

Two New Species of the Hermit Crab Genus *Pagurixus* (Decapoda: Anomura: Paguridae) from the Western Pacific

Tomoyuki Komai¹ and Junji Okuno²

¹Natural History Museum and Institute, Chiba, 955–2 Aoba-cho, Chuo-ku, Chiba, 260–8682 Japan
e-mail: komai@chiba-muse.or.jp

²Coastal Branch of Natural History Museum and Institute, Chiba, 123 Yoshio, Katsuura, Chiba, 299–5242 Japan
e-mail: okuno@chiba-muse.or.jp

Abstract Two new species of the pagurid hermit crab genus *Pagurixus* Melin, 1939 are described and illustrated. *Pagurixus purpureus* sp. nov., known from Japan and Papua New Guinea, is morphologically similar to *P. boninensis* (Melin, 1939), *P. paulayi* Komai and Osawa, 2006, and *P. ruber* Komai and Osawa, 2006. *Pagurixus acanthocarpus* sp. nov., so far restricted to Japanese waters, appears close to *P. fasciatus* Komai and Myorin, 2005, *P. handrecki* Gunn and Morgan, 1992, *P. nanus* Komai and Takada, 2006, and *P. dissimilis* Osawa and Komai, 2007. Distinguishing characters between respective new species and their allies are discussed.

Key words: Decapoda, Anomura, Paguridae, *Pagurixus*, new species, Japan, New Guinea.

The pagurid hermit crab genus *Pagurixus* Melin, 1939 is widespread in tropical to warm temperate waters in the Indo-Pacific regions. Presently, 27 species are known in the genus (McLaughlin and Haig, 1984; Gunn and Morgan, 1992; Morgan, 1993; Komai and Asakura, 1995; de Saint Laurent and McLaughlin, 2000; Komai and Myorin, 2005; Komai, 2006; Komai and Osawa, 2006, 2007; Komai and Takada, 2006; Osawa *et al.*, 2006; Osawa and Komai, 2007), of which 14 species have been described in the last eight years. Many of the known species inhabit shallow sublittoral reefs where only divers equipped with SCUBA are accessible.

During ongoing studies on the sublittoral hermit crab fauna in Japan, conducted by us, a number of undescribed species or poorly known species have been found, amongst them two undescribed species of *Pagurixus*. Furthermore, examination of abundant material from various western Pacific localities, kindly made available for study by Dr. Gustav Paulay of the Florida Museum of Natural History, University of Florida, has resulted the finding of one of the two undescribed species also in Papua New Guinea. In the present paper the two new species are de-

scribed. The first, *P. purpureus* sp. nov., appears closely related to *P. boninensis* (Melin, 1939), *P. paulayi* Komai and Osawa, 2006 and *P. ruber* Komai and Osawa, 2006, all referred to the *P. boninensis* species group (cf. Komai and Osawa, 2006). The second, *P. acanthocarpus* sp. nov., belonging to the *P. anceps* group (cf. Komai and Osawa, 2006), appears morphologically similar to *P. fasciatus* Komai and Myorin, 2005, *P. handrecki* Gunn and Morgan, 1992, *P. nanus* Komai and Takada, 2006, and *P. dissimilis* Osawa and Komai, 2007. Affinities of these two new species are discussed in detail. Descriptions of the coloration in life, which is known to be species specific in the genus, are also provided for both species.

The type specimens of the new species are deposited in the National Museum of Nature and Science, Tokyo (NSMT), the Natural History Museum and Institute, Chiba (CBM), Coastal Branch of Natural History Museum and Institute, Chiba, Katsuura (CMNH), and the Florida Museum of Natural History, University of Florida, Gainesville (UF). The shield length, abbreviated as SL, is measured from the tip of rostrum to the midpoint of posterior margin of the shield. Ter-

minology used in the description follows McLaughlin (2003), with the exceptions of numbered thoracic sternites and pleon for abdomen.

Taxonomy

Genus *Pagurixus* Melin, 1939

Pagurixus boninensis species group

Pagurixus purpureus sp. nov.

[New Japanese name: Sumire-hime-hon-yadokari]

(Figs. 1–4; 9A, B)

Material examined. Holotype: NSMT-Cr 19740, male (SL 3.4 mm), Issoh, Yakushima Island, Ohsumi Islands, 20 m, 11 January 2007, SCUBA diving, coll. Shigeru Harazaki.

Paratypes: Japan. CMNH-ZC 2251, 1 female (SL 2.1 mm), Akino-hama, Izu-Oshima Island, Izu Islands, 4 m, 15 May 2005, SCUBA diving, coll. Hirohito Arima; CMNH-ZC 2252, 1 male (SL 2.1 mm), CMNH-ZC 2253, 1 female (SL 2.3 mm), same locality, 4 m, 2 June 2005, SCUBA diving, coll. H. Arima; NSMT-Cr 19859, 1 female (SL 2.3 mm), Kashiwa-jima Island, Ohtsuki, Kochi Prefecture, 3 m, 10 June 2005, SCUBA diving, coll. Naoki Nishimura; CBM-ZC 9560, 2 females (SL 2.0, 2.3 mm), same locality, subtidal, SCUBA diving, coll. Eiji Myorin. Papua New Guinea. UF 5398, 1 male (SL 2.4 mm), 4 ovigerous females (SL 1.7–2.1 mm), “Brooker Channel” in Calvados Channel, Milne Bay Province, Louisiade Archipelago, 11°03.09'S, 152°28.62'E, 5–10 m, 1 June 1998, coll. Gustav Paulay.

Non-type. CMNH-ZC 1881, 1 young male (SL 1.2 mm), Akinohama, Izu-Oshima Island, Izu Islands, 13 m, 20 March 2005, SCUBA diving, coll. H. Arima.

Description. Shield (Fig. 1A) 1.00–1.15 times longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; dorsal surface weakly convex, with few tufts of short setae laterally. Rostrum triangular, not reaching level of midlength of ocular acicles, moderately broad, terminating acutely. Lateral projections slightly produced,

each with submarginal spinule.

Ocular peduncles (Fig. 1A) moderately long, relatively slender, 0.60–0.70 length of shield, each with row of tufts of short setae on dorsal surface mesially; corneas slightly dilated, corneal width 0.26–0.38 of peduncular length; basal part somewhat inflated, slightly broader than corneal width. Ocular acicles subtriangular or subovate, each with small submarginal spine distally.

Antennular peduncles (Fig. 1A) overreaching distal corneal margins by 0.30–0.50 lengths of ultimate segments. Ultimate segment with tufts of long setae at dorsolateral distal angle; ventral surface with 2 longitudinal rows of setae, consisting of mixture of short and long setae in distal half (Fig. 1B). Basal segment with small lateral spine on statocyst lobe. Ventral flagellum with row of numerous long setae on lateral and mesial margins.

Antennal peduncles (Fig. 1A) overreaching distal corneal margins by 0.30 lengths of fifth segments. Second segment with tiny spinule at dorsomesial distal angle; laterodistal projection short, not reaching midlength of fourth segment, terminating in simple or bifid spine. First segment with small laterodistal spine; ventromesial distal margin produced, unarmed or with spinule just lateral to antennal gland opening. Antennal acicle moderately long, arcuate, terminating in slender spine, overreaching base of cornea but not reaching distal corneal margin, mesial margin with row of sparse stiff setae. Flagellum moderately long, exceeding 4.00 length of shield.

Third maxilliped moderately stout; ischium with well-developed crista dentata and 1 accessory tooth.

Right cheliped of males (Figs. 2A, B, 3A) not particularly elongate, moderately stout, distinctly longer than left cheliped. Chela subovate in dorsal view, 1.80–2.10 times longer than broad. Dactylus distinctly shorter than palm; dorsomesial margin not delimited; surfaces microscopically finely granular; cutting edge with row of small calcareous teeth in proximal 0.75 and row of small corneous teeth in distal 0.25, terminating in small corneous or calcareous claw. Palm

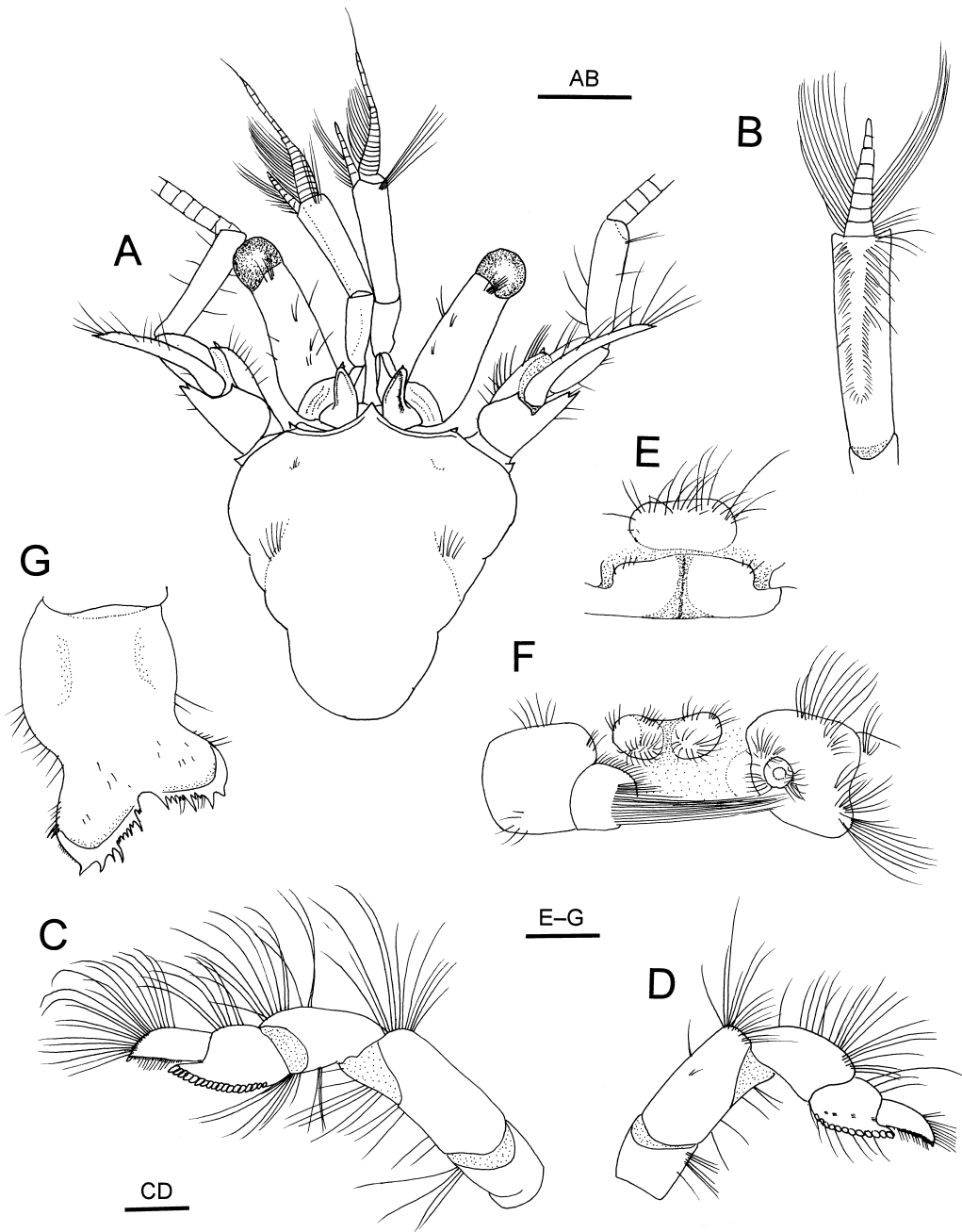


Fig. 1. *Pagurixus purpureus* sp. nov., holotype, male (SL 3.4 mm), NSMT-Cr 19740. A, shield and cephalic appendages, dorsal view; B, ultimate segment and ventral flagellum of left antennular peduncle, ventral view; C, left fourth pereopod, lateral view; D, right fourth pereopod, lateral view; E, sixth thoracic sternite, ventral view; F, coxae of fifth pereopods and eighth thoracic sternite, ventral view; G, telson, dorsal view. Scale bars: 1 mm for A; 0.5 mm for B–G.

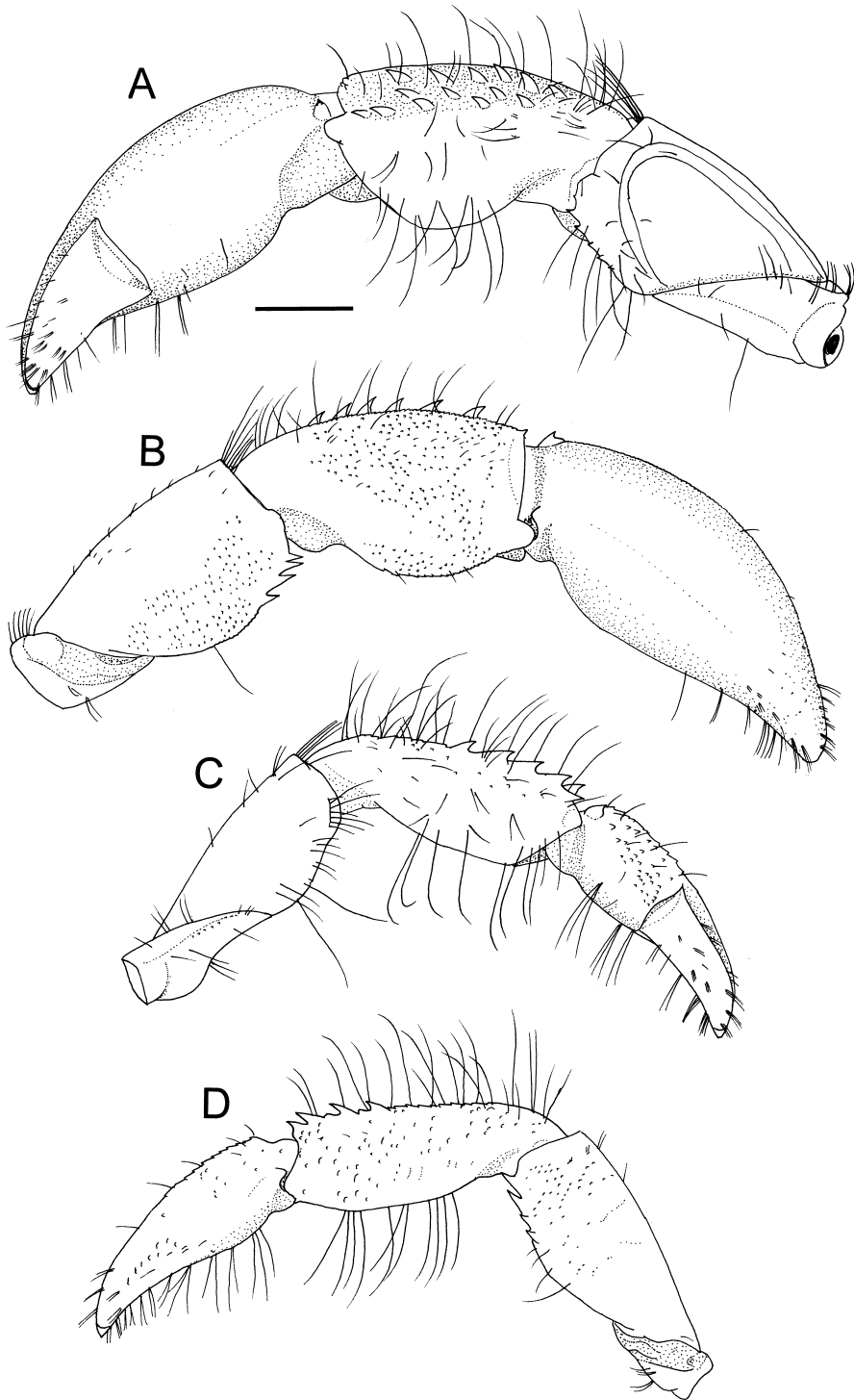


Fig. 2. *Pagurixus purpureus* sp. nov., holotype, male (SL 3.4 mm), NSMT-Cr 19740. A, right cheliped, mesial view; B, same, lateral view; C, left cheliped, mesial view; D, same, lateral view. Scale bar: 1 mm.

slightly longer than carpus; convex dorsal surface microscopically granular, with small but conspicuous spine at proximomesial angle; dorsolateral and dorsomesial margins not delimited; lateral, mesial and ventral surfaces minutely granular or nearly smooth, and occasionally with some tufts of short setae on ventral surface. Cutting edge of fixed finger with row of tiny calcareous teeth and with 1 moderately large, blunt calcareous tooth proximal to midlength, terminating in small calcareous claw. Carpus 1.50–1.70 times longer than broad; dorsal surface granular (granules strongest mesially), with few small spines adjacent to dorsodistal margin and with 2 rows of moderately large spines mesially; dorsolateral margin not delimited, unarmed; lateral, mesial and ventral surfaces also granular, lateral surface without longitudinal median ridge, ventrolateral margin with row of minute granules; mesial face with several short to long setae directed mesially, ventromesial margin smooth, unarmed; ventral surface moderately convex. Meral-carpal articulation lacking any pronounced clockwise rotation; dorsal surface of merus with trace of transverse ridges and row of short setae, dorsodistal margin with row of stiff setae; lateral face nearly smooth in dorsal half and minutely granular in ventral half, ventrolateral margin with row of 5 moderately small spines in distal 0.30; mesial face smooth, with several stiff setae, ventromesial margin with row of 5 small spines; ventral surface convex, with scattered granules and long setae. Ischium with smooth ventromesial margin; surfaces unarmed.

Right cheliped of females (Fig. 3C–E) moderately stout for genus, slightly longer than or subequal in length to left cheliped. Chela 1.90–2.10 times longer than broad. Dactylus longer than palm; cutting edge with row of small, blunt calcareous teeth in proximal 0.60–0.70 and row of small corneous teeth in distal 0.30–0.40, terminating in small corneous claw. Palm distinctly shorter than carpus; dorsal surface with scattered minute granules and minute setae, and with 1 conspicuous spine at proximomesial angle; dorsomesial margin not delimited, dorsolateral mar-

gin faintly delimited by row of small, low granules extending onto fixed finger. Cutting edge of fixed finger with row of small blunt calcareous teeth in proximal 0.80 and row of small corneous teeth in distal 0.20, terminating in small corneous claw. Carpus 1.30–1.80 times longer than broad, subequal in length to merus; dorsal surface with 2 rows of moderately large spines mesially and with row of tiny tubercles laterally, dorsodistal margin with few small spines; lateral and mesial surfaces coarsely granular, former nearly perpendicular, without longitudinal ridge, latter with several stiff setae directed mesially; ventrolateral and ventromesial margins unarmed; ventral surface convex. Merus with row of very low protuberances on dorsal surface, dorsodistal margin with several stiff setae; lateral surface with numerous minute vertical ridges, ventrolateral margin with 2–6 spines in distal one-third, otherwise nearly smooth; ventromesial margin tuberculate or granular, without conspicuous spine. Ischium with row of minute granules on ventromesial margin, surfaces otherwise unarmed.

Left cheliped (Figs. 2C, D, 3B) moderately slender, morphologically similar between male and female. Chela 2.60–2.70 times longer than broad. Dactylus subequal in length to or slightly longer than palm, with sparse tufts of setae on surfaces (setae on ventral surface longest); cutting edge with row of small corneous teeth, terminating in small corneous claw. Palm about half length of carpus; dorsal surface slightly elevated in midline and bearing scattered tiny tubercles or granules, dorsolateral and dorsomesial margins not delimited; mesial surface with small granules dorsally, smooth ventrally; ventral surface smooth, with some tufts of long stiff setae. Cutting edge of fixed finger with row of small, slender calcareous teeth in proximal 0.60–0.70 and row of small corneous teeth in distal 0.30–0.40, terminating in small corneous claw. Carpus relatively slender, slightly longer than chela or merus; length about 2.80 of distal width and about 2.70 of greatest height; dorsal surface with lateral row of 2–7 moderately small spines and low protuberances, and with mesial row of 4–7

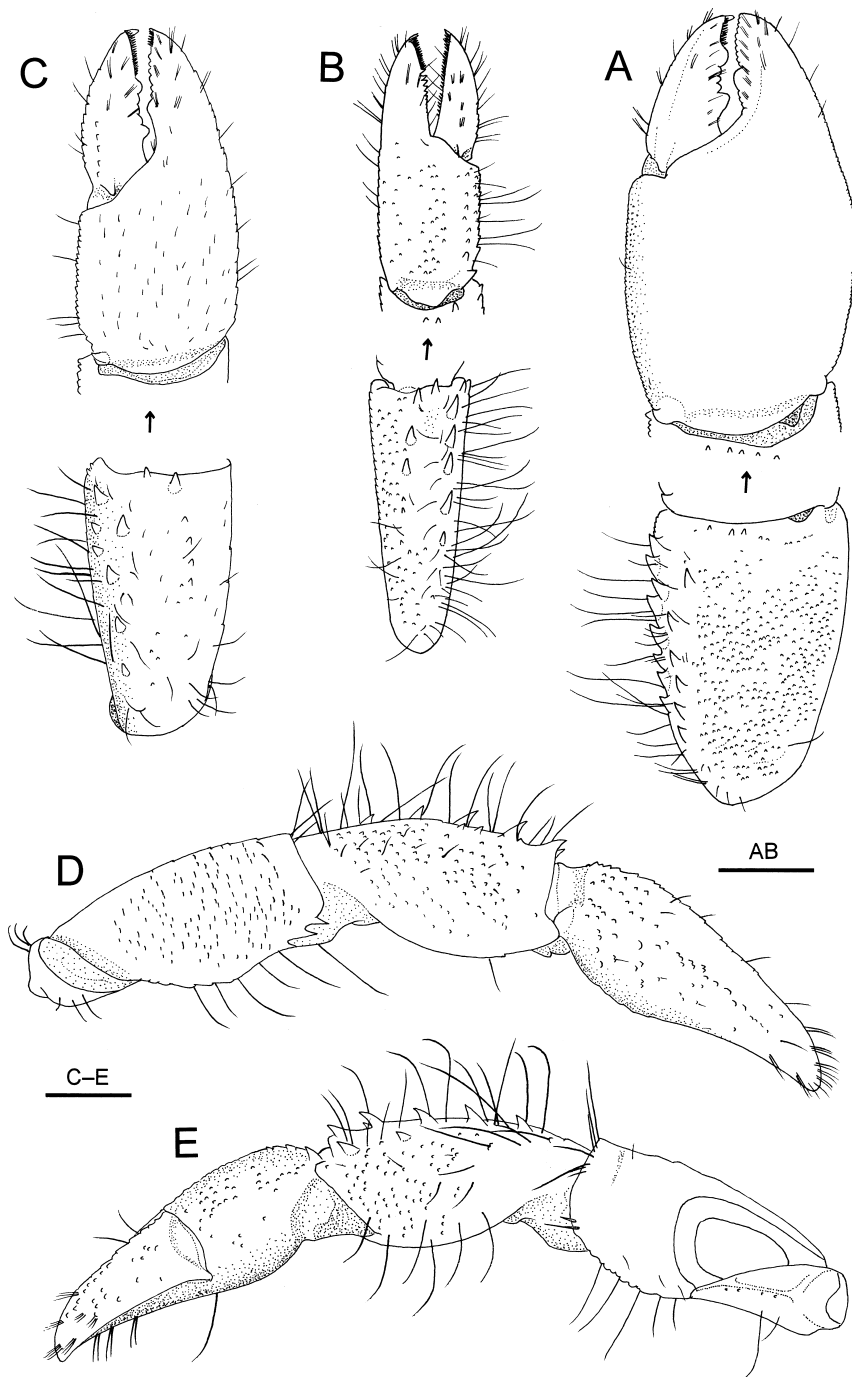


Fig. 3. *Pagurixus purpureus* sp. nov., holotype, male (SL 3.4 mm), NSMT-Cr 19740 (A, B); paratype, female (SL 2.0 mm), CBM-ZC 9560 (C–E). A, C, chela and carpus of right cheliped, dorsal view; B, left cheliped, dorsal view; D, right cheliped, lateral view; E, same, mesial view. Scale bars: 1 mm for A, B; 0.5 mm for C–E.

spines, dorsodistal margin unarmed or armed with 1 small spine; lateral face steeply sloping, covered with coarse granules, without longitudinal median ridge, ventrolateral margin unarmed; mesial surface with granules dorsally and with numerous short to long stiff setae directed mesially, ventromesial margin unarmed. Merus nearly smooth on dorsal surface, dorsodistal margin with stiff setae; lateral surface sparsely granular, ventrolateral margin with 3–6 small spines in distal one-third to half; mesial surface nearly smooth, with several stiff setae ventrally, ventrolateral margin unarmed; ventral surface weakly convex, with few granules and long stiff setae. Ischium with row of minute denticles on ventromesial margin, otherwise unarmed.

Ambulatory legs (Fig. 4A, B) moderately long and slender, generally similar from right to left in both male and female. Dactyli (Fig. 4C, D) 0.84–0.92 (second) or 0.99–1.09 (third) length of propodi, 5.30–6.20 times longer than high, terminating in large corneous claws; dorsal surfaces each with row of sparse stiff setae; lateral and mesial faces each with few tufts of short setae, mesial faces unarmed (second) or each armed with few corneous spinules adjacent to dorsal margin (third); ventral margins each with 6–10 relatively long corneous spines notably increasing in size distally. Propodi slightly tapering distally, 3.90–4.10 (second) or 3.10–3.80 (third) times longer than high; dorsal surfaces nearly smooth or with trace of low, transverse ridges, bearing tufts of short to moderately long stiff setae; lateral faces nearly smooth; ventral margins each with row of 4–9 corneous spinules, ventrodistal margins each with paired corneous spines. Carpi each usually with small dorsodistal spine, dorsal surface smooth, with row of tufts of stiff setae; lateral faces nearly smooth. Meri nearly smooth on dorsal surfaces, each with single setae or tufts of setae; lateral surfaces smooth; ventrolateral distal margins each with small subdistal spine (second) or unarmed (third), ventral surfaces with few spinules at about distal 0.30 (second) or smooth (third), all with few short setae.

Fourth pereopods (Fig. 1C, D) slightly to markedly unequal in both male and female. Dactyli terminating in very small corneous claws, with numerous, dense long setae on dorsal margins (setae much longer and more numerous in left than in right); left dactylus much broader than right. Propodi with tuft of several setae on mesial face at base of ventrodistal extremity; propodal rasp consisting of single row of corneous scales; mesial faces nearly flat, with several long setae dorsally. Carpi each with tuft of setae on mesial face near ventrodistal angle (setae longer and more numerous in left than in right).

Anterior lobe of sixth thoracic sternite (Fig. 1E) roundly subrectangular, anterior margin with row of short to long setae. Eighth thoracic sternite (Fig. 1F) composed of two unequal, rather widely separated, rounded lobes, each with numerous short stiff setae.

Males with coxae of fifth pereopods slightly unequal (Fig. 1F). Ventromesial protrusion originating from surface of right coxa well developed, clearly demarcated; setae arising from terminal margin of ventromesial protrusion, extending to left coxa; left coxa with distinct gonopore partially obscured by short setae; numerous setae present along ventrolateral margin. Female with single left gonopore.

Telson (Fig. 1G) with terminal margins slightly oblique, bearing 4 or 5 prominent, slender spines and several mesial spinules interspersed by spines; dorsal surface adjacent to terminal margins slightly upturned, strongly calcified.

Coloration in life. Shield translucent, with yellowish-brown tint; posterior carapace also translucent. Ocular peduncles pale yellowish-brown, with tinge of purple. Ultimate segment of antennular peduncle violet; penultimate and basal segments purplish. Antennal peduncle generally purple, fifth segment with distinct lateral and mesial stripes; flagellum alternated with purple (5 or 6 articles) and white (1 or 2 articles). Right cheliped purplish-brown or reddish-brown; fingers whitish. Left cheliped generally purple, distal part of fingers whitish. Ambulatory legs

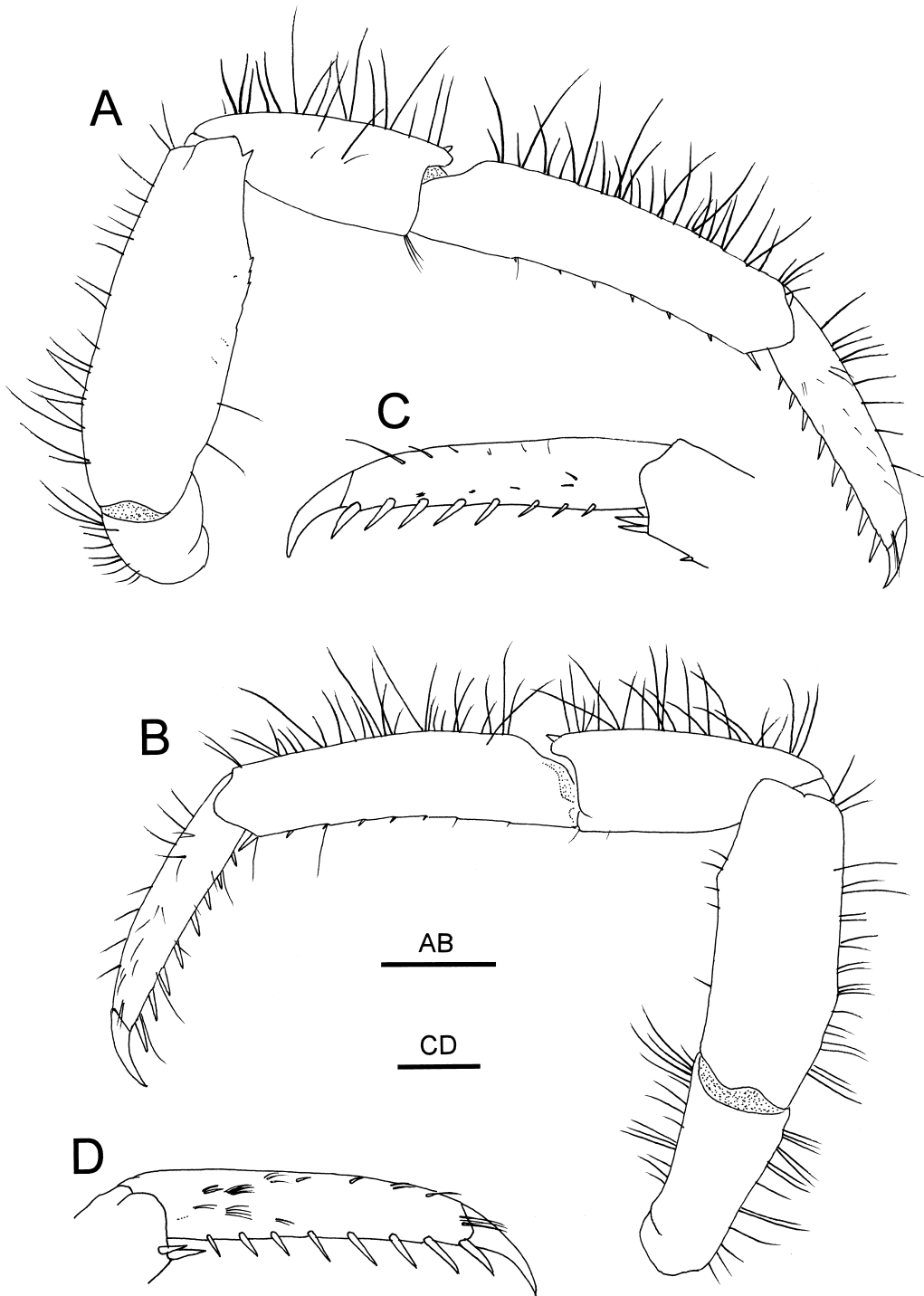


Fig. 4. *Pagurixus purpureus* sp. nov., holotype, male (SL 3.4 mm), NSMT-Cr 19740. A, right second pereopod, lateral view; B, left third pereopod, lateral view; C, dactylus of right second pereopod, mesial view; D, dactylus of left third pereopod, mesial view. Scale bars: 1 mm for A, B; 0.5 mm for C, D.

striped with purple and white; dorsal and ventral surfaces of dactyli and propodi purple, lateral and mesial faces of these segments each with purple median stripe, otherwise white; meri each with purple dorsal stripe extending onto mesial surface distally and median stripe, ventral surface purple, and otherwise white. Pleon translucent. See Fig. 9A, B.

Distribution. So far known from Japan (Izu Islands to Yakushima Island) and Papua New Guinea; subtidal to 13 m.

Remarks. *Pagurixus purpureus* sp. nov. belongs to the *P. boninensis* group because of the possession of two setal rows on the ventral surface of the ultimate segment of the antennular peduncle. This informal species group includes the following 13 species: *P. laevimanus* (Ortmann, 1892), *P. maorus* (Nobili, 1906), *P. boninensis* (Melin, 1939), *P. tweediei* (Forest, 1956), *P. festinus* McLaughlin and Haig, 1984, *P. nomurai* Komai and Asakura, 1995, *P. brachydactylus* Komai and Osawa, 2006, *P. carinimanus* Komai and Osawa, 2006, *P. concolor* Komai and Osawa, 2006, *P. paulayi* Komai and Osawa, 2006, *P. pse-liophorus* Komai and Osawa, 2006, *P. pulcher* Osawa, Fujita and Okuno, 2006, and *P. ruber* Komai and Osawa, 2006. Among them, *P. boninensis*, *P. paulayi* and *P. ruber* are close to the new species in the lack of a longitudinal ridge on the lateral surface of the carpus of each cheliped and the relatively slender ambulatory dactyli. Differences among the four species are summarized in Table 1. The new species appears unique in having two dorsomesial rows of relatively large spines on the carpus of the right cheliped. In *P. boninensis* and *P. paulayi*, there are one or two rows of small spines on the dorsomesial surface of the carpus of the right cheliped; and there is no dorsomesial row of spines in adults of *P. ruber*, although a single small dorsomesial spine may be present in females. In the pattern of the ventral setal rows on the ultimate segment of the antennular peduncle, the new species is similar to *P. paulayi*, but the non-spinulose palm of the right cheliped, the presence of one or more spines on the ventrolateral margin of the merus

Table 1. Comparison among four species of *Pagurixus*, *P. purpureus* sp. nov., *P. boninensis*, *P. paulayi* and *P. ruber*.

Items	<i>P. purpureus</i> sp. nov.	<i>P. boninensis</i>	<i>P. paulayi</i>	<i>P. ruber</i>
Setal rows of ultimate segment of antennular peduncle	consisting of mixture of short and long setae	consisting of tufts of short setae	consisting of mixture of short and long setae	consisting of tufts of short setae
Dorsal surface of right palm	non-spinulose	non-spinulose	spinulose	non-spinulose
Dorsal surface of carpus of right cheliped	with 2 mesial row of moderately large spines	with 1 mesial row of few small spines	with 1 or 2 mesial rows of small spines	non mesial row of spines
Ventrolateral margin of merus of right cheliped	with 2–6 small spines	with 1 or 2 subdistal spines	with 1 subdistal spine	with 1 subdistal spine
Coxa of right fifth pereopod of males	with prominent ventromesial protrusion; setal tuft long	with prominent ventromesial protrusion, setal tuft long	with prominent ventromesial protrusion; setal tuft long	without ventromesial protrusion; setal tuft very short
Left gonopore of males	present	present	absent	absent
Color of ambulatory legs	striped with purple and white	striped with reddish brown and white	generally light purple in preservative	generally red or reddish purple, with white distal ring

of the right cheliped, and the possession of the left gonopore in males distinguish the new species from *P. paulayi*. The new species is readily distinguished from *P. ruber* by the different pattern of the ventral setal rows on the ultimate segment of the antennular peduncle, the presence of two to six spines on the ventrolateral margin of the merus of the left cheliped, and the possession of a well-developed ventromesial protrusion and tuft of long setae on the coxa of the right fifth pereopod in males. From *P. boninensis*, *P. purpureus* differs in the different pattern of the ventral setal rows on the ultimate segment of the antennular peduncle, and more prominent setal tufts of the dactylus and carpus of the left fourth pereopod. The living coloration of the new species is distinctive in the violet antennular peduncle and the ambulatory legs longitudinally striped with purple and white. *Pagurixus boninensis* also has similarly striped ambulatory legs, but the base color is reddish brown; the antennular peduncle is also reddish brown. Chelipeds and ambulatory legs of *P. ruber* are almost entirely purplish red occasionally with white distal rings on the propodi of the ambulatory legs. Coloration in life remains unknown in *P. paulayi*, although the preservative color was described by Komai and Osawa (2006).

Etymology. Named in reference to the vivid purple color in life.

***Pagurixus anceps* species group**

***Pagurixus acanthocarpus* sp. nov.**

[New Japanese name: Konpeitou-hime-hon-yadokari]

(Figs. 5–8; 9C)

Material examined. Holotype: NSMT-Cr 19741, male (SL 1.5 mm), Kashiwa-jima Island, Ohtsuki, Kochi Prefecture, subtidal, 30 June 2005, SCUBA diving, coll. Eiji Myorin.

Paratypes: CBM-ZC 9517, 1 male (SL 1.6 mm), same data as holotype; CMNH-ZC 1871, 1 female (SL 1.8 mm), Akino-hama, Izu-Oshima Island, Izu Islands, 8 m, 26 December 2004,

SCUBA diving, coll. Hirohito Arima.

Description. Shield (Fig. 5A) 1.05–1.11 times as long as broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface naked. Rostrum triangular, not reaching midlength of ocular acicles, moderately broad, terminating acutely. Lateral projections obtuse, each with submarginal spinule.

Ocular peduncles (Fig. 5A) moderately stout, 0.60–0.70 length of shield, each with few tufts of short setae on dorsomesial surface; middle part slightly inflated, subequal to corneal width; corneas slightly dilated, corneal width 0.30–0.36 of peduncular length. Ocular acicles subtriangular, each with submarginal spinule.

Antennular peduncles (Fig. 5A) overreaching distal corneal margins by 0.20–0.40 lengths of ultimate segments. Ultimate segment with 1 short seta at dorsolateral distal angle; ventral surface lacking longitudinal rows of setae. Basal segment with small spine on distal margin of statocyst lobe. Ventral flagellum with few short setae on lateral and mesial margins.

Antennal peduncles (Fig. 5A) slightly reaching beyond distal corneal margins. Third segment with small spine at distomesial angle. Second segment with spinule at dorsomesial distal angle; laterodistal projection reaching midlength of fourth segment, terminating in simple spine. First segment unarmed on lateral face; ventromesial distal margin strongly produced, but unarmed. Antennal acicle arcuate, terminating in slender spine, overreaching base of cornea but not reaching distal margin; mesial margin with few stiff setae. Flagellum relatively short, about 2.5 times longer than shield.

Third maxilliped moderately stout; ischium with well-developed crista dentata and 1 accessory tooth.

Male right cheliped (Fig. 6A–C) large, not particularly elongate. Chela subovate in dorsal view, about 1.60 times longer than broad. Dactylus slightly shorter than palm, terminating in small corneous claw; dorsomesial margin not delimit-

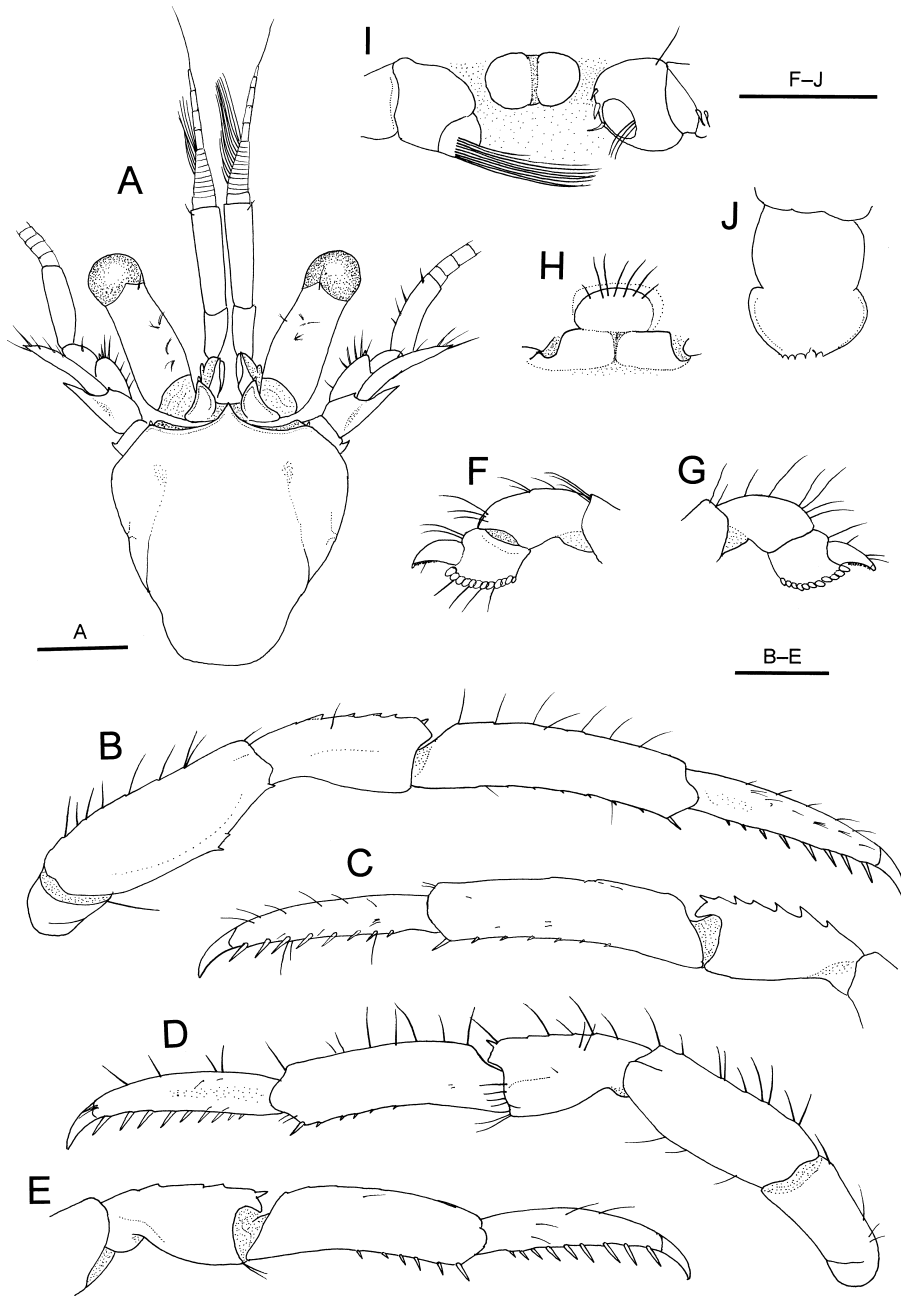


Fig. 5. *Pagurixus acanthocarpus* sp. nov., holotype, male (SL 1.5 mm), NSMT-Cr 19741. A, shield and cephalic appendages, dorsal view; B, right second pereopod, lateral view; C, dactylus to carpus of right second pereopod, mesial view; D, left third pereopod, lateral view; E, dactylus to carpus of left third pereopod, mesial view; F, dactylus to carpus of left fourth pereopod, lateral view; G, same of right fourth pereopod, lateral view; H, sixth thoracic sternite, ventral view; I, coxae of fifth pereopods and eighth thoracic sternite, ventral view; J, telson, dorsal view. Scale bars: 0.5 mm.

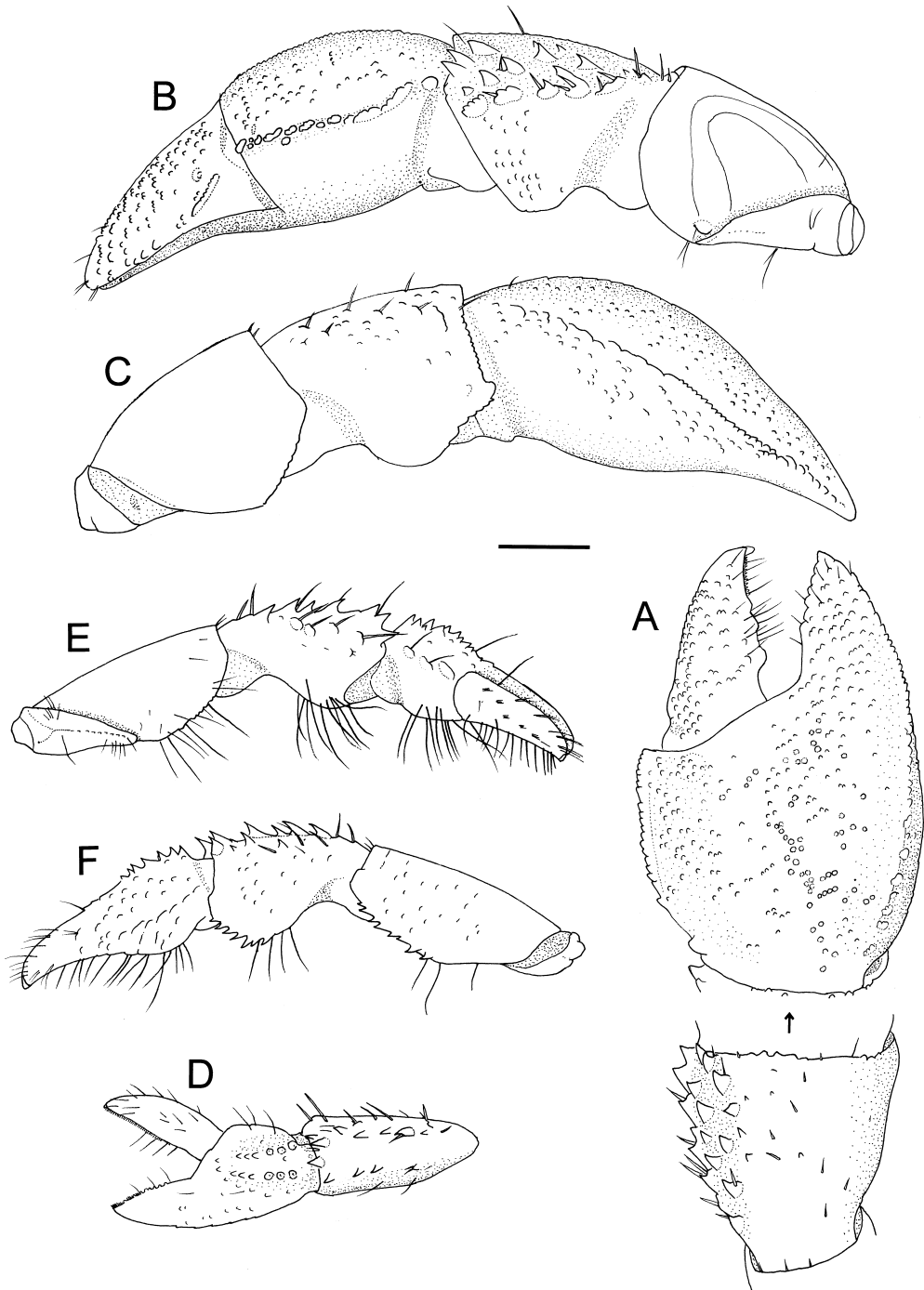


Fig. 6. *Pagurixus acanthocarpus* sp. nov., holotype, male (SL 1.5 mm), NSMT-Cr 19741. A, chela and carpus of right cheliped, dorsal view; B, right cheliped, mesial view; C, same, lateral view; D, chela and carpus of left cheliped, dorsal view; E, left cheliped, mesial view; F, same, lateral view. Scale bar: 0.5 mm.

ed; dorsal and mesial surfaces with numerous small granules, latter with short oblique ridge proximally; cutting edge with 3 low calcareous teeth in proximal 0.70 and row of small corneous teeth in distal 0.30. Palm subequal in length to carpus; convex dorsal surface covered with small granules; dorsolateral margin distinctly delimited by tuberculate or granular ridge extending onto fixed finger; dorsomesial margin also delimited by sharp, granular ridge; lateral surface with scattered, coarse granules, mesial and ventral surfaces nearly smooth. Fixed finger terminating in calcareous claw; cutting edge with row of low, blunt calcareous teeth. Carpus nearly as long as broad and subequal in length to merus; dorsal surface nearly smooth, but with some scattered short spiniform setae, bearing 2 rows of small to moderately large spines adjacent to dorsomesial margin, dorsolateral surface rounded; dorsomesial margin weakly delimited by row of small spines or spinulose tubercles occasionally bearing spiniform setae; dorsodistal margin with row of small tubercles or granules; lateral surface nearly smooth, ventrodistal margin with subdistal spinule followed by row of low tubercles; mesial surface with scattered granules distally, distal margin unarmed; ventral surface strongly convex, naked. Meral-carpal articulation lacking any pronounced clockwise rotation; dorsal surface of merus smooth, dorsodistal margin with few short setae; lateral face smooth, ventrodistal margin slightly tuberculate; mesial face smooth, convex ventromesial margin smooth; ventral surface also smooth, with only few short setae. Ischium with smooth ventromesial margin; surfaces unarmed.

Female right cheliped (Fig. 7A–C) moderately large, distinctly longer than left. Chela about 1.40 times longer than broad, with markedly arched lateral margin. Dactylus longer than palm, terminating in small corneous claw; dorsal surface with tuberculate median ridge extending beyond midlength; dorsomesial margin delimited by row of tiny tubercles or granules; mesial surface with scattered tiny tubercles or granules proximally; cutting edge with row of small corneous teeth on distal 0.75. Palm distinctly shorter than carpus;

weakly convex dorsal surface covered with coarse granules, row of larger, occasionally multifold granules on midline, and short, distinct granular ridge proximomesially; dorsolateral margin delimited by sharp, granular ridge extending to tip of fixed finger; dorsomesial margin also delimited by sharp, faintly granular ridge; lateral surface with scattered low protuberances, mesial surface nearly smooth, and ventral surface with few low protuberances and tufts of setae. Fixed finger terminating in small corneous claw; cutting edge with row of small, subacute calcareous teeth in proximal half and row of small corneous teeth in distal half. Carpus slightly longer than broad and subequal in length to merus; dorsal surface with scattered small spines and granules laterally and with 2 rows of moderately large spines mesially, dorsodistal margin with 3 small spines; lateral surface with scattered small, low protuberances, ventrolateral margin with few small granules; mesial surface with row of small spines dorsally, but otherwise nearly smooth, ventromesial margin granular in distal part; ventral surface strongly convex, naked. Meral-carpal articulation lacking any pronounced clockwise rotation; dorsal surface of merus with very low transverse ridges, dorsodistal margin with few short setae; lateral face with scattered granules, ventrolateral margin with row of small spines or tubercles; mesial face smooth, convex ventromesial margin nearly smooth; ventral surface also smooth, with only few setae. Ischium with smooth ventromesial margin; surfaces unarmed.

Male left cheliped (Fig. 6D–F) moderately short and stout. Chela about 2.10 times longer than wide, distinctly longer than carpus. Dactylus distinctly longer than palm, terminating in small corneous claw; surfaces smooth, rounded dorsomesially, with scattered short setae; cutting edge with row of small corneous teeth. Palm about half length of carpus; dorsal surface convex, with 2 rows of small spines medially and scattered granules on dorsolateral face; trace of delineation of lateral margin formed by low protuberances; ventrolateral face with low protuberances; mesial surface with 3 low, short ridges

dorsally, otherwise nearly smooth; ventral surface weakly convex, with several tufts of moderately long setae. Fixed finger terminating in small corneous claw, cutting edge with row of small tiny calcareous teeth and interspersed with minute corneous teeth. Carpus somewhat compressed laterally, shorter than merus; length about 2.0 times distal width and 1.5 times height; dorsal surface with 3 lateral spines and 6 mesial spines, dorsodistal margin with 1 spine medially; lateral face nearly perpendicular, with scattered granules and few spiniform setae dorsally, ventrolateral margin with row of small spines; mesial face dorsally with low protuberances bearing spiniform setae, ventrodistal margin unarmed; ventral surface convex, with several long setae. Merus smooth on dorsal surface, dorsodistal margin unarmed; lateral surface with sparse granules, ventrolateral margin with row of small spines in distal half; mesial face smooth, ventromesial margin minutely tuberculate; ventral surface weakly convex, smooth, with some long setae. Ischium with row of minute granules on ventromesial margin, otherwise unarmed.

Female left cheliped generally similar to that of male, but granulation and sculpture of chela more pronounced. Chela (Fig. 7D–F) 1.70 times longer than wide with noticeably arched lateral margin. Dactylus with few granules proximodorsally. Dorsal surface of palm notably elevated medially, with prominent, granular ridge mesial to midline, and lower, but similarly granular ridge slightly lateral to midline, sloping dorsolateral surface with scattered granules, dorsomesial to mesial faces with sparse granules; lateral margin delimited by sharp, weakly granular ridge extending onto fixed finger as interrupted ridge.

Male ambulatory legs (Fig. 5B–E) moderately slender, generally similar on right and left in second, left third slightly stouter than right. Dactyli 0.90–1.00 length of propodi, 5.30–6.20 times longer than high, terminating in large corneous claws; dorsal surfaces each with few short setae; lateral and mesial faces smooth; ventral margins each with 8 or 9 long corneous spines increasing in size distally. Propodi weakly curved, not taper-

ing distally, about 4.20 times longer than high (second and right third) or 3.50 times (left third); dorsal surfaces smooth, with sparse short setae; lateral faces smooth; ventral margins each with 5 or 6 corneous spinules (spinules on left third longer than those on other legs), ventrodistal margins each with paired corneous spines. Carpi each with small dorsodistal spine; dorsal surface of right second with 1 (paratype) or 5 (holotype) small spines, that of left second with 1 small spine arising proximal to midlength, and those of third pereopods each with low, tiny protuberances; row of sparse setae present on each dorsal surface; laterodistal margin of left third with row of stiff setae, those on other legs naked. Meri with smooth dorsal margins bearing sparse setae; lateral surfaces nearly smooth; ventrolateral distal margins each with small subdistal spine (second pereopod) or unarmed (third), ventral surfaces armed with few spinules (second pereopods) or unarmed (third pereopods).

Female ambulatory legs (Fig. 8A–E) generally stouter than those of males, third pereopods appreciably dissimilar, left distinctly stouter than right. Number of ventral spines on dactyli 7 in second, 10 in right third, and 8 in left third. Propodi each with 4–7 ventral spines and 1 or 2 ventrodistal spines. Carpus of left third pereopod with row of stiff setae on laterodistal margin; dorsal surfaces without conspicuous spines except for dorsodistal spines, but with tiny, low protuberances in right second pereopod.

Fourth pereopods (Fig. 5F, G) subequal and similar on right and left. Dactyli moderately broad, slightly curved, terminating in small corneous claws; dorsal margins with few short setae. Propodi each with 1 tuft of setae on dorsal margins; mesial face nearly flat or slightly convex, with few short setae; propodal rasp of single row of corneous scales. Carpus without prominent tufts of setae on mesial face.

Anterior lobe of sixth thoracic sternite (Fig. 5H) roundly subrectangular, with row of short to long setae on anterior margin. Eighth thoracic sternite (Fig. 5I) composed of 2 subequal, closely-set, rounded lobes; ventral surface of each

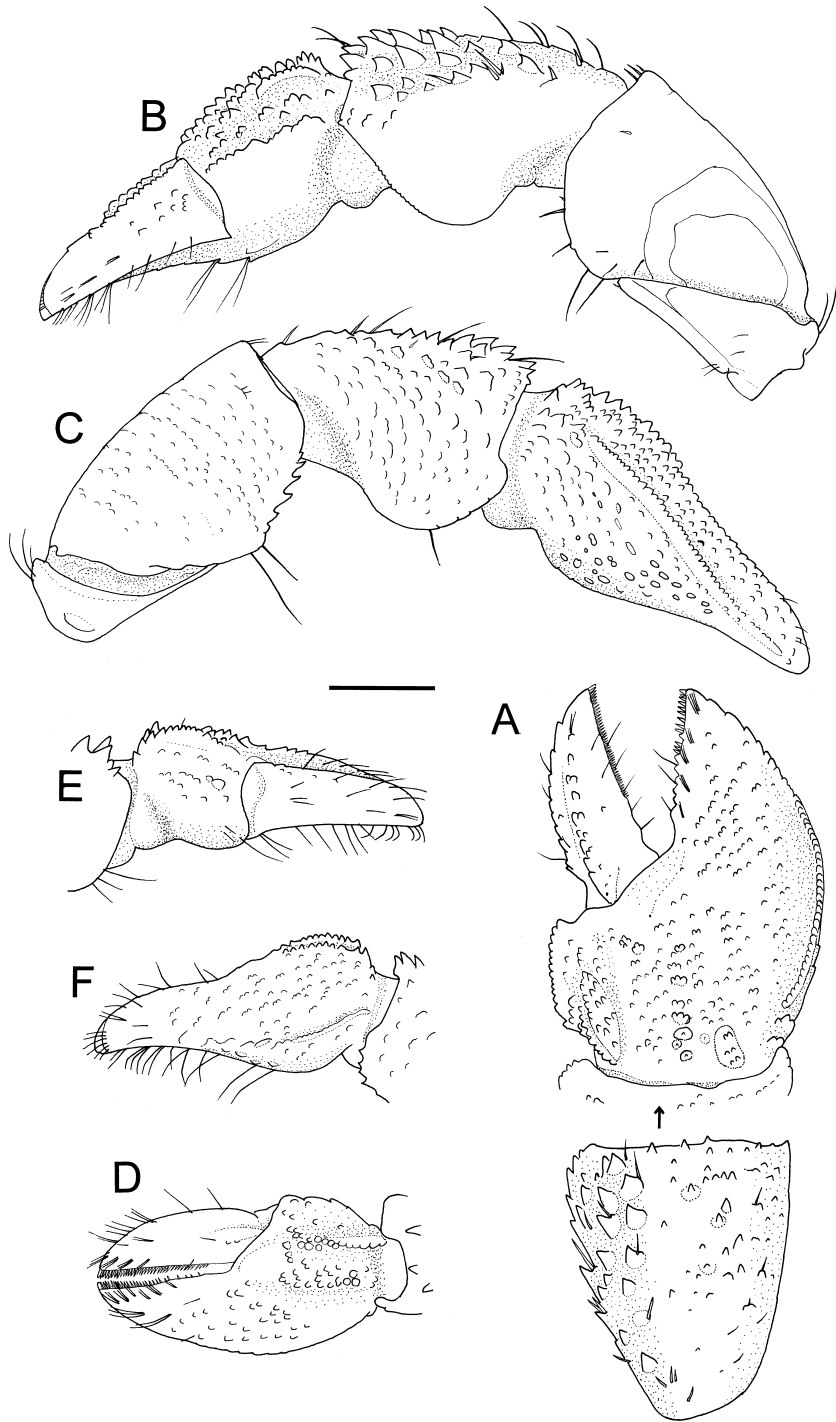


Fig. 7. *Pagurixus acanthocarpus* sp. nov., paratype, female (SL 1.8 mm), CMNH-ZC 1871. A, chela and carpus of right cheliped, dorsal view; B, right cheliped, mesial view; C, same, lateral view; D, chela of left cheliped, dorsal view; E, same, mesial view; F, same, lateral view. Scale bar: 0.5 mm.

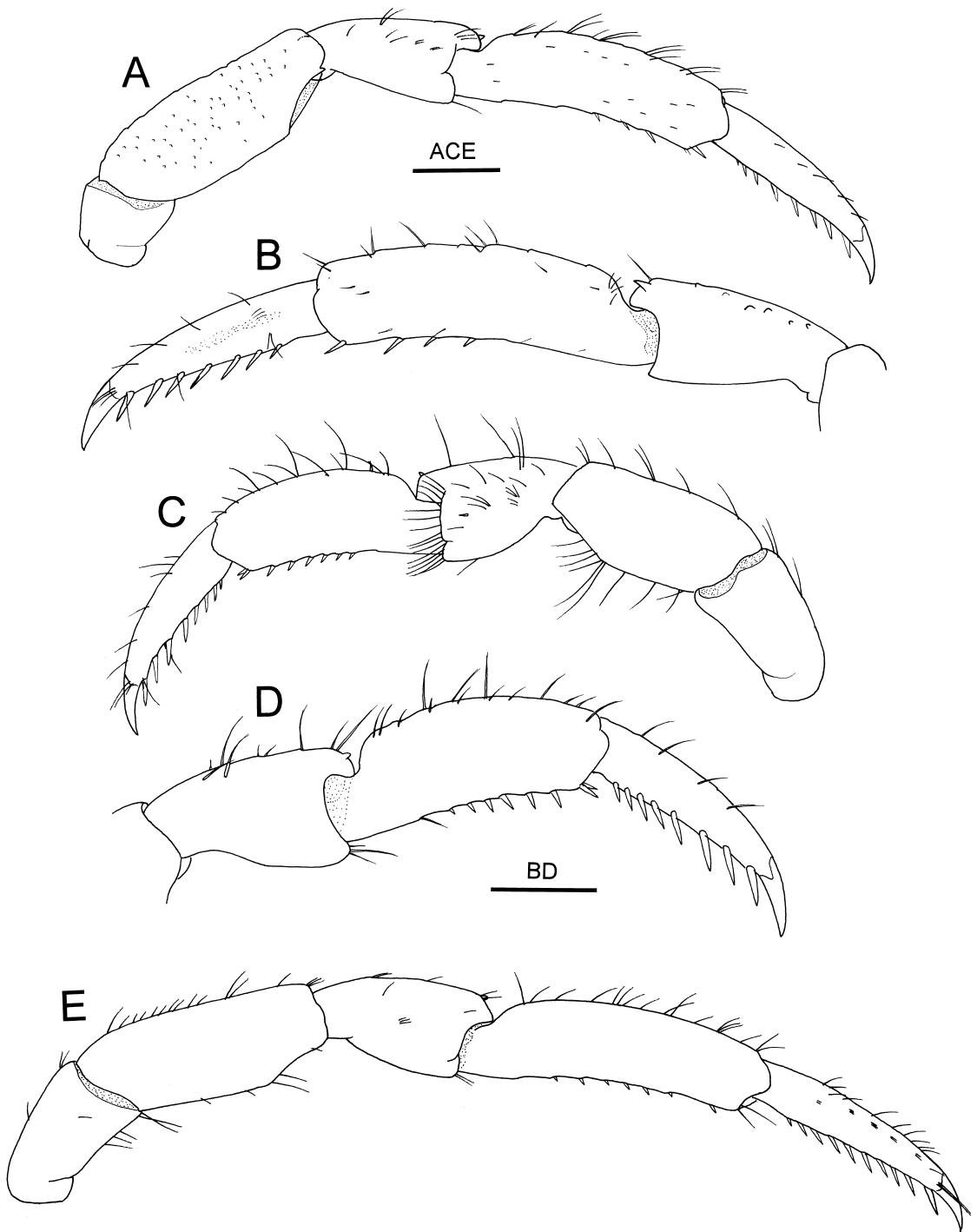


Fig. 8. *Pagurixus acanthocarpus* sp. nov., paratype, female (SL 1.8 mm), CMNH-ZC 1871. A, right second pereopod, lateral view; B, dactylus to carpus of right second pereopod, mesial view; C, left third pereopod, lateral view; D, dactylus to carpus of left third pereopod, mesial view; E, right third pereopod, lateral view. Scale bars: 0.5 mm.

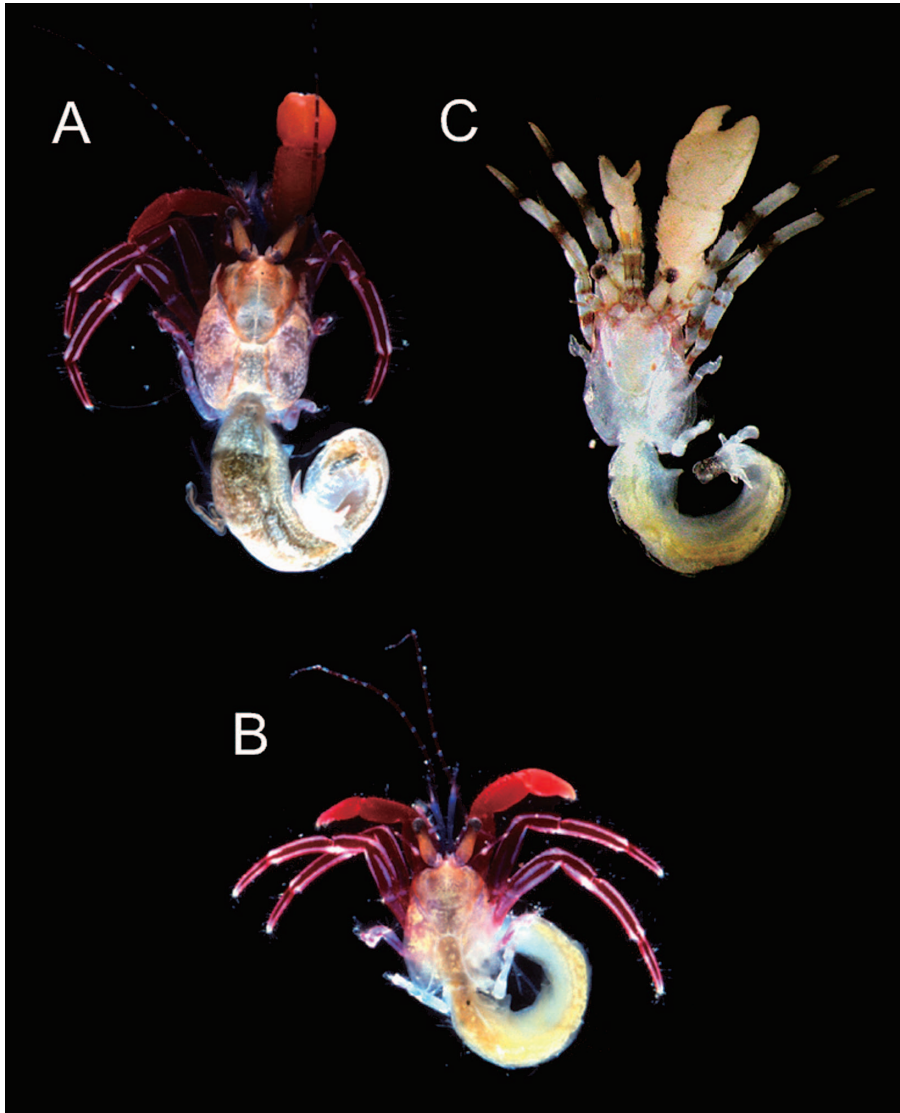


Fig. 9. Entire animal in dorsal view. A, *Pagurixus purpureus* sp. nov., holotype, male (SL 3.4 mm), NSMT-Cr 19741, photo by J. Okuno; B, *Pagurixus purpureus* sp. nov., paratype, female (SL 2.3 mm), NSMT-Cr 19859, photo by J. Okuno; C, *Pagurixus acanthocarpus* sp. nov., holotype, male (SL 1.5 mm), NSMT-Cr 19741, photo by T. Komai.

lobe flattened, naked.

Coxae of male fifth pereopods (Fig. 5I) slightly unequal; weak ventromesial protrusion arising from surface of right coxa, bearing prominent tuft of setae arising at midlength and reaching to left coxa. Left coxa with gonopore. Female with left gonopore.

Telson (Fig. 5J) with terminal margins nearly

horizontal, bearing 4 (left) or 2 (right) spinules; lateral margins of posterior lobes not calcified.

Coloration in life. Carapace translucent; shield with tinge of brown posterior to base of ocular peduncles and pair of brown spots laterally. Ocular peduncles translucent, with tinge of brown basally. Antennular peduncles with broad brown band on penultimate segment; ultimate

segment generally brown, proximal and distal portions colorless; flagella yellowish brown. Antennal peduncle generally translucent, second segment with tinge of brown basally; fifth segment marginally brown; flagellum entirely light brown. Right cheliped generally white, merus with dark brown blotches dorsally. Left cheliped also white, with dark brown transverse band on merus. Ambulatory legs banded with white and dark brown; dactyli dark brown in proximal one-third, becoming paler distally; propodi each with band occupying about proximal one-third; carpi with tinge of brown proximally; meri each with 2 transverse bands subdistally and proximally; ischia each with brown patch laterally. See Fig. 9C.

Distribution. Kashiwa-jima Island, Ohtsuki, Kochi Prefecture, and Izu-Oshima Island, Izu Islands; subtidal to 8 m.

Remarks. The single female specimen is different from the two males in many respects, for example, the armature of the chelipeds and of the carpus of the second pereopods, although the coloration in life agrees well for each other. In general, the armature of the chelipeds is more pronounced in the female specimen than in the two males, whereas the armature of the carpus of the right second pereopod is greatly reduced in the female specimen. Similar variation in the armature of the chelipeds between different sexes has been reported in other congeneric species (e.g., McLaughlin and Haig, 1984; Gunn and Morgan, 1992; Komai and Myorin, 2005; Komai and Osawa, 2006).

Pagurixus acanthocarpus sp. nov. is referred to the *P. anceps* species group because of the lack of setal rows on the ventral surface of the ultimate segment of the antennular peduncle. This informal species group is represented by the following 14 described species: *P. hectori* (Filhol, 1883), *P. anceps* (Forest, 1954), *P. jerviensi* McLaughlin and Haig, 1984, *P. handrecki* Gunn and Morgan, 1992, *P. amsa* Morgan, 1993, *P. granulimanus* Morgan, 1993, *P. stenops* Morgan, 1993, *P. kermadecensis* de Saint Laurent and McLaughlin, 2000, *P. fasciatus* Komai and Myorin, 2005, *P. longipes* Osawa, Fujita and Okuno,

2006, *P. patiae* Komai, 2006, *P. nanus* Komai and Takada, 2006, *P. haigae* Komai and Osawa, 2007 and *P. dissimilis* Osawa and Komai, 2007. The distinctly ridged dorsomesial margin of the right palm links the new species to *P. fasciatus* and *P. handrecki*. In the other 12 species, the dorsomesial surface of the right palm is rounded or faintly ridged. Differences among the three species are summarized in Table 2. The new species is characteristic in having conspicuous spine(s) on the dorsal surface of the carpus of the right second pereopod in addition to a dorsodistal spine, at least in the male. In the other two species, the carpus of the second pereopod does not have spines on the dorsal surface, except for the dorsodistal spine. With regard to the female, it is difficult to fully assess intraspecific variation. Nevertheless, *P. acanthocarpus* differs from the latter two species in the dissimilar third pereopods, of which the left is appreciably shorter and stouter. Furthermore, as summarized in Table 2, the general armature and ornamentation of the chelipeds seems to be more pronounced in *P. acanthocarpus* sp. nov. and *P. handrecki* than in *P. fasciatus*. Differences between the new species and *P. handrecki* are seen in details of the armature and ornamentation of the chelipeds (see Table 2). Coloration in life is quite different among the three species. For example, *P. handrecki* has reddish brown longitudinal stripes on the ocular peduncles, chelipeds and ambulatory legs (Gunn and Morgan, 1992; Poore, 2004), whereas no stripes are seen on those appendages in the other two species. The coloration of *P. acanthocarpus* differs from that of *P. fasciatus* as follows. In the new species, the dactyli are dark brown in the proximal one-third, becoming paler distally; each propodus bears a dark brown band occupying about proximal one-third, the remainder is white; the carpi have brown tinge proximally. In *P. fasciatus*, the dactyli are entirely dark brown; each propodus has a white ring occupying the distal one-fourth, and the remainder is generally dark brown with a white patch proximally; the carpi are generally dark brown, but distal parts are white (see Komai and Myorin, 2005).

Table 2. Comparison among three species of *Pagurixus*, *P. acanthocarpus* sp. nov., *P. fasciatus*, and *P. handrecki*.

Items	<i>P. acanthocarpus</i> sp. nov.		
	<i>P. fasciatus</i>	<i>P. handrecki</i>	
Male right cheliped			
Dorsal surface of palm	coarsely granular	apparently smooth, but microscopically granular delimited by weak ridge	minutely granular
Dorsolateral margin of palm	crenulate, extending onto fixed finger as granular ridge	distinctly ridged over entire length	crenulate
Dorsomesial margin of palm	distinctly ridged over entire length		distal one-third to one-fourth
Dorsal surface of carpus	with moderately large spines arranged in 2 or 3 rows adjacent to dorsomesial margin delimited by spinulose protuberances		obsoletely ridged
Female right cheliped			dorsomesial margin with irregular rows of large spines
Dorsal surface of palm	with small spines on midline and coarse granules	nearly smooth	with spinulose tubercles or small spines on elevated midline
Dorsolateral margin of palm	sharply delimited by granular ridge extending onto fixed finger	sharply delimited by smooth ridge extending onto fixed finger	sharply delimited by row of small spines extending onto fixed finger
Dorsomesial margin of palm	delimited by irregularly granular ridge	delimited by granular ridge	delimited by row of small spines
Dorsal surface of carpus	with 2 rows of large spines adjacent to dorsomesial margin delimited by single row of smaller spines	with 1 dorsomesial row of small spines	with 1 or 2 dorsomesial rows of large spines
Left cheliped			
Dorsal surface of palm	with 2 rows of small spines (male) or 2 rows of spinulose tubercles (female) on elevated midline delimited by distinct ridge	with scattered small tubercles or granules on elevated midline	with row of spines or tubercles on elevated midline
Lateral margin of palm		not delimited	with irregular row of small tubercles
Male ambulatory legs			
Second pereopod carpus	dorsally with 1–5 spines	no spine	no spine
Female ambulatory legs			
Third pereopods	left appreciably shorter and stouter than right	generally similar	generally similar
Female gonopores	unpaired, only left present	unpaired, only left present	paired
Color of propodi of ambulatory legs	with reddish brown stripes on white back ground	white in distal two-thirds, dark brown in proximal one-third	white in distal one-fourth, remainder generally dark brown

The presence of at least one dorsal spine on the carpus of the right second pereopod links the new species to *Pagurixus nanus* and *P. dissimilis*, but the poorly developed general armature of the chelipeds and the non-delineated dorsolateral and dorsomesial margins of both chelae, as well as the quite different coloration in life immediately distinguish *P. nanus* and *P. dissimilis* from *P. acanthocarpus* (cf. Komai and Takada, 2006; Osawa and Komai, 2007).

Etymology. Named in reference to the presence of spines on the dorsomesial surface of the carpus of the right cheliped and the dorsal surface of the carpus of the right second pereopod in males.

Acknowledgments

We thank Hirohito Arima (Izu-Oshima Island), Shigeru Harazaki (Yakushima Island), Eiji Myorin (Kanazawa City), and Naoki Nishimura (Kashiwa-jima Island, Ohtsuki Town) for donating the valuable specimens to us for study. Sincere thanks are also extended to Patsy A. McLaughlin (Shannon Point Marine Center, Western Washington University) and Masayuki Osawa (Department of Marine and Environmental Sciences, University of the Ryukyus) for reviewing the manuscript and for offering valuable suggestions for improvements.

References

- Gunn, S. and G. J. Morgan, 1992. A new species of *Pagurixus* (Crustacea: Decapoda: Paguridae) from southern Australia. *Memoirs of Museum Victoria*, **53**: 31–41.
- Komai, T., 2006. A new species of *Pagurixus* Melin, 1939 (Crustacea: Decapoda: Anomura: Paguridae) from the Ryukyu Islands, Japan. *Zoosystema*, **28**: 507–516.
- Komai, T. and A. Asakura, 1995. *Pagurixus nomurai*, new species, and additional record of *Pagurixus maorus* (Nobili, 1906), hermit crabs from Kume-jima Island, the Ryukyus, Japan (Decapoda: Anomura: Paguridae). *Journal of Crustacean Biology*, **15**: 341–154.
- Komai, T. and E. Myorin, 2005. A new species of *Pagurixus* (Crustacea: Decapoda: Anomura: Paguridae) from southern Japan. *Zootaxa*, (876): 1–12.
- Komai, T. and M. Osawa, 2006. A review of the *Pagurixus boninensis* species group, with descriptions of six new species (Crustacea: Decapoda: Anomura: Paguridae). *Zootaxa*, (1214): 1–107.
- Komai, T. and M. Osawa, 2007. A new species of the hermit crab genus *Pagurixus* Melin (Crustacea: Decapoda: Anomura: Paguridae) from the Indo-West Pacific. *Raffles Bulletin of Zoology*, **55**: 97–105.
- Komai, T. and Y. Takada, 2006. A new species of the hermit crab genus *Pagurixus* (Crustacea: Decapoda: Anomura: Paguridae) from shallow coral reefs in Ishigaki Island, Ryukyu Islands. *Species Diversity*, **11**: 327–337.
- McLaughlin, P. A., 2003. Illustrated keys to families and genera of the superfamily Paguroidea (Crustacea: Decapoda: Anomura), with diagnoses of genera of Paguridae. *Memoirs of Museum Victoria*, **60**: 111–144.
- McLaughlin, P. A. and J. Haig, 1984. A review of *Pagurixus* (Decapoda, Anomura, Paguridae) and descriptions of new species. *Crustaceana*, **47**: 121–148.
- Melin, G., 1939. Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln 1914. *Kongliga Svenska Vetenskapsakademiens Handlingar*, Serien 3, **18**: 1–119.
- Morgan, G. J., 1993. Three new species of *Pagurixus* (Crustacea, Decapoda, Paguridae) from Western Australia, with notes on other Australian species. In: Wells, F. E., D. I. Walker, H. Kirkman and R. Lethbridge (eds.), *Proceedings of the Fifth International Marine Biological Workshop: The Marine Flora and Fauna of Rottneest Island, Western Australia*. Pp. 163–181. Western Australian Museum, Perth.
- Osawa, M., Y. Fujita, and J. Okuno, 2006. Two new species of *Pagurixus* (Crustacea: Decapoda: Anomura: Paguridae) from submarine caves of the Ryukyu Islands, southwestern Japan. *Zootaxa*, (1148): 27–45.
- Osawa, M. and T. Komai, 2007. A new hermit crab species of the *Pagurixus anceps* group (Crustacea: Decapoda: Anomura: Paguridae) from southern Japan, and supplemental note on *P. patiae* Komai, 2006. *Zootaxa*, (1627): 41–51.
- Poore, G., 2004. *Marine Decapod Crustacea of Southern Australia*. ix+574 pp. CSIRO Publishing, Victoria.

Manuscript received 8 May 2008; revised 30 September 2008; accepted 15 October 2008.

Associate editor: T. Komai