.

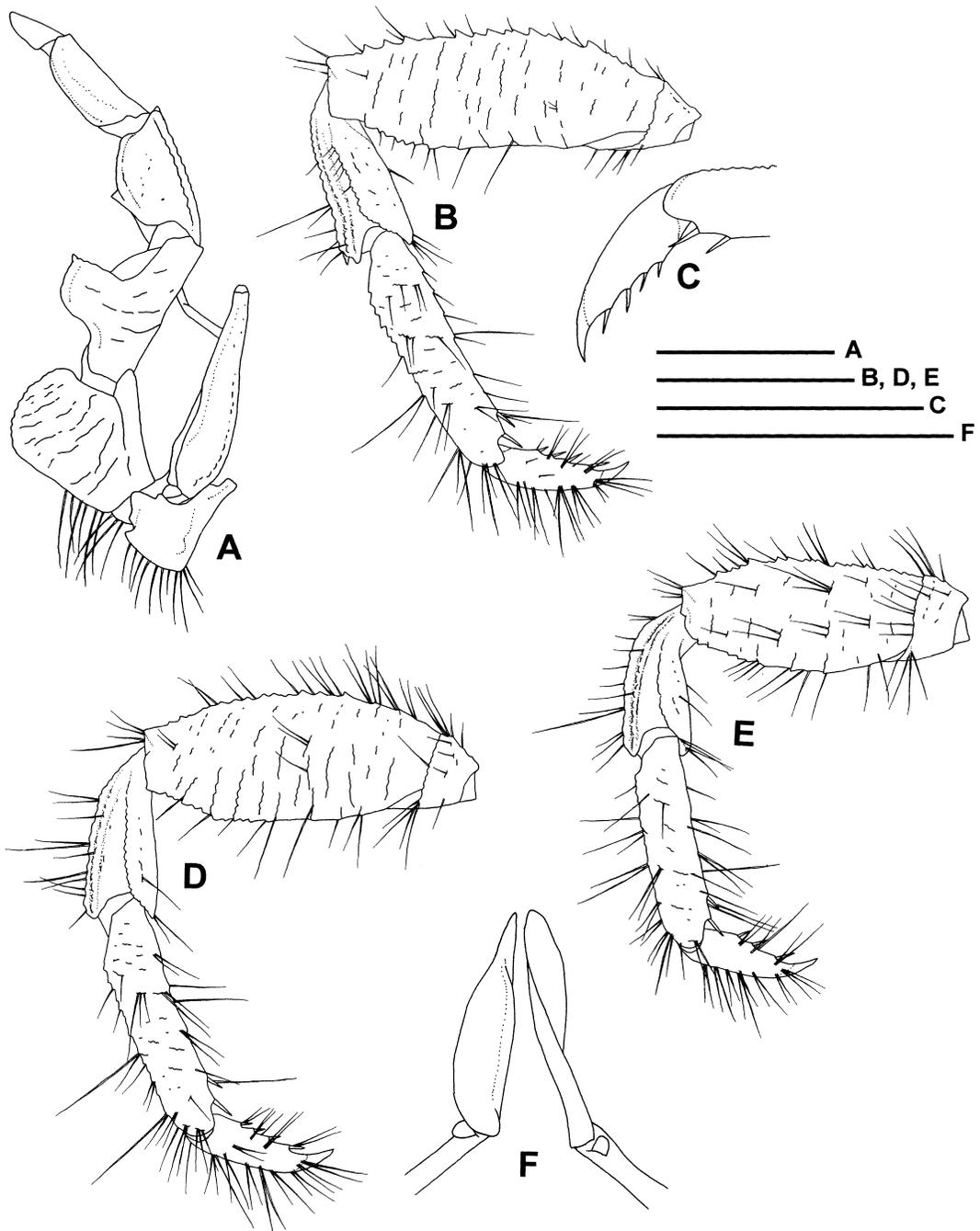


Fig. 3. *Enosteoides lobatus* sp. nov. Holotype, male (cl 3.4 mm), NSMT-Cr 18096. A, left third maxilliped, ventral view (setae omitted); B, left second pereopod, lateral view; C, same, dactylus and distal part of propodus, lateral view; D, left third pereopod, lateral view; E, left fourth pereopod, lateral view; F, gonopods, ventral view (setae omitted). Scales: 1.0 mm (A–E); 2.0 mm (F).

short simple setae and 20–30 scythe-like setae on flexor surface; dactylus with row of short simple setae on extensor surface.

Abdominal segments with short plumose setae on lateral margins; dorsal surface with scattered, short and long simple and plumose setae; setae more numerous in female than male.

Telson (Fig. 1G) composed of 7 plates; posterior plates broader in female than male.

Male with pair of pleopods modified as gonopods on second abdominal segment (Fig. 3F); endopod elongate ovate, somewhat twisted, bearing marginal setae, distal margin rounded; exopod small. Female with pairs of developed pleopods on third to fifth abdominal segments, third pair smaller than fourth and fifth pairs.

Coloration (Fig. 4A, B). Carapace cream or reddish brown. Abdomen cream. Third maxilliped, chelipeds, and ambulatory legs reddish brown. Setae on chelipeds and ambulatory legs pale brown.

Distribution. At present, only known from the Tokara and Okinawa Islands of the Ryukyu Archipelago, southern Japan; intertidal to subtidal depths of 3–5 m. In the collection site of Okinawa Island, the new species was found within a narrow space underneath a dead coral block attached to the substratum near outer edge of reef flat.

Remarks. Species of *Enosteoides* and *Capilliporcellana* Haig, 1978 share common morphological characters including the carapace being as long as or longer than broad and strongly areolate on the dorsal surface, the antennal peduncle with the second to fourth articles excluded from the orbit by the large first article, and the dactyli of the ambulatory legs each terminating in a single claw. However, *Enosteoides* is distinguished from *Capilliporcellana* by the presence of a median concavity or notch on the anterior margin of the rostrum in dorsal view, spines on the lateral margins of the carapace, and by having flattened chelipeds. *Capilliporcellana* species have a produced, anteromedial margin of the rostrum in dorsal view, no spines on the lateral margins of the carapace, and inflated chelae. The present

new species is assigned to *Enosteoides* based on these diagnostic characters.

The new species is more closely allied to *Enosteoides melissa* and *E. palauensis* than *E. ornatus* in the armatures on the anterolateral margin of the carapace, basal article of the antennular peduncle, and palm of the cheliped. The supra-orbital and hepatic margins have distinct, acute or blunt spines in *E. ornatus*, but they are unarmed in the other three species. The basal article of the antennular peduncle in *E. ornatus* is provided with three or four acute, narrow anterior teeth (each tooth is located at the mesial and lateral angles of the dorsal and ventral margins, but a dorsomesial tooth is present or absent), whereas it possesses two blunt, broad lobes mesially on the anterior dorsal margin in *E. melissa*, *E. palauensis*, and *E. lobatus* sp. nov. The extensor side of the dorsal surface of the palm of the cheliped is distinctly tuberculate in *E. ornatus*, but it is granular or has scattered small flattened tubercles in the other three species. *Enosteoides lobatus*, however, is distinguishable from the other congeners in the shapes of the rostrum and third thoracic sternite. In dorsal view, the lateral lobe of the rostrum is subtriangular in *E. lobatus*, but it is bluntly or indistinctly produced in *E. melissa*, *E. ornatus*, and *E. palauensis*. The anteromedial margin of the third thoracic sternite is concave in the new species unlike convex in the other three species.

Enosteoides lobatus is similar to *E. melissa* in the carapace and pereopods of uniform brown coloration, but may be different from the later species by having the pereopods of more reddish tinge. *Enosteoides palauensis* is distinguished from the other two species by the propodi, carpi, and distal half of the meri of the ambulatory legs being dark red.

Etymology. The specific name is derived from the Latin, *lobatus* (lobed), in reference to the distinctive form of the lateral lobes of the rostrum.

Enosteoides melissa (Miyake, 1942)

[Japanese name: Sango-kanidamashi]

(Fig. 4C)

For synonymy see Osawa (2007: 9).

Material examined. CBM-ZC 9470, 1 ovigerous female (cl 8.7 mm), Hoshizunanohama, Iriomote Island, Yaeyama Islands, intertidal, under rock on sea grass area, 14 July 2000, coll T. Komai.

Holotype: ZLKU 4265, female (cl 8.5 mm), Off Ngatmé, Babldáob Island, Palau, 14 March 1938, coll. S. Murakami.

Diagnosis. Carapace as long as broad or slightly longer than broad. Branchial margins crenulated, with 2 or 3 blunt spines. Gastric and anterior branchial regions with several low tuber-

cles and protuberances. Supraorbital and hepatic margins without spines. Outer orbital angle slightly produced. Lateral lobes of rostrum low, obtuse in dorsal view, roundly truncate or subtriangular and approximately as broad as median lobe in frontal view. Third thoracic sternite with median lobe broadly convex, slightly exceeding narrow lateral lobes. Basal article of antennular peduncle with 2 lobes on mesial half of anterior dorsal margin, lobes blunt and subequal in size. Cheliped moderately broad; carpus 1.5–1.9 times as long as broad, dorsal flexor margin with 2 or 3 low, blunt teeth on proximal half, extensor margin crenulate but without distinct spines; chela 2.4–2.5 times as long as broad, with row of small tuberculate spines and plumose setae on extensor margin; palm with numerous granules on exten-

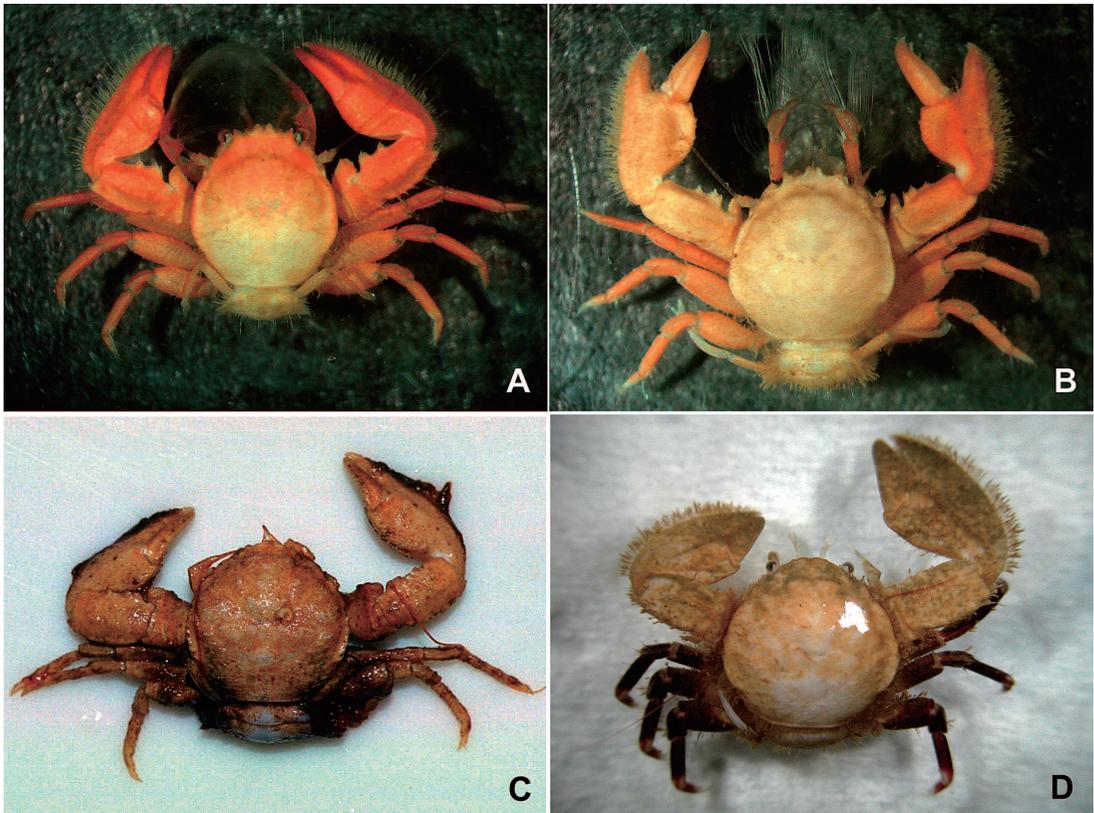


Fig. 4. Entire animals in dorsal view. A, *Enosteoides lobatus* sp. nov., holotype, male (cl 3.4 mm), NSMT-Cr 18096; B, *Enosteoides lobatus* sp. nov., paratype, female (cl 4.3 mm), NSMT-Cr 18097; C, *Enosteoides melissa* (Miyake, 1942), ovigerous female (cl 8.7 mm), CBM-ZC 9470; D, *Enosteoides palauensis* (Nakasone and Miyake, 1968), female (cl 5.9 mm), CBM-ZC 9471.

side of dorsal surface. Ambulatory legs slender; merus of second pereopod 3.3–4.1 times as long as broad, crenulated on extensor margin; propodus of second pereopod 4.5–5.5 times as long as broad, extensor margin slightly crenulated, flexor margin with 3–10 corneous spines on distal 0.7; dactylus with 5 corneous spines on flexor margin.

Coloration (Fig. 4C). Body and pereopods entirely brown, no distinct markings. Setae dark brown.

Distribution. Zanzibar, Madagascar, Seychelles, Philippine Islands, Palau, New Caledonia, Loyalty Islands; littoral to depth of 110 m; sand and corals (Haig, 1981, 1989; Osawa, 2007). The present specimen from Iriomote Island was collected from the intertidal zone, inhabiting under a coral rock on sea grass bed.

Remarks. The present specimen possesses eight to ten corneous spines, which are arranged in a partially double row, on the distal two-thirds of the flexor margin of the second pereopod (first ambulatory leg), but the holotype has only one subdistal and two distal corneous spines. Nevertheless, the examined specimen agrees well with the holotype in other diagnostic aspects.

Although Miyake (1982: 204, 239) mentioned the occurrence of *Enosteoides melissa* from Japan, he gave no definite information of the record or voucher material. To the best of my knowledge, the species has not been reported so far from Japanese waters. The coloration in life of *E. melissa* is reported for the first time.

Enosteoides palauensis (Nakasone and Miyake, 1968)

[New Japanese name: Palao-kanidamashi]

(Fig. 4D)

For synonymy see Osawa (2007: 11).

Material examined. CBM-ZC 9471, female (cl 5.9 mm), Mizugama, Yomitan, Okinawa Island, Ryukyu Islands, 1 m, dead coral block, 5 June 2001, coll. Y. Fujita.

Holotype: ZLKU 4266, ovigerous female (cl

3.6 mm), Ngadarák Reef, Palau, 23 May 1939, coll. S. Miyake.

Paratype: ZLKU 4267, 1 ovigerous female (cl 3.1 mm), same data as holotype.

Diagnosis. Carapace approximately as long as broad. Branchial margins weakly crenulate, with 2 acute spines. Gastric and anterior branchial regions with several low protuberances. Supraorbital and hepatic margins without spines. Outer orbital angle not produced. Lateral lobes of rostrum indistinct in dorsal view, low, rounded, narrower than median lobe in frontal view. Third thoracic sternite with median lobe broadly convex, not exceeding narrow lateral lobes. Basal article of antennular peduncle with 2 lobes on mesial half of anterior dorsal margin; lobes blunt, lateral lobe distinctly larger than mesial. Cheliped broad; carpus 1.3 times as long as broad, dorsal flexor margin with 2 or 3 small subtriangular teeth or spines on proximal half, extensor margin crenulate, with 3–5 small spines; chela 1.9–2.0 times as long as broad, with row of very small tuberculate spines (some spines larger) and plumose setae on extensor margin; palm with numerous granules on extensor side of dorsal surface. Ambulatory legs comparatively stout; merus of second pereopod 2.4–2.5 times as long as broad, weakly crenulated on extensor margin; propodus of second pereopod 4.1–4.3 times as long as broad, extensor margin with row of oblique ridges of granules, flexor margin with 5 or 6 corneous spines on distal half (including 2 spines at distal end); dactylus with 4–6 corneous spines on flexor margin.

Coloration (Fig. 4D). Carapace and chelipeds entirely whitish. Ambulatory legs dark red; meri, propodi, and dactyli each with white mark distally. Setae brown.

Distribution. Hainan Island in China, Palau, New Caledonia, and now Ryukyu Archipelago, southern Japan. The present specimen of Okinawa Island was collected from interspaces of dead coral block at a depth of 1 m, whereas the specimens of New Caledonia were obtained at depths of 7–31 m (Osawa, 2007).

Remarks. The present specimen from Okinawa

Island agrees very well with the type material of *Enosteoides palauensis* in every diagnostic aspect. It represents the first record of the species from Japanese waters. The coloration in life of *E. palauensis* is also herein reported for the first time.

Enosteoides palauensis is easily distinguished from *E. melissa* by the shape of the rostrum and the basal article of the antennular peduncle, and the presence of acute spines on the lateral margin of the carapace and on the extensor margin of the carpus of the cheliped, in addition to the comparatively broader chela, stouter ambulatory legs, and coloration in life of the ambulatory legs.

Acknowledgments

I am indebted to T. Komai of the Natural History Museum and Institute, Chiba, Y. Fujita of the University of the Ryukyus, and M. Shimomura of the Kitakyushu Museum of Natural History and Human History, for the loan or donation of the specimens examined. I also thank R. K. Kropp of the Battelle Marine Sciences Laboratory, T. Komai, and two anonymous reviewers for providing valuable comments on this manuscript. This study was partially supported by grants from the 21st Century COE program "The Comprehensive Analyses on Biodiversity in Coral Reef and Island Ecosystems in Asian and Pacific Regions" from the Ministry of Education, Culture, Sports, Science and Technology, Japan (Monbukagakusho) and the Mikimoto Fund for Marine Ecology.

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Manuscript received 3 May 2008; revised 1 October 2008; accepted 15 October 2008.

Associate editor: T. Komai